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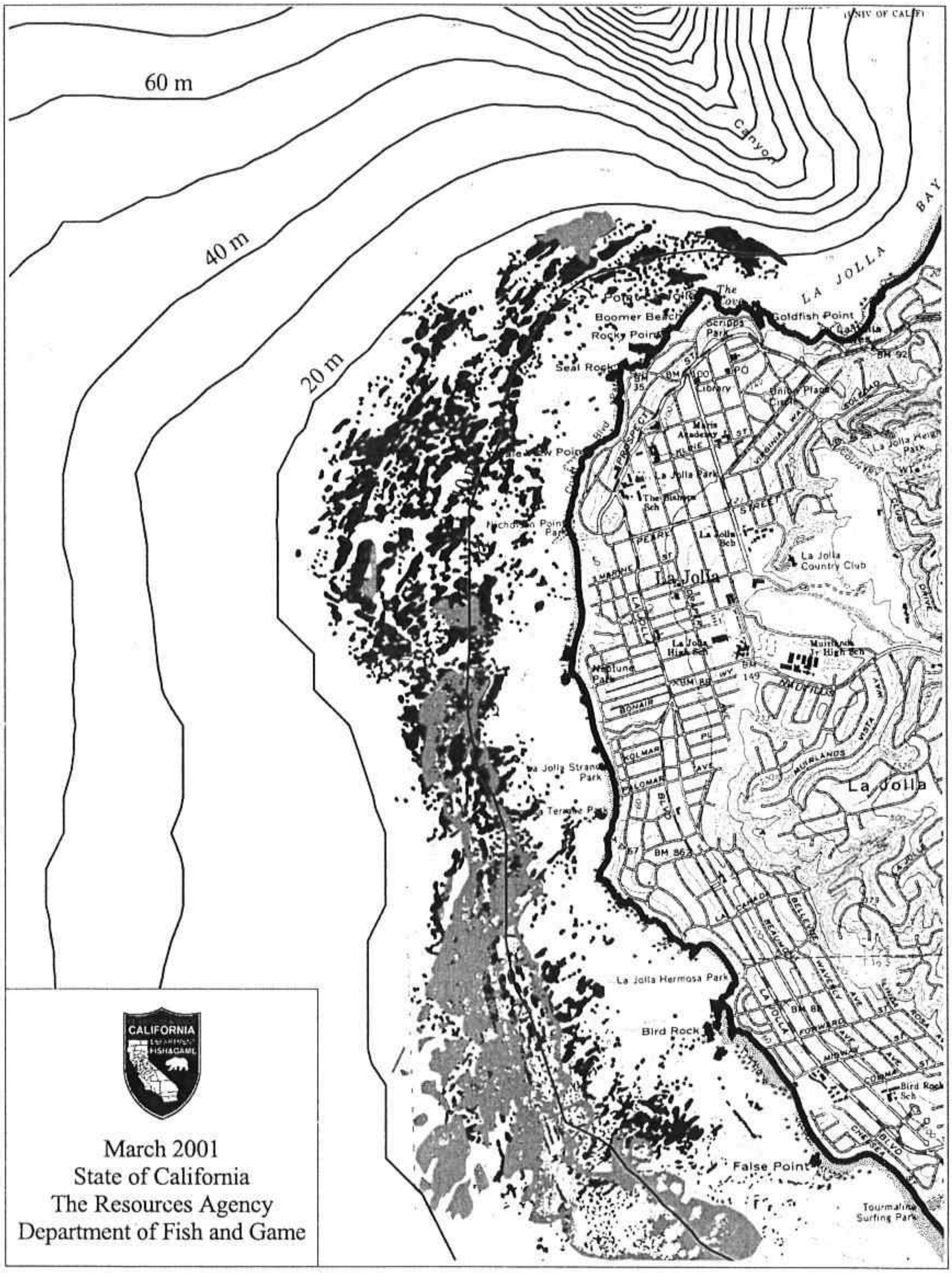
Draft

Final Environmental Document

Giant and Bull Kelp Commercial and Sport Fishing Regulations

(Sections 30 and 165, Title 14, California Code of Regulations



CALIFORNIA

March 2001

State of California

The Resources Agency

Department of Fish and Game

COVER: This map shows Administrative Kelp Bed #4 located off the coast of La Jolla, in San Diego County. The bed extends from a line drawn 272° true north from the south jetty of Mission Bay to a line drawn 283° true north from Scripps Pier. The bed's greatest potential canopy area is 2.53 square miles. The large green kelp layer was derived from 1989 summer kelp canopy estimates from 35 mm aerial photography (Ecoscan, 1989). The smaller blue kelp layer was derived from 1999 winter kelp canopy estimates from large format aerial photography (I.K. Curtis, 1999). This comparison of summer and winter kelp canopy area illustrates seasonal changes in kelp abundance. Canopy area is one of many important factors used in the management of kelp harvest and conservation of kelp-reef habitat. The depth contour lines (in meters) show one element of oceanographic influence on bed #4. La Jolla Canyon and La Jolla Point, on the northern end of the bed, both contribute to seasonal impacts on kelp persistence.

Cover Map Scale: 1:35,000
Land Map selected from USGS 1:24,000 Digital Raster Grahpics
Map Design by DFG Marine Region GIS Lab

Draft

2000 Final Environmental Document

Giant and Bull Kelp Commercial and Sport Fishing Regulations

Section 30 and 165, Title 14, California Code of Regulations

by

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CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3S37	inches
meters (m)	3.281	feet
kilometers (km)	0.6214	miles
square meters (m^2)	10.76	square feet
square kilameters (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons	1.102	short tons
kilocalories (kcal)	3.968	BTU
Celsius degrees	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
acres	0.4047	hectares
square miles (mi^2)	2.590	square kilometers
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
short tons (ton)	0.9072	metric tons
British thermal units (BTU)	0.2520	kilocalories
Fahrenheit degrees	0.5556(°F - 32)	Celsius degrees

SUMMARY

Summary of Proposed Project

Existing law (§6653 and §6750, Fish and Game Code, Appendix 1) provides the Commission with authority to establish regulations to ensure the proper harvesting of kelp and aquatic plants for commercial and sport purposes. Under the authority provided by §6653, the Commission has established license and permit requirements; established fees and royalties; required report of take; established open and closed seasons; established or changed possession limits; established and changed area or territorial limits for harvesting; and prescribed the manner and the means of taking kelp and aquatic plants for commercial purposes.

Section 6750 of the Fish and Game Code gives the Commission the authority to regulate the taking, collecting, harvesting, gathering, and possession of marine aquatic plants for purposes other than profit. Under this authority, the Commission has established, extended, shortened, and abolished open and closed seasons; established, changed, and abolished bag limits, possession limits, and size limits; established and changed areas or territorial limits for taking; and prescribed the manner and means of taking kelp and aquatic plants for recreational purposes.

Proposed Project

The Department is recommending that the Commission adopt regulations that will provide for the continued commercial and recreational take of kelp. Specifically, the Department is recommending the Commission continue the existing regulations (§30 ,

§165, and § 165.5 Title 14, CCR, Appendix 1) that became effective May 8, 1984 and January 2, 1991 respectively, as modified by changes suggested by the Department and interested parties intended to address particular resource problems or issues.

Effects on the Environment

The Department is recommending the continued use of existing regulations as modified (Proposed Project, p. 2–1) to address resource concerns. In addition to the proposed project, the Department is also providing the Commission with one alternative which could feasibley attain the basic objectives of the project, and a no–action alternative.

Alternative 1 expands the suite of amendments in the proposed project to include a precautionary measure to prevent over-harvest by limiting the amount of kelp that can be harvested from any kelp bed. This alternative is reviewed and evaluated in Chapter 6. While the alternative would achieve the project objective, the ecological gains would not be significant in most geographical areas and may cause a shift in harvest pressure to more sensitive areas. The Department would prefer to develop a biologically tenable threshold value beyond which impacts could be anticipated before imposing harvest limitations on a broad scale.

The no–action alternative would continue the commercial and recreational harvest of kelp under existing regulations with no modifications. However, this alternative does not provide for changes to the existing regulations which may be justified. This alternative is reviewed and evaluated in Chapter 6.

An analysis of the proposed project's potential impacts is set forth in Chapter 4.

The Department has determined, based on this analysis, that the proposed project will not adversely affect the giant and bull kelp resources of the state. Table 1–1 summarizes Department findings associated with the proposed project and the project alternatives.

Table 1–1. Summary of significant impacts expected by the proposed project and the alternatives				
Alternative	Significant Impact	Nature of Impact	Mitigation Available	Nature of Mitigation
Proposed project	No	None	N/A	N/A
No Action	No	None	N/A	N/A
Alternative 1: statewide harvest controls	Yes	Economical and Biological	N/A	N/A

N/A - Not applicable

Public Input

The California Environmental Quality Act (CEQA) encourages public input. One of the primary purposes of the environmental document review process is to obtain public comment, as well as to inform the public and decision makers. It is the intent of the Department to encourage public participation in this environmental review process.

Prior to preparing this environment document (ED), the Department issued a Notice of Preparation (NOP). The NOP was provided to the State Clearinghouse for distribution as well as to affected agencies, interested organizations, and individual.

CEQA encourages an early consultation, or scoping process to help identify the range of actions, alternatives, and significant effects to be analyzed in depth in an environmental document, and to help resolve concerns of affected agencies and individuals. This environmental document was prepared after 3 scoping sessions were conducted for the purpose of receiving input from the public and interested agencies and organizations. The scoping sessions were conducted on February 24, 2000 in Monterey, March 2, 2000 in Long Beach, and March 13, 2000 in Santa Rosa.

Section 15087 of the CEQA guidelines requires that the draft document be available for public review for no less than 45 days. During this period, the public is encouraged to provide written comments regarding the draft document to the Fish and Game Commission, 1416 Ninth Street, Sacramento, California 95814. Additionally, oral testimony regarding the document will be accepted by the Commission at properly noticed hearings. The Department anticipates that this document will be considered by the Commission early in 2001. The first discussion hearing is tentatively scheduled for the December 2000 meeting in Eureka. A second discussion hearing is tentatively scheduled for the first meeting on the 2001 schedule. The Commission's website (www.dfg.ca.gov/fg_comm) provides Commission agendas once they are finalized.

Areas of Controversy

The public comment received at the scoping sessions or during the public comment period following the scoping sessions raised the following concerns:

- The potential effects of harvesting on kelp associated species including incidental mortality from harvesting and impacts from creating patchiness in the kelp canopy (increased predation).
- The potential for harm to divers from boats or mechanical harvesters if dive flags are not recognized or are ignored and the potential for harm to shore divers that do not use dive flags.

- The negative socio-economic effects if there is not and the positive effects if there is a healthy, accessible kelp resource and a stable regulatory environment to support businesses dependent upon kelp harvest.
- The potential effects from intense and localized harvest on canopy forming kelp.
- The potential beneficial effects from enhancement of kelp resource using artificial reefs.
- The potential negative effects of kelp harvesting on the sea otter population in California.
- The potential effects from other human activities (boating) or pollution (pesticides and sedimentation) on kelp.
- The potential effects if kelp is not managed based on harvesting under worst case scenarios (for example, El Nino events) and does not consider cumulative impacts.
- The need for harvest data to help evaluate socio-economic factors in determining whether harvesting is in public's best interest.
- The need to consider specialized uses for harvested kelp (herring-roe on kelp).
- The potential effects from non-consumptive uses of kelp (diving and kayaking).
- The potential effects from managing based on regulations that do not specify criteria that identify when emergency closures are warranted.
- The potential positive and negative ecological effects associated with harvesting drift kelp or wrack.
- The potential effects from managing kelp without a secure funding base to support monitoring, enforcement, and enhancement.

Issues to be Resolved

The decision before the Commission is whether or not the commercial and sport take of giant and bull kelp should be continued under existing regulations as amended by the preferred project. If these activities are authorized, decisions are needed to specify the areas, authorize method of take, possession and bag limits, and other special conditions under which commercial and sport harvest of giant and bull kelp may be conducted.

Conclusion

Dr. Wheeler North wrote " all studies cited above indicate that a general equilibrium presently exists between man's withdrawal of resources from the kelp environment and replacement by natural productivity. It cannot be assumed that the various inputs and withdrawals will remain constant and certainly natural and artificially induced changes in the environment will affect the overall system" (North and Hubbs, 1968). He based this statement on the extensive research that was conducted to assess the impact of kelp harvesting on nearshore marine ecosystems prior to 1968. The information gathered and presented in this environmental document finds that Dr. North's statement is still true in 2000. The numerical relationship of species within some kelp beds has changed due to removal of dominant kelp inhabitants by various sources. The relative magnitude of the changes potentially attributable to kelp harvesting are minor compared to these changes. Consequently, the proposed project is not expected to have any adverse impacts on the giant or bull kelp resources or on their associated communities.

Chapter 2. PROJECT DESCRIPTION

Few people living along the California coast have failed to notice the wonder and beauty of the California kelp beds. The kelp beds not only provide scenic and recreational relief to humans but also provide food and habitat for numerous microscopic and macroscopic organisms such as plankton, zooplankton, invertebrates, fish, birds, mammals and other algal species (Quast, 1968a - d; North, 1971a and 1971b; Burge and Schultze, 1973; Miller and Giebel, 1973; Kimura and Foster, 1984; Foster and Schiel, 1985; McPeak *et al*, 1988). In southern California, kelp beds are primarily composed of giant kelp (*Macrocystis pyrifera*) while the beds along the central coast are a mix of giant and bull kelp (*Nereocystis luetkeana*). Bull kelp dominates the beds in northern California (Dawson and Foster, 1982; Foster, 1982; Ecoscan, 1989).

These two species are subject to harvesting pressure from both recreational and commercial user groups, and for this reason, are managed by the Fish and Game Commission. Numerous other species of algae, including another species of *Macrocystis* (*M. integrifolia*), are taken incidentally during harvest operations but, as they are not targeted for harvest, will not be considered in this document.

For the purposes of this document the term "kelp" will mean either *M. pyrifera* or *N. luetkeana* or both unless otherwise stated.

2.1 Proposed Project

The proposed project is the amendment of the regulations managing the human harvest of giant (*Macrocystis pyrifera* (Linneaus) C. A. Agardh) and bull kelp (*Nereocystis luetkeana* (Mertens) Postels et Ruprecht) resources under the State's jurisdiction (Figure 2-1a,2-1b, and 2-1c). The regulations are being considered for inclusion in the California Code of Regulations (CCR) to implement the State's policies for management of these species. Specifically, the Department is recommending the Commission continue the existing regulations (Sections 30 to 30.10 and Sections 165 and 165.5, Title 14, CCR (Appendix 1) that became effective May 9, 1984 and January 2, 1991, respectively, with the following substantive amendments:

1) Requirements for weighting harvested kelp (§165(b)) should be amended to clarify what weighing methods are acceptable;
2) Landing Record requirements for reporting harvest information (§165(b)) should be amended to clarify what information is needed and what reporting processes need to be used;
3) Regulations controlling the commercial harvest of bull kelp (§165(c)) should be amended to restrict acceptable harvest methods and seasons to protect that species near the southern limits of its geographic distribution; (Figure 2-2)
4) Regulations that specify which kelp beds are closed to harvest (§165(c)) should be amended to include those beds where there has historically been little resource to prevent focused or repeated harvest where the potential is highest for resource damage;

5) That section should also be amended to close a portion of bed 220 near Monterey to reduce user conflicts; (Figure 2-3)
6) The regulations should also be amended to provide a method for placing temporary harvest controls in beds or portions of beds where necessary for resource protection; and
7) Regulations guiding the leasing of kelp beds for exclusive harvest of kelp (§165.5 (b)) should be amended to provide a method where interested parties can easily determine which beds are currently available for leasing.

In general, existing regulations for the take of kelp provide the following:

Noncommercial

Under existing sportfishing regulations, kelp may be taken by anyone younger than 16 years of age without a license or anyone 16 years or older who possesses a valid fishing license. There is no closed season, closed hours or minimum size limit for any species of aquatic plants for which take is authorized. The bag limit is 10 pounds (wet weight) of kelp in aggregate except when taken during the herring roe–on–kelp season. The bag limit is then 25 pounds (wet weight) of roe and aquatic plants in combination. Furthermore, marine aquatic plants may not be cut or harvested in marine life refuges, ecological reserves, national parks or state underwater parks.

Commercial

Under existing law, kelp may be taken for commercial purposes only under a revocable permit, subject to specific regulations prescribed by the Commission. Current regulations specify: permit qualifications, permit limitations, landing and monitoring requirements for kelp harvesting and drying operations. Further regulations denote kelp lease and non–lease beds, closure areas, harvesting restrictions, harvesting fees and royalties, as well as the requirements for leasing kelp beds for the exclusive harvest of *Macrocystis* and *Nereocystis* beds.

Amendments

The modification of existing commercial harvesting regulations and the addition of regulations specific to bull kelp will provide for continuation of careful management of California's kelp resources.

Statute provides the department with the authority to approve any weighting method to determine the amount of kelp that has been landed or delivered. The first amendment clarifies that a harvester must obtain department approval to use a volume to weight conversion to determine the amount of kelp that has been harvested. Absent that approval, only direct weighing is acceptable.

The second regulation change provides explicit guidance as to what reporting processes need to be followed by the harvester in order to provide the department with the information it needs to meet its management responsibilities. The changes are clarifying in nature and do not materially alter the reporting requirements.

The third substantive change extends an existing geographic restriction that requires hand harvesting of bull kelp from Point Montera southward to Santa Rosa Creek. Hand harvesting encourages the harvesting of mature bull kelp plants that have released reproductive tissue into the local area. It also protects that resource from the large-scale harvest that could occur if mechanical harvesters were used in large patches of bull kelp. The recommended change also imposes a restriction on all harvesting of bull kelp within the Monterey Bay National Marine Sanctuary from March 1 through July 31 each year (Figure 2-2). The seasonal closure was requested by the Sanctuary. Its inclusion will provide an opportunity to evaluate a seasonal closure during the plant's reproductive peak as a management tool for protecting bull kelp elsewhere in the state. It also recognizes the Sanctuaries mandated requirement to manage kelp resources within their boundaries.

The fourth recommended change expands the list of kelp beds that are closed to harvest. The beds that have been added to the list of beds closed to harvest are those where trend data suggest that the actual size of the surface canopy has been and continues to be very small (< 0.5 square miles). Research reviewed in Chapter 3 suggests that the repeated and frequent harvest of individual kelp plants poses the greatest potential for damage from harvesting. Small beds are, by virtue of limited option, exposed to a greater risk of this type of damage. Closures direct harvest pressure toward beds that are substantially larger and less susceptible to any potential harvest impacts.

The fifth recommended regulatory change seeks to limit conflict between consumptive and nonconsumptive users of the state's kelp resource in the Monterey area. The suggested change closes a portion of bed 220 that is closest to the harbor (Figure 2-3). If implemented, the closure would protect that portion of the bed that is most sensitive to overharvest during the winter. It simultaneously provides an area of canopy that is protected from harvest for non-consumptive uses where it would be most valued.

The sixth recommended change would provide the Commission with the authority to control the harvest of kelp in any bed or portion of a bed when circumstances suggest that the control is warranted. It specifically allows implementation of those controls through the use of emergency regulations, recognizing that in some circumstances formal adoption of regulations will not be warranted or desired. The control measure would limit the amount of kelp that a harvester could remove from a control area for a designated period of time. This provides a management tool that is less prohibitive than the only current option which is to close beds in circumstances where there is a potential for harvesting to destroy or impair a bed.

The final recommended regulation change provides a mechanism whereby interested parties can easily determine which beds are currently available for leasing.

2.2 Project Objectives

The proposed project objectives are as follows:

* Insure that kelp harvesting does not impair the health and diversity of marine ecosystems and marine living resources;
* Where compatible with that objective, endeavor to maintain a sustainable harvest and recognize the importance of aesthetic, educational, scientific, and recreational uses of the state's kelp resources; and
* Insure a supply of kelp for all interested harvesters. At least one-fourth of the total area of the state's kelp beds, as designated by the Department, shall remain unleased and thus open to any licensed harvester.

2.3 Functional Equivalent

CEQA requires all public agencies in the State to evaluate the environmental impacts of projects that they approve or carry out. If there are potentially significant environmental impacts, most agencies satisfy this requirement by preparing an Environmental Impact Report (EIR). If no potentially significant impacts exist, a Negative Declaration (ND) is prepared. However, an alternative to the EIR/ND requirement exists for State agencies with activities that include protection of the environment as part of their regulatory program. Under this alternative, an agency may request certification of its regulatory program from the Secretary for Resources. With certification, an agency may prepare functional equivalent environmental documents in lieu of EIRs or NDs. The regulatory program of the Fish and Game Commission has been certified by the Secretary for Resources. Therefore, the Commission is eligible to submit an environmental document in lieu of an EIR (CEQA Guidelines Section 15252).

The Department and the Commission hold the public trust for managing the State's wildlife populations. That responsibility is fulfilled by a staff of experts including experts in marine resources management and enforcement issues related to the harvesting of kelp resources. The knowledge and training represented by that expertise qualifies them to perform the review and analysis of the proposed project contained in this document.

2.4 Scope and Intended Use of Environmental Document

This environmental document contains a description of the proposed project and its environmental setting, potential effects of the proposed project, and reasonable alternatives to the project. It has been prepared pursuant to the California Environmental Quality Act (CEQA, Public Resources Code Section 21080.5) and the CEQA Guidelines (Title 14, Sections 750 - 781.5, California Code of Regulations). The document fully discloses potential cumulative impacts and provides a discussion of mitigation of adverse environmental effects related to the proposed project and the alternatives. In addition, it considers relevant policies of the Legislature and Commission.

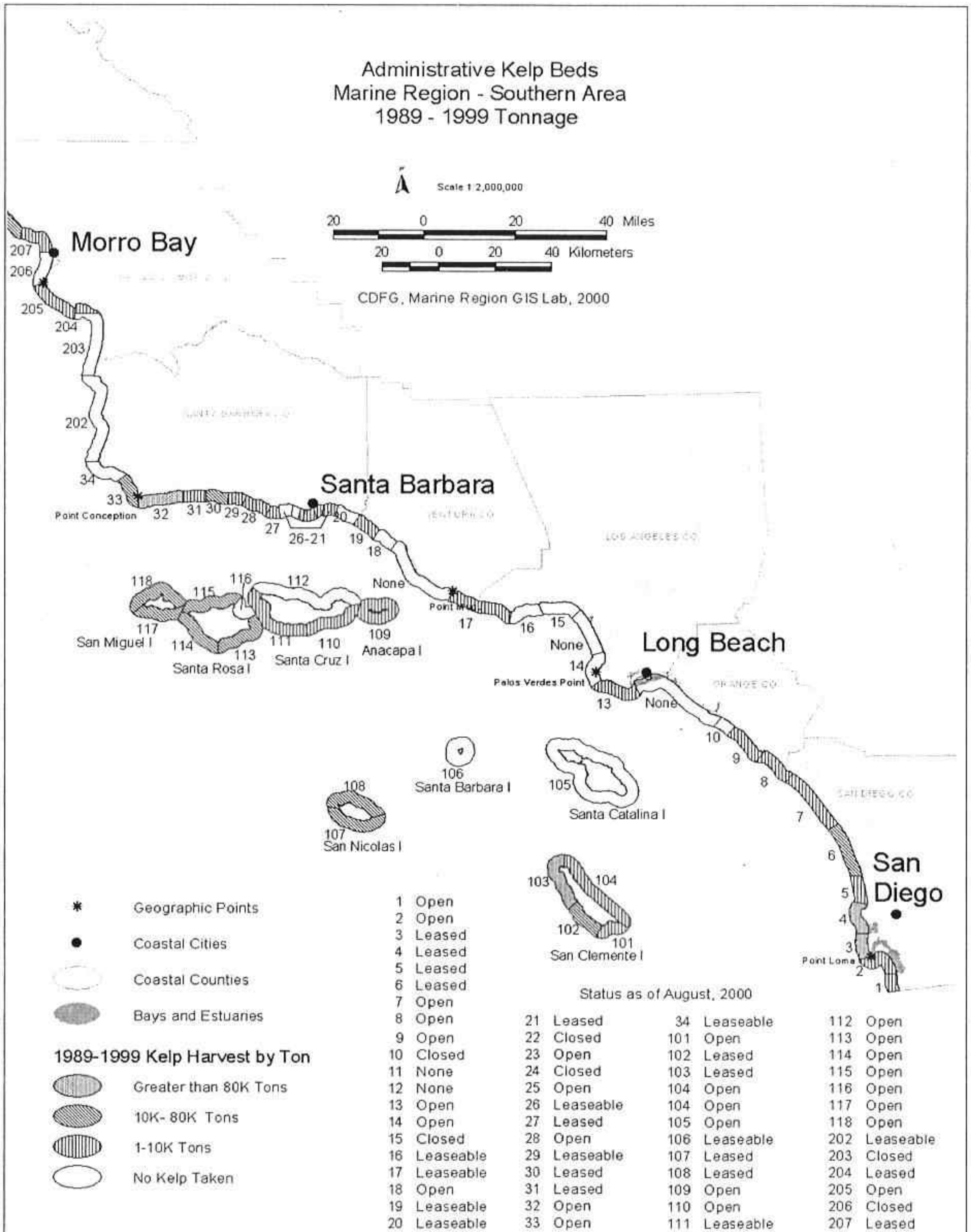


Figure 2-1a. Administrative Kelp Beds, Mexico to Morro Bay

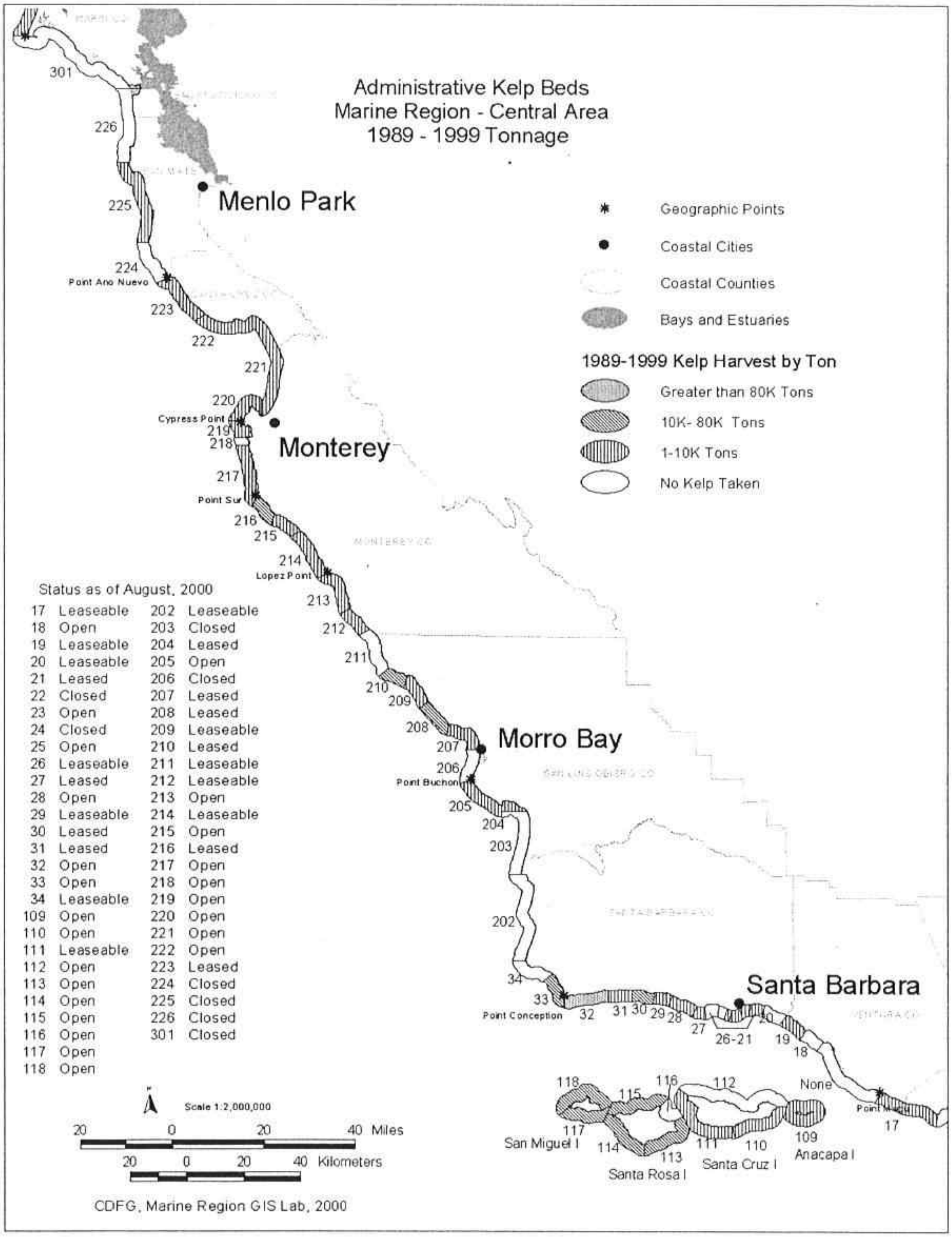


Figure 2-1b. Administrative Kelp Beds, Santa Barbara to Bodega Bay

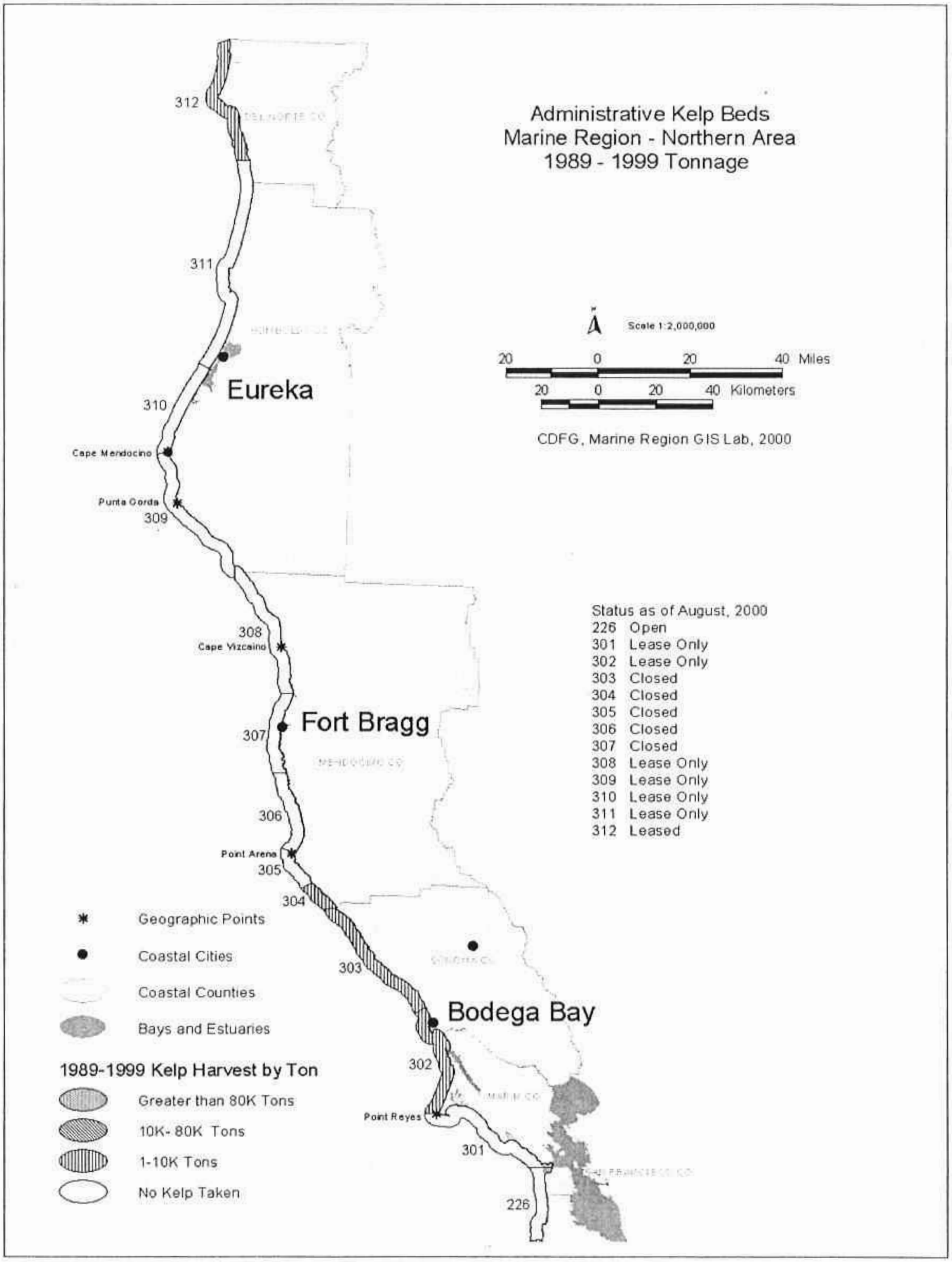


Figure 2-1c. Administrative Kelp Beds, Bodega Bay to Oregon.

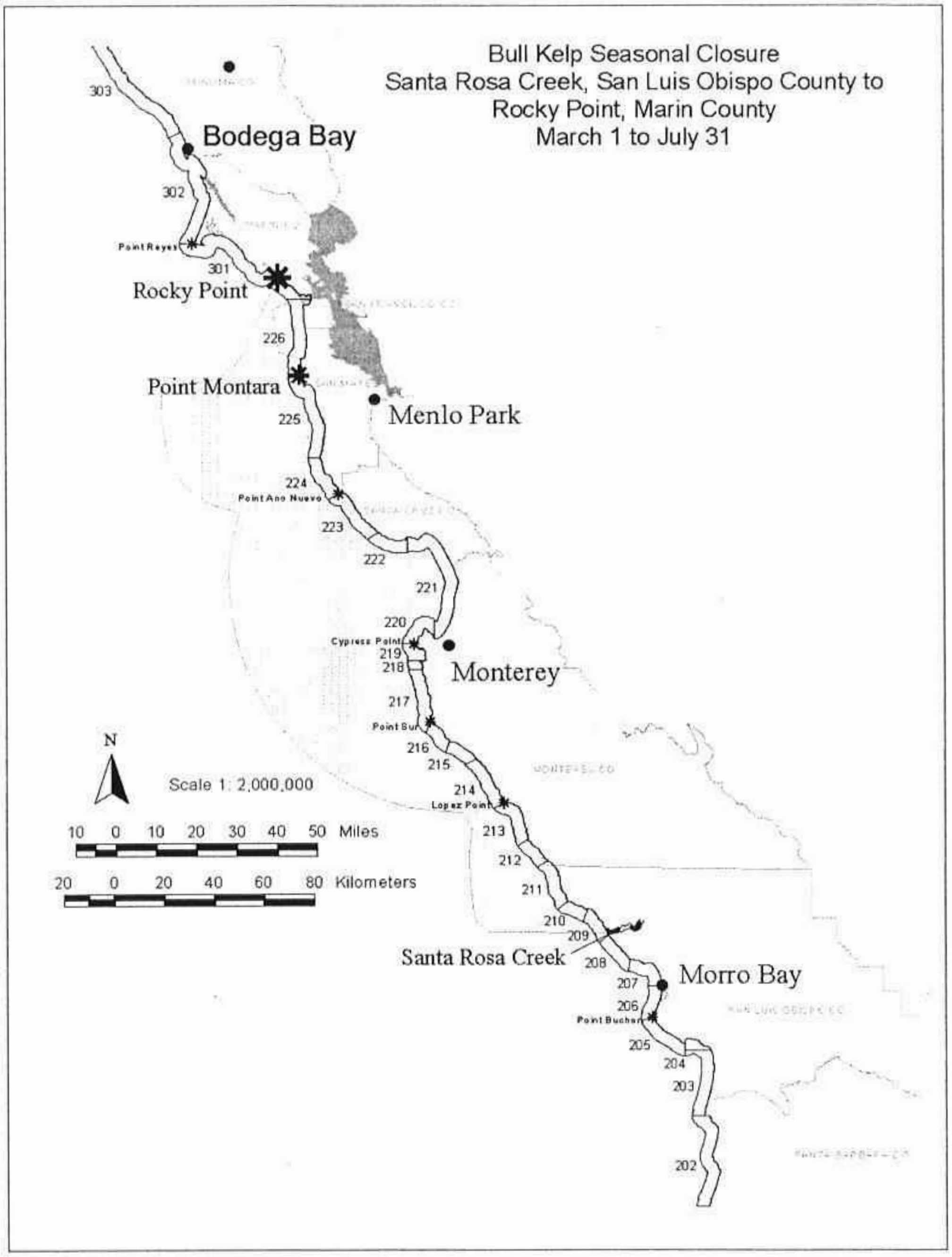
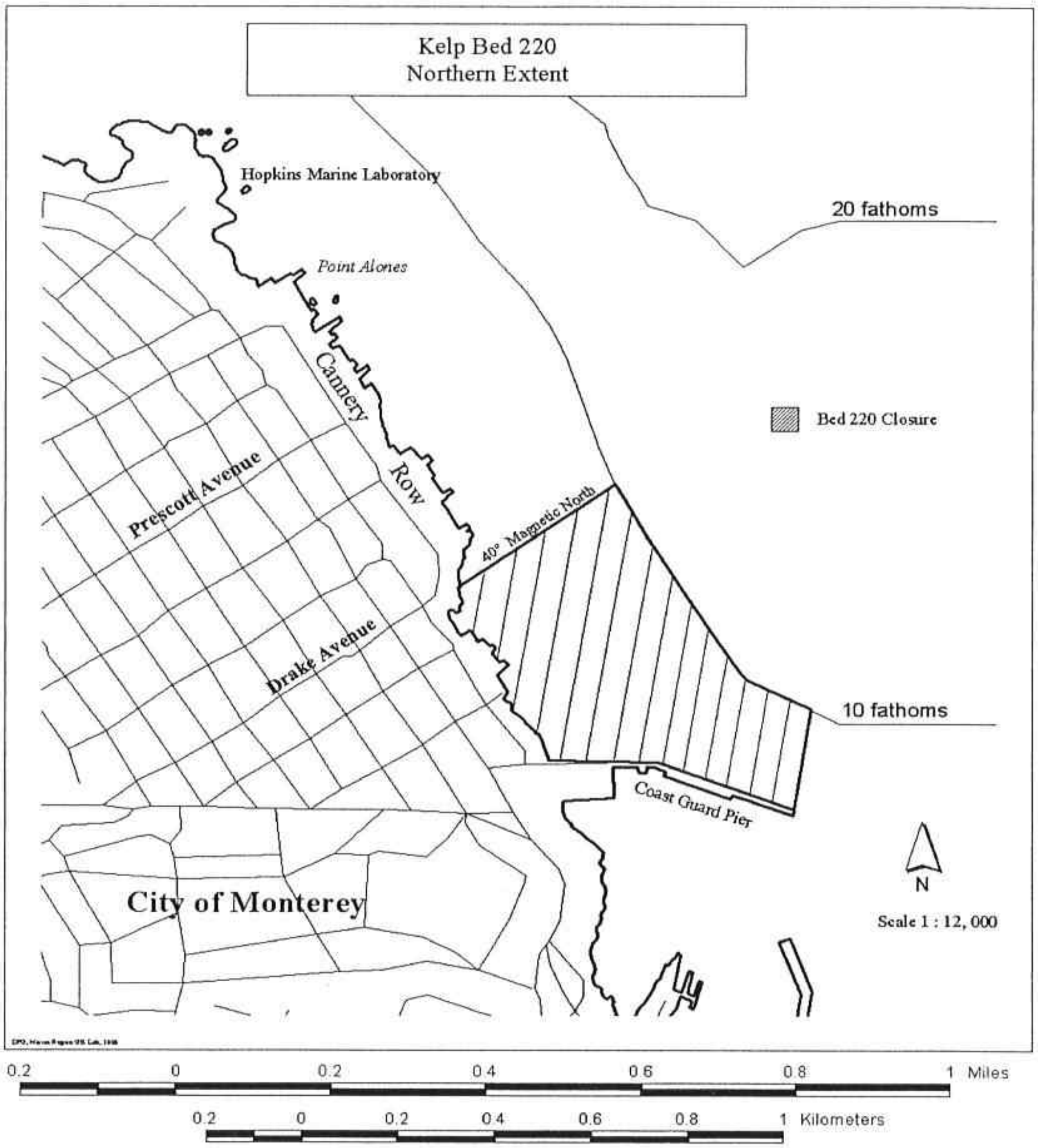


Figure 2-2. Proposed area/time closure in the Monterey Bay National Sanctuary.



2-3. Proposed closure area in Administrative Bed 220.

This environmental document presents information to allow a comparison of the potential effects of reasonable alternatives. All alternatives may not achieve the project's objectives equally well. They are presented to provide the Commission and the public with additional information related to the options available. The alternatives take the form of amendment, or change to an existing body of regulations (Section 165 and 165.5, Title 14, CCR). The no action alternative is also considered as required by CEQA (Section 15126, Public Resources Code).

2.5 Management Techniques

Many tools, some promulgated as regulations, are available for managing and regulating commercial and sport use of the State's aquatic resources. Management techniques available to the Department and the Commission include, but are not limited to, the following methods and restrictions.

2.5.1 Regulatory

2.5.1.1 Closures

The harvest of marine resources may be restricted, if necessary, in a number of ways, including: area of take, time of year, and the take of specific species. Time-area closures are used extensively to control human activity. These closures may be temporary or permanent. They are most applicable to species showing substantial changes in seasonal availability or area availability. Some of the first closed seasons for the taking of fish in California waters were established in 1901, others have been added from time to time since then.

2.5.1.1.1 Temporary Closures

Temporary closures are usually recommended when it is necessary to protect a species from harvest during a limited period of its life cycle. For fish, the time chosen for a closed season often coincides with spawning activities (grunion) or some similar critical life stage when a species is determined to be especially defenseless or vulnerable to capture, i.e., sturgeon-San Francisco Bay. For aquatic plants, such as kelp, temporary closure of kelp beds may be recommended by the Commission if it is found that harvesting activities are causing the destruction or impairment of any kelp bed or beds, or part thereof, or tending to impair or destroy the supply of food for fish. Notices of the closure would then be sent to all licensed harvesters. A kelp bed or beds may be closed to harvest for up to one year.

2.5.1.1.2 Permanent Closures

Generally, commercial and sport fishing regulations adopted by the Commission provide for the coastwide take of marine species. However, permanent closure areas have been established in certain waters of the state for species that have been determined to have limited populations or distribution or when continued fishing pressure could be detrimental to the resource. These areas have been set aside as reserves by both the Commission and the Legislature (section 630, Title 14; sections 1580 to 1584, 10500 to 10514, Fish and Game Code) (Smith and Johnson, 1989). Such reserves are generally established to protect selected forms of marine life, or areas of special biological significance.

The Commission has established two types of reserves: reserves where the taking of all forms of marine life is prohibited and reserves where limited consumptive uses are authorized. Marine reserves established by the Legislature generally allow for the take of specified fish, invertebrates and marine plants; but the Legislature has also established four refuges where only researchers, licensed by specified educational institutions, can remove invertebrates or marine plants. In 1972, legislation known as the "Tidal Invertebrate Act" (Smith and Johnson, 1989) was enacted to extend protection to all marine invertebrates along the entire California coast between the high tide line and 1,000 feet offshore. Marine invertebrates not utilized historically for food may not be taken in that area except under special collecting permits. Those species, however, for which the Commission has established seasons and bag limits to protect their stocks, may be taken within 1,000 feet of the low tide mark.

The net effect of the "Tidal Invertebrate Act" is that we now have only minor differences in the authorized uses of refuges and reserves established by Legislative act and Commission regulations.

The Commission also has the authority to close selected kelp beds to commercial harvest (§ 6653, Fish and Game Code). Under existing regulations (§ 165(c), Title 14) four kelp beds, with 5.29 square miles of canopy, are closed to commercial harvesting.

2.5.1.2 Method of Take

The marine resources of the state are many and varied, as are the methods used to capture them. Consequently, gear restrictions are utilized as valuable management tools in protecting immature fish, preventing overharvest, and to prevent unnecessary destruction of the resources or their habitat. Some types of gear are prohibited because they are so efficient at harvesting a targeted species that their use would place certain species in danger of destruction. A prime example of this occurred during the early years of kelp harvesting. A particularly destructive harvest method entailed encircling a portion of a [kelp] bed with a cable and power pulling the plants into a bundle so that the stems could be cut. Use of this method destroyed many holdfasts (Scofield, 1959).

The Commission has established regulations for the commercial harvest of giant and bull kelp. Both species must be taken by cutting, except that a harvester may pick up drift or loose kelp, and giant kelp cannot be harvested at a depth greater than 4 feet (1.2 meters) below the surface of the water at the time of cutting. However, there are no specific gear restrictions placed on sport harvesters by the Commission. This lack of regulation is probably due to the small bag limit, and quantity of kelp harvested annually by sport harvesters (less than 25 tons per year) (Crooke, personal communication).

2.5.1.3 Harvest Limits

The establishment of harvest limits generally reflect the considered opinions of resource managers as to the amount or number of individuals of a given species or aggregate of species that can be taken daily, monthly, or annually, without placing the population in danger of over exploitation.

2.5.1.3.1 Commercial Harvest

The Commission has provided regulations to ensure the continued existence of the kelp resources in the state and to prevent wastage of kelp harvested. No more than 50 percent of the total kelp bed resources within the state may be leased. Additionally, commercial harvesters cannot exclusively lease more than 25 square miles (65 square kilometers) or 50 percent of the total area of the kelp resource (whichever is greater), as shown on the maps of the resource prepared by the Commission. Exclusive leases may be held for up to 20 years but come up for renewal prior to the end of the lease as negotiated by the lessee and the Commission. Further, the Commission can negotiate harvest limits as part of a harvester's lease agreement. For example, the Commission might stipulate, as terms of a lease agreement, that only half of any kelp bed or beds leased by a licensed harvester may be taken during a given period.

While there is no limit to the quantity of giant kelp canopy (only the upper 4 feet of giant kelp plants may be harvested) that can be taken by any one harvester, the Commission does limit the take of bull kelp north of Point Arguello, to protect this species at a time when biological knowledge and the effects of harvesting are being evaluated.

2.5.1.3.2 Sport Harvest

While numerical bag limits can be employed as a tool to control the take of many species of fish and shellfish, the harvest of kelp and other aquatic plants, because of their morphology, can best be controlled by use of weight limits.

A number of marine plant species, including kelp, are harvested for bait and for human food. In order to provide for a satisfying daily sport harvest, a limit of 10 pounds wet weight in the aggregate of marine aquatic plants was established by the Commission.

An exception to the 10 pound weight limit is made during the herring roe–on–kelp season. Pacific herring are school spawners that produce adhesive eggs that stick to the substrate or marine vegetation when released. Herring spawn deposited on various species of edible marine algae is called *kazunoko kombu*, a product highly esteemed by Asian fishermen. To allow for a harvest of this commercially valuable product without endangering the herring resoûrce and to prevent waste, a limit of 25 pounds of herring eggs on seaweed was authorized. A limit of 25 pounds in the aggregate was considered a satisfying day's sport.

2.5.2 Nonregulatory

In addition to regulatory programs used to manage the state's marine resources, there are a number of nonregulatory programs employed by the Department as well. These programs (artificial reefs, kelp restoration, artificial spawning and release of marine fish (Ocean Resources Enhancement Hatchery Program)) have been developed to increase marine fish, invertebrate and aquatic plant populations that have become depressed by natural (El Niño events, storms, disease) and human–induced (pollution, fishing pressure) causes.

Kelp restoration will be discussed in more detail in Chapter 3, Environmental Setting.

2.6 Authorities and Responsibilities

The Legislature formulates the laws and policies regulating the management of fish and wildlife in California. The State's policy with respect to aquatic resources is to encourage the conservation, maintenance and utilization of the living resources of the ocean and other waters under the jurisdiction and influence of the state for the benefit of all the citizens of the state. It is also the State's policy to promote the development of local fisheries and distant-water fisheries based in California in harmony with international law respecting fishing and the conservation of the living resources of the oceans and other waters under the jurisdiction and influence of the state (Section 1700, Fish and Game Code). This policy includes the following objectives:

- The maintenance of sufficient populations of all species of aquatic organisms to insure their continued existence;
- The recognition of the importance of the aesthetic, educational, scientific, and nonextractive recreational uses of the living resources of the California Current;
- The maintenance of a sufficient resource to support a reasonable sport use, where a species is the object of sport fishing, taking into consideration the necessity of regulating individual sport fishery bag limits to the quantity that is sufficient to provide a satisfying sport;
- The growth of local commercial fisheries, consistent with

aesthetic, educational, scientific, and recreational uses of such living resources, the utilization of unused resources, taking into consideration the necessity of regulating the catch within the limits of maximum sustainable yields, and the development of distant-water and overseas fishery enterprises;

- The management, on a basis of adequate scientific information promptly promulgated for public scrutiny, of the fisheries under the state's jurisdiction, and the participation in the management of other fisheries in which California fishers are engaged, with the objective of maximizing the sustained yield; and
- The development of commercial aquaculture.

A specific policy relating to the management of marine resources is contained in Fish and Game Code Sections 7050 through 7056 as follows:

- The Legislature finds and declares that the Pacific Ocean and its rich marine living resources are of great environmental, economic, aesthetic, recreational, educational, scientific, nutritional, social, and historic importance to the people of California.
  It is the policy of the state to ensure the conservation, sustainable use, and, where feasible, restoration of California' s marine living resources for the benefit of all the citizens of the state. The objective of this policy shall be to accomplish all of the following:
  (1) Conserve the health and diversity of marine ecosystems and marine living resources.
  (2) Allow and encourage only those activities and uses of marine living resources that are sustainable.
  (3) Recognize the importance of the aesthetic, educational, scientific, and recreational uses that do not involve the taking of California's marine living resources.
  (4) Recognize the importance to the economy and the culture of California of sustainable sport and commercial fisheries and the development of commercial aquaculture consistent with the marine living resource conservation policies of this part.
  (5) Support and promote scientific research on marine ecosystems and their components to develop better information on which to base marine living resource management decisions.
  (6) Manage marine living resources on the basis of the best available scientific information and other relevant information that the commission or department possesses or receives.
  (7) Involve all interested parties, including, but not limited to, individuals from the sport and commercial fishing industries, aquaculture industries, coastal and ocean tourism and recreation industries, marine conservation organizations,

local governments, marine scientists, and the public in marine living resource management decisions.
(8) Promote the dissemination of accurate information concerning the condition of, or management of, marine resources and fisheries by seeking out the best available information and making it available to the public through the marine resources management process.
(9) Coordinate and cooperate with adjacent states, as well as with Mexico and Canada, and encourage regional approaches to management of activities and uses that affect marine living resources. Particular attention shall be paid to coordinated approaches to the management of shared fisheries.

- The Legislature finds and declares that it is the policy of the state that:
(a) California's marine sport and commercial fisheries, and the resources upon which they depend, are important to the people of the state and, to the extent practicable, shall be managed in accordance with the policies and other requirements of this part in order to assure the long-term economic, recreational, ecological, cultural, and social benefits of those fisheries and the marine habitats on which they depend.
(b) Programs for the conservation and management of the marine fishery resources of California shall be established and administered to prevent overfishing, to rebuild depressed stocks, to ensure conservation, to facilitate long-term protection and, where feasible, restoration of marine fishery habitats, and to achieve the sustainable use of the state's fishery resources.
(c) Where a species is the object of sportfishing, a sufficient resource shall be maintained to support a reasonable sport use, taking into consideration the necessity of regulating individual sport fishery bag limits to the quantity that is sufficient to provide a satisfying sport.
(d) The growth of commercial fisheries, including distant-water fisheries, shall be encouraged.

- In order to achieve the primary fishery management goal of sustainability, every sport and commercial marine fishery under the jurisdiction of the state shall be managed under a system whose objectives include all of the following:
(a) The fishery is conducted sustainably so that long-term health of the resource is not sacrificed in favor of short-term benefits. In the case of a fishery managed on the basis of maximum sustainable yield, management shall have optimum yield as its objective.
(b) The health of marine fishery habitat is maintained and, to the extent feasible, habitat is restored, and where appropriate, habitat is enhanced.
(c) Depressed fisheries are rebuilt to the highest sustainable yields consistent with environmental and habitat conditions.
(d) The fishery limits bycatch to acceptable types and amounts, as determined for each fishery.
(e) The fishery management system allows fishery participants to propose methods to prevent or reduce excess effort in marine fisheries.

(f) Management of a species that is the target of both sport and commercial fisheries or of a fishery that employs different gears is closely coordinated.
(g) Fishery management decisions are adaptive and are based on the best available scientific information and other relevant information that the commission or department possesses or receives, and the commission and department have available to them essential fishery information on which to base their decisions.
(h) The management decision making process is open and seeks the advice and assistance of interested parties so as to consider relevant information, including local knowledge.
(i) The fishery management system observes the long-term interests of people dependent on fishing for food, livelihood, or recreation.
(j) The adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies are minimized.
(k) Collaborative and cooperative approaches to management, involving fishery participants, marine scientists, and other interested parties are strongly encouraged, and appropriate mechanisms are in place to resolve disputes such as access, allocation, and gear conflicts.
(l) The management system is proactive and responds quickly to changing environmental conditions and market or other socioeconomic factors and to the concerns of fishery participants.
(m) The management system is periodically reviewed for effectiveness in achieving sustainability goals and for fairness and reasonableness in its interaction with people affected by management.

In addition to this policy, the Legislature has provided further direction for the management of kelp resources in Chapter six (§6650 through §6751) of the Fish and Game Code (Appendix 1). The Legislature has delegated authority to the Commission to establish regulations to ensure the proper harvesting of kelp and other aquatic plants through §6653 of the Fish and Game Code. In addition, the Commission has the authority to regulate the taking, collecting, harvesting, gathering, or possession of kelp for purposes other than profit (§6750, Fish and Game Code; Appendix 1).

2.7 Location and General Characteristics of the Project Area

The commercial harvest of kelp is proposed statewide, in all areas defined as ocean waters (Sec. 27.00, Title 14, CCR) except where prohibited or restricted, as specified, in state parks, state beaches, state recreation areas, state underwater parks, state refuges and reserves, national parks, national monuments or national seashores.

The shoreline of California is one of the longest in the nation. There are approximately 1,072 miles of wave-washed shoreline along the mainland coast, and 300 miles around the offshore islands. The mainland shore is comprised of about 354 miles of rocky headlands and cliffs; 602 miles of sandy beaches; and 110 miles of rocky beach. The only enclosed bays of significance (in the state) are: Humboldt (17,000 surface acres); Tomales (7,760 surface acres); San Francisco (320,000 surface acres); Morro Bay (2,101 surface acres) and San Diego (11,500 surface acres).

The marine environment is composed of numerous micro-habitats, each of which supports a distinct assemblage of species uniquely adapted to their environment. Information about the specific habitat preferences and life history aspects of giant and bull kelp is provided in Chapter 3, Environmental and Biological Setting.

Chapter 3. Environmental Settings

3.1 General Description of the Marine Environment

3.1.1 Weather, Oceanography, and Geology

Weather conditions along the coast of California are influenced by oceanographic conditions of the eastern Pacific Ocean boundary current region. Ocean currents can be thought of as a simple combination of the geostrophic current field and the field of Ekman drift (Bakun and Parrish 1980). Large water masses, principally wind-driven, rotate in a general clockwise direction in the North Pacific due to the Coriolis effect, which results from the earth's rotation. The dominant oceanographic feature of the eastern Pacific boundary is the California current, a broad, slow-moving current that originates about 500 km off the Oregon, Washington and southern British Columbia coasts between 45° and 50° N latitude (Hickey 1979, Williams et al. 1980). Driven primarily by wind stress patterns over the North Pacific, it flows southward in a band 500-1,000 km wide and 100-500 m deep at a mean speed of 10-30 cm/sec (Hickey 1979, Williams et al. 1980). Water in the California Current is characterized by low temperatures and low salinity; near the coast and north of Cape Mendocino it originates primarily from the west wind drift and is primarily subarctic in type (Hickey 1979, Williams et al. 1980). The percentage of subtropical water increases towards the south and west (Hickey 1979). The California Current is characterized by large flow variability, and the mean southward flow is only in a large-scale sense (Bernstein et al. 1977, Owen 1980, Parrish et al. 1981).

In contrast to the cold current moving southward along the coast, there is an intermittent northerly moving inshore counter-current, called the Davidson Current consisting of semitropical warm waters moving in a general northwesterly direction. The colder current is predominant along the California coast, especially north of Point Conception, because prevailing winds and currents in that area come from the north and northwest. During fall and winter months, however, these winds weaken and the warm Davidson Current becomes more predominant (Department of Navigation and Ocean Development, 1971).

Inshore of the dominant currents, a general upwelling or rising of subsurface waters occurs seasonally around islands and headlands along the coast. Upwelling along the west coast results from the interaction of the California Current and the winds generated by the North Pacific High (Hickey 1979). Due to the Coriolis effect, these northwesterly along-shore winds entrain surface waters to the west, or away from the coast, a process known as Ekman transport (Thurman 1975, Beer 1983). The transported water is replaced by cold, nutrient-rich, subsurface water. Water is upwelled from depths greater than 60 m south of Cape Mendocino (Huyer 1983). The region of maximum southward wind stress shifts northward from around 25° N in January to about 39° N in July; the strongest winds are observed in July off northern California, where the offshore pressure gradient is steepest. South of San Francisco, upwelling may occur year-round, with a peak in April (Huyer 1983). The offshore extent of the primary upwelling zone appears to be 10-20 km along the entire coast (Parrish et al. 1981, Huyer 1983).

Upwelling is extremely important for the productivity of our coastal waters because the rising water brings nutrient salts into the lighted layers, which results in the proliferation of phytoplankton, the basis of the marine food chain. The two most conspicuous centers of upwelling along the California coast occur at Point Conception (35°N) and Cape Mendocino (41°N) (Sverdrup, Johnson & Fleming, 1942; Jones and Stokes Associates, Inc., 1981).

The coastal climate is primarily controlled by moisture-laden, prevailing northwesterly winds sweeping on shore from the semipermanent Pacific Anticyclone, a high pressure area known as the North Pacific High. The winds resulting from the pressure gradient between the North Pacific High and a low pressure area over the desert Southwest begin in April and continue until the fall. At this time the North Pacific High moves southward reaching about 28° N latitude in February (Huyer 1983). The air temperature variations between day and night are normally small, summers are cool, winters are moderately warm, and there is considerable fog. From south to north, air temperature variations increase and there is a greater contrast between summer and winter. Fog is more frequent and lasts longer in the north (De Santis, 1985).

Rainfall patterns vary with latitude and altitude all along the California coast, with mountainous areas receiving much more rain than lower altitudes. Northcoast areas average about 30-40 inches per year. In contrast, the annual rainfall along the southern California coast averages about 12 inches per year. San Francisco, located approximately in the middle of these extremes, receives about 18 inches of rain a year. The rainy season normally begins by late September, with the greatest precipitation occurring in December and January. The dry season starts about June. Snowfall is uncommon along the coast, except in the northern counties, where it does occur occasionally (Department of Parks and Recreation, 1970).

Ocean surface water temperatures and salinities also vary from an average of 54.5° F and 32.5°/oo salinity in the north, to an average of 67° F and 33.45°/oo salinity in the south. California has, in fact, two very distinct oceans. Point Conception, situated approximately two-thirds of the way down the California coast, marks an abrupt change in the character of our ocean waters. North of Point Conception, the waters are uniformly 10°F colder, and have 1°/oo lower salinity, than the waters south of the Point. North of the Point, the northwesterly winds are much stronger, which tend to make the ocean waters more turbulent (Sverdrup, Johnson & Fleming, 1942; Bureau of Land Management, 1974).

Point Conception is, in addition to being an oceanographic boundary, a biological boundary as well. Southwesterly from Point Conception, a large eddy is formed where the Davidson Current, deflected westward by the Point, is turned southward by the California Current. The abrupt temperature and salinity change at the north edge of the eddy acts as an effective barrier to the mixing of fish and shellfish species acclimated to environmental conditions found to the north and south.

Much of the California coastline is mountainous and characterized by a mix of rocky headlands, cliffs, and beaches, with few major estuaries and embayments. From Crescent City, south to the Los Angeles Basin, only a few alluvial plains are found at the mouths of broad valleys. The shoreline is relatively straight, lacking in barrier beaches and lagoons for protection (Department of Parks and Recreation, 1970; United States Army Corps of Engineers, 1971; National Marine Fisheries Service, 1990).

The morphology of the coastal region and the nearshore subtidal region of California has been shaped essentially by three processes: 1) the convergence of tectonic plates, 2) seismic activity along the San Andreas Fault zone, and 3) sea level fluctuations. California straddles the Pacific and North American plates in such a way that San Francisco is on the North American plate while Los Angeles is on the Pacific plate. The two plates are separated by the San Andreas Fault, which is a relatively straight, northwest–tending fault that extends 992 miles from the Salton Sea through the Coast Ranges to the Mendocino Escarpment (Jones and Stokes Associates, Inc, 1981b; Anderson et al., 1990). Both plates generally move the opposite directions with the American plate moving in a southeast direction while the Pacific plate tends to move northwest. When these plates collided, the North American plate was lifted up and over the other plate producing the Coastal and Transverse mountain ranges.

Anderson et al. (1990) attributed the current geomorphology of the north coast (southern Oregon to Cape Mendocino) to tectonic convergence. This area has undergone significant uplifting as a result of the collision of three plates: the Gorda, Pacific, and the North American plates. While the geomorphology of the central coast (Cape Mendocino to Morro Bay) is attributed to the right–lateral, strike–slip motion of the San Andreas fault more than to the convergence of the two plates. The faulting action has created folded, sheared, and metamorphosed jumble blocks with a north–south orientation (Anderson et al., 1990).

Coincidental to the geologic processes were sea level fluctuations. The fluctuations, which were caused by changes in the worldwide climatic conditions, lead to periods of shoreline advance and retreat (Jones and Stokes Associate, Inc, 1981b). During glacial periods, the shoreline retreated as far as the edge of the present day continental shelf. During interglacial times, the shoreline advanced to near modern levels. Each of these oscillations in sea level lead to varying degrees of erosion of the shelf and coastal mountains. Evidence of this can be found in the presence of broad, gently sloping, wave–cut terraces on land (Anderson et al., 1990). These terraces have been lifted to their present day levels through a combination of seismic activity and the retreat of glaciers. The weight of the ice masses pushed the underlying land down much like the effect of putting weight on a dock does. Much of the land surface of the Oceanside–San Diego area represents a series of marine terraces that were cut into the coastal plain that parallels the Peninsular ranges (Hertlein and Grant, 1954).

The ocean bottom seaward of the California coastline is called the Continental Shelf. This shelf, part of the continent that is presently submerged beneath the ocean waters, is an area where a considerable portion of our marine resources occur. The Continental Shelf off California varies considerably in width. The ocean bottom drops seaward at a moderate gradient to the point where it reaches the Continental slope, and then descends to the floor of the offshore ocean basins. The edge of the shelf normally occurs at a depth of approximately 600 feet. The continental slope starts where the shallow bottom gradient of the shelf increases rapidly from a gradual drop of about three feet in 3,000 feet to a rate of three feet in 300 feet (Ingmanson and Wallace, 1973).

The Continental Shelf, from the Oregon border to Cape Mendocino, is relatively broad (20 to 30 miles) and un-dissected. The coastal shelf from Cape Mendocino to Point Conception, however, is much narrower (3 to 18 miles) and is bisected by numerous submarine canyons, including the Monterey Submarine Canyon. The Monterey Canyon, one of the largest in the world, originates one-half mile offshore from Moss Landing at a depth of 300 feet, and extends into the center of Monterey Bay. A southerly branch, the Carmel Canyon, originates one-quarter mile from the mouth of San Jose Creek. It extends offshore westerly and northerly for approximately 15 miles where it joins the Monterey Canyon at a depth of approximately 3,000 feet and about six miles offshore (State Water Resources Control Board, 1979; National Oceanic and Atmospheric Administration, 1980; NOAA, 1990a).

South of Point Conception, the shelf is characterized by a series of ridges capped by islands and deep basins. Here, the width of the shelf varies from less than two to more than 14 miles. This shelf area is also bisected by a deep submarine canyon known as the Scripps-La Jolla Canyon. This canyon complex is located just north of San Diego. The head of the northern Scripps Canyon branch extends almost to the surf zone, one-half mile offshore, and extends steeply to a depth of 800 feet, approximately two miles offshore, where it is joined by the southern tributary canyon.

The southern tributary, La Jolla Canyon, heads approximately two miles offshore at a depth of approximately 50 feet and joins the Scripps Canyon one and one-half miles to the northwest. The Canyon from the point of merger meanders across the

Continental Shelf for approximately nine miles westward, where it turns south to empty into the San Diego trough at a depth of approximately 2,600 feet (Sverdrup, Johnson & Fleming, 1942, Bureau of Land Management, 1974).

3.1.2 Habitat

In the preceding section, the variations in meteorological, oceanographic and geological conditions found along the California coast, from north to south, were discussed. Consequently, these different elements in combination create a variety of distinct habitat types.

The more than 550 species of marine fishes, coupled with the multiplicity of invertebrate species and marine plants that are found along our shores, give ample evidence that a great variety of marine habitat is available. Even though a wide variety of habitats exists, each species is adapted to a narrow range of conditions. As an example, the sandy bottom habitat chosen by a California halibut would certainly not be to the liking of a rockpool blenny who prefers rocky intertidal areas. Therefore, marine habitat types are broken down into categories having similar features such as water depth, distance from shore, and type of substrate. These are: pelagic; benthic (muddy, sandy and rocky bottom); kelp beds; nearshore; intertidal; bays and estuaries; islands; natural and artificial reefs (Fitch, 1963; Eschmeyer et al., 1983; Department of Fish and Game, 1987).

3.2 Life History

Giant and bull kelp are members of the large brown algae (Phaeophyta) that are a conspicuous part of the marine environment. These two species, while being members of the same family, have developed different strategies for survival in the marine environment. The most notable is that giant kelp (*Macrocystis pyrifera*) is a perennial (has a life span of more than 2 years) while bull kelp (*Nereocystis luetkeana*) is a annual species.

3.2.1 Taxonomy and Morphology

Giant Kelp

Scientific name........*Macrocystis pyrifera* (Linnaeus) Agardh
Class.......................Heterogeneratae
Order.......................Laminariales
Family.....................Lessoniaceae

The genus *Macrocystis* was first described by C A. Agardh in 1820. There are presently two species of *Macrocystis* recognized living in California: *M. integrifolia*, a shallow subtidal to intertidal species that produces flattened holdfasts and occurs from central California, near San Simeon northward; and *M. pyrifera*, a subtidal species that attaches to solid or soft substrate, produces holdfasts that are either conical or low mounds, and occurs throughout southern and central California.

Neushul (1971a) recognized a third species of *Macrocystis*, *M. angustifolia* growing on unconsolidated bottom (soft sediment) near Santa Barbara. Later authors, however, have not recognized *M. angustifolia* as a valid species, but rather a morphological variation of *M. pyrifera* (Nicholson et al., 1976; Brostoff, 1988). This morph produces holdfasts that are low mounds measuring up to 10 or l5 feet across. Brostoff (1988) used transplant experiments and detailed morphological comparisons to conclude that the Santa Barbara *M. angustifolia* of Neushul was a variation of *M. pyrifera*. For the purpose of this report we consider all *Macrocystis* harvested commercially in California *M. pyrifera*. We will, however, describe the unique habitat where giant kelp grows on soft sediment near Santa Barbara.

Each mature *M. pyrifera* plant consists of a holdfast, a cluster of reproductive blades called sporophylls, and anywhere from a few to several hundred fronds (Figure 3–1). The holdfast is cone-shaped or a mound and is the attachment organ. It is composed of a tangle of rootlike haptera that grow down from the primary stipe and attach to the substrate. The haptera branch frequently to create a dichotomous pattern. The lifespan of a hapteron is probably only a few months, and therefore, continual production and growth by new haptera is necessary to maintain the holdfast with firm attachment to the underlying substrate. When the plant is young, the entire holdfast consists of living haptera. New haptera overgrow the old haptera as the holdfast enlarges with age. Holdfasts that are several years old consist of an inner core of dead haptera covered by living haptera. Only the living haptera attach the plant to the substrate (North, 1971a).

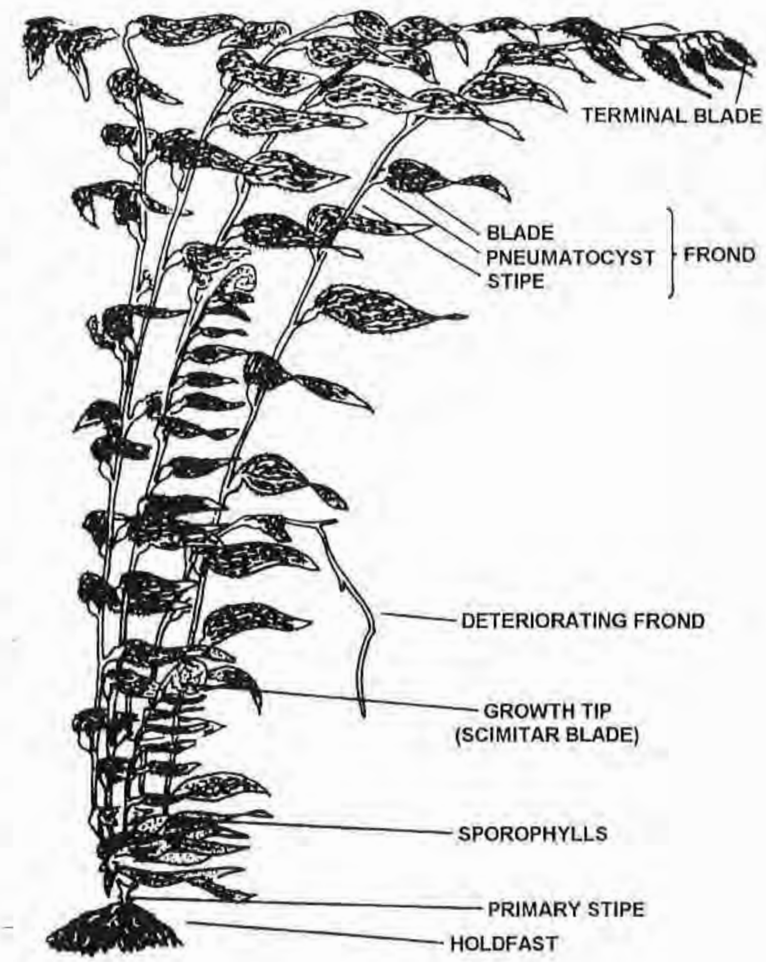


Figure 3-1. Giant kelp morphology.

Large amounts of foliage normally occurs at the holdfast apex. Reproductive blades (sporophylls), basal meristems and frond initials are usually the most numerous blade types within this basal foliage. All blades are attached to a complex branching system of stem–like stipes that also emerge from the holdfast near the apex.

Bundles of fronds extend up vertically from the basal foliage through the water column. Individual fronds consist of a stem–like stipe and numerous attached leaf–like blades. A single bladder, at the base of each blade, attaches to the stipe. The distance between each bladder (internodal distance) decreases from the base upwards. There may be as many as 200 blades on growing fronds. Young fronds have a special scimitar–shaped blade (apical blade) at the distal end. This special blade is also referred to as the apical meristem (see page 3-9 for information on the role that the apical meristem plays in plant growth). All *Macrocystis* fronds originate from the basal foliage just above the holdfast.

Bull Kelp

Scientific name........*Nereocystis luetkeana* (Mertens) Postels & Ruprecht
Class........................Heterogeneratae
Order........................Laminariales
Family......................Lessoniaceae

The morphology of bull kelp is quite different from that of giant kelp (Figure 3–2). While bull kelp is attached to the substrate by a holdfast, the size of the holdfast is much smaller than that of giant kelp. The holdfast resembles a small disk with haptera emanating as a whorl from the junction between the lower stipe and holdfast. Adult bull kelp plants produce holdfasts that are over 1 foot in diameter (MacMillan, 1899; Abbott and Hollenberg, 1976).

Sporophytes of bull kelp possess a single stipe and pneumatocyst throughout their life span. Much like giant kelp, the stipe of a bull kelp sporophyte is long, reaching length of up to 130 ft, and slender (1/3 inch in diameter). However, the bull kelp stipe does not have the same tensile strength (2.9 MN m^{-2} per stipe) as giant kelp but is more elastic under stress. Bull kelp is able to stretch more than 38 percent of its length before reaching its breaking point (Koehl and Wainwright, 1977). The pneumatocyst gives rise to short dichotomous branches from which between 30 to 64 blades are borne. Since blades occur only on the terminal end of the stipe, the bull kelp canopy provides most of the photosynthetic and nutrient absorbing surface for energy production (Manley, 1985; Nicholson, 1970; Nicholson, 1968). Blade lengths of more than 13 ft have been reported for mature plants but it is typical to find a range of blade sizes (2 to 11 ft) on most plants (Foreman, 1970). The reproductive structures (sori) are located on the blades with mature sori located near the blade tips and immature regions near the base of the blades.

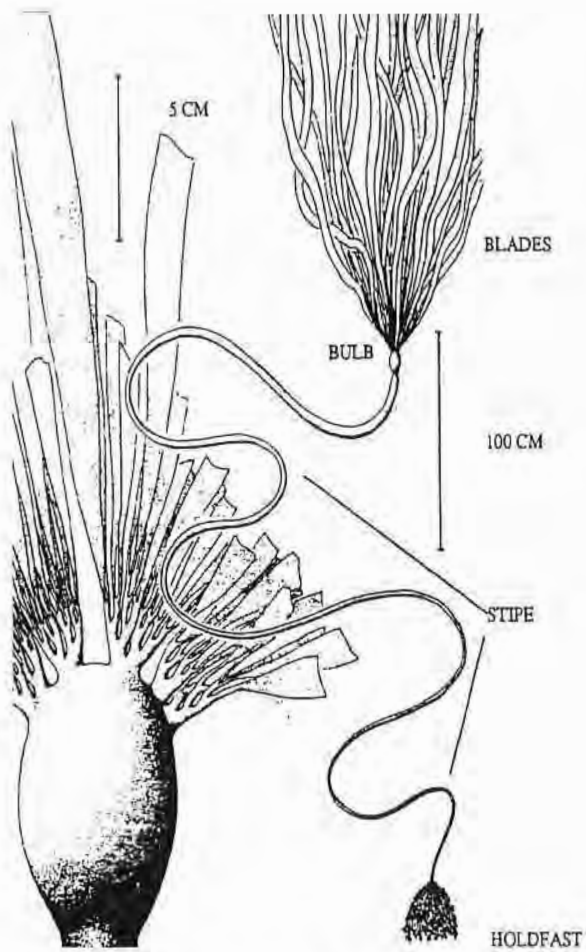


Figure 3-2. Bull kelp morphology. (Source - Abbott and Hollenberg, 1976)

3.2.2 Distribution

Giant Kelp

The genus *Macrocystis* occurs in many parts of the world, but is most widely distributed in the southern hemisphere. In the northern hemisphere, *M. pyrifera* commonly occurs from Baja California Sur, Mexico to Santa Cruz, in central California (Druehl, 1970). A few scattered small patches of *M. pyrifera* occur along the California coast, north of San Francisco (Kalvass, pers. comm.)

Occurrences of *M. pyrifera* in California are frequently controlled by wave exposure and the availability of rocky substrate. Populations of giant kelp frequently form distinct patches that are referred to as kelp beds. Except for the specialized populations of *M. pyrifera* growing on sand near Santa Barbara, holdfasts require solid substrate for secure attachment (North, 1971b). This is especially true along wave-exposed coastlines (Harrold et al., 1988).

The unique kelp beds near Santa Barbara that develop on sand are located in well-protected waters. The large holdfasts of these plants are able to penetrate into the soft bottom for secure anchorage.

The vertical distribution of *Macrocystis* is usually determined by local biotic and abiotic factors. Giant kelp can occur intertidally in protected areas (North, 1971b). However, recruitment of *Macrocystis* to shallow areas may be limited by high light irradiance (Photosynthetically active radiation (PAR)) which has a negative affect on postsettlement stages (Graham, 1996). The inner boundary of *Macrocystis* beds may be determined by where the largest waves normally break and or disturbance-mediated competition for space with algal turf communities (Seymour et al., 1989; Graham, 1997). The outer limit of kelp beds is probably determined by water clarity, since gametophytes and tiny sporophytes require adequate bottom illumination for development (Dean and Deysher, 1983). The offshore edge of *Macrocystis* beds in turbid waters usually occurs at depths of 50 to 60 ft, while in clear water around the channel islands of southern California, the offshore edge of the kelp bed may extend to more than 100 ft (North, 1971b).

Bull Kelp

Bull kelp is primarily found adjacent to exposed and semi–exposed shorelines along the Pacific coast of North America, ranging from Unalaska Island, Alaska to San Luis Obispo County, California (Hawkes et al., 1978; Scagel et al., 1987). Miller and Estes (1989) found a large, mature population of *Nereocystis* at the southwest end of Umnak Island, Alaska. The discovery of this bed expands the range of this species approximately 186 miles west of Unalaska Island, Alaska.

Along the central California coast, *Macrocystis* and *Nereocystis* occur together, forming extensive kelp forests in this region. However, from Carmel, California northward to Alaska, *Nereocystis* becomes the dominant surface–canopy species in coastal waters (Abbott and Hollenberg, 1976; Foreman, 1984).

Within the nearshore environment, bull kelp, like giant kelp, is associated with hard substrates such as moderate relief bedrock, nearshore reefs, pinnacles, and boulder/cobble fields (MacMillan, 1899; Hurd, 1916; McLean, 1962; Foreman, 1970). Foreman (1970) noted that bull kelp sporophytes also attached to the stipes of the brown algae *Pterygophora californica*. Bull kelp occurs subtidally at depth of approximately 13 ft to 72 ft (McLean, 1962; Nicholson, 1970; Vadas, 1972).

Distribution of marine algae is not only restricted geographically but also limited by a number of abiotic factors within the nearshore environment (Foreman, 1970; Vadas, 1972, Foster and Schiel, 1985). These factors include water movement, light, temperature, nutrients, pollution, competition, and predation (Foster and Schiel, 1985).

Foreman (1970) reported that bull kelp distribution is limited by the combination of bottom type and wave exposure. Young sporophytes which settle on smooth substrate or small–size cobble beds within areas of violent wave action are swept away before the holdfasts become well developed. However, those plants that settle among boulders, or in areas of moderate relief are protected from wave energy and survive.

3.2.3 Life Cycle

3.2.3.1 Reproduction and Development

Giant Kelp

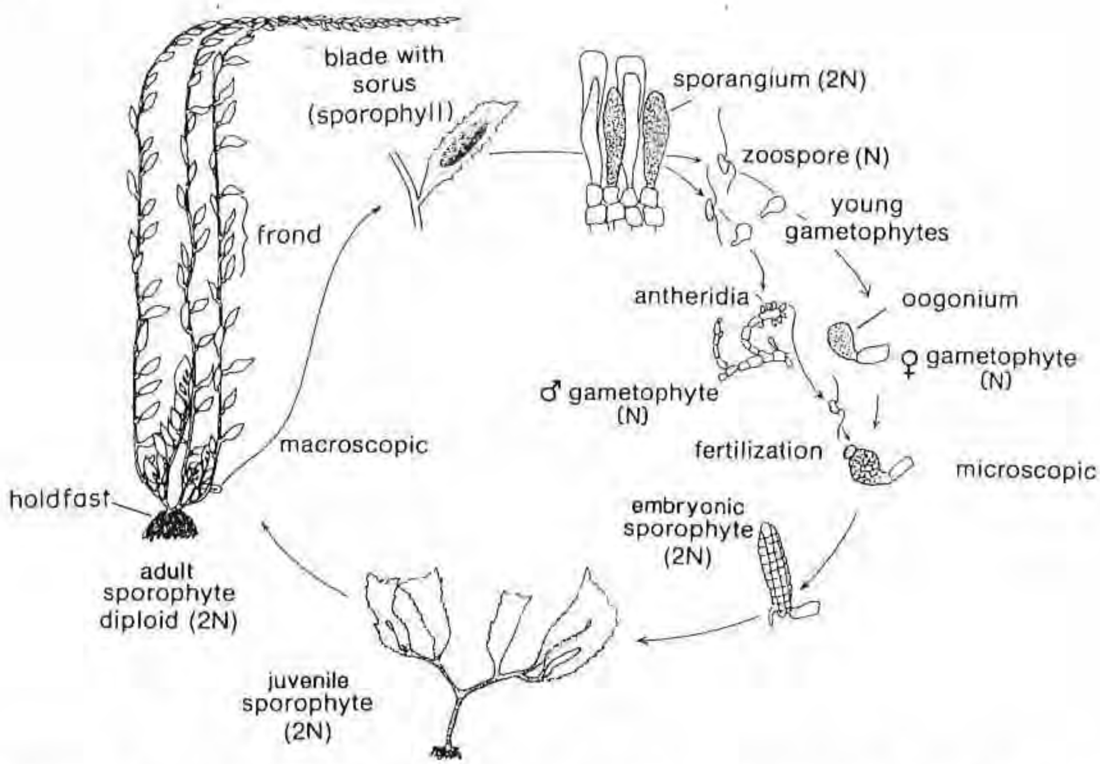


Figure 3-3. Giant kelp life cycle. (Source - Foster and Schiel, 1985)

Macrocystis has a typical laminarian life cycle, alternating between microscopic gametophytes and macroscopic sporophytes (Figure 3-3). The reproductive blades (sporophylls), located just above the apex of the holdfast, produce and liberate spores continuously throughout the year (Anderson and North, 1967). The liberated spores are transported away from the sporophyte by water movement and their own swimming. Spores that find suitable substrate attach and usually produce germ tubes within a few hours. Spore contents migrate down the germ tube and emerge at the distal end as the first cell of the gametophyte (North, 1994).

As the gametophyte grows it will become either multicellular (male) or remain uni-or-bicellular (female). Gametes are usually produced (gametogenesis) in about two weeks. Many sperm emerge from male gametophytes, while one or more large ova are produced by female gametophytes. Eggs are extruded by the female and fertilization occurs. The zygote undergoes rapid cell division to produce a microscopic embryonic sporophyte (North, 1971b).

Small sporophytes (< 0.25 in long) may develop in a few weeks with suitable illumination and ample nutrients. The tiny sporophytes at this stage are single lanceolate blades just visible to the unaided eye. Other members of the Laminariales (kelps) also produce a single blade that is virtually identical to the blade-stage of *Macrocystis*. A few weeks of additional growth yields an inch long blade, that may be smooth or may have transverse corrugations. Giant kelp is easily distinguished from other kelps at this early stage because a cleft develops at the base of the blade. The basal cleft produces a hole that elongates toward the tip, and divides the 5 to 6 in long blade into two equal halves.

The two blades continue growing and produce additional basal clefts that yield four, then eight blades. The two outer blades become frond initials and each develops an apical meristem (apical blade). The two inner blades become the first basal meristems (North, 1971b). The apical blade is divided by a series of basal clefts that elongate and divide the blade into separate strips of tissue that will become the normal blades along the frond. Eventually the apical meristem produces the 100 to 200 blades of the mature frond. The basal portion of the apical meristem thickens and becomes stipe tissue. The junction between the newly-formed blades and the stipe develops a hollow gas-filled cavity (the pneumatocyst) that buoys the developing frond in the water column. Continuation of blade and pneumatocyst production and growth, plus stipe elongation, eventually results in a fully mature, canopy-forming frond (North, 1994).

The basal meristems also continue to divide by forming basal clefts. The innermost blade of the resulting pair continues as a basal meristem. The outermost blade becomes a frond initial. Every other division, however, produces two basal meristems. This allows the developing young plant to increase the numbers of basal meristems and eventually the numbers of fronds (North, 1994).

Complete sets of blades are usually retained until the fronds are half-grown. Losses of the lower blades begins before the fronds reach the surface and mature fronds usually lack many or all the blades in the ascending stipe bundle (Wing and Clendenning, 1971). In the usual mixture of juvenile, mature, and senescent fronds on an adult plant between 1/3 to 1/2 of the total blade surfaces have been lost by natural sloughing.

The bulk of the blades on a *Macrocystis* frond are formed before the tip of the frond reaches the surface. The canopy blades are pushed into their position on the surface by expansion of submerged internodes. Apical meristematic activity at the surface produces only a small part of the total surface blades (Clendenning, 1971a). The ability of *Macrocystis* to regenerate its canopy rapidly and to dominate large areas along the coast is due to the continuous production of new fronds by established holdfasts and the intercalary growth mechanism. The remarkable speed of canopy formation occurs by small incremental growth distributed through the internodes on the complete frond (Clendenning, 1971a).

Bull Kelp

Reproduction in bull kelp undergoes a cyclic alternation of generations similar to that of giant kelp and other Laminarians. The large plant known as bull kelp represents the sporophytic phase while the microscopic gametophytic phase is unrecognizable in nature (Figure 3-4). During it's sporophytic phase, spore production begins several weeks after the blades reach the surface (Foreman, 1970). Biflagellate spores are formed within fertile patches (sori) on the blades. Sori are borne at the base of each blade (near the pneumatocyst), with maturing sori progressing towards the blade tip during blade growth and subsequent sloughing. These patches are continually produced throughout the summer and fall. As the spores reach maturation, the sori are abscised from the blades (Nicholson, 1970; Amsler and Neushul, 1989). The abscission of sori is unique to *Nereocystis* and is thought to insure a wider dispersal of spores than might otherwise be obtained (Gadgil, 1971; Walker, 1980).

Upon settlement, germination begins, closely following the process described for *Macrocystis* above. Germ tube formation and transfer of spore contents occur within 48 hours of settlement. Over the course of several weeks, somatic growth gives rise to multibranched filamentous plants. By the ninth week, differentiation of gametophytes become apparent with the production of antheridia and oogonia. Under sufficient light and nutrient levels the gametophytes reach sexual maturity in approximately 10 to 11 weeks (Hartge, 1928; Vadas, 1972). At this point motile sperm are released from the antheridia and fertilization of the oospores (eggs) takes place. The resulting zygotes grow as sporophytes.

Hartge (1928) felt that *Nereocystis* differed from other laminariales because gametophytic growth took far longer to reach maturation than any other laminariales; the antheridial gametophyte was more branched and extensive than those described for other brown algae; and the gametophyte of *Nereocystis* could live through several years. Vadas (1972) reported that under poor light conditions the gametophyte would continue to grow vegetatively for over a year. When light conditions improved gametophytes began producing reproductive structures. This seems to support Hartge's work.

The developing sporophyte is largely unrecognizable as *Nereocystis* until it reaches a height of about 5 cm. Prior to this point, the plant consists of a short stipe and single blade. The juvenile plant becomes recognizable when zones of weakness appear on the primary blade, which precedes splitting. At the end of the first week of growth the development of a small swelling occurs at the junction of the blade and stipe. A short time after the appearance of the ping–pong ball shaped pnuematocyst, the first dichotomous splitting of the blade takes place. The process of splitting begins at the bottom of the blade and results in two equal sized blades. Elongation of the blade and stipe continues during this process giving the plant a spindly appearance. The pnuematocyst maintains its spherical shape through the second dichotomous splitting of the blades. During this phase, the splitting takes place at the top and bottom of the blades. The juvenile plant is approximately 21 days old at this time. The apophysis (wide, hollow portion of the upper stipe) develops and the third dichotomy begins at about 41 days. The apophysis is initially filled with loosely woven filaments which later disappear forming a continuation of the pnuematocyst. The stipe elongation rate increases considerably while blade elongation remains constant. At about 60 days of age, the plant increases growth of both the stipe and blades. This rate is maintained until the sporophyte reaches the water surface at which point the stipe elongation rate decreases. By the time the surface is gained the plant has developed on average 30 blades. Once at the surface, the stipe and blade elongation rates decrease while the plant increases in biomass. The increase in biomass results from an increase in radial growth of the stipe, blade thickening, and continued dichotomy of the blades (Foreman, 1970).

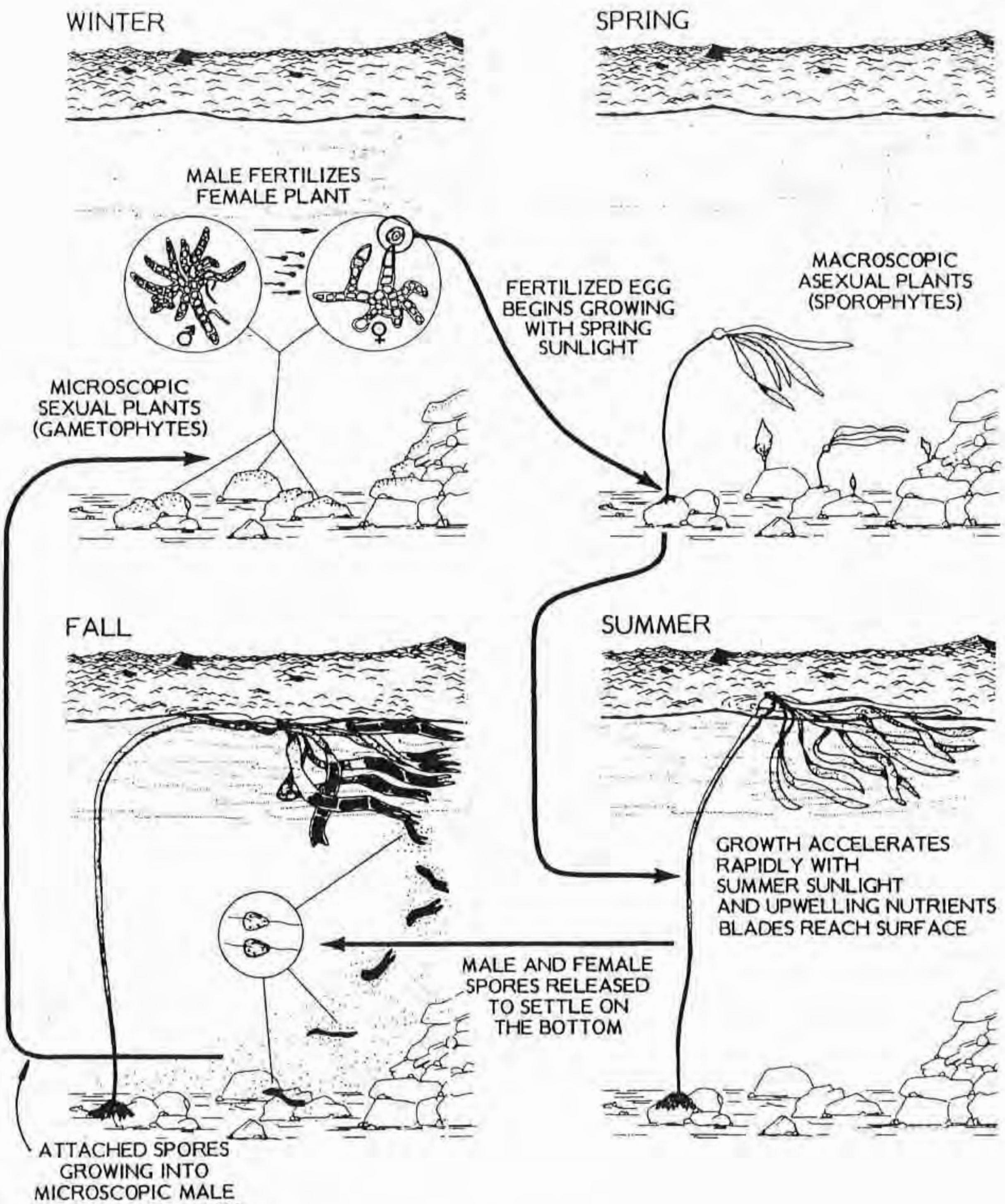


Figure 3-4. Bull kelp life cycle. (Source - Tera Corporation, 1982)

3.2.3.2 Dispersal and Recruitment

Giant Kelp

Giant kelp plants have tremendous capacity to produce spores. They begin production when they reach a size ranging from two to eight stipes at an age of nine to twelve months (Anderson and North, 1967). Release rates as high as 76,000 spores/min./cm^2 were recorded by Anderson and North (1967). Peaks in spore production tended to appear in late spring-early summer, while a secondary peak was sometimes noted in fall and early winter.

Reed (1987) found that vegetative biomass of a giant kelp plant greatly influenced spore production. Removal of 75% of the vegetative fronds resulted in a drastic decrease in sporophyll and spore production.

Some authors have suggested that effective spore dispersal in kelps is limited to a few meters and that recolonization of an area results from spores being released from drifting fertile plants (Dayton, 1985; Schiel and Foster, 1986). Evidence of relatively dense recruitment has been observed more than a mile away from stands of fertile adults (Ebeling et al., 1985; Reed et al. 1988). Reed et al. (1988) measured the weekly variation in recruitment of *Macrocystis* off southern California on replicate frosted glass slides placed at different distances from stands of fertile adult plants. Recruitment density rapidly declined with distance from the adult stand; significantly lower recruitment was observed as little as 10 ft from the adults. Spores settled as far as a mile from the source. Recruitment out to a mile appeared to occur uniformly and coincided with recruitment at the spore source and at all intermediate distances. This suggests that dispersal over long distances was probably by individual spores rather than via clumps of drifting plants as suggested by previous studies (Reed et al., 1988).

The distance over which propagules can successfully colonize new sites depends on processes that increase the time they remain competent while being dispersed (Reed et al., 1992). Algal spores can contribute to their own nutrition, via photosynthesis, during dispersal (Amsler and Neushul, 1991). Laboratory experiments revealed that spores of *Macrocystis* did not die after they stopped swimming; most germinated in the water column and retained their capacity to produce viable sporophytes. The viable planktonic stage of *Macrocystis*, therefore, is not necessarily restricted to the spore but may include later life history stages (Reed et al., 1992). The laboratory results provide biological evidence that spores and germlings of giant kelp can remain competent in the plankton for extended periods of time, which is consistent with previous findings that their dispersal can occur over greater distances than previously thought possible.

A minimum density of at least 1 spore/mm^2 was needed for successful recruitment of *Macrocystis* (Reed, 1990). This minimum density was probably determined in part by the maximum distances that could separate male and female gametophytes while still allowing fertilization to occur. Density-dependent mortality occurred whenever there was recruitment. The requirement for spores to settle at relatively high densities, coupled with the large difference in size between spores (0.01 mm) and early recruits (20 mm), insures that density-dependent mortality will occur at early stages (Reed, 1990).

Good recruitment of giant kelp usually occurs following storm disturbances that remove or thin populations of adult *Macrocystis*, allowing light to penetrate to the bottom. Dayton et al. (1984) followed survivorship of *Macrocystis* that recruited at Point Loma, California following storm disturbances in 1973. The recruitment occurred during an upwelling period in May and June 1973, following a major reduction in surface canopy. The new recruits appeared in patches in very high density. Dayton et al.

(1984) followed 1,543 recruits, of which 300 survived to 5 cm; and 259 survived to 1 to 2 m; 35 of these reached the surface to produce canopy at the age of nine months.

A phenomenal example of recruitment following destruction of adults by a storm occurred at San Clemente Island after a severe storm in January 1988 (R. McPeak, pers. obs.). The storm was deemed the worst in 200 years and referred to as a "200 year storm." Nearly all adult *Macrocystis* were either uprooted or snapped at the base. Tremendous recruitment of giant kelp occurred almost immediately after the storm and canopies reached the surface at San Clemente Island within six months of the storm.

Good recruitment of *Macrocystis* also occurs following a die–off of sea urchins. Die-offs of sea urchins and subsequent recruitment of giant kelp has been observed off Santa Cruz, California (Pearse and Hines, 1979), Point Loma, California (McPeak and Barilotti, 1993), and Soledad Bay, Baja California, Mexico (McPeak, pers. obs.). When sea urchins die, the bottom is released from grazing. Settling spores and embryonic stages of giant kelp are then able to survive.

Bull Kelp

Since bull kelp is an annual plant, it is imperative that spore production and release begin as early as possible. Foreman (1970) estimated that reproductive maturity is attained when *Nereocystis* sporophytes are about 11 weeks old or 2 to 3 weeks after plants reach the surface. This time line is based on his observations of developing bull kelp at Salt Point, Sonoma County. Burge and Schultz (1973) observed that plants initiated in late March in Diablo Cove had developing sori prior to reaching the surface in May and that spore release via abscission of the sorus began as early as June. Foster et. al. (1979a) observed a similar time scale at Greyhound Rock and China Rock near Half Moon Bay, San Mateo County. It has been reported that *Nereocystis* beds located in protected areas near Crescent City, California have begun spore production as early as February (Van Hook, pers. comm.). Burge and Schultz (1973) noted that new plants initiate at least through August, and sori develop and mature through March of the following year. These conditions would account for the overlap of annual sporophyte generations. In general, bull kelp spore production begins as early as June and lasts until fall and winter storms remove most of the adult sporophytes (Scagel, 1947; Nicholson, 1968; Foreman, 1970; Burge and Schultz, 1973).

Throughout the course of the typical growing season (June to October), changes occur in the fertility of *Nereocystis* blades, the maturity of the sori, the number of sori per blade, the average area of the sori, and the total reproductive tissue per blade. These changes have been recorded for beds in Barkley Sound, British Columbia (Leaman, 1980). This information is not yet available for bull kelp beds in California. However, preliminary studies conducted in Port Orford, Oregon on peak sori production mirrored Leaman's results (Fanning, pers. comm.). *Nereocystis* blade fertility (number of immature versus mature and released sori) reached a peak in early July as did the number of sori per blade (1.7 sori/blade), and the total area of reproductive tissue per blade (60 cm^2). To illustrate this point, imagine a single plant with 30 5–foot blades. In July, each blade will contain at least one immature sorus, approximately two mature sori, and will have 2 to 3 sori release scars. Thus an average plant will have 30 immature sori, 60 sori that are ready for release, and has already produced 60 to 90 sori, which have released spores. These maxima were followed by a slight dip, a lesser peak in late July and subsequent decline in all levels through August. A slight upswing in number of sori, average sori area, and immature sori occurs in September/October with the averages of the three variables being 0.45, 28 cm^2, and 10% respectively (Leaman, 1980). This increase comes as the density of the beds are diminishing because of shortened day length and decreasing light levels as well as increases in the frequency and intensity of storms.

Bull kelp has evolved a unique way of releasing its spores which seems to enhance dispersion (Amsler and Neushul, 1989). As the blades lengthen and mature, the sori gradually differentiate from the laminae. The sori gradually become a greenish–brown as they mature reaching a dark brown to black color prior to being released. As the spores are developing a darker pigmentation, the opposite is occurring in the surrounding tissue. The cells at the perimeter are undergoing a clearing of pigmentation and this cleared area is the locus of separation (Scagel, 1947; Walker, 1980). The clearing is caused by the senescence and autolyzing of the non–fertile cells (paraphyses) around the sorus (Walker, 1980). This leads to a mechanical weakening of the tissue and aids in the release of the sorus from the blade. Amsler and Neushul (1989) found that individual plants usually abscised sori in pulses. They observed that all fertile blades on a plant would have the same number of sori and these sori would be of the same maturity level (Walker, 1980). Spore release followed a pattern of abscission of a "cohort" of sori from a plant on a single day or over a 2 to 3 day period followed by a short period (< one week) without sorus release and then another pulse (Amsler and Neushul, 1989). On occasion, the sorus will remain attached for a considerable time and sporulation may go on without actual separation of the sorus; in this case the patches gradually become blotched and finally completely colorless as advanced sporulation takes place (Scagel, 1947; Walker, 1980).

The timing of sori separation was also monitored by Amsler and Neushul (1989) in the field and in the laboratory under simulated day and night conditions. They found, in field observations, evidence of sori release at dawn but none during daytime or nighttime. In the laboratory, separation of sori occurred 79.1% of the time at dawn (2 hours prior to sunrise and 4 hours after sunrise). This pattern was consistent for plants collected at different sites in central California (Piedras Blancas, Spooner Cove, and Point Joe). The residual percentage of abscission was equally divided between the other two periods and similar numbers of released sori were recorded (Amsler and Neushul, 1989). In British Columbia, bull kelp appears to release sori in conjunction with lowest low tide series of the month (Foreman, pers. comm.). Amsler and Neushul (1989) did not observe this phenomenon in central California.

Nicholson (1970) found that most spores were released from the sorus within the first hour of separation from the plant. Laboratory investigations support these observations. Spore release was significantly higher during the first hour after abscission (51.5 %) than any other hourly interval. After four hours, 94.2% of spores had been released (Amsler and Neushul, 1989).

The production of spores and the rate of spore release from the bull kelp sori is significantly higher than other macroalgae. Tera Corporation (1982a - c) found that about 3.5×10^5 spores/ml were released from sori collected from Diablo Cove. The rate of spore release averages 2.3×10^5 spores/cm^2/min with a maximum of 4.5×10^5 spores/cm^2/min (Amsler and Neushul, 1989). As mentioned previously, giant kelp has a maximum release rate of 7.6×10^4 spores/cm^2/min. Thus bull kelp's release rate is approximately 6 times faster than giant kelp.

Once released into the water column, the spores become a part of the plankton with a limited ability to direct their movement within the water column through use of two flagella and an eyespot (Walker, 1980). In Diablo Cove, Burge and Schultz (1973) observed sori accumulated in gullies surrounded by buff colored clouds of swarming zoospores. In addition to being motile, bull kelp spores are capable of photosynthesis. This ability, which is also shared by giant kelp, *Pterygophora californica* and *Laminaria farlowii*, enables the spores to conserve carbon reserves for germination and early growth or for prolonged planktonic viability (Amsler and Neushul, 1991). Thus the spores of kelp and of other marine macroalgae species seem to be more similar to planktotrophic benthic invertebrate larvae than the spores and seeds of other plants (Amsler and Neushul, 1991).

The method in which *Nereocystis* disperses its reproductive material is probably adaptive in: 1) maximizing the photosynthetic potential of the spores by releasing them at dawn, 2) spreading the vertical and temporal distribution of spores to maximize their dispersal potential. The release of the sorus, which is heavier than the spores, insures vertical distribution of spores within the water column. Since currents are variable at different depths and over time, wider dispersal of spores can be accomplished (Wheeler, 1980; Amsler, 1988; Amsler and Neushul, 1989), and 3) maximizing the chance that the other spores will settle in the same habitat in which the parental plants have successfully matured (Amsler and Neushul, 1989).

Recruitment into suitable habitat is essential for the survival of a population or subpopulation (Gadgil, 1971). While studies have determined the density of *Macrocystis* spores necessary to ensure recruitment into an area, little to no work on this topic has been done for *Nereocystis.* The density of young sporophytes at the point of recognition as bull kelp have been reported by various workers. Foreman (1970, 1984) reported densities of juvenile bull kelp sporophytes (5–15 cm in length) ranged from 200 to 400 plants/m^2 at Salt Point, and in British Columbia, equaled less than 100 per m^2 . The mortality rate of these plants was high. Nicholson (1968) reported mortality rates of 48% for intertidal plants while Burge and Schultz (1973) recorded a rate of approximately 35%. In all these cases, healthy bull kelp beds developed but these examples only give a partial indication of the volume necessary to ensure success.

3.2.4 Age and Growth

Giant Kelp

Giant kelp plants are perennial and may live for more than 7 years (Rosenthal et al., 1974; Dayton et al., 1984). However, the average life-span for an adult is about 1 to 2 years (Dayton et al., 1984; Dean et al., 1983). The individual fronds that makeup the plant, live six to nine months, while the blades live about four months (North, 1971c; Gerard, 1976). Continued existence of a plant, therefore, involves constant replacement of lost and dying fronds by juvenile material arising from frond initials just above the holdfast.

Giant kelp uses energy from sunlight to produce organic compounds (photoassimilates) that are used for growth. This is the process of photosynthesis. Giant kelp is remarkably different from land plants of similar size in that it possesses the capacity for photosynthesis in all parts of the sporophyte above the holdfast, as well as at successive stages of its asexual and sexual reproduction (Clendenning, 1971c). The pneumatocysts and cylindrical stipes have about the same photosynthetic capacity per unit area as the blades. The sporophylls at the base of the plant, the planktonic spores they release, the gametophytes that develop from the spores, and the blades of all sizes on sporophytes possess photosynthetic capacities (Clendenning 1971c).

Macrocystis tissues are composed of two regions, an outer cortex and an inner medulla (Parker, 1971a). Sieve tubes, located in the medulla, are involved in the movement of photoassimilates from photosynthetically active blades in well-illuminated regions, to growing tissues where light is insufficient to support photosynthesis. The movement of the products of photosynthesis is translocation (Parker, 1971b) and it is through this process that young fronds receive photoassimilates for growth from longer fronds.

The pattern of import and export of ^{14}C-labeled assimilates was studied in a population of *Macrocystis* in southern California by Lobban (1978). Actively growing tissues imported and did not export. As a blade reached maturity it began to export, at first only to the apex that formed it, later also down the frond to sporophylls and frond initials at the base of the frond; and into the apical regions of juvenile fronds.

Good growth in *Macrocystis* requires ample light for photosynthesis, cool water rich in nutrients, and translocation of photoassimilates to the growing areas of the plant.

There are many abiotic factors that affect the growth of *Macrocystis*, including temperature, nutrients, and light. Considerable seasonal, year-to-year, and even daily differences in these variables occur within the range of giant kelp forests. The effects of one variable on *Macrocystis* growth can vary depending on the other variables. These interactions have demonstrated importance for *Macrocystis* (Lüning and Neushul, 1978; Dean et al., 1983).

Giant kelp must obtain all of its nutrients from the water because holdfasts do not serve in nutrient uptake. The plants take up nutrients through all frond tissues. DeBoer (1981) suggested that nitrogen, phosphorus, iron, and perhaps manganese and zinc may limit growth of macroalgae in nature. North (1980) concluded that copper could also be limiting for *Macrocystis*.

Inorganic nitrogen concentrations vary widely in nearshore waters. They are particularly high during upwelling or periods of terrestrial runoff (North et al., 1982). Inorganic nitrogen levels are typically low in summer and fall in southern California. Levels are especially low during periods when warm water masses move into the region from the south, or when the water is thermally stratified (Jackson, 1977; Wheeler and North, 1981; North et al., 1982; Zimmerman and Robertson, 1985).

Water temperatures and nutrients are indirectly correlated (Zimmerman, 1983; Zimmerman and Kremer, 1984) and it is often difficult to separate the combined effects of these on growth of giant kelp. Best growth of giant kelp occurs during periods of upwelling, when temperatures are low and nutrient levels are high (North, 1971b). In southern California, nitrates drop to very low levels (below about one micro gram atom/liter) when ocean temperatures reach about 59° F. (Zimmerman and Kremer, 1984). A plot of mean frond elongation rates against the mean monthly nitrate concentration showed a clear relationship between the two variables. Growth rates were reduced when the estimated nitrate concentration dropped below 1.0 micro gram atom/liter (Zimmerman and Kremer, 1984).

Reduced nitrogen concentrations may have been responsible for the poor growth and massive loss of *Macrocystis* during the warm–water period in the late 1950s (North, 1971b; Jackson 1977, North et al., 1982). Negligible amounts of nitrate were found above 59°F (Jackson, 1977, 1983; Gerard, 1982a; Zimmerman and Kremer, 1984). Deepened isotherms associated with the 1982-84 El Niño resulted in severe nutrient limitation and very poor kelp growth (Zimmerman and Robertson, 1985). Frond growth rates were so low at Santa Catalina Island during this El Niño event that terminal blades formed before reaching the surface, eliminating the formation of canopy.

Inorganic nitrogen (nitrate, nitrite, and ammonium) concentrations in the water must be in the order of 1-2 micro gram atoms/liter to support a giant kelp growth rate of 4% increase in wet weight per day (Gerard (1982a).

Adequate light is also essential for the growth of *Macrocystis*. Adult plants are usually insensitive to changes in subsurface light because they usually form a surface canopy and can translocate the products of photosynthesis toward the holdfast and juvenile fronds (Parker, 1963). Light transmission to the bottom is affected by the amount of light at the surface, the water, dissolved and suspended material in the water, and shading by attached plants (Foster and Schiel, 1985). Water clarity or turbidity is influenced by plankton abundance, wave action, or terrestrial runoff (Quast, 1971c; Clendenning 1971b). *Macrocystis* plants, themselves, have a great impact on light that reaches the bottom and may reduce irradiance by over 90% (Neushul, 1971b; Dean et al., 1983; Reed and Foster, 1982).

There are many ways to evaluate growth of *Macrocystis*. One can measure elongation rates of fronds, changes in tissue weight, or changes in area of tissue (Clendenning, 1960; North, 1971c; Gerard, 1976; Gerard, 1982b; Kain, 1982; Jackson et al., 1985).

North (1971c) proposed a mathematical model for frond elongation that modified the equation for simple logarithmic growth. Growth (G) in North's model represented the frond elongation rate normalized to a "standard" length of one meter. The model allowed comparison between measurements on fronds of differing lengths by mathematically adjusting their elongation rates to corresponding values when both were one meter long.

North (1971c) compared mean values of standard growth rates, G, from samples taken from kelp beds between Pacific Grove, California and Turtle Bay, Baja California Sur, Mexico. Mean G values ranged from 5.6 to 8.0% per day.

González-Fragosos et al. (1991) evaluated frond elongation rates during autumn-winter, spring, and summer in shallow water (25 ft depth) kelp in Bahia Papalote, northern Baja California, Mexico. Frond elongation was maximum during the spring and minimum during the winter. Average frond elongation rates varied between 0.3 to 11% per day during the study period.

Hernandez (1996) followed growth rates in a control and a harvested *Macrocystis* bed in Bahia Tortugas, Baja California Sur, Mexico. Frond elongation growth rates in the control bed were at a maximum during the winter and at a minimum in the summer.

Clendenning (1960) reported elongation rates of 2 ft per day as common and described the growth as the fastest recorded for any plant, terrestrial or marine. Coon (1981a) noted that evaluations of the growth rate of *Macrocystis*, and its designation as "the fastest growing plant," are based on comparisons of the elongation rates of single fronds, only a portion of an entire plant. Coon (1981a) considered the *Macrocystis* plant a complete organism rather than a collection of fronds of varying sizes. He described the growth of intact entire adult plants living in the sea, by measuring changes in all the fronds on a few plants. The plants exhibited symmetry in structure, with distinct frond pairs. Component frond growth rates were highly variable and decreased with increasing frond length. Tissue gains were offset by tissue losses due to breakage and sloughing. The growth rates of whole plants varied between 6.4% and 8.9% per day over short intervals (2 to 5 days). Total growth for plants measured in spring and fall averaged 1.4% and 0.9% per day, respectively (Coon, 1981a).

Suspended particles may affect water clarity and reduce bottom illumination. Lüning (1981) suggested that the lower limit of kelp is where light is reduced to 1% of that at the surface. In addition, the quality of light that reaches gametophytes can affect reproduction. Blue light is necessary for development of gametes but is not necessary for growth of the gametophytes. Dean et al. (1983) estimated that *Macrocystis* gametophytes outplanted on artificial substrata in the San Onofre kelp forest must receive the light necessary to become fertile within 40 days. Beyond this time mortality is too high and few survive.

Foster and Schiel (1985) indicated that growth of gametophytes of a variety of kelp species in southern California is generally optimal at 62° F while fertilization is optimal at 54° F. Deysher and Dean (1984) noted that sporophyte production is dependent on a variety of physical and chemical factors and that these factors interact to determine the eventual success of sporophyte recruitment.

Bull Kelp

Bull kelp, as mentioned in Section 3.2, is an annual species having a life span of about one year. Early investigators first reported that *Nereocystis* was a perennial (Foreman, 1970). However, this theory was corrected by several investigators (Setchell, 1908; Fallis, 1915; Nicholson, 1968; Foreman, 1970) when they demonstrated that *Nereocystis* sporophytes which reached the surface in one year, rarely survive into the next year and new sporophytes are not seen until the spring. Most sporophytes are dislodged during winter storms and no new plants are seen until early spring. Foreman (1970) observed that some late developing sporophytes (those that did not reach the surface prior to winter) survived into the next season and that, while these plants were heavily coated with epiphytes, the plants did produce new blades and reach sexual maturity. He concluded, that under favorable conditions, *Nereocystis* could be considered a facultative biennial.

As an annually occurring plant, bull kelp has developed an accelerated growth rate to utilize optimal environmental conditions (light, high nutrient levels, water clarity) to insure continued survival. Recent *Nereocystis* growth studies have focused on the plant as a whole (haptera, stipe, and blades) instead of concentrating on a single aspect as had been the case in earlier research.

Nicholson (1968) and Foreman (1970) examined the rate of growth of *Nereocystis* in field studies. Both researchers measured elongation of the stipe and blades of developing sporophytes, with Nicholson's work including haptera growth rates, and Foreman including weight changes. The result of their work is a clearer picture of how growth occurs in *Nereocystis*.

After initiation, sporophyte development (haptera, stipe, primary blade) is slow for the first 3 to 4 weeks. The total growth rate is less than 0.1 cm per day. When the sporophyte reaches a height of 5 to 10 cm, the stipe elongation rate increases to approximately 1.7 cm per day while blade elongation increases to 1.0 cm per day. For the period from the 100–cm stage to attaining the water surface, the growth rate is phenomenal. The stipe can grow up to 12.7 cm per day, or more, depending on the depth of water (Foreman, 1970; Burge and Schultz, 1973)). Blades grow at a rate of about 1.6 cm per day and the haptera grow at a rate of 2.8 mm per day. Just prior to the sporophyte reaching the surface, blade growth accelerates to a rate of 9 cm per day. Nicholson (1968) found that once *Nereocystis* reached the surface, stipe elongation stopped. However, Foreman (1970) reported that stipe lengthening significantly decreased but did not stop. Both investigators showed that blade elongation continues at a rate ranging from 6 to 8 cm per day. At maturity the growth rate of the holdfast increases to 3.8 mm per day. Total plant growth rates for this species range between 22 and 27 cm per day (Nicholson, 1968; Foreman, 1970; Burge and Schultz, 1973).

Nereocystis biomass undergoes an interesting transition during its growth. Total plant biomass is divided equally between the stipe and primary blade when the juvenile sporophyte is about 5 to 15 cm tall. However, during the midwater growth phase, the stipe accounts for approximately 56% of the biomass. Once the sporophyte reaches the surface, blade growth accounts for about two–thirds of plant biomass. This increase is the result of radial growth and dichotomy of the blades (Nicholson, 1968; Foreman, 1970). On average, a mature plant will have 40 or more blades (Foreman, 1970).

Growth in this species is not confined to any one area of the plant although a number of investigators (Sheldon, 1915; Fallis, 1915; Hurd, 1916; Frye, 1930; and Scagel, 1947) have shown that the most rapidly growing portions of the plant were the upper stipe and the basal region of the blades. Nicholson (1968) found that the primary growth in juvenile plants occurs at the base of the blades, the upper stipe, and the holdfast. At maturity, growth arises at the bases of the blades and at the lower stipe where new haptera are produced. Rapid elongation of the stipe and subsequent blade growth is probably a result of necessity. As an annual plant, *Nereocystis* needs to reach maturity during optimal environmental conditions to acquire energy for spore production, haptera growth, and to replace blade material lost due to spore production (Nicholson, 1968; Amsler and Nueshul, 1989).

Water temperature plays an important role in the growth of *Nereocystis*. Mean sea surface temperatures over the distributional range of *Nereocystis* vary from 13°C to 15°C at the southern end to 4°C to 10°C off the Aleutian Islands (Druehl, 1970). Lüning and Freshwater (1988) examined the temperature tolerances of several northeast Pacific marine algae. They reported that *Nereocystis* was able to survive one week at temperatures ranging from -1.5°C to 18°C. They classified the laminariales as cold–stenothermic seaweeds, meaning that these species are "fine tuned" to their environment and require a stable thermal climate (Lüning and Freshwater, 1988). They also concluded that a species' upper temperature limit was a conservative taxonomic trait and determines the southern limit of its distribution.

PG&E (1987) reported that the population of bull kelp in Diablo Cove was adversely affected by the warm water discharge from the Diablo Canyon power plant. Plants in contact with the discharge experienced deterioration of blade tissue, which resulted in early death. This observation, in combination with that of Lüning and Freshwaters' (1988) research may in part explain the decline of *Nereocystis* that occurs during periods of increased water temperature (El Niño events).

Tera Corporation (1982b) examined the effects of temperature and light on gametophyte and young sporophytes of bull kelp. They demonstrated significant differences in the effects of temperature and light on germination in contrast to growth. Whereas spores would germinate under a range of temperatures (9, 13, 13.8, 17, 21, 25°C) and at the same approximate rates (except 25°C), growth was significantly lower at 21°C. Light did not markedly affect germination but did have a strong effect on growth as is to be expected. The optimal temperature for initial growth was between 13°C and 17°C at 77 to 110 $\mu E/m^2/s$ (Tera Corporation, 1982b).

Fertility of bull kelp gametophytes is linked to water temperature and light levels. In laboratory studies, the fertility of both male and female gametophytes was found to be optimal at 16.7°C to 17.8°C, with a higher percentage of fertility with increasing light intensity. There was a two day difference in development between male and female gametophytes. Approximately 65% of males were fertile 10 days into the experiment while females reached about the same level of fertility at day 12 (Tera Corporation, 1982b). This delay is expected due to the higher energy demands necessary to produce ova (Srb et. al., 1965). Sporophyte development occurred within the same range of temperatures and light levels discussed above (Tera Corporation, 1982b).

Vadas (1972), in laboratory culture of *Nereocystis* gametophytes and sporophytes in Puget Sound, found that the effective temperature limits for reproduction in both these generations was 3°C to 17°C. Burge and Schultz (1973) reported that sporophyte development was first seen each spring at Diablo Cove in central California after sea floor temperatures declined to yearly lows following fall and winter maxima. Sporophyte development occurred at 10°C and 11.2°C in 1967 and 1968, respectively. From this research, it would appear that *Nereocystis* is capable of developing across a range of low water temperatures but is inhibited by high water temperatures (>18°C). The biggest factor in growth of *Nereocystis* is the availability of light and quantity of light (Vadas, 1972; Burge and Schultz, 1973). Plants depend upon light as a source of energy necessary for the photosynthetic process and changes in light intensity or duration due to season or depth of immersion affect the metabolism and growth of algae (Wort, 1955). In laboratory culture, gametophytes did not reach sexual maturity when light intensity levels were at or below 15 foot–candles. There was also a retardation of sporophyte growth at these same light levels (Vadas, 1972).

Vadas (1972) also measured light intensity at various water depths adjacent to and beneath both primary and secondary kelp canopies. Light levels below the surface canopy decreased by 99.6% and below the secondary canopy were reduced well below the minimum level necessary for growth. Thus in established kelp communities there appears to be insufficient light for recruitment and growth of bull kelp (Vadas, 1972). Similar results were found in studies of two other brown algae, *Laminaria hyperborea* and *Desmarestia aculeata* (L) (Kain, 1966; Chapman and Burrows, 1970; Kain, 1971).

3.2.5 Nutrient Uptake

Giant Kelp

Giant kelp must obtain all of its nutrients directly from the water because holdfasts do not serve in nutrient uptake. DeBoer (1981) suggested that nitrogen, phosphorus, iron, and perhaps manganese and zinc may limit growth of macroalgae in nature. North (1980) concluded that copper could also be limiting.

Gerard (1982a) studied nitrate uptake rates *in situ* by enclosing blades of *Macrocystis* in bags. She developed a mathematical model that described nitrate uptake by whole plants for specified concentrations and vertical distributions of nitrate. The model indicated than an adult plant should be free of growth limitations when nitrate concentrations throughout the water column are about 1 to 2 **u**M.

Nutrient uptake rates in *Macrocystis* vary for different tissue types (Gerard, 1982a; Manley, 1985). Rates generally increased along the frond from apex to the region of mature blades, then declined towards the base. Gerard (1982a), however, found highest rates of nitrate uptake at the apex with a declining gradient basally. Manley (1985) found that phosphate uptake rose significantly within four days of when blades were transferred from a high to a low phosphate medium. The uptake rate almost tripled within eight days.

Light, temperature, and water motion can also affect the uptake rates of nutrients by *Macrocystis*. Gerard (1982a) found an inverse relation between the nitrate uptake rate and water depth. She noted that nitrate uptake rates among deeply shaded *M. pyrifera* blades were 26 to 33% lower than for well illuminated blades. Wheeler (1978) reported a 48% enhancement of nitrate uptake when plants were illuminated but no enhancement for uptake of phosphate or ammonium. Uptake rates of phosphate increased by a factor of 1.6 for a temperature increase of 50°F to 68°F. The rate declined at temperatures above 77°F.

Water motion significantly enhanced uptake of nitrate, ammonium, and phosphate (Wheeler, 1980). Water motion could be either unidirectional or as turbulence. Gerard (1982b) reported that nitrate uptake became saturated at 3 cm s^{-1} in her field experiments. She concluded that water motion in surface layers always exceeded this critical value, even within dense canopies during calm seas.

There is evidence that luxury uptake of nitrogen and phosphorous occurs in *Macrocystis* (Gerard, 1982c; Manley and North, 1984). Reserves accumulated during times of abundant nutrient supplies are utilized at times of scarcity. The stored nitrogen may last for up to 30 days (Zimmerman and Kremer, 1984).

North (1994) concludes that uptake and incorporation of nutrients by whole *Macrocystis* plants is extremely complex; being influenced by tissue type, recent history of the tissue, and environmental conditions that may differ throughout the water column.

Bull Kelp

An essential part of plant development is the ability to absorb nutrients from the surrounding water. Since a bull kelp plant consists of a long stipe with blades emanating from a single pneumatocyst, the plant has to be capable of acquiring nutrients through the epithelial tissue of the stipe or of translocating energy and nutrients from the fronds to the rest of the plant. The latter is indeed the case. Riggs (1915), Nicholson (1968), and Schmitz and Lobban (1976) showed that photosynthesis occurred within the blades and that the associated energy is transported to the stipe and holdfast. Energy in the form of carbohydrates (mannitol) is moved via the medulla of the blades through the stipe to the medulla of the holdfast. Sieve filaments, which appear to be analogous to sieve tubes in terrestrial plants, are the major component of the medulla and are embedded in the filament of the stipe and holdfast (Nicholson, 1968; Schmitz and Lobban, 1976). Thus energy and nutrients taken up by the blades can easily be transported to areas of rapid growth such as blade bases and haptera. Removal of the blades either by natural (storms, predators) or by human–induced causes (motoring through a bed, harvesting) would result in loss of energy production and death (Nicholson, 1968; 1970; Foreman, 1970; 1984).

Nicholson (1968) and Schmitz and Lobban (1976) measured the rate of translocation of photosynthates in *Nereocystis*. The translocation rate for this species range from 110 mm/hour to 570 mm/hour and is much slower than the translocation rate of *Macrocystis* (780 mm/hour). One possible explanation for this difference may be due to the morphology of both plants. *Nereocystis* has a single stipe with fronds only at the water's surface, and although the blades may vary in size, all are undergoing some amount of photosynthetic activity. Energy in the form of carbohydrates only needs to be transported to the stipe and haptera. In contrast, *Macrocystis* has numerous fronds of varying ages and positions in the water column. Young fronds are shaded by the canopy of older fronds and are acting as energy sinks more than energy contributors. Thus the higher rate of photosynthesis and translocation of energy in *Macrocystis* is probably necessary to accommodate the development of new fronds, as well as the continued growth of young fronds (Schmitz and Lobban, 1976).

The seasonal and microhabitat variation of nutrient levels influences the growth of *Nereocystis* populations (Dawson, 1966; Rosell and Srivastava, 1984). The nutrients that seem to be most important to the development of *Nereocystis* are macro–nutrients: nitrogen (in the form of nitrite), phosphate, potassium, calcium, and magnesium, as well as, micro–elements: boron, iodine, and zinc (Rosell and Srivastava, 1984). In addition, *Nereocystis* has the ability to accumulate a variety of other metallic and nonmetallic elements from sea water (Whyte and Englar, 1980b). The exact role they play in *Nereocystis* growth is unknown. However, there is some evidence that divalent cations (i.e. calcium, magnesium, strontium) are bound to alginic acid, which is a constituent of the cell walls, and their concentrations parallel the rise and fall of vegetative growth in this species. Other elements such as iron, aluminum, and silicon are probably bound to proteins and polymeric compounds. To what extent these minor elements are limiting to *Nereocystis* growth has not been determined as yet (Whyte and Englar, 1980a, b; Rosell and Srivastava, 1984).

3.2.6 Productivity

Giant Kelp

Giant kelp is highly productive. Coon (1982) compiled the available information on biomass and productivity of eastern north Pacific *Macrocystis*. Gerard (1976) studied a single site in central California for over 2.5 years and found that giant kelp biomass varied from 0.7 to 6.3 wet kg/m^2 (3.12 to 28.0 tons/acre). The standing crop biomass for a southern California forest of giant kelp ranged from 3.0 to 22.0 wet kg/m^2 (13.36 to 97.93 tons/acre).

A variety of techniques have been used to measure productivity of *Macrocystis*. These include the following: field harvests (Clendenning, 1971b), growth measurements (Gerard, 1976), changes in oxygen content of forest water (McFarland and Prescott, 1959; Jackson, 1977), field measurements of radioactive carbon uptake (Towle and Pearse, 1973), and extrapolations from laboratory measurements (Wheeler, 1978).

Gerard's (1976) study in central California revealed that monthly productivity varied between 0.4 wet kg/m^2 and 3.0 wet kg/m^2, with an average of 23 wet kg/m^2/yr. (= 102.4 tons/acre/yr.). She concluded that giant kelp biomass in the central California site turned over 6.6 times per year (productivity of 23 wet kg/m^2/yr. divided by a mean biomass of 3.5 wet kg/m^2 = turnover rate of 6.6 times/yr.).

The high productivity of kelp helps contribute to the productivity of ecosystems via the transfer of carbon through the decay of algal drift. Harrold et. al. 1998 evaluated the importance of macroalgal drift exported from nearshore forest of giant kelp to adjacent submarine- canyon and continental-shelf habitats. In the study, they estimate the rate of carbon flux from *Macrocystis* drift to the Carmel Submarine Canyon to be 45.2 mg C / m^2 / d^2 and that drift kelp can account for 20-83 % of the total particulate organic carbon that reaches the sea floor. Their conclusion is that drift macroalgae can provide significant enrichment of organic carbon to the benthos above ~~the~~ that provided by vertically sinking particulate organic material.

Bull Kelp

The productivity of bull kelp is great due to the senescence of sori throughout the summer and fall months in addition to the loss of blade tips via erosion by water motion. Foreman (1984) suggested that the standing crop is roughly equal to the biomass lost by *Nereocystis* through sporophyte mortality and attrition of laminae. Gotshall et. al. (1986) reported estimates of the number of bull kelp stipes present in Diablo Cove, San Luis Obispo County kelp bed for a 12–year period (1970 to 1971, 1973 to 1987). Using these estimates and total plant weights developed by Foreman (1970) for his Class 8 plants (plants 80 days older or older), the biomass production of *Nereocystis* in Diablo Cove averaged 9 kg/m^2 (40.5 tons/acre). For the period 1975 – 1982, biomass declined from a high of 45 kg/m^2 (200 tons/acre) in 1975 to a low of 1.09 kg/m^2 (4.8 tons/acre) in 1982. Barnes and Kalvass (1993) estimated the 1989 bull kelp biomass for Van Damme Bay near Fort Bragg, California. They reported a biomass potential of 640 metric tons (705 short tons) at 1.4 kg/m^2 (6 tons/acre). These numbers are comparable to *Nereocystis* biomass in British Columbia, Canada (Coon et. al., 1979).

In partial compliance with regulations adopted in 1996 for bull kelp harvest in a 300 series bed, the bed 312 lessee, Abalone International Co., conducted a biomass estimate survey and reported the results to the Department as part of the bed lease application process (Van Hook, pers.comm.). The survey was conducted in late November in the 205 acres estimated as growing kelp bed within bed 312. Survey results estimated 2.55 plants per m^2 for an estimated biomass of 27 tons per acre. Though the Abalone International survey revealed a much higher biomass per unit area than the Van Damme survey noted above, plant density was very similar (Van Damme - 2.7 plants/m^2). Most of the explanation for the higher biomass in bed 312 is due to the greater weight per plant as that survey was conducted at the end of the growing season and limited to mature sporophytes.

Nicholson (1970) experimented on bull kelp's ability to regenerate tissue by removing all but 5 or 10 cm of each blade. In her experiment, the rate of blade growth initially decreased (< 2 cm/day) then increased to a rate of 2.2 and 3.0 cm/day for the 5– and 10–cm blades. Total length of blades increased to a maximum (usually 2–5 m) but their bases continued to show growth. This was evident by the increased distance between tag marks on the blades. Nicholson felt that the rate of erosion at the tips was approximately equal to the rate of growth at maximum blade length (Nicholson, 1970). Based on her research, *Nereocystis* contributes considerable amounts of organic material to the surrounding kelp bed community.

3.2.7 Natural Mortality

3.2.7.1 Abiotic Factors

Giant Kelp

There are many abiotic factors that cause mortality in *Macrocystis*. Moving or shifting sediment can scour or bury established populations of giant kelp in rocky areas (Weaver, 1978). During severe storms, gravel, cobble, and disintegrated rocky reefs become wave-driven projectiles that can cause mortality of *Macrocystis*. Dayton et al. (1989) reported extensive mortality, at a depth of 68 feet, off Point Loma, caused by these projectiles during the "200 year storm" (see below).

The substrate that giant kelp attaches to is important in determining survival. *Macrocystis* usually needs solid rocky substrate to develop into a canopy-producing population. The exception to this would be the population of giant kelp that has developed on soft sediment near Santa Barbara (as previously described in this document). The type of substratum that *Macrocystis* attaches to affects the nature of wave damage to the population. Plants that attach to hard rock substrata are more likely to have stipe breakage and canopy loss, while plants on soft bottoms (i.e.. mudstone, siltstone) are likely to be torn off the bottom completely (Foster, 1982).

Giant kelp develops on cobble bottom in several San Diego County areas (i.e. San Onofre, Tourmaline near La Jolla, and Imperial Beach). *Macrocystis* survives well in this cobble habitat when the ocean is calm. Plants may be dislodged, frequently with the cobble still attached, when the ocean is rough, or stormy conditions prevail. Following storms, beaches near cobble habitats are frequently littered with cobble-bearing *Macrocystis* (McPeak, pers. obs.).

Storms and large swells also cause the greatest mortality of *Macrocystis* in other habitats (Cowen et al., 1982; Dayton et al., 1984; Foster and Schiel, 1985; Dayton, 1985; North, 1986; Seymour et al., 1989). In southern California, storms cause a gradient of damage to *Macrocystis*, ranging from "scars" of single holdfasts to cleared areas several acres in size resulting from massive entanglements following unusually severe storms (Dayton et al. 1984). Destructiveness from storm-generated swell may exceed the numbers of individual plants torn loose by a storm. Rosenthal et al. (1974) observed that loosened plants become entangled with, and dislodge, attached plants. The drifters pick up additional plants, resulting in a "snowball" effect (Rosenthal et al., 1974). As many as 19 detached plants have been observed in one drifter (Rosenthal et al., 1974). Dayton et al. (1984) noted that the average number of detached plants in each drifter at Point Loma was 4.7 (range 1 to 19). Plants that were killed by encounters were usually less than 2 years old or more than 4 years old. Entanglement effectively culled out young plants with small holdfasts that were not securely attached, or older plants with decaying holdfasts.

The decade of the 1980s was one of the stormiest in California history causing significant damage to the giant kelp forests of the State (Dayton et al., 1989; Seymour et al., 1989). Unusually powerful storms struck the California coastline during the winter of 1982-1983, an El Niño period (Namias and Cayan, 1984; Seymour et al., 1984). In addition, the worst storm in 200 years (the "200 year storm") devastated forests of giant kelp in southern California January 17-18, 1988 (Dayton et al., 1989; Seymour et al., 1989). The waves associated with this storm exceeded 33 ft in height in offshore waters, near San Nicolas Island, and 20 ft in height along the coast of San Diego. Drag and inertial forces associated with the January 1988 storm were about twice as high as forces associated with the previous worst storms of the century (i.e. 1982-1983) (Dayton et al., 1989). Mortality of *Macrocystis* exceeded 90% at some Point Loma sites being studied by Scripps researchers (Seymour et al., 1989). Significant damage was also noted off San Clemente Island, in southern California and as far south as Cedros Island, in Baja California, Mexico (McPeak pers. obs.).

Microscopic stages of giant kelp (gametophytes and sporophytes) are also affected by abiotic factors, such as sedimentation, light, temperature, and nutrients. Devinny and Volse (1978) found that light sedimentation (10 mg/cm^2) interfered with spore settlement. Deposits sufficient to cover germlings developing from settled spores, led to high mortality.

The health of *Macrocystis* forests in California is strongly influenced by the relationship between temperature and nutrients (Tegner and Dayton, 1987). Water temperature and nutrients are inversely correlated (Zimmerman, 1983) and it is often not possible to separate the combined effects. Unusually deep thermoclines during El Niño conditions expose plants to warm temperatures and low nutrients for several months. Such adverse conditions cause widespread destruction of *Macrocystis* populations (North, 1994). Giant kelp survives well when there is a thermocline and the base of plants are exposed to nutrient-rich cold water. A superb example of this occurred off Point Loma during August 1971. Sea surface temperatures reached 77° F in surface canopies at that time (McPeak, pers. obs.). Canopies began to deteriorate immediately when the water became warm. The deterioration penetrated to the thermocline, a depth of about 15 feet. Surface fronds disintegrated, dropped to the bottom, and filled depressions to a depth of several feet. The basal portion of the forest (below the thermocline) was bathed in cool, nutrient-rich water. The plants survived and formed canopy again by late 1971.

Bull Kelp

Within the physical environment of the coastal waters a number of factors (substrate, light, nutrients, temperature) play a significant role in the life of marine fauna and flora. For *Nereocystis* the most influential factor is light availability (Vadas, 1972). Bull kelp needs high light levels for growth and sexual maturity of gametophyte as well as sporophyte growth. Reduction of light caused by plankton blooms, storm turbulence, periods of overcast or foggy conditions, or overshadowing by other algae can inhibit or significantly reduce growth (Vadas, 1972; Dayton et. al., 1984; Miller and Estes, 1989).

Secondary to *Nereocystis*' light requirements are nutrient levels and water temperature. Typical of most marine plants, *Nereocystis* growth and development is also dependent on the amount of available nitrates and phosphates in the ocean. The level of these two elements is usually high in the spring due to the degradation of plant and animal material in the winter (Dawson, 1966). These elements are brought to the surface as wind direction shifts from onshore to offshore and upwelling begins. There is also a clear relationship between temperature and nutrient concentrations. Temperatures above 16°C show no measurable amount of nitrates while temperatures below 16°C show increases in the amount of available nitrates (Jackson, 1983).

The destructive nature of storms and their effects on giant kelp forests is well documented as has been shown above. However, little work has been done to document these effects on bull kelp forests and must be inferred from our knowledge of *Macrocystis*.

The timing and frequency of storms has a varying affect on *Nereocystis*. Foreman (1970) found that spring storms were the principal cause of mortality in young sporophytes. If the frequency of storm was about one per week the mortality rate equaled 50%. However if storms were absent for three to four weeks the survival rate among juveniles increased. The principal causes of this high level of mortality were due to the smallness of the developing holdfast in comparison to the rest of the plant, and settlement on unsuitable substrate. Spores that attach to smooth surfaces with no protective relief or to small cobble stones are easily swept away by surge and sand souring (Rigg, 1915; Foreman, 1970). The longer a plant has to develop between high energy episodes, the better its chances of survival.

Summertime storms have little effect on this species. *Nereocystis* is more abundant in the presence of severe and persistent disturbances such as exposure to large swells. The ability to survive under these conditions is due to the resiliency and strength of the stipe of this plant. Koehl and Wainwright (1977) found that *Nereocystis* stipes can stretch approximately 38% of stipe length and has a breaking stress of 2.9 $MN\ m^{-2}$. In addition, Koehl and Alberte (1988) demonstrated that the location of the long, thin fronds at the terminus of the pnuematocyst, allowed the blades to collapse together into a more streamlined bundle and experience lower drag per blade area at a given flow rate. This allows bull kelp to withstand greater wave motion and currents without breaking or becoming detached.

Adult sporophytes that break lose during summer storms have often been grazed near the base of the stipe and the holdfast. This weakening of the stipe causes it to break under turbulent conditions (Foreman, 1970). Those plants that detach can become tangled with attached specimens and the increase in drag can cause those sporophytes to become dislodged and wash up onto the shore (Koehl and Wainwright, 1977).

During winter storms, *Nereocystis* canopies are typically removed by wave action. This is a result due more to the life history of bull kelp than any other factor. Because this species is an annual, mature plants have virtually stopped absorbing and translocating energy by late fall, resulting in weakened holdfasts. The increase in wave energy in combination with shortened day length (reduced light levels) and the decline in photosynthetic activity within these plants results in their death.

In conjunction with increased wave energy is the increase of sediment in nearshore waters. Sediment affects *Nereocystis* by decreasing water clarity and subsurface light levels. As pointed out in Section 3.2.7.1, light is the most limiting factor to growth in bull kelp. Burge and Schultz (1973) reported that unusually heavy rains and runoff during the winter of 1968–69 resulted in turbid waters during the late winter/early spring. Subsequently, *Nereocystis* sporophytes were not seen in the vicinity of Diablo Cove until the middle of July, 1969. The decrease in nearshore light levels inhibited the growth and development of bull kelp for three months and the resulting bed was reported to be one–quarter of the size of the bull kelp bed in 1968 (Burge and Schultz, 1973).

The decrease in salinity levels caused by freshwater run–off has an impact on bull kelp. Brown (1915) found that exposure of *Nereocystis* to freshwater for periods of up to one week would cause the fronds to deteriorate and fall off. Bull kelp experiences little noticeable damage from reduced salinity levels if exposure to run–off occurs for less than three days,.

Hurd (1915) found that young sporophytes could adapt and survive in salinities as low as 15 parts per million if the reduction in salinity was gradual. However, if the salinity was reduced suddenly, by an influx of freshwater run–off, the sporophyte would develop blisters and wilt.

3.2.7.2 Parasites and Disease

Giant Kelp

Our knowledge of kelp diseases is increasing as interest in marine microbiology increases (Goff and Glasgow, 1980; North et al., 1986). Microorganisms have been found associated with tissue deterioration on stressed *Macrocystis*, but it is not known if these microbes are causative agents or represent an incidental appearance, taking advantage of local circumstances (North, 1994).

Black rot, a common disease among canopy blades of *Macrocystis*, generally occurs during the summer and fall, when water temperatures are above normal (Scotten, 1971). Black rot is a darkening of the blades that usually first appears at the tips and then spreads toward the base. The blade softens (as color deepens) and becomes mushy, eventually sloughing (North, 1979). The size of the bacterial population on *Macrocystis* blades correlated with water temperatures, being high in summer and low in winter (North, 1994). Giant kelp tissues exude an active substance during late winter that inhibits bacterial growth (Scotten, 1971).

North (1979) observed a condition called "stipe rot" on three occasions. The observed disease occurred in close association with discharged sewage. Stipe rot is a progressive darkening and deterioration near the basal attachment stipes. The rot only involves a few inches of tissue on the stipe and not the entire organ as in black rot (North, 1979). As stipe rot progresses, the tissues weaken and the entire frond above the lesion is lost. *Macrocystis* plants disappeared from an estimated 250 acres off Point Loma in 1967-1968 (North, 1968a). Similar areas with diseased plants were observed at Point Loma in the mid-1980s (McPeak, pers. obs.).

Bull Kelp

Little information exists about the diseases and parasites of bull kelp. There is only one reported parasitic algae that commonly occurs on *Nereocystis*. The brown algae, *Streblonema* sp., is thought to cause distortions on the stipe of bull kelp that range from pustules (galls) to extended rugose areas. Setchell and Gardner (1925 reported that these infections could have slight to disastrous effects depending on the extent of death in surface and underlying cells. The weakening of stipe tissue could result in plant loss under adverse weather conditions (Apt, 1988).

Bull kelp does not seem to be susceptible to black rot disease, which affects *Macrocystis* and *Egregia* in the spring and summer months, or to stipe blotch disease, which infects two other genera of brown algae, *Alaria* and *Laminaria*. Both of these conditions can cause considerable damage to blades and stipes and result in hugh losses of kelp biomass (Andrews, 1976). In addition, *Nereocystis* is not affected by a fungus that infects its predominant epiphyte *Porphyra nereocystis* (Kerwin et.al., 1992).

3.2.7.3 Mortality Caused by Animals and Plants

Giant Kelp

Many species of animals graze *Macrocystis*, but only a few species (sea urchins, fishes, amphipod and isopod crustaceans) cause mortality (Dayton, 1985; Tegner and Dayton, 1987). Sea urchins are by far the most important grazers in California in terms of frequency and extent of damage to forests of giant kelp. Lawrence (1975) reviewed the general literature regarding worldwide destruction of algal stands by sea urchins, while Harrold and Pearse (1987) reviewed the ecological role of sea urchins and other echinoderms in kelp forests. Foster and Schiel (1985) noted that in sites where sea urchins were abundant, their effects have generally been documented in three categories: (1) wholesale removal of algae; (2) the alteration of species diversity via feeding preferences and selective removal of algal species; and (3) the provision of cleared primary substratum suitable for kelp recruitment.

The rapid denudation of *Macrocystis* and other species of algae in California has been well studied by many researchers (Leighton et al., 1966; Leighton, 1971; North, 1974; Dean et al., 1984; and Harrold and Reed, 1985).

Three species of sea urchins commonly graze forests of *Macrocystis* in California: red sea urchins (*Strongylocentrotus franciscanus)*, purple sea urchins (*S. purpuratus*), and white sea urchins (*Lytechinus anamesus*). Leighton (1966) showed that the two *Strongylocentrotus* species preferred *Macrocystis* to other species of algae tested in the laboratory.

Grazing by *Lytechinus* has been observed, especially in deeper water, but is usually superficial and not as destructive as that by the two species of *Strongylocentrotus* (North, 1994). Dean et al. (1984) observed that white sea urchins on a cobble bottom at San Onofre rarely consumed adult *Macrocystis*. The *Lytechinus* did eat young stages of giant kelp and apparently prevented the San Onofre kelp bed from extending offshore. White sea urchins were observed consuming giant kelp that was transplanted offshore of La Jolla in 1976 (McPeak, pers. obs.).

The impact of purple and red sea urchins at Point Loma has been well documented (North,1964; Leighton et al.,1966; North and Pearse, 1970; Leighton (1971); Tegner, 1980; Tegner and Dayton, 1991, Tegner et. al. 1995a). Leighton (1971) noted that mixed populations of red and purple sea urchins destroyed a *Macrocystis* kelp bed off south Point Loma. The sea urchins, which had formed "fronts" (dense concentrations of grazing sea urchins), were monitored along transects for three months. The purple and red sea urchins attacked holdfasts and basal portions of fronds on adult *Macrocystis*. Fronds were severed and drifted away, while the remaining living material of the holdfast was consumed in place. The sea urchins destroyed the kelp forest at the rate of 33 ft per month and turned the bottom into "barren grounds" as described by Lawrence (1975). Similar grazing and mass destruction of giant kelp at Point Loma was reported by Glantz (1992a). Besides the direct removal of kelp plants through urchin grazing, Tegner et. al. (1995a) also documented the loss of plants by a combination of biotic and abiotic factors. Red and purple sea urchins sheltering in the holdfasts of Macrocystis and feeding on the haptera eventually created cavitation damage, which leads to structural failure of the holdfast when the plants were stressed by large waves.

Dean et al. (1984) found both moving and stationary aggregations of red sea urchins in the kelp forest at San Onofre. The aggregations were observed at the same time and within 100 m of one another. The stationary aggregations probably subsisted mainly on drift kelp and had no effect on kelp recruitment or adult abundance. In contrast, red urchins in large, motile aggregations (fronts) ate nearly all the macroalgae in their path. The motile aggregations formed after 2 years of declining kelp abundance. Dean et al. (1984) proposed that the scarcity of drift algae for food resulted in a change in the behavior pattern of the red urchins and thus lead to the formation of these aggregations.

Harrold and Reed (1985) described a situation at San Nicolas Island, an exposed island site, where the biotic status alternated between an urchin barrens and a kelp-dominated community. There were no significant changes in urchin densities at the study site during switches from one status to the other. Climatic conditions (i.e. presence or absence of major storms) determined which state prevailed. When algal biomass was plentiful, drift weeds were abundant and were captured by sea urchins inhabiting crevice environments. If the standing crop of *Macrocystis* and other algae was substantially reduced by a severe storm, drift became scarce, sea urchins left their crevice habitat to forage, attacking the remaining vegetation. This behavioral change among urchins led to the appearance of barren areas. Harrold and Reed (1985) observed that calm weather, low temperatures, and abundant nutrients produced strong algal recruitment, resulting in less sea urchin foraging and increased survival of the *Macrocystis*. The availability of drift, therefore, altered the feeding behavior of the sea urchins, allowing more algal recruitment. The status returned to its original condition of a high standing algal biomass and urchins inhabiting crevices.

Some studies have indicated that urchin recruitment into barren areas, after they have formed, may maintain the populations of urchins at high densities so that the barren status persists for many years (North, 1983; Pearse et al., 1970). Some sea urchin barren areas have persisted for more than 13 years (North, 1994).

Harrold and Pearse (1987) indicated that the ecological impact of sea urchin grazing often seems to be "all-or-none." That is, sea urchins intensely graze and consume almost all macroalgae, or they graze little if at all and instead feed on pieces of kelp litter. There seem to be "threshold" conditions that must prevail before sea urchins begin to graze attached plants. If the threshold is met or exceeded, the sea urchins abandon their cryptic habitats and switch to an active grazing mode of feeding that results in the formation of deforested areas (Harrold and Pearse, 1987).

Ebeling et al., (1985) studied Naples Reef, near Santa Barbara, and found that winter storms had different effects on the kelp forest community. A storm in 1980 removed all canopies of giant kelp but spared most understory kelps. The large accumulation of detached drift kelp, mostly *M. pyrifera*, disappeared following the storm. Red and purple sea urchins emerged from their shelters to find alternative food. They destroyed most living plants, including the surviving understory kelp. A storm in 1983 reversed the process by eliminating exposed urchins, while clearing rock surfaces for widespread kelp settlement and growth. Extensive canopies of giant kelp developed by the end of 1984, despite elevated water temperatures during the summer and fall of 1983.

Amphipod and isopod crustaceans also graze and destroy populations of giant kelp in California, however, the frequency of intense grazing by these animals is very low compared to sea urchins. Tegner and Dayton (1991) noted mortality of *Macrocystis* off Point Loma in 1985 due to grazing by gammarid amphipods, including *Ampithoe humeralis*. The isopod, *Idotea resecata*, is a common inhabitant of kelp forests and normally feeds upon but does not cause mortality of *Macrocystis*. In 1979, however, tremendous populations to *I. resecata* were observed grazing the basal fronds, sporophylls, and holdfasts of giant kelp at the west end of San Nicolas Island (McPeak, pers. obs.). Several acres of giant kelp forest were eliminated by the combined effects of grazing isopods and sea urchins.

Mortality of giant kelp due to fish grazing by opaleye (*Girella nigricans*) and halfmoon (*Medialuna californiensis*) was reported by North (1972). The fish nibble on blades of giant kelp that are encrusted with bryozoans and other invertebrates. Harris et al. (1984) found these two species of fishes were important grazers of small *Macrocystis* sporophytes on a local scale off Naples Reef, near Santa Barbara. They reported fishes grazed 59% of the sporophytes (< 10 cm tall) that were concealed in turf of ephemeral algae, while 94% of those on open reef quadrates were grazed.

Bull Kelp

The primary grazers of *Nereocystis* are red abalone (*Haliotis rufescens*), red and purple sea urchins, a variety of trochid snails (*Callistoma ligatum*, *C. annulatum*, and *Tegula* spp.), limpets (*Collisella pelta*), and miscellaneous crustaceans (Nicholson, 1968; Burge and Schultz, 1973). North of Point Conception, *Nereocystis* is the predominant food item of red abalone (Cox, 1962). Ebert (1968) reported that juvenile abalone, particularly the flat abalone (*H. walallensis*), and to a lesser extent the pinto (*H. kamtschatkana*) and the red, are often commensal with red sea urchins in bull kelp communities of central California. He found that small abalone (<7 cm) occurred under red sea urchins, presumably moving and feeding on seaweed with the urchins. The extent of *Nereocystis* mortality caused by abalone grazing has not been quantified to date.

Sea urchin grazing, as mentioned in the giant kelp section, exerts a enormous amount of pressure on kelp forests. The extent of this pressure on bull kelp forests has been documented by a number of researchers (Paine and Vadas, 1969; Breen et. al., 1976; Pearse and Hines, 1979; Duggins, 1980; Pace, 1981). Breen et. al. (1976) found that red sea urchins controlled the seaward boundary of bull kelp beds. When red sea urchins were removed from the area, the density of the *Nereocystis* beds increased and there was recruitment of sporophytes to greater depths. Foreman (1970), working at Salt Point, California, reported young sporophyte densities of between 200 to 400 plants per meter^2 in the absence of urchins. Pace (1981), working in Barkley Sound, found that the density of *Nereocystis* was 4.6 plants/m^2 in the presence of *S. franciscanus*. Urchins were then removed and the density of bull kelp sporophytes increased the next spring to 13.9 plants/m^2. In addition, *Nereocystis* doubled its occurrence throughout the study area. At the start of the experiment, bull kelp was found in 5 of 11 plots with sea urchins. Following removal of the sea urchins, *Nereocystis* occurred in 10 of the 11 plots. Similar results were reported in Torch Bay, Alaska when sea urchins (*Strongylocentrotus* spp.) were removed (Duggins, 1980). In the year following urchin removal, kelp biomass increased from zero standing crop to about 60 kilograms wet mass/m^2, with *Nereocystis* contributing to the bulk of the weight and increased species diversity. A species' ability to influence the nearshore environment has far reaching implications and gives credibility to the managing of marine resources as a whole ecosystem rather than species by species.

Burge and Schultz (1973) reported that mortality of young bull kelp sporophytes was extremely high in the presence of algivores but they did not quantify their observations. In addition to grazing of developing plants there is a significant amount of mortality caused by grazing on mature *Nereocystis*. Nicholson (1968) reported finding sporophytes in the intertidal zone and on the shore that had limpet scars in the stipes and pneumatocysts. The limpet, *C. pelta*, will rasp away tissue of the upper stipe and pnuematocyst resulting in deep cavities that weakens the integrity of the thallus. Markham (1969), in his study of epiphytes living on mature *Nereocystis*, reported that epiphytes were absent from the lower portion of the stipe. This lack of epiphytic growth was due to grazing by a variety of molluscan species including *Margarites* spp. and *Lacuna spp.* Koehl and Wainwright (1977) reported that 90% of detached sporophytes found as solitary individuals and 55% of tangled specimens had broken at a flaw in the stipe caused by abrasion or a sea urchin bite.

Bull kelp forests provide protection and food for a number of fish (Burge and Schultz, 1973; Leaman, 1980; Bodkin, 1986). Most of these species feed on small crustaceans (shrimp, crabs, isopods, amphipods), polycheates, molluscs, echinoderms, and bryozoans that occur on, around, or below the canopy. Any ingestion of *Nereocystis* is probably incidental to the other food items and does not result in significant loss of plants. A number of fish are herbivorous (i.e. opaleye, kelp greenling, giant kelpfish), however there has been no direct mention of feeding on *Nereocystis* until recently.

Hobson and Chess (1988) reported that blue rockfish (*Sebastes mystinus*) will ingest bull kelp sori during upwelling periods when preferred food items (gelatinous zooplankton) are unavailable. *S. mystinus* seems able to utilize only algal tissues that include the zoospores of *Nereocystis*. The zoospores of *Nereocystis* have a cell membrane instead of a cellulose cell walls, thus making the spores easier to digest (Hobson and Chess, 1988).

Epiphytes growing on bull kelp can cause mortality. As many as 50 different species of epiphytic algae may colonize the blades and stipe *Nereocystis* (Markham, 1969). The most common epiphytes are the filamentous green algae *Enteromorpha* sp., the filamentous red algae *Antithamnion* spp., and the foliose red *Porphyra nereocystis*. As the summer progresses, the combined weight of these epiphytes can overcome the buoyancy of the pnuematocyst and cause the entire plant to sink beneath the surface. At this point, the photosynthetic activity of the blades is reduced and the blades come within reach of the primary grazers, sea urchins (*S. franciscanus* and *S. purpuratus*) and abalone (*Haliotis* spp.). The second source of mortality due to epiphytes is the subsequent increase in the drag coefficient caused by their growth. During storm conditions this increase may facilitate the detachment of adult sporophytes (Foreman, 1970). No direct measure, or estimate, of the loss indirectly caused by epiphytic growth on *Nereocystis* populations has been made.

3.2.8 Competition

Giant Kelp

Giant kelp in California competes with many other species of macroalgae for light, substrate, and nutrients. Dayton et al. (1984) described distinct patch types of macroalgae composed of species that could be categorized into vegetation layers distinguished by distinct morphological adaptations. These layers include (1) a floating canopy (*Macrocystis*, *Pelagophycus porra*, and *Nereocystis*) supported at or near the surface by floats; (2) a stipitate, erect understory in which the fronds are supported well above the substratum by stipes (*Pterygophora californica*, *Eisenia arborea*, and *Laminaria setchellii*); (3) a prostrate canopy in which the fronds lie on or immediately above the substratum (*L. farlowii*, *Cystoseira osmundacea*, and *Dictyoneurum californicum*); (4) a densely packed algal turf of articulated coralline algae (especially *Calliarthron* spp.) and many species of foliose and siphonous red algae; and (5) encrusting coralline algae such as *Lithophyllum* spp. and *Lithothamnion* spp.

Competition between *Macrocystis* and associated macroalgae frequently affects local distribution (North, 1994). Interference with recruitment by *Macrocystis* and other algae through shading by adults of all species is a common competitive mechanism (Edwards, 1998; Reed and Foster, 1982; Pearse and Hines, 1979; Foster, 1975a). Stipitate kelps such as *P. californica* and *L. setchelii* can also shade the bottom with their understory canopies, inhibiting recruitment of *Macrocystis* juveniles. Occasionally, giant kelp recruits within dense patches of *Pterygophora* during the winter, when foliage of this stipitate species is minimal. The recruits of giant kelp, however, generally do not survive after *Pterygophora* adds foliage in the spring, decreasing light to the developing plants (R. McPeak, pers. obs.).

Studies at Catalina Island revealed a negative association between *Macrocystis* and the introduced species, *Sargassum muticum* (Nicholson et al., 1981; Ambrose and Nelson, 1982). *Sargassum* grew well at elevated temperatures, while giant kelp did poorly and vice versa. Articulated and crustose corallines were competitively superior to *Macrocystis* at Catalina Island because they tolerated strong water motion that destroyed the giant kelp (Wells, 1983).

Foster (1975b) studied patterns of algal succession that occurred on concrete blocks that were placed in a *Macrocystis* forest. The substrates were initially colonized by rapidly–growing ephemeral species. These were later replaced by perennials characteristic of the kelp forests. *Macrocystis* colonization was greatest during spring. Encrusting animals competed with plants for attachment space on the substrates. Encrusting animals were favored when grazing fishes and sea stars were excluded from the blocks by caging (Foster, 1975a).

The inner border of the *Macrocystis* zone in southern California (i.e. San Diego County) is often dominated by *Egregia menziesii*, a floating species better adapted to withstanding wave action (North, 1971b). The offshore border of the *Macrocystis* bed near San Diego is dominated by elk kelp, *Pelagophycus porra* (North, 1971b). This species is better adapted to lower light conditions in deeper water and outcompetes *Macrocystis* at depths greater than 70 feet.

Algal competition frequently produces patchy distributions within kelp forests (North, 1994) and small areas become dominated by species other than *Macrocystis*. Dayton et al. (1984) studied three aspects of competition and patch dynamics in California kelp forests: (1) persistence of the patches; (2) inertia (resistance of the patches to invasion by other species); and (3) resilience (ability to recover after invasion by another species). The research by Dayton et al. (1984) was conducted in three very different habitats: along the exposed coast of Point Loma, in the protected waters at Birdrock, Catalina Island, and along the exposed coast of central California near Pt. Piedras Blancas.

Dayton et al. (1984) studied how *Macrocystis* competed with several patch types at Point Loma, including stipitate kelps *Pterygophora californica*/*Eisenia arborea* and prostrate kelps *Laminaria farlowii*/*Cystoseira osmundacea*. Many of the species that compete with giant kelp are quite long-lived (i.e. *Eisenia* >12 yrs, *Pterygophora* >11 yrs, *Laminaria* = 6 yrs, *Cystoseira* = 6 yrs). Persistence was high among patches studied in the Point Loma kelp forest, with borders remaining virtually unchanged throughout the ten year study period. The ten years encompassed passage of more than one generation of the dominant species within a patch. Giant kelp was able to invade patches of *Pterygophora* when entangled bundles of *Macrocystis* drifters caused cleared areas in the *Pterygophora* patch and swamped the area with spores. Dayton et al. (1984) noted that the overstory and understory relationships were similar at Birdrock, Catalina Island, and Point Loma. *Macrocystis* suppressed the ephemeral understory of *Dictyota flabellata* and *Pachydictyon coriaceum* at Catalina Island.

At Pt. Piedras Blancas, *Macrocystis* dominated the deeper, more stable substrata while *Nereocystis* dominated the shallower, more exposed localities, or areas with unstable cobble substrata. Patches of *Pterygophora* and *L. setchellii* were common on the inshore edge of the canopy-producing kelps. The *Pterygophora* and *Laminaria* were better adapted to withstand the surge and swell and *Macrocystis* was not able to penetrate these patches.

Various natural forces such as storms and grazing by sea urchins may partially or completely eliminate established patches. The nature of successful new colonizers in such cases depends on availability of reproductive propagules moving into the cleared area. Dayton and Tegner (1984) called this "scramble competition." Dayton et. al. (1984) noted that tall-statured kelps such as *Macrocystis* are more impacted by storms and large swell than their stipitate competitors such as *Pterygophora* and *Eisenia* or prostrate competitors, *L. farlowii* and *Cystoseira*.

Bull Kelp

Nereocystis is an opportunistic colonizer that takes advantage of substrate clearing caused by storms, sand scouring, or other natural disturbance (Paine and Vadas, 1969). While bull kelp can rapidly recruit to a newly cleared location, its longevity as the dominant canopy–forming species depends on environmental conditions being conducive for its survival and detrimental for its major competitor *Macrocystis*. Bull kelp, as mentioned in Section 3.2.2, is found at depths of between 3 to 21 meters in areas that experience a high to moderate degree of wave force. *Nereocystis* is also able to exist in sea urchin–dominated areas that lack perennial algal cover and have high light levels (Pearse and Hines, 1979). If these conditions exist in the recruitment area then bull kelp will become the dominant species and exert considerable influence on the recruitment of red and brown algae below its canopy. However, if the conditions are the opposite (shallow, protected waters free of sea urchins) then giant kelp spores can become established during the summer/fall and develop over the winter months when *Nereocystis* is declining. In the spring, a dense *Macrocystis* canopy can reduce the understory light levels, shading out *Nereocystis* sporophytes as well as *Laminaria dentigera* and *Pterygophora californica* and foliose red algae. *Nereocystis* is competively subordinate to the dense canopy–forming perennial *Macrocystis* (Miller and Estes, 1989).

Nereocystis is unable to compete with or "invade" established assemblages of understory algae. The understory is composed of several layers: a stipitate, erect group in which the fronds are suspended above the bottom (*Pterygophora californica*, *Eisenia arborea*, *L. setchellii*), a layer of prostrate canopy in which the fronds lay on the substrate (*L. farlowii*, *Cystoseira osmundacea*, *Dictyoneurum californicum*) and a dense turf community composed mostly of articulated coralline algae, foliose and filamentous red algae (Dayton et. al., 1984). The denseness of these layers can prevent bull kelp spores from reaching and settling the substrate. Thus, the spores are transported away by bottom currents. In situations where spores do penetrate the ground cover, light levels below the secondary and tertiary canopies are less than one percent of surface light and are suboptimal for development of *Nereocystis* gametophytes and young sporophytes (Vadas, 1972).

3.2.9 Kelp Community

The kelp forests of California are among the most productive communities in the sea (Foster, 1979). The kelp forests influence, or lessen, the effect of winds, water currents, and nutrient fluctuations within and inshore of these areas (Leaman, 1980; Jackson, 1983). The most noticeable demonstration of this is seen on windy days when wind riffles appear on the outside of a kelp bed and calm water on the inside. The ecological importance of giant and bull kelp has been well documented. They provide food, habitat, and substrate for a wealth of invertebrates, fishes, birds, marine mammals, and even other plants. (Limbaugh, 1955; North, 1971a; Burge and Schultz, 1973; Miller and Geibel, 1973; Foster et. al., 1979a; Leaman, 1980; Coyer, 1984; Foster and Schiel, 1985; Gotshall et. al., 1984; Snider, 1985; Bodkin, 1986, 1988; DeMartini and Roberts, 1990).

Macrocystis and *Nereocystis* are fairly unique among marine algae because they extend throughout the water column. Thus, kelp forests can be divided into three types of habitat: the canopy, stipe or midwater, and holdfast/seafloor. Each of these levels provides refuge for a unique set of inhabitants as well as crossover species. Due to the vertical aspect of kelp plants, Clendenning (1960) estimated that the surface area of the plants in an average *Macrocystis* kelp bed is 15 times the surface area of the bottom of the plants not including the additional area and complex structure provided by the holdfast. Giant and bull kelp also provide additional habitat in the form of drift kelp and beach wrack.

3.2.9.1 Invertebrates

Giant Kelp

The canopy environment has been studied by a number or researchers (Limbaugh, 1955; Wing and Clendenning, 1971; Miller and Geibel, 1973; Feder et al., 1974; Bernstein and Jung, 1980; Coyer, 1984, 1986). The canopy habitat is a dynamic habitat that is ephemeral, subject to change, and submergence (Feder et al., 1974).

The community of epiphytes growing on blades of *Macrocystis* in canopies of southern California is simple, consisting primarily of the bryozoans *Membranipora membranacea*, *Hippothoa hyalina*, and *Lichenopora buskiana*; the serpulid polychaete *Spirorbis spirillum*, and hydroids *Obelia sp.* and *Campanularia sp.* (Bernstein and Jung, 1979). Two species of nudibranchs, *Corambe pacifica* and *Doridella steinbergae* mimic *Membranipora* and feed exclusively on it. These nudibranchs are frequently encountered in the canopy. Wing and Clendenning (1971) found tremendous populations of motile animals on fronds of giant kelp encrusted with the bryozoan *Membranipora*. The total number of motile animals on canopy fronds increased with increasing weight of *Membranipora*. Tiny copepods were usually the most numerous motile animal in canopy samples taken by Wing and Clendenning (1971). Twelve of twenty-three summer canopy samples had motile animal populations greater than 100,000 per m^2 of plant tissue.

Coyer (1984) reported 11 species of gammarid amphipods from *Macrocystis* canopies at Santa Catalina Island in southern California. These species accounted for the major portion of invertebrate biomass in the canopy. Copepods were more numerous than gammarid amphipods but accounted for very little of the total biomass of invertebrates in the canopy. Mysids and shrimps were a minor component of the canopy numerically but contributed a major portion of the biomass. Gammarid amphipods, mysids, and shrimps in the canopy were larger in size compared to the same groups at lower levels in the forest.

Coyer (1986) found that molluscs comprised only 1.0% (by numbers) of the invertebrates associated with fronds in the canopy. The fewest numbers of molluscs was found in the canopy zone compared to lower levels. Only one mollusc, a nudibranch *Polycera tricolor*, was more abundant in the canopy than in lower levels.

Feder et al., (1974), recorded 30 species of invertebrates, of which 25 were considered characteristic of the canopy habitat; and 59 species of fishes, of which six were considered characteristic.

Miller and Geibel (1973) evaluated the macro-organisms (larger than 10 mm) living in the canopy of a central California *Macrocystis* forest. They estimated the number of macro-organisms per ton of kelp and per acre of forest cut at about 10 ft. Sections of *Macrocystis* canopy were cut and gently floated over a burlap blanket (20 X 30 ft), where the motile animals were prevented from escaping during counting.

Samples were taken at three different times between February and early August 1970. The mean number of organisms per sample varied considerably during the course of the study. The isopod, *Idotea resecata*, far outnumbered all other species of macro-organisms in the samples and averaged about 7,500 per acre (Miller and Geibel, 1973). The other common species averaged (per acre) as follows for the three samples: kelp crab, *Pugettia producta* - 300; *Calliostoma* snails (3 species)- 700; *Tegula* snails (3 species)- 3,000; and fishes (8 species)- 1,000.

The tangled mass of fronds rising from the bottom to the surface constitutes the midwater level. This level extends from about three feet above the holdfast to three feet beneath the surface. Many of the animals described from this level also occur in the surface canopy or around the holdfast. Organisms that enter the mid-level are motile forms that are free to climb or swim, and sessile forms that attach to the kelp (Feder et al., 1974). Feder et al. (1974) listed 29 species of invertebrates observed by diving in the mid-level zone of which, five species of invertebrates were considered characteristic of this habitat. Wing and Clendenning (1971) found incredible numbers of small motile invertebrates associated with surfaces of *Macrocystis* at mid-level. One kelp sample collected from a depth of 25 ft, yielded 12,000 copepods from an area of kelp tissue 4 in^2 in size. The following are descriptions of a few of the species encountered in this region. For more information consult Limbaugh (1955), North (1971a), Coyer (1984, 1986), and Foster and Schiel (1985).

Crustaceans (amphipods, isopods, decapods, etc.) are numerically the dominant animals in kelp forests. Coyer (1984, 1986) studied the motile invertebrate assemblage associated with giant kelp at Santa Catalina Island. Crustaceans were very abundant in the mid-level and numbered nearly 6,900/kg of plant tissue (Coyer, 1984). The following four species of gammarid amphipods were by far the most common crustaceans encountered in the mid-level: *Microjassa litotes*, *Gitanopsis vilordes*, *Anoroides columbiae*, and *Porcellidium viridae*. The isopod, *Idotea resecata*, is one of the more common inhabitants of the mid-level. This species grazes on *Macrocystis* and appears to prefer the portion of the blade near the point of attachment of the pneumatocyst (Jones, 1971). These crustaceans are well adapted for life on giant kelp. They have seven pair of legs, each leg with hooked tips to help cling to the substrate.

Coyer (1986) recorded 41 species of molluscs on fronds of giant kelp at Santa Catalina Island. Molluscs comprised only 1.6% (by number) of all invertebrates associated with the mid-level. The mean number of species of molluscs encountered in the mid zone was 15.6. *Granulina marginata* and *Crepidula* sp. were by far the most abundant molluscs in the mid-level zone.

Foster and Schiel (1985) list many species of molluscs that feed upon giant kelp in the canopy and mid-level. In central California, three species of *Tegula* (*T. pulligo*, *T. montereyi*, and *T. eiseni*) and three species of *Calliostoma* (*C. annulatum*, *C. ligatum*, and *C. canaliculatum*) commonly occur on fronds of *Macrocystis*. Smaller snails, *Mitrella carinata* and *Lacuna unifasciata*, are often the most abundant gastropods on mid-level fronds in southern California (Jones, 1971). *Mitrella* feeds primarily on detritus while *Lacuna* feeds directly on giant kelp stipes.

Holdfasts, which vary in size from a few cm^3 to more than 120,000 cm^3, provide a complex crevice environment for animals. Holdfasts may contain thousands of small animals; some using the crevice environment for hiding, others using tissues of the holdfast for food (Ghelardi, 1971). Andrews (1945) found over 23,000 individual animals in five holdfasts of *Macrocystis* that he collected in central California. The holdfast structure is also a very favorable environment for early development of urchins and abalone.

Ghelardi (1971) described three sub-habitats of *Macrocystis* holdfasts: (1) small holdfasts composed entirely of living plant material (haptera), and large holdfasts consisting of (2) living outer shells, and (3) dead centers. He noted three categories of animals living in these sub-habitats: (1) animals most frequent and abundant in living portions of both large and small holdfasts, (2) animals most frequent in dead portions of large holdfasts, and (3) animals equally abundant in dead or live portions of holdfasts. Polychaetes, isopods, and gammarid amphipods were the most frequent and abundant groups encountered by Ghelardi (1971) in holdfasts. He identified more than 130 species of animals in holdfasts of giant kelp off La Jolla, California. The most abundant and frequent species of the three major groups in the living portion of the holdfasts were: gammarid amphipod, *Ampithoe rubricata*; polychaeta, *Phyllodoce lineata*; and isopoda, *Janiralata rajata*. The most frequent and abundant species in the dead portions were: gammarid amphipod, *Eurystheus thompsoni*; polychaeta, *Jasmineira* sp.; isopoda, *Cirolana parva*. These animals and the other species that occupy holdfasts of giant kelp are important sources of food for fishes and invertebrates. For more detailed information on the animals that inhabit holdfasts of giant kelp in southern California see Ghelardi (1971) and Snider (1985).

Snider (1985) examined the emergence patterns of demersal zooplankton inhabiting holdfasts of *Macrocystis* pyrifera at scales of 24 hours, a lunar cycle, and a year in a kelp bed off Point Loma, California. Gammarid amphipods and copepods numerically dominated the emerging zooplankton over all three temporal scales. Three general patterns of emergence were observed over the course of a diel cycle: (1) night emergence exhibited by amphipods, isopods, and shrimp, (2) day emergence shown by copepods and medusae, and (3) variable emergence exemplified by mysids and ostracods.

Snider (1985) found seventeen species of resident gammarid amphipods to be numerically abundant in kelp holdfasts, however, only eight species were abundant in the emergent fauna. The gammarid amphipods *Batea transversa* and *Lysianassa dissimilis* were consistently the most abundant species of emergent amphipods. Small inconspicuous organisms emerged during the day while large, conspicuous organisms emerged at dusk or during the night.

An interesting isopod, the gribble, *Limnoria algarum*, lives in holdfasts of giant kelp (Jones, 1971). This species burrows into older haptera, creating tunnels. A row of small holes on a hapteron indicate that gribbles are at work. These isopods feed on the haptera.

Brittle stars are very abundant in holdfasts of giant kelp. Andrews (1945) found brittle star densities up to $300/m^2$ in holdfasts in central California. *Ophiothrix spiculata* and *Amphiolis pugetana* were most abundant in holdfasts in central California.

Bull Kelp

Since bull kelp is an annually occurring species and declines in abundance for several months each year, the animals and plants that utilize these forests are opportunistic colonizers, moving in each spring from perennial algal species as the young bull kelp sporophytes begin to grow. Thus, the invertebrate assemblage found in the canopy are similar to those found associated with *Laminaria* or *Pterygophora* as well as the giant kelp forests of central California (McLean, 1962; Burge and Schultz, 1973).

Due to the physical differences between giant kelp and bull kelp (see cover page), the animals that live on *Nereocystis* stipes are limited to epiphytic algae and sessile invertebrates as well as amphipods, isopods, and snails, which move up and down the stipe (Andrews, 1925). Markham (1969) noted a total of 14 genera and 23 species of epiphytes on *Nereocystis* stipes in Washington state. The species found included three species of Chlorophyta, three Phaeophyta, and 16 Rhodophyta. Seven of the red algal species are in the genus *Antithamnion*. Of sessile invertebrates, *Membranipora membranacea* is the most abundant followed by hydriods (*Obealia* sp.) and barnacles (*Balanus* spp.). The motile animals consist of caprellid amphipods, *Idotea* sp. and top snails (*Callistoma* spp.).

Several benthic surveys have been conducted within bull kelp beds and have provided a detailed picture of this community (McLean, 1962; Burge and Schultz, 1973; Foster et. al., 1979a and b; Gotshall et. al., 1984, 1986). Only one study looked directly at bull kelp holdfasts as habitat and food for invertebrates. Andrew (1925) reported that the abundance of invertebrates is greatest in and around the holdfast, with upwards of 40 species being identified living within the haptera. On examination of nine holdfasts, he found 2605 individuals which rivals the numbers found in giant kelp holdfasts. The species most commonly found in the holdfasts are amphipods, *Idotea* sp., caprellids, *caprella* sp., nudibranchs, polychaetes (*Nereis* spp.), blood worms (*Amphiporus bimaculatus*), brittle stars (*Ophiopholis* spp.), crabs (*Pagurus* sp., *Cancer* spp.), chitons (*Leptidochitonia lineata*, *Mopalia ciliata*), sea urchins (*Strongylocentrotus* spp.); and young abalone (*Haliotis* spp.). The holdfast can be considered nursery areas for immature forms, and a refuge for some maturing and a few adult forms (Andrew, 1945).

In addition to the holdfast providing forage material and protection, the surrounding environment is also utilized by various invertebrates and fishes. Foster et. al. (1979) surveyed beds of giant and bull kelp between San Francisco and Monterey. The seafloor beneath the *Nereocystis* canopy was covered by several algal species. The understory algal cover was composed of approximately thirty species, of which *Polyneura latissima*, *Desmarestia* spp. and encrusting corallinaceae (*Lithothamnium crassiusculum*, *L. microsporum* and *Lithophyllum lichenare*) were most abundant. Beneath the algal cover are tube polychaetes, hydroids, encrusting sponges, cup corals, anemones, barnacles, colonial tunicates, bryozoans, erect sponges, clams, and solitary tunicates. Sea urchins, abalone, sea stars (*Pisaster brevispinus*, *P. ochraceus*, *P. giganteus*, *Asterina miniata*, and *Pycnopodia helianthoides*), and crabs (*Cancer* spp.) were abundant in crevices and on the substrate beneath the bull kelp (Foster et. al., 1979a, b).

Gotshall et. al. (1984) compiled 5 years of subtidal survey data from three transect sites in Diablo Cove. This information supports Foster's description of the subtidal environment beneath *Nereocystis* beds. As mentioned before, the abundance of all these animals, except sea urchins, was higher in giant kelp beds than in bull kelp beds. Red sea urchin densities within *Nereocystis* beds was approximately 2.57/m^2 while only 0.64/m^2 in *Macrocystis* beds (Foster et. al., 1979). The density of purple sea urchins was also higher in bull kelp beds than giant kelp beds. Pearse and Hines (1979) observed similar densities in their studies off Point Santa Cruz. There is no clear reason why urchin abundance is higher in bull kelp beds versus giant kelp beds although it may be related to the abundance of understory algal cover. Morphological difference between the two species allows more surface light penetration in *Nereocystis* beds, and in turn, a higher abundance of subcanopy algae, which probably attracts sea urchins.

3.2.9.2 Fish

Giant Kelp

Giant kelp provides forage and shelter for a large number of fishes, many of which are important to recreational and commercial fisherman (Quast, 1971a and b; Feder et al., 1974; Foster and Schiel, 1985; Bodkin,1988). Kelp forests support large numbers of mysids, amphipods, and other small invertebrate prey and provides hiding places, both of which are of particular importance to juvenile fishes. Tropical fish families such as Pomacentridae, Labridae, Serranidae, and Kyphosidae are dominate in southern California kelp forests. In contrast, temperate families such as Scorpaenidae, Hexagrammidae, and Embiotocidae are dominant in central and northern California kelp beds (Foster and Schiel, 1985).

Kelp improves the habitability of an area for fishes by providing reference or orientation points throughout the water column (Quast, 1971). Demersal fishes are reluctant to move beyond visual range of their habitat and the reference points provided by kelp probably encourages them to extend their feeding zones upwards in the water column (Quast, 1968a). The columns of kelp act as guideposts to the bottom and provide special refuge and foraging areas.

DeMartini and Roberts (1990) studied the relationship between fish and kelp density in southern California and found that in areas where the bottom is relatively flat, fish and kelp density is positively correlated. They looked at 14 fish species and found that fish and kelp density were significantly related for 18 of 30 life stages. In contrast, Stephens et al. (1984) suggested that the presence of giant kelp may have little effect on the abundance of most fish species in a high relief environment. Attraction of kelp canopies for adult fishes was small or inconsequential in kelp beds where the bottom relief was high (Stephens et al., 1984; Ebeling and Laur, 1988).

Holbrook et al. (1990) studied the effect of giant kelp on the local abundance of seven species of fishes in southern California and found that six species had a positive relationship and one had a negative relationship with giant kelp. Of the six species which had a positive relationship, kelp surfperch (*Brachyistius frenatus)* and giant kelpfish (*Heterostichus rostratus*) had the strongest correlation between kelp density and fish abundance. Kelp rockfish *(Sebastes atrovirens)* was absent from reefs without kelp, however there was no strong correlation between kelp density and fish density. The abundance of young-of-the-year kelp bass (*Paralabrax clathratus*) was positively related to the amount of kelp on the reef, however this was not the case for adults. Changes in the understory algal community caused by giant kelp appeared to benefit black surfperch (*Embiotoca jacksoni*) and pile surfperch (*Damalichthys vacca*). The importance of giant kelp for fishes is strongly related to habitat requirements by different life history stages of a species. They note that a prolonged absence of giant kelp may lead to a lower local abundance of adults for species that recruit to kelp such as kelp bass and many rockfishes.

Ebeling et al. (1980) compared the fish community between a mainland kelp bed and a Channel Island bed. They documented changes in the community associated with habitat (canopy, mid-water, and benthic), year, and water quality parameters. They found that canopy assemblages were simpler and less variable than benthic assemblages, annual variation was relatively small, and mid-water planktivores exhibited the greatest variation.

Car (1989) investigated the relationship between fish recruitment and macroalgae at Santa Catalina Island, and found that the density of juvenile kelp bass, kelp surfperch, and giant kelpfish was significantly greater in areas with giant kelp than in nearby reef areas devoid of kelp. Abundance of the Island kelpfish (*Alloclinus holderi*) and several *Gibbonsia* spp. was lower in areas with giant kelp.

Hartney (1996) investigated homing behavior and site fidelity of señorita (*Oxyjulis californica),* blacksmith (*Chromis punctipinnis)*, and kelp bass in a kelp forest at Santa Catalina Island. All three species had a limited home range. Approximately 80% of the tagged señorita and 100% of the tagged blacksmith returned to the site of their initial collection. However, none of the tagged young-of-the-year or juvenile kelp bass returned to the site where they were first collected.

Feder et al. (1974) examined the fish community associated with giant kelp canopy habitat off southern California. They recorded 59 species of fishes, six of which were considered characteristic: the kelp pipefish (*Syngnathus californiensis)*; topsmelt *(Atherinops affinis)*; kelp surfperch; manacled sculpin (*Synchirus gilli)*; kelp gunnel (*Ulvicola sanctaerosae*); and the kelp clingfish (*Rimicola muscarum*).
Foster and Schiel (1985) reported that the kelp gunnel, kelp clingfish, and the manacled sculpin were also common in giant kelp canopies off central California.

Pondella and Stephens (1994) noted that the abundances of newly recruited kelp bass, opaleye (*Girella nigricans*), and giant kelpfish increased with the emergence of giant kelp on the breakwaters in King Harbor, Redondo Beach.

Juvenile rockfishes recruit to central California kelp forests in tremendous numbers during the upwelling season from spring through summer (Burge and Shultz 1973). Initial recruitment occurs in May and juveniles remain in the canopy until the winter storms commence (Foster and Schiel, 1985). Singer (1985) studied seven species of rockfishes that recruit to giant kelp forests off central California, and noted that three species commonly recruited to the canopy. The copper rockfish (Sebastes caurinus), and the gopher rockfish (S. carnatus) initially recruit to the canopy in late June and July. Kelp rockfish recruit to the canopy in central California in late July and August. While in the canopy, copper rockfish feed primarily on calanoid copepods, with harpacticoid copepods and zoea also eaten. The gopher rockfish feeds almost exclusively on calanoid copepods. The kelp rockfish feeds mainly on gammarid amphipods and calanoid and harpacticoid copepods, as well as mysid shrimp. He also noted that juveniles and adults of most species had similar foraging patterns. The lack of aggressive interactions among species and the large differences in intraspecific foraging strategies indicated that competition for food was probably negligible.

Limbaugh (1955) noted 62 species of fishes that he observed in or around giant kelp canopies in southern California. Four species preferred the canopy habitat: topsmelt, kelp surfperch, kelp gunnel, and kelp pipefish. He also noted that juveniles of nine species were common in kelp canopies. In southern California, the kelp clingfish is probably tied closest to the kelp canopy and eggs of this inch-long fish were frequently encountered there. Limbaugh (1955) reported that eggs of other fishes were observed far less frequently in kelp canopies. The kelp surfperch is one of the relatively few fishes that forages in kelp canopies off southern California. It preys extensively on gammarid amphipods and copepods in the canopy (Hobson and Chess, 1976).

Larson and DeMartini (1984) compared the abundance of fishes between a kelp forest and an adjacent cobble reef without kelp in southern California. Areas with kelp supported a greater standing stock of fishes (except for *Paralabrax clathratus*). They concluded that low relief reefs with kelp, even in moderate densities, are necessary to support a large diversity and biomass of fishes.

Patton et al. (1994) identified fish grazing as a major factor controlling the distribution of giant kelp on rocky substrate in southern California. They identified four fish as being the primary grazers of giant kelp in southern California: halfmoon, opaleye, garibaldi (*Hypsypops rubicundus*) and sheephead (*Semicossphus pulcher*).

Miller and Geibel (1973) recorded the following species in their collections from central California: striped kelpfish (*Gibbonzia metzi*); penpoint gunnel (*Apodichthys flavidus*); rockweed gunnel (*Xererpes fucorum*); kelp gunnel, kelp clingfish, saddleback sculpin (*Oligocottus rimensis*); juvenile rockfishes, *Sebastes* spp.; and pipefish *(Syngnathus* spp.)

The midlevel zone extends from three feet off the bottom to three feet below the surface. Feder et al. (1974) listed 56 species of fishes observed by diving in the midlevel zone, eight of which were considered characteristic of this habitat: kelp bass, kelp surfperch; white surfperch (*Phanerodon furcatus*); rubberlip surfperch (*Rhacochilus toxotes*); blacksmith, senorita, opaleye, and halfmoon (*Medialuna californiensis*).

During the summer, rafts of giant kelp form as a result of natural sloughing or due to physical trauma on the plants caused by grazing animals or storms. These rafts become home to numerous juvenile and adult fish (Dawson and Foster, 1982).

Bull Kelp

A bull kelp forest typically consists of older plants near the surface and an understory canopy composed of young *Nereocystis* sporophytes of different heights and either pure or mixed stands of *Laminaria* spp. or *Pterygophora californica* (Foster et. al., 1979; Foster and Schiel, 1985). The understory provides cover for fish as well as invertebrates. Bodkin (1986) compared the fish assemblages and abundance in *Macrocystis* and *Nereocystis* beds in central California. He found that species composition was similar but *Macrocystis* beds supported a higher biomass of species (2.4 times). Also, he reported that the abundance of rockfish (*Sebastes spp.)* was 4.5 times greater in giant kelp beds than in bull kelp beds. Bodkin (1986) encountered the following midwater species in *Nereocystis* beds during his surveys: blue rockfish, (*Sebastes mystinus*); olive rockfish (*S. serraniodes*); kelp rockfish, black rockfish (*S. melanops*); juvenile rockfish; señorita, tube–snout (*Aulorhynchus flavidu*), and jacksmelt (*Atherinopsis californiensis*). Ecological studies on the fish of *Nereocystis* beds conducted in British Columbia, Canada and at Diablo Cove, California produced similar midwater species lists (Leaman, 1980; Gotshall et. al., 1984).

Fish diversity and abundance is greater at the bottom than the other two regions (midwater and canopy). Gotshall et. al. (1986) developed a list of over 30 fish species seen during benthic surveys conducted in Diablo Cove. The most diverse and abundant group continued to be rockfish (*Sebastes* spp.), followed by greenlings (*Oxylebius pictus, Hexagrammos decagrammus*), lingcod (*Ophiodon elongatus*) and cottids (*Artedius corallinus, Orthonopias tracis, Scorpeanichthys marmoratus*). Bodkin (1986) also reported greater diversity for benthic fish within *Nereocystis*. Nineteen species were identified as common in both giant kelp and bull kelp; however, the biomass of fish associated with *Macrocystis* was 34% greater than the biomass found in *Nereocystis* (Bodkin, 1986). For more information on this topic see Burge and Schultz (1973), Leaman (1980), and Gotshall et. al. (1986).

Leaman (1980), examined the ecology of fishes in a bull kelp bed in British Columbia. He looked at species assemblage, seasonal dynamics, food habits, and growth of selected species. Kelp forest fishes were grouped into the following categories: neritic resident, neritic associated, neritic transient, benthic resident, benthic associated, and benthic transient. The spiny dogfish, *Squalus acanthias*, would be considered a neritic transient species because it is only occasionally found in kelp beds while kelp surfperch are neritic residents. He also classified kelp bed fishes according to their feeding habits: predator, grazer, and planktivor. He found that two pairs of the four most abundant benthic fishes were directly competing for food resources (primarily caprellid amphipods). He concluded that food was not a limiting resource during his study period since few fish had empty stomachs. In contrast, he found little dietary overlap between neritic fishes. He noted that neritic and benthic fishes exploited the increased spatial heterogeneity that is provided by the holdfast, stipe and laminae. He found no correlation between fish diversity and kelp density.

3.2.9.3 Birds

Kelp provides three different habitats for birds (Foster and Schiel, 1985): 1) kelp forest - living attached kelp in association with rocky or sandy habitat, 2) drift kelp - detached kelp that may be found floating far out to sea in the pelagic zone, and 3) kelp wrack - detached kelp that is deposited on the beach. The canopy and mid-level regions of kelp beds provide habitat for many different species of birds. Some of the birds associated with kelp canopies are also found with drift kelp away from shore. Shorebirds commonly forage for food in the kelp wrack washed ashore.

Giant Kelp

Many species of birds perch on giant kelp canopy or scavenge for food among its fronds. Large numbers of elegant terns (*Sterna elegans*) and Heermann's gulls (*Larus heermanni*) have been observed roosting on kelp canopy off central California (Foster and Schiel, 1985). These birds pick small fishes from the canopy by surface plunging (Angell and Balcomb, 1982). Several other species of gulls have been observed scavenging on surface kelp canopy, notably the western gull (*Larus occidentalis*) and Bonaparte's gull (*L. philadelphia*) (Foster and Schiel, 1985). The great blue heron (*Ardea herodias*) and the snow egret (*Egretta thuls*) are often seen perched on kelp canopy stalking prey at the water's surface.

Shorebirds, such as the willet (*Catotrophorus semipalmatus*) and the wandering tattler (*Heteroscelus incanus*) may forage on the surface of kelp forests. The northern phalarope (*Phalaropus lobatus*) has been observed feeding on plankton within openings giant kelp canopies in central California (Foster and Schiel, 1985).

There are several species of birds that frequent the mid-level region of giant kelp forests. Brandt's cormorant (*P. penicillatus*) and the pelagic cormorant (*P. pelagicus*) are most closely associated with California's kelp forests (Ainley, pers. comm. in Foster and Schiel, 1985). Brandt's cormorants feed almost exclusively on fishes that inhabit the mid-level habitat among fronds of giant kelp (Hubbs et al., 1970). The pelagic cormorant has similar feeding habits to Brandt's. Horned grebes (*Podiceps auritus*) and eared grebes (*P. nigricollis*) are commonly observed in kelp forests. One of their major food items is mysids and it is probable that they feed on the swarms of mysids that occur within the mid-level of the kelp community (Foster and Schiel, 1985). The seaward fringe of kelp forests probably supports the greatest diversity of birds. Loons, grebes, cormorants, and scoters are all foot-propelled pursuit divers that may forage along the edge of kelp beds (Foster and Schiel, 1985). Diving birds such as loons, cormorants, pelicans, and grebes also utilize the mid-levels of bull kelp when available.

Bull Kelp

Along the north coast, bull kelp is the dominant canopy–forming species. When the *Nereocystis* canopy is fully developed, a number of nearshore and marine birds forage in and around the beds. Sowls et. al. (1980) reported that 42% of California's breeding seabirds reside in northern California. Large portions of the state's breeding population of fork–tailed storm–petrals (*Oceanodroma furcata*), Leach's storm–petrals (*O. leucorhoa*), double–crested cormorants (*Phalacrocorax auritus*), common murres (*Uria aalge*), rhinoceros auklets (*Cerorhinca monocerata*), and tufted puffins (*Lunda cirrhata*) inhabit this part of the coast. Six other species also have small breeding populations in this region: Brandt's cormorant (*P. penicillatus*), pelagic cormorant (*P. pelagicus*), black oystercatcher (*Haematopus bachmani*), western gull (*Larus occidentalis*), pigeon guillemot (*Cepphus columba*), and Cassin's auklet (*Ptychoramphus aleuticus*). Studies on the feeding ecology of various seabirds show that the major components of their diets are fish (rockfish, sculpin, gunnels, kelpfish) and invertebrates (amphipods, euphausids, isopods) associated with kelp beds (Briggs et. al., 1987). As mentioned in the giant kelp section, deep diving birds such as loons, cormorants, pelicans, and grebes utilize the kelp beds while foraging for food.

3.2.9.4 Mammals

Giant Kelp

Like sea birds, marine mammals utilize the kelp beds in a variety of ways. North (1971a) lists the sea otter, gray whale, killer whale, harbor seal, and California sea lion as mammals associated with kelp forests in California. The sea otter (*Enhydra lutris*) exhibits the closest association with canopies of giant kelp of all the marine mammals. The main portion of the sea otter population presently occurs along the mainland in southern and central California from Gaviota Point, Santa Barbara County to Pillar Point, San Mateo County. Until recently, the sea otter population along the mainland had generally increased at about 5% per year since the 1930's. Based on the results of a spring rangewide count, the mainland population peaked in 1995 (n = 2377). Each succeeding spring count suggested a population decline was occurring until the 2000 count (n = 2317), which was over 10% higher than the preceding count (Wendell, pers. comm.). Sea otters were also reintroduced into southern California at San Nicolas Island, beginning in 1987. A total of 140 animals were translocated from central California to the island from 1987 through 1990. A resident population of about 23 animals were observed at San Nicolas Island in 2000 (Hatfield, pers. comm.).

The preferred habitat of the sea otter in California is in giant kelp canopy near rocky substrata with deep crevices (Woodhouse et al., 1977). If surface canopies are present, otters sleep in them, and are often seen with strands of kelp draped over their bodies, presumably to prevent them from drifting away (Kenyon, 1969). Sea otters are most commonly found in protected inshore waters in central California during the winter, when storms remove canopies in deeper, unprotected water. Otters gradually move out into offshore canopies as these reform in the spring and summer (Jameson, pers. comm. in Foster and Schiel, 1985). During the severe winter of 1982-83, sea otters in central California were observed inhabiting the few small shallow patches of giant kelp that remained (Foster and Schiel, 1985). Sea otter distribution, however, is not limited to kelp bed habitats. They have reoccupied areas nearshore with soft-bottom and offshore habitats that do not support kelp bed communities (Wendell, pers. comm.)

Kelp forests also function as nursery areas for female sea otters with pups. When seas are rough, females often leave their pups in surface canopy while they forage (Sandegren et al., 1973). During winter storms, when canopy is reduced, increased competition between mother-pup pairs may occur for space in available canopy (Sandegren et al., 1973).

Sea otters are frequently found rafting in beds of *Macrocystis* or foraging in them. The otters consume an amount of food equivalent to 23-33% of their body weight each day (Costa, 1978). They feed upon epibenthic invertebrates while foraging from the low intertidal out to depths of over 60 m, and on invertebrates on kelp fronds. Sea otters in central California commonly feed upon *Tegula* spp. and crabs associated with giant kelp (Woodhouse et al., 1977).

Gray whales, *Eschrictius robustus*, migrate yearly from their summer feeding grounds in the Bering and Chukchi Seas to their winter breeding grounds along the coast of Baja California, Mexico. Cow-calf pairs migrate northward along an inshore route that takes them along the outer edges of kelp beds or within beds of giant kelp (Foster and Schiel, 1985). Cow-calf pairs may use the inshore route that passes near kelp forests for two reasons: 1) kelp forests may provide protection from predation by killer whales, and 2) kelp forests may provide food for the nursing cow. Baldridge

(1972) described the attack of a pod of killer whales on a cow-calf pair near a kelp forest off Carmel Bay, California. The cow escaped into the kelp, while the calf was cut off from the forest and subsequently killed. Gray whales may also feed upon dense swarms of mysid shrimp within or along the edge of kelp beds (Wellington and Anderson, 1978).

Pinnipeds (seals and sea lions) are frequently seen in forests of giant kelp. The three common species of pinnipeds in California are expanding at 6 to 12% per year. The California sea lion (*Zalophus californianus*) population was estimated to have between 167,000 and 188,000 animals when last assessed in 1998. The California breeding stock of the Northern elephant seal (*Mirounga angustirostris*) was estimated at 84,000 in 1996. The third common pinniped, the harbor seal (*Phoca vitulina*), was estimated at 30,293 animals based on a 1995 survey (R. Reed, pers. comm.). Harbor seals frequently rest in canopies of giant kelp. Both harbor seals and sea lions forage around forests of giant kelp and in deeper water for a variety of prey items. Elephant seals usually forage in deep water, offshore of kelp beds. They may pass through forests of giant kelp on their way to the offshore feeding grounds.

Bull Kelp

Marine mammals utilize the bull kelp beds in the same manner they do the giant kelp beds. Sea lions and harbor seals have been observed foraging in northern California kelp beds for rockfish, crab, and octopus in the summer and fall (Warner, pers. comm.).

The movement of sea otters into the Diablo Cove area may be partially responsible for the decline of *Nereocystis* in the area. Sea otters, by removing macro–invertebrate herbivores (sea urchins, abalone, turban snails) can have a profound effect on algal community structure and succession in the nearshore marine environment (Estes and Palmisano, 1974). Gotshall et. al. (1986) noted the change in bull kelp abundance and increase in subsurface algae (*Laminaria* and *Pterygophora*) as early as 1976, approximately two years after the otters began to feed within the cove.

3.2.9.5 Representative Communities

Extensive beds of kelp occur along the California coast. The composition of these beds differs from site to site depending upon many variables. Foster and Schiel (1985) provide a good view of the distributional variation among sites in California by describing ten sites that have been studied in some detail. Five of the sites are in central California and five are in southern California. Added to these descriptions is a depiction of two often overlooked byproducts of kelp forests, drift kelp and beach wrack.

Central California

<u>Greyhound Rock</u>

This site is located approximately 15 miles north of Santa Cruz and 2 miles south of Año Nuevo Island, the northern limit of large beds of *Macrocystis pyrifera*. Greyhound Rock is a *Nereocystis luetkeana* forest that has been surveyed several times (Yellin et al., 1977; Foster et al., 1979a, b; Foster and Reed, 1980; Foster and Heine, 1981; Foster, 1982). The substratum is composed of mudstone ridges interspersed with sand that terminates in a large sand plain at about 65 ft depth. *N. luetkeana* occurs on the tops of ridges at depths of 25 to 45 ft. There are sparse stands of understory kelps *Pterygophora californica* and *Laminaria setchellii* along with foliose red algae beneath. This site is fully exposed to northwest swells and the water is usually turbid. Inshore of the bull kelp forest, the rocky ridges are covered with multiple layers of foliose red algae along with scattered patches of understory kelps, *Dictyoneurum californianum* and *L. setchellii*. Large foliose red algae are rare seaward of the *Macrocystis* bed.

Sandhill Bluff

There is a *Macrocystis pyrifera* forest at this site, which is located about 6 miles south of Greyhound Rock. This site is described in the literature cited for Greyhound Rock and in Cowen et al. (1982). The rocky substratum is relatively flat mudstone interspersed with sand patches. The rock terminates in sandy bottom in deeper water (45 to 55 ft) beyond the kelp bed. The kelp forest is in the lee of a small point and is slightly protected from the northwest swell. Giant kelp forms surface canopy at depths between 20 to 45 ft. The bottom inshore of the kelp bed is dominated by foliose red algae similar to Greyhound Rock, however, these plants are attached to a dense cover of bryozoans, sponges, and tunicates. Understory algal cover is reduced beneath the *Macrocystis* canopy. Foliose red algal cover is greater offshore of the kelp bed.

Point Cabrillo Kelp Forest

This forest is located in southern Monterey Bay off the Hopkins Marine Station in Pacific Grove. It has been extensively studied (Lowry and Pearse, 1973; Miller and Geibel, 1973; Devinny and Kirkwood, 1974; Lowry et al., 1974; Gerard, 1976; Harrold, 1981; Reidman et al., 1981; Breda 1982; Hines, 1982; Watanabe 1983, 1984a, b). The surface canopy is *M. pyrifera* and *Cystoseira osmundacea* that grows attached to large granite outcrops and boulders in an area very protected from swells. *Macrocystis* grows in very shallow water (about 10 ft depth) at this site. Extensive beds of surf grass, *Phyllospadix*, patches of feather boa kelp *Egregia menziesii*, and in summer, dense masses of the floating reproductive fronds of *C. osmundacea* occur inshore of the giant kelp. *Cystoseira osmundacea* also occurs intermixed with *Macrocystis* out to 45 ft. Beyond 45 ft, the rock is replaced by sand. The kelp *Dictyneuropsis reticulata* forms a sparse understory beneath the surface canopy and the bottom is dominated by foliose red algae and encrusting corallines.

Stillwater Cove

The Stillwater Cove forest of giant kelp is located inside Carmel Bay. The site has been described by Andrews (1945), Foster et al. (1979 a, b), Foster (1982), and Reed and Foster (1982). Stillwater Cove faces south and is protected from northwest swells. The conglomerate and sandstone bottom is a mosaic of plateaus and pinnacles surrounded by relatively flat rock and fields of small boulders. *Macrocystis integrifolia* occurs from lower intertidal to a depth of about 3 ft. Both *Cystoseira osmundacea* and *Egregia menziesii* occur with the *M. integrifolia* and seaward into the *M. pyrifera* forest. The understory kelp *Laminaria setchellii* occurs in patches down to about 25 ft, while *M. pyrifera* occurs at depths between 6 and 100 ft and terminates at the sand bottom in deep water. Dense stands of tall (over 3 ft tall) *Pterygophora californica* occur beneath the *Macrocystis*. Articulate and encrusting corallines cover most of the flat substratum beneath the *Pterygophora*.

Granite Creek

The site is located south of Monterey and was studied by McLean (1962) between 1959 and 1961. At the time of the study, the most abundant canopy kelp was *Nereocystis luetkeana*, growing on an irregular granite bottom fully exposed to swells. Both *Nereocystis* and *M. pyrifera* have occurred at the site since the early study (Foster and Schiel, 1985). In 1959-1961, *Egregia menziesii, Cystoseira osmundacea* and *M. pyrifera* formed a mixed canopy inshore of the *Nereocystis* at depths from 0 to 33 ft. The bottom in the inshore area was covered by articulate and encrusting corallines and an occasional patch of *Laminaria setchellii*. *Nereocystis* grew attached to the irregular substratum between 33 ft and 66 ft. Rock was replaced by sand offshore. The understory beneath the *Nereocystis* was dominated by dense stands of large palm kelp, *Pterygophora californica*. This site is now dominated by *Macrocystis* and has been since the mid–80's (R. McPeak, pers. obs.).

Southern California

Campus Point, Goleta

This site is located at the northwest end of Goleta Bay, approximately 10 miles northwest of Santa Barbara. The description below is based upon Neushul et al. (1976) and Foster and Schiel (1985). Campus Point is protected from most swells by Point Conception to the west and the Channel Islands to the southwest. The bottom at this site is low relief mudstone interspersed with extensive sandy areas and occasional rocky outcrops. *Macrocystis pyrifera* (*M. angustifolia* in Neushul et al., 1976) occurs between depths of 15 and 65 ft. The inner edge of the *Macrocystis* forest is bounded by patches of feather boa kelp, *Egregia menziesii*, and bottom cover is composed of articulate corallines, fleshy reds, and various species of brown algae. *Pterygophora californica* grows in dense stands beneath the *Macrocystis* canopy.

Anacapa Island

In contrast to the mainland, waters around the Channel Islands are generally clearer and high relief rock is more common. The following description is based upon Neushul et al. (1967) and Clark and Neushul (1967), who surveyed along a transect through a giant kelp forest from a depth of 0 to 130 ft. Clark and Neushul (1967) recognized three broad zones along the transect. The shallow zone, from 0 to 25 ft, was dominated by abundant understory kelps (*Eisenia arborea* and *Laminaria farlowii*) and surf grass (*Phyllospadix torreyi*). The wide mid-depth zone occurred from depths of 25 ft to 110 ft. It was dominated by giant kelp growing over understory kelps *Agarum fimbriatum* and *Pterygophora californica*. *Macrocystis* did not occur below depths of 110 ft. The deep zone was dominated by *Agarum fimbriatum* and various species of small red algae.

Santa Catalina Island

The relatively warm waters of Santa Catalina Island contain species not found in the more northern areas that have already been described. One of the more conspicuous of these is the elk kelp, *Pelagophycus porra*. The Catalina site is located on the leeward side of the island and the description is based upon Dykzeul and Given (1979) and Foster and Schiel (1985). The shallow subtidal zone east of Big Fisherman's Cove is composed of metamorphic (schist) boulders of varying size that terminate in sand at about 115 ft. The bottom is dominated by understory kelp, *Eisenia* *arborea*, from 0 to 25 ft. Several species of brown and red algae are common in the shallow water. *Macrocystis pyrifera* occurs from about 25 ft to 65 ft. The understory beneath its surface canopy is relatively reduced. There are patches of *Cystoseira neglecta*, *Sargassum muticum*, *Dictyota flabellulata*, and *Pachydictyon coriaceum*, especially where surface canopy is thin. The deeper water outside of giant kelp canopy is dominated by understory algae *Eisenia arborea*, *Agarum fimbriatum*, and *Laminaria farlowii*. *Pelagophycus porra* can be found on the sandy bottom at depths below about 70 ft.

Del Mar

The bed of giant kelp at Del Mar is isolated by surrounding sand. Rosenthal et al. (1974) characterized this kelp forest during their study done between 1967 and 1973. Plants in this stand occur on mixed sandstone and siltstone bottoms, with large areas of sand and silt among the rock. The depth of this low relief is between 45 ft and 65 ft. The understory vegetation beneath the giant kelp canopy at Del Mar was relatively sparse, with only a few *Pterygophora californica* and *Laminaria farlowii* and a few foliose browns and reds occurring. Most of the bottom was covered with encrusting corallines.

Point Loma

The Point Loma kelp bed is located along the western edge of Point Loma between the entrance to Mission Bay and San Diego Bay. The kelp forest has varied considerably in size since the early 1900s (North, 1969; Dayton et al., 1984). The bed was 4200 x 10^3 m^2 in 1989 (North, 1994). Turner et al. (1968) described the Point Loma kelp bed using four transects along the coast. Foster and Schiel (1985) combined the four transects to present an idealized view of the Point Loma kelp bed. The kelp forest at Point Loma occurs on a broad, gently-sloping mudstone-sandstone terrace, with pockets of sand, cobbles, and boulders. There are also areas of pinnacles that occur within the kelp forest (R. McPeak, pers. obs).
Macrocystis pyrifera is common from about 20 ft to 70 ft on rocky substrata. The inshore area is dominated by surf grass *Phyllospadix torreyi*, feather boa kelp *Egregia menziesii*, and *Cystoseira osmundacea*. Dayton et al. (1984) described distinct patches of *Pterygophora/Eisenia* and *Laminaria farlowii* / *Cystoseira osmundacea* that occurred within the giant kelp bed. Elk kelp, occurs in deeper water (60 ft to 110 ft), outside the bed of giant kelp, or occasionally mixed with the giant kelp (Dorr, 1992).

3.2.9.6. Drift Kelp and Kelp Wrack

Plants that drift offshore, commonly known as kelp "paddies", may live for several months and become an important seaweed dispersal agent as well as provide habitat for many small invertebrates and both juvenile and adult fishes (Dawson and Foster, 1982; Kingsford, 1995). Detachment of kelp plants occurs mainly in winter, but the yearly variation in seasonal mortality of kelp is great (Hobday, 2000). Mitchell and Hunter (1970) observed 21 species of fishes belonging to 15 families under kelp paddies drifting off southern California and northern Baja California, Mexico. Many seasonal migrants (i.e. yellowtail, dorado, yellow fin tuna) frequent floating kelp. The floating kelp is used as a fish attracting device by commercial passenger fishing boats, especially during summer months. Estimated annual biomass of drifting kelp is as high as 376,000 tons in the Southern California Bight (Hobday, 2000).

Some of the drift kelp ends up on the beach as wrack which is important as habitat and food for various intertidal invertebrates such as shore crabs, sea urchins, beach hoppers (*Orchestroidea* spp.), and sand flies (Yaninek, 1980). Wrack is also a source of organic detritus which can support foodwebs that include benthic suspension feeders, nearshore fishes, and shorebirds. After being broken down and fragmented by physical processes and detritivores, fragments of wrack can be washed back to sea to provide food for filter feeders, grazing gastropods, and fish (Kirkman and Kendrick, 1997). Wrack remaining on the beach supports an abundant community of insects and crustaceans (Yaninek, 1980). Bradley and Bradley (1993) hypothesize an increase in wintering shorebird populations along the rocky Palos Verdes Peninsula is related to larger amounts of wrack generated by increased local kelp abundance.

Although important for some organisms, kelp wrack is often viewed as a nuisance to beach goers. Beaches in southern California are regularly cleared of kelp, which is transported to landfills for disposal (Larson and Vejar, pers. comm.). The effects of wrack removal are not well studied, but at the least it reduces the amount of food and habitat available to beach organisms as well as the amount of organic debris washing out to the ocean bottom. Regular removal of wrack also prevents the development of the invertebrate communities which can provide food for shorebirds. In Australia, among the main concerns for increased removal of seaweed wrack were the disturbance of shorebirds and their habitat and the need to assess the relative importance of wrack in recycling nutrients and detritus to the nearshore ecosystem (Kirkman and Kendrick, 1997). These issues need to be researched in California as well.

3.2.10 Importance of Habitat Loss, Degradation, and Modification

The coastal region of California has been the focal point of human habitation and commerce throughout its long history and this continues to be true today. This habitation has contributed to changes in the complexion of the coastline and of the nearshore marine environment. In 1900 for example, there were 381,000 acres of tidal marshes and mudflats. By 1980, only 10 percent of California's wetlands remained untouched (NOAA, 1990b). Harbor and marina development, as well as run–off and sewage discharge, are only a few factors that have lead to the modification, degradation or loss of habitat in the coastal zone.

3.2.10.1 Coastal Development

Since the 1800s, improvements have been made to natural anchorages such as Humboldt Bay, San Francisco Bay, Monterey Bay, and San Diego Bay. In addition, new harbors and marinas were created to accommodate the increase in the coastal population and changes in recreational activities (California Department of Navigation, 1977; Department of Finance, 1992). Subsequent changes to the coastal landscape have had indirect, and in some cases, direct effects on kelp forests. The creation of breakwaters, installation of discharge pipes, and the dredging of channels leads to physical displacement of marine plants in addition to changing water currents, turbidity, and sedimentation (Foster and Schiel, 1985). The demise of giant kelp canopies on Dago Bank has been attributed to the dumping of rock, shale, and mud removed during the widening of the main channel and the West Basin of Los Angeles Harbor from 1920 to 1930 (Schott 1976). North et al. (1993) report two instances of possible impact on kelp forests from construction. There was a serious decline in the kelp bed off Dana Point in 1969 and a temporary disappearance of "Barn Kelp" (kelp patches offshore of Camp Pendleton, San Diego County) from 1979 to 1986. High turbidities that were observed in these beds during the critical periods of decline may have been caused by construction (North et al., 1993).

Two large subtidal areas influenced by sediment plumes from landslides along the central California coast (Lone Tree and Big Sur) were surveyed and compared to nearby control areas for impacts from sedimentation. In the Lone Tree site, *Nereocystis* was the canopy forming kelp, while at the Big Sur site the canopy was dominated by *M. pyrifera*. At both areas, brown algae were more abundant at the unimpacted sites (Konar and Roberts 1996).

3.2.10.2 Waste Disposal

Sewage and thermal discharges as well as oil spills and leaks have the potential of impacting forests of giant and bull kelp. The effects of sewage discharge can be negative or positive, depending upon the amount of nutrients in the discharge, turbidity and sedimentation created by the discharge, and toxics in the discharge. Domestic wastes contain nutrients that may nourish kelp and may increase plankton productivity as well. These wastes may also contain significant amounts of sludge particles that increase turbidity as well as sedimentation rates and sediment thickness on the bottom (Foster and Schiel, 1985). Industrial wastes may cause similar effects, and also may contain toxic metals and organic compounds that can directly affect the kelp forest ecosystem.

Giant Kelp

There is good indirect evidence that sewage from the Los Angeles area, discharged near Palos Verdes, contributed to the decline and eventual loss of giant kelp forests (Meistrell and Montagne, 1983). The decline of kelp forests around the Palos Verdes Peninsula began in the 1940's and 1950's as discharge rates increased. The kelp community did not recover after the El Niño in the late 1950's (Grigg and Kiwala, 1970; Wilson, 1982). Increased turbidity, sludge on the bottom, toxic substances in the discharge such as DDT, and possibly copper and other metals may have all contributed to the decline and lack of recovery. With improvements in the discharge quality in the Los Angeles area and assistance from restoration programs, the *Macrocystis* beds around Palos Verdes improved significantly. Canopies around the peninsula increased to 1.28 mi^2 by 1989 (Ecoscan, 1989).

The role of sewage in sea urchin nutrition and persistence of sea urchin populations near outfalls was evaluated by Pearse et al. (1970) and North (1983). Sea urchins can accumulate a wide variety of organic substances from seawater at very low concentrations (Clark, 1969; Pearse et al., 1970). Computations based on measured uptake rates of dissolved free amino acids (DFAA) at concentrations near outfalls by Clark et al. (1972) showed that the purple sea urchin (*Strongylocentrotus purpuratus*) could meet 50% of the daily maintenance requirement from DFAA alone (Clark, 1969). Pearse et al. (1970) and North (1983) concluded that there was a strong possibility that sea urchins near outfalls were utilizing discharged organics, resulting in persistence of "urchin barrens" devoid of giant kelp. They speculated that sea urchins that would normally perish from lack of food, would persist because of the additional nutrition provided by the DFAA and other organics of sewage origin.

Sewage can also apparently have a positive affect on *Macrocystis*. The Point Loma outfall, near San Diego, discharged approximately 140 million gallons of advanced primary treated sewage daily into the ocean in early 1992. The sewage effluent was discharged in 210 feet of water, approximately 1.4 miles offshore of the Point Loma *Macrocystis* forest. During early February, the outfall pipe broke within the kelp bed and began discharging the sewage directly into the *Macrocystis* bed.

There was initial concern that the turbidity caused by the discharge in the kelp bed would harm nearby young-adult plants that were just reaching the surface in early February. Wastes were discharged directly into the kelp bed for two months, until the outfall pipe was repaired in early April, 1992. During routine aerial surveys of kelp resources in southern California, D. Glantz (pers. comm.) noted that the young adult *Macrocystis* near the outfall break continued to grow and were dark brown in color. *Macrocystis* plants that were some distance from the outfall break (0.5 miles or more away) continued to grow poorly and never took on the dark brown color indicating high tissue nitrogen levels. Presumably, nutrients from the outfall were available for plants near the break and were utilized by these plants for growth. The young adult plants near the break survived and were the most productive part of the Point Loma kelp bed in 1993 (R. McPeak pers. obs.).

The ecological impacts to the Point Loma kelp forest community due to the outfall break was studied by Tegner et. al. 1995b. Although initially there were negative impacts to kelp germination and growth surrounding the area of the sewage break, the kelp forest recovered quickly after the repair of the pipeline. Kelp forest suspension feeders and detritivores showed no significant change in their population due to the sewage leak. Overall the authors believe that the sewage pipeline burst represented a modest disturbance similar to the natural vagaries of kelp recruitment.

Toxic contaminants in urban runoff also have negative impacts to sensitive life stages of giant kelp (Bay et.al. 1996). This study carried out by Southern California Coastal Water Resources Project (SCCWRP) examined the toxicity of dry weather flow from Ballona Creek and three other drains that discharge into Santa Monica Bay. They also conducted toxicity tests using sensitive life stages of red abalone, purple sea urchin, and giant kelp. The invertebrates were found to be more sensitive than the kelp spores with toxic effects produced by dry weather flow of 5.6 % or greater. The study also reported that the constituents causing toxicity in dry weather flow were variable.

There are two major nuclear generating plants that discharge heated water in the vicinity of kelp forests in California: the San Onofre Nuclear Generating Station (SONGS) near Oceanside, and the Diablo Canyon nuclear power plant near San Luis Obispo. Extensive long-term studies have been done at each power plant to determine the effect of discharged heated water on nearby kelp forests.

SONGS consists of three electric power generating units, each using a nuclear reactor equipped with a once-through seawater cooling system that discharges heated effluent into the nearby ocean (Grove, 1993). SONGS Unit 1 began operation in 1968 and was retired from service in November, 1992. It was the smallest of the three units, generating 0.44 million kW. Units 2 and 3 generate 1.1 million kW and use 124 m^3/sec of cooling seawater for both units combined. This water, which is 20° F warmer than the intake water, is discharged between 1.14 mi. and 1.58 mi. offshore. The last 0.48 mi. of each discharge pipe contains 63 discharge ports to ensure rapid mixing of the effluent with ambient water. Unit 2 began operation in August, 1983 and Unit 3 in April, 1984.

The California Coastal Commission appointed an independent review committee, the Marine Review Committee (MRC), to monitor and evaluate SONGS impacts on the marine environment. The MRC monitored SONGS from 1975 through 1989. Identifying impacts solely attributable to SONGS was complicated because of the 1982-1984 El Niño that created significant anomalies in natural ocean processes surrounding SONGS (Grove, 1993).

The MRC final report, issued in 1989, identified substantial impacts to the San Onofre kelp bed due to reduced light and increased sedimentation induced by turbidity in the discharge plume (MRC, 1989; Grove, 1993). As a result of the statistically calculated increase in local water column turbidity caused by the diffuser plume, the MRC estimated there would have been 60% more kelp in the San Onofre kelp bed if SONGS were not operating.

A positive impact associated with the discharge plume of SONGS was reported by Jahn et. al. 1998. In their study the researchers hypothesized that the multiport diffuser system which creates the discharge plume should on average provide more inorganic nutrients such as nitrogen to the surrounding ambient surface waters than is normally present. Effects from the plume were investigated by sampling kelp canopy tissues and analyzing them for nitrogen content. The results of their study showed that the San Onofre kelp bed nearest the offshore diffuser consistently had higher than average nitrogen on a percent dry weight basis, and there was an overall pattern of decreasing enrichment with distance from the diffusers.

The effects of large oil spills on beds of *Macrocystis* have been documented twice along the western Pacific coast; once during 1957 when a small tanker, the Tampico, spilled a load of mineral oil in a cove along Baja California; the other during the 1969 offshore well blow-out and spill in the Santa Barbara Channel (Foster and Schiel, 1985). North et al. (1964) studied the Tampico spill and noted that there was massive mortality of invertebrates, including sea urchins, in the cove. Damage to *Macrocystis* was not obvious and within five months of the spill, vegetation in the cove was increasing and juvenile *Macrocystis* began to develop. Presumably, the diesel oil had killed sea urchins that had been maintaining the bottom. Once the urchins were killed, *Macrocystis* and other species of algae began to develop (North et al., 1964). Giant kelp plants that recruited following the loss of sea urchins produced canopy in the cove, approximately 18 months after the spill.

Crude oil from the 1969 Santa Barbara spill polluted a large portion of the mainland coast, and many of the offshore Channel islands (Foster et al., 1971a). Assessment of the effects of the spill was complicated by record storms and rainfall that occurred at the same time as the spill. There was little damage to the *Macrocystis* beds, even though considerable quantities of crude oil fouled the surface canopies (Foster et al., 1971b). The partially weathered crude oil appeared to stay on the surface of the water and did not stick to the fronds of the giant kelp.

Besides the direct effects from oil spills on giant kelp, there are documented negative effects on kelp from substances used in oil spill clean up operations. The surfactant-based oil dispersant, Corexit 9554 has been shown to have acutely toxic negative effects on the early life stages of giant kelp (Singer et.al. 1995).

There are also extensive natural gas and oil seeps that occur near beds of giant kelp near Santa Barbara (Mertz, 1959). These seeps produce continuous oil slicks on the surface of the water and even visible tar mounds on the bottom within kelp beds (Spies and Davis, 1979). The natural seeps appear to cause no visible damage to nearby *Macrocystis* beds, since extensive canopies regularly develop in these beds when oceanographic conditions are good for growth (McPeak, pers. comm.).

Bull Kelp

Little is known about the effect of domestic and industrial discharge on bull kelp plants. James et. al. (1987) investigated the toxic threshold of 10 species of brown algae gametophytes and young sporophytes to hydrazine, a specialized oxidant. Hydrazine is routinely used to scavenge dissolved oxygen in high–pressure boilers to decrease corrosion. Excess hydrazine may find its way into natural waters when boiler water is discharged into a waste stream.

James et. al. (1987) work showed that bull kelp was the most sensitive to hydrazine. When *Nereocystis* gametophytes were exposed to hydrazine at levels of 0.025 parts per million (ppm), the gametophytes were permanently inhibited and sporophyte production could not occur. In contrast, *Pterygophora californica* was the least sensitive, showing no effect at levels of 0.25 ppm (a magnitude higher than the treatment bull kelp received). Thus, exposure to this compound could have profound effects on the survival of bull kelp.

Hydrazine degrades slowly in seawater (0.15% per hour). Thus high concentrations of this substance might occur in an effluent for several hours. In areas where mixing is minimal and the poorly diluted effluent is not flushed out quickly, the presence of hydrazine could have a serious effect on sensitive seaweed species (James et. al., 1987).

Thermal effects research on seaweeds, invertebrates, and fishes was conducted at the Diablo Canyon power plant onsite marine laboratory by Tera Corporation (1982). In the study, they exposed juvenile *Nereocystis* sporophytes to water temperatures ranging from 10°C to 20°C in the laboratory for a period of 44 days. The results showed that juvenile bull kelp sporophytes cannot endure prolonged exposure to water temperatures of 18°C and above. Also, 25% of those plants held at 15.9°C died after being exposed to this temperature for 36 days. Visual inspection of the plants indicated a reduced capacity for wound–healing in plants at this temperature (Tera Corporation, 1982). Field observation of the effect of increased water temperature on *Nereocystis* was observed in Diablo Cove. During the first year of power plant operation (1985), bull kelp plants that came in contact with the thermal plume (surface to 15 feet depth) experienced premature blade loss (PG&E, 1987). Bull kelp stands continued to exist in those areas where the plume was deflected (such as at Diablo Rock) or in areas where cold water currents prevailed. This occurrence was repeated in 1986 as well and eventually *Macrocystis*, which is more heat tolerant, colonized the areas affected by the plume (PG&E, 1987).

The effects of three petroleum products (diesel fuel, intermediate fuel oil or IFO, and crude oil) were tested on *Nereocystis* plants. Whole plants were exposed for specific time periods and then transferred to the field. Bioassays were performed to measure the effects of petroleum exposure on photosynthetic rate and respiration rate. Diesel treatments had a greater negative effect on net photosynthetic rate than did the IFO treatments. Experimental evidence also verified the susceptibility of *Nereocystis* tissues to the damaging effects of exposure to petroleum. The most severe tissue necrosis was noted in the meristematic zone at the junction of stipe and bulb. Based on these experiments the most damaging effects were from weathered diesel fuel, with the least harmful from weathered crude oil (Antrim et al., 1995).

The abundance and size distributions of subtidal algae, including *Nereocystis*, were measured in Prince William Sound, Alaska one year after the Exxon Valdez oil spill. There were no differences in the total density, biomass or percentage cover of macroalgae between oiled and control sites. However, there were generally smaller plants at oiled sites, suggesting recent recruitment or slower growth there (Dean et al. 1996).

3.2.11 Kelp Restoration

Giant Kelp

Forests of *Macrocystis* that were once productive off San Diego, Orange, and Los Angeles Counties, began to deteriorate in the 1950s and 1960s. The decline was attributed to several factors including: pollution from domestic and industrial wastes; siltation caused by rainfall; increased sea urchin grazing caused by a reduction in predators; storms; low nutrients and high temperatures caused by El Niño conditions (Wilson and McPeak, 1983; Tarpley and Glantz, 1992).

Kelp restoration was initially undertaken in 1963, off Point Loma, in an effort to reverse the trend of decline. The Scripps Institution of Oceanography and Kelco began a cooperative project to develop techniques to protect and restore forests of *Macrocystis*. The efforts proved successful (North, 1967). Kelp canopies at Point Loma increased from approximately 60 acres to nearly 2,000 acres (North, 1968a). The dramatic recovery at Point Loma was probably the result of several factors, including restoration, changes in water quality, and changes in oceanographic conditions (Wilson and McPeak, 1983). Kelco continued restoration work in San Diego County after 1968, and this work continued through mid–1993.

Kelp restoration off Palos Verdes Peninsula (PVP), Los Angeles County, began in 1967 and continued through 1980. The work was originally started by Dr. W. J. North of the California Institute of Technology. Only two adult *Macrocystis* plants remained in 1967 from a forest that was previously 1,500 acres (North, 1967). The California Department of Fish and Game (CDFG) began parallel restoration work at PVP in 1971 (Wilson et al., 1977, 1979). By 1971, the first naturally expanding kelp forest in twenty years was observed developing off PVP. Nearly 600 acres of kelp had become established off PVP by 1980, when restoration work was discontinued. Aerial surveys in 1989 revealed over 1,100 acres of kelp off PVP (Ecoscan, 1989).

Restoration of *Macrocystis* has also been conducted off Orange County between Newport Beach and Laguna Beach. A total of 18 acres of kelp was planted in this area from 1987 through 1989 by MBC Applied Environmental Services under contract with the CDFG (MBC, 1990). The Orange County Coastkeeper has recently (September 2000) applied for a grant to restore kelp near Reef Point in the Crystal Cove State Park Marine Reserve. They plan to raise kelp in the lab on small tile strips. After six to eight weeks the tile strips will be transferred to the restoration site and attached to the reef with rubber bands. Their goal is to restore one acre of kelp canopy by May 2001.

Kelp restoration was also conducted off Santa Barbara County in areas where *Macrocystis* grows on sandy substrates. These beds were destroyed by storms and warm water/low nutrients associated with the 1982-84 El Niño (Kelco, 1990, 1992; McPeak and Barilotti, 1993). Kelco began developing restoration techniques for this unique sandy habitat following the 1982-84 El Niño. In 1987, under contract with the CDFG, Kelco began work to restore the giant kelp growing on sand near Santa Barbara. Restoration work was supported by the CDFG from 1987 through 1991, and by Texaco in 1992. Best results were obtained offshore of Gaviota, where approximately 3000 plants had been secured to the bottom by mid–1993 (Glantz, pers. comm.).

Kelp restoration methods in California have evolved considerably since the first efforts were initiated in 1963. Restoration work can be divided into five area: (1) grazer control, (2) kelp transplanting, (3) securing plants in soft sediment habitats, (4) competitive seaweed control, and (5) providing substrate (Wilson and McPeak, 1983; McPeak and Barilotti, 1993). Table 3–1 lists restoration techniques that have been used successfully to restore *Macrocystis* in California. The following is a brief description of some of the techniques. For more detailed information see Wilson et al. (1977), Wilson and McPeak (1983), MBC (1990), Glantz (1991, 1992a, 1993), McPeak and Barilotti (1993).

Three species of sea urchins commonly graze and destroy forests of *Macrocystis* and create urchin barrens: *Strongylocentrotus franciscanus*, the red sea urchin, *S. purpuratus*, the purple sea urchin, and *Lytechinus anamesus*, the white seaurchin. Red and purple sea urchins prefer giant kelp to other species of seaweed in southern California (Leighton, 1966, 1971). Five sea urchin control methods have been used to protect or expand existing beds of *Macrocystis*: 1) hammering, 2) suction dredging, 3) quickliming (CaO), 4) feeding sea urchins, and 5) commercial fishing (Wilson and McPeak, 1983; Glantz, 1991, 1992a, b; 1993).

Hammers have been used effectively at Point Loma, especially in areas where sea urchins averaged less than $5/m^2$ (Wilson and McPeak, 1983). Kelco biologists used hammers to control sea urchins in 125 acres of urchin dominated habitat at south Point Loma in 1981. The work resulted in development of *Macrocystis* throughout the 125 acre area.

Table 3–1. *Macrocystis* Restoration Techniques Used in California

I. **Hard Bottom Substrate**

A. Grazer Control (Sea Urchins)
- Dredging
- Hammers
- Quicklime
- Commercial Fishing
- Feeding Sea Urchins

B. Kelp Transplanting
- Large adults secured to heavy anchor chain
- Large adults secured to rocky substrate by nylon line threaded through the holdfast
- Sub-adults secured to substrate with circlets of inner tube
- Sub-adults attached to a mudstone bottom using rubberbands, stakes, VEXAR, and tie-wraps
- Young plants attached to "stubs" of *Pterygophora* and *Eisenia* using rubberbands

C. Competitor Control
- Competitive seaweeds cleared using knife, hacksaw, or scythe

II. **Soft Bottom Substrate (Santa Barbara Area)**

A. Kelp Transplanting
- Attach cultured juvenile plants to mushroom anchors
- Attach natural juvenile plants to mushroom anchors
- Attach adult plants to mesh bags filled with rock

B. Providing Substrate
- Use mushroom anchors as substrate for natural kelp recruitment
- Use VEXAR as substrate for natural kelp recruitment

C. Securing Plants
- Use rebar staples to secure developing *Macrocystis* in soft sediment

A suction dredge has been used successfully to control purple sea urchins at Point Loma. A 4 inch pump, powered by a 9 HP Dietz Diesel, delivered approximately 700 gallons of seawater per minute. Sea urchins were dislodged with a hand rake and dredged through the 4 inch diameter hose. The technique worked especially well where sea urchins average 30 or more per m^2 (Wilson and McPeak, 1983).

Quicklime (CaO) was first used in 1963 to control dense sea urchin concentrations at Point Loma (IMR, 1963). The technique was developed by Dr. Dave Leighton, of the Scripps Institution of Oceanography, and was used through 1979. The CaO was dispersed from the surface in pebblized form until 1976. A diver-directed quickliming device was then developed that allowed dispersion underwater. The use of quicklime was in a large part responsible for successful restoration at Point Loma in the 1960s and 1970s.

A more recent technique that was tested for kelp restoration involved the use of artificial kelp plants constructed of plastic (Vasquez and McPeak 1998). These plastic plants were successful in reducing the density of purple and red sea urchins in sea-urchin-dominated areas by 85 % and 75 %, respectively. The sweeping motion of the blades across the substrate created a whiplash effect which is similar to that reported in natural kelp populations in Chile and southern California. The artificial plants also effectively protected giant kelp transplants that were placed in sea-urchin-dominated areas.

Research has shown that well fed sea urchins move little and allow recruitment and development of *Macrocystis* (Harrold and Reed, 1985). Kelco developed a unique method of sea urchin control in 1991 that involved feeding the grazing sea urchins to stop their destructive movement (Glantz, 1992b). The restoration work was done at a Point Loma site where sea urchin densities often exceeded $100/m^2$. These urchins were destroying the kelp forest at a rate of 45 ft per month. Chopped kelp was pumped through a diver-directed hose to the grazing sea urchins along a front and in the barrens. Sea urchins in the front that were fed, no longer fed on the attached adult *Macrocystis*, stopped scouring the bottom, and allowed recruitment of juvenile plants to develop along the front as well as in the barrens.

Commercial fishing for red sea urchins has also resulted in protecting or restoring forests of giant kelp in some areas of California. The red sea urchin fishery in California began in 1972. The purple sea urchin fishery first began in 1993 but remains a minor component of total urchin harvest . The affect of sea urchin fishing on the *Macrocystis* community varies considerably, depending upon the numbers and species of the sea urchin population (Wilson and McPeak, 1983). In areas where the sea urchin population is mostly reds, harvesting can result in protecting and increasing the area of kelp. In areas where a mixed urchin population exists (and purples are not harvested), harvesting may result in slowing the destruction of loss of *Macrocystis* (Wilson and McPeak, 1983). In some instances, harvesting reds while leaving purples has resulted in a corresponding increase in purple sea urchins and no protection of the kelp resource.

Many transplanting techniques have been developed over the years to restore kelp to large areas. Only a few to these methods will be discussed here. For more information consult McPeak (1977), Wilson et al. (1977), Wilson and McPeak (1983), MBC (1990), Kelco (1992), and McPeak and Barilotti (1993).

Large adult plants have been secured to anchor chains by lacing nylon through the holdfast, attaching the plant to a buoy, that is tethered to the chain (Wilson and McPeak, 1983). Adult giant kelp has also been tied directly to rocky substrate by lacing nylon line through the holdfast and securing the plant.

Juvenile and sub-adult plants (2-10 fronds) have been transplanted and secured to the substrate using circlets of innertube placed over the holdfast. McPeak (1977) reported transplanting more than 35,000 young *Macrocystis* plants to La Jolla from 1973 through 1976. The young plants were attached to the cut "stubs" of competitive seaweeds *Pterygophora* and *Eisenia*.

A different transplanting technique was developed by Kelco biologists in 1990 for anchoring young adult plants (averaging 6-8 fronds) to mudstone bottom off Point Loma. The technique involved using nails, large rubberbands, tie-wraps, and Vexar to secure the plants. A total of 884 plants were transplanted to a 10 acre area off south Point Loma (McPeak and Barilotti, 1993). There were almost no *Macrocystis* in the area when the transplanting occurred. Excellent recruitment of giant kelp developed throughout the transplant area and in the surrounding areas, resulting in the development of *Macrocystis* canopies throughout south Point Loma.

Kelp beds near Santa Barbara are unique because most of them grow on sand. These beds were virtually destroyed by storms, warm water, and low nutrient conditions associated with the 1982-84 El Niño (McPeak and Barilotti, 1993). Restoration of

Macrocystis to these soft sediments requires special techniques. Giant kelp growing on soft substrates usually gets started by recruiting upon polychaete worm tubes of *Chaetopterus variopedatus* and *Eudistylia vancouverensis*. Many plants regularly recruited to these substrates, but few have survived, especially during periods of moderate to heavy water movement. Kelco biologists have found that the best method for restoring beds of *Macrocystis* on soft bottom is to secure naturally developing plants that would otherwise be lost to storms. Two rebar staples, each measuring approximately 18 inches in length, are used to staple each plant in the soft sediment. The stapled plants eventually develop huge holdfasts that are secure and partially buried in the sediment.

Kelp can also be restored or introduced into areas through the use of properly designed artifical reefs. Artificial reefs such as Mission Beach, Topanga, and Pitas Point were designed to provide habitat for kelp. All three reefs have produced kelp canopies. Southern California Edison has completed construction of an extensive experimental reef designed to recruit and sustain kelp canopies off San Mateo Point as part of an agreement to mitigate for canopies lost due to the operation of the San Onofre Nuclear Generating Plant.

Bull Kelp

Unlike the extensive restoration work done for giant kelp in southern California, no bull kelp restoration has ever been undertaken in the state. The technology to restore *Nereocystis* beds exists and has been utilized in Washington state for environmental mitigation and habitat improvement (Merrill, 1989; Merrill, 1991).

3.2.12 Importance of El Niño Events

The El Niño/Southern Oscillation (ENSO) is a large scale oceanic phenomenon linked to fluctuations in atmospheric pressure over the Pacific and Indian Oceans. Such phenomena may trigger oceanic and meteorologic events of global consequence. The El Niño was originally defined in terms of events off the west coast of South America that were frequently responsible for mass mortalities of marine organisms (Arntz, 1984). Under normal conditions the trade winds tend to deflect the Peru Current away from shore, resulting in considerable upwelling along the coast of Ecuador and Peru. The upwelled water, which can be 4-6° F colder than waters of the Peru Current, is rich in nutrients such as nitrates and phosphates. During the El Niño off South America, the normal current and wind patterns are disrupted, upwelling ceases, and warm nutrient-poor water persists. When the condition strengthens and persists for a year or more, it can have catastrophic effects on the anchoveta population and marine species that depend on these bait fish as food (Norton, et al., 1985).

Strong El Niños, that begin off South America, can eventually influence the climate, resources, and fisheries of California (Norton et al., 1985). A "California El Niño" is characterized by warm sea surface temperatures, a deeper surface mixed layer, a depressed thermocline, nutrient-poor water, greater poleward flow, and an anomalous high sea level (Barber and Chavez, 1983; Dayton and Tegner, 1984; Tegner and Dayton, 1987; North et al., 1993). El Niños impact forests of *Macrocystis* in California in a variety of ways that result in little or no canopy being produced, depending upon the severity of the event. Such impacts also affect kelp forest population dynamics, succession, and competitive interactions among kelp forest kelp species (Tegner et.al. 1997) The impact of the El Niño in California depends on the strength of the event. Mild El Niños, that slowed kelp growth, were felt along the coast of California during 1977-1978 and 1992-1993. Especially strong events impacted kelp resources and stopped commercial kelp harvesting off California in 1941, 1957-1959, and 1982-1984. The 1982-1984 El Niño was the largest ever recorded off South America and California (Rasmusson, 1984). Storms associated with the 1982-1984 El Niño also devastated kelp beds throughout California. The effects of this El Niño on *Macrocystis* in southern California were studied by Gerard (1984), Dayton and Tegner (1984), Zimmerman and Robertson (1985), Dean and Jacobsen (1986), Tegner and Dayton (1987, 1991), and North et al. (1993).

Zimmerman and Robertson (1985) studied a forest of giant kelp at Santa Catalina Island during the 1982-1984 major event. They found that deepened isotherms associated with the El Niño resulted in severe nutrient limitation and very low kelp productivity. Frond growth rates were so low that terminal blades formed before the frond reached the surface, eliminating canopy formation. Frond initiation rates were also extremely low and resulted in significant reductions in mean plant size. Plants growing above 33 ft were more severely affected by the nutrient limitation than plants growing at 66 ft. These results suggested that nutrient pulses associated with internal waves were critical for survival of *Macrocystis* pyrifera in nutritionally marginal habitats in southern California (Zimmerman and Robertson, 1985).

The mean nitrogen content of *Macrocystis* tissues (measured as % dry weight), which typically ranges from 1 to 4% in southern California, can be used as an indicator of the nutritional status (Gerard, 1982a; North et al., 1982). Gerard (1982c) concluded that the critical level representing no nitrogen reserves for growth was a nitrogen content of 1.1% for laminar tissue. Tegner and Dayton (1987) found some spring upwelling at Point Loma during the spring of 1983. *Macrocystis* at Point Loma had nitrogen reserves after the spring upwelling; basal blades averaged 2.7% N and canopy blades averaged about 1.5% N in early July, 1983. By October 1983, basal blades had dropped to between 1.1 to 2% and canopy blades to between 0.8 to 1.0% (Tegner and Dayton, 1987).

The relative growth rates of juvenile *Macrocystis* in southern California were substantially reduced during the 1982–1984 El Niño (Dean and Jacobson, 1986). The lower growth rates were correlated with increased temperature and decreased nitrogen availability. Fertilization of juvenile plants with slow-release nitrogen-phosphorus fertilizer increased the growth rate of juveniles to levels previously observed when the temperature was low and nutrient levels were high (Dean and Jacobson, 1986). The limitation in growth of juvenile giant kelp by levels of available nutrients during the El Niño was in contrast to the usual limitation in growth by irradiance during non-El Niño years. There was a shift in the relative importance of factors controlling growth of juvenile *M. pyrifera* during the El Niño (Dean and Jacobson, 1986).

In conclusion, in terms of kelp forest ecosystem changes, large-scale, low frequency oceanographic phenomena, such as El Niño or La Niña play a very important role in kelp forest successional processes, population dynamics, and competitive interactions with understory kelps (Tegner et. al. 1997). In terms of social-economics, El Niños can drastically reduce the standing crop and canopies of *Macrocystis* in California, resulting in a cessation or reduction of kelp harvesting for many months. Aquaculture, algin, and herring roe-on-kelp industries can all be severely impacted by significant El Niños in California.

3.3 Status of the Kelp Population in California

The areal coverage of giant and bull kelp canopies in California changes frequently. Canopies may be extensive one year or one season, only to disappear the next (North et al., 1993). Conditions that affect canopies are quite different in southern

California compared to central California and northern California. In southern California, conditions tend to be more benign resulting in reduced seasonal variability in the kelp forest community and dense canopy throughout the year (Rosenthal et al., 1974). Many southern California forests of giant kelp go through a three to five year cycle of abundance and decline (North, 1971b; Rosenthal et al., 1974). This cycle is usually associated with holdfast deterioration in older plants. Winter swells are larger and more frequent in central and northern California, than in southern California. There is a regular seasonal canopy cycle in central and northern California with maximum canopy in the summer and minimum in the winter (Miller and Geibel, 1973; Gerard, 1976; Foster, 1982; Kimura and Foster, 1984; Reed and Foster, 1982; Barilotti et al., 1985).

Many factors may be responsible for changes in the distribution of canopy, including: sewage pollution (Leighton et al., 1966; Wilson, 1982), El Niños (Jackson, 1977; Tegner and Dayton, 1987, 1991), sea urchin grazing (Leighton et al., 1966; Tegner and Dayton, 1991; Glantz, 1992), sea urchin grazing stimulated by sewage (North, 1974), sea urchin grazing caused by removal of sea urchin predators by man (North, 1974; Tegner and Dayton, 1981), and storms (Dayton and Tegner, 1984; Seymour et al., 1989).

The earliest detailed maps of kelp canopy distribution along the California coast were done in 1911-1912 (Crandall, 1915). The kelp beds were charted from a boat using a sextant and triangulation. Crandall (1915) reported 100.19 mi^2 of kelp canopy in California during his 1911-12 survey. Hodder and Mel (1978) suggested that Crandall's early survey may have over–estimated the size of the kelp beds in California, while Neushul (1981) thought that the early mapping was probably accurate because the size of some of the beds reported by Crandall have been repeated.

The California Department of Fish and Game charted and numbered the kelp beds in the nearshore waters of California in 1931 to assist with the management of commercial kelp harvesting. The numbering system has changed over the years and presently there are 74 beds designated in California from the Mexican–United States border to Point Montara, San Mateo County (Figure 2–1a,b,c,). In 1995, 13 additional beds were designated covering the area from Pt. Montara to the Oregon-California border. The official beds are designated in Section 165.5(j) and (k) of Title 14, California Code of Regulations (Appendix 1). These beds are not individual patches but rather geographic areas that are delineated along the coast by true bearings given from landmarks or points. Each kelp bed, therefore, is of a varying length and contains differing amounts of kelp canopy that change with time.

Official kelp beds in southern California, from the Mexico–United States border to Point Arguello in Santa Barbara County, are numbered 1-34 along the mainland (there are no Beds 11-12) and 101-118 around the offshore Channel islands. Beds from Point Arguello to Point Montara, San Mateo County (a point located approximately 20 miles south of San Francisco) are numbered 202-225. Official kelp beds were not delineated for the coastal area north of Point Montara until 1995, presumably because

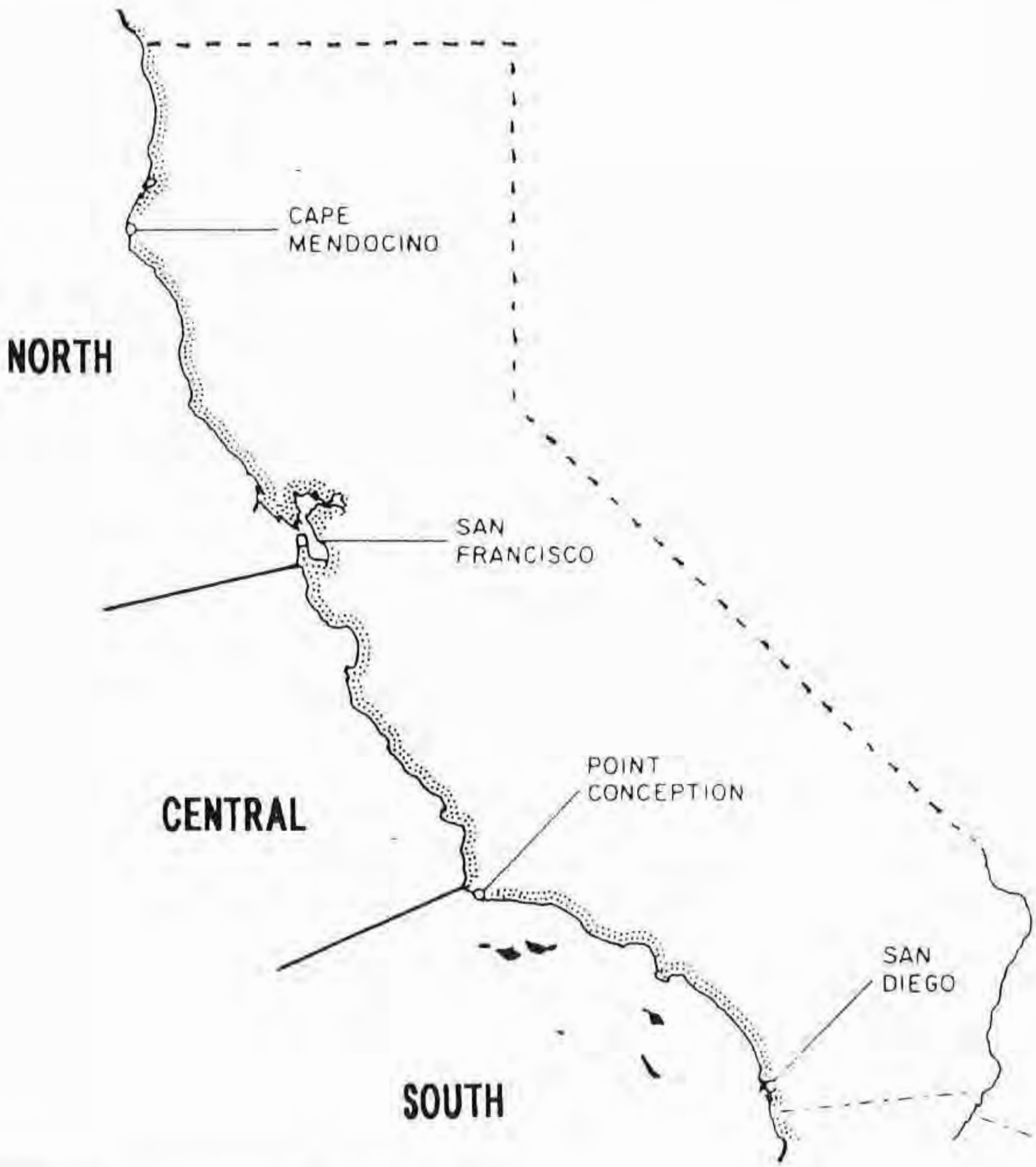


Figure 3-5. Regional division of California.

there was a paucity of giant kelp in the area when official beds were first established in 1917. There are, however, extensive beds of *Nereocystis* that occur from Point San Pedro, San Mateo County to Point Saint George, Del Norte County, which have been numbered 301-312.

Consequently, it is necessary to divide the state into three geographic regions to adequately address the status of the kelp populations in California: northern, central, and southern (Figures 3–5, 3-6a, 3-6b, 3-6c).

The northern region extends from the California–Oregon border to Point Montara, San Mateo County. This area experiences a high degree of wave energy because of frequent winds and storms. Water temperatures are usually cold and range from about 46°F (8°C) to 59°F (15°C). *Nereocystis* appears to grow well and persist under these cold water and stormy conditions. The central region extends from Point Montara to Point Arquello, Santa Barbara County. This region is also exposed to stormy conditions, especially during winter and spring months. Water temperatures are usually cold and range from about 50°F (10°C) to 59°F (15°C). *Macrocystis* is presently the most abundant species of canopy–forming kelp in the region, however, *Nereocystis* is also abundant along this stretch of coast.

The southern region extends from Point Arquello to the U.S.–Mexican border and includes the offshore islands. The region has a south facing aspect caused by the eastward turn of the coastline at Point Conception. The northern Channel Islands help protect much of the mainland from the northwest swells generated by storms to the north and from northwest winds. Water temperatures range from about 55°F (13°C) to 69°F (21°C) during the year, depending upon the area being sampled. Temperatures are colder to the north around San Miguel Island and warmer to the south around Santa Catalina Island and San Diego. *Macrocystis* is the dominant canopy–forming kelp species in the south coast region. *Nereocystis* does not occur in this region.

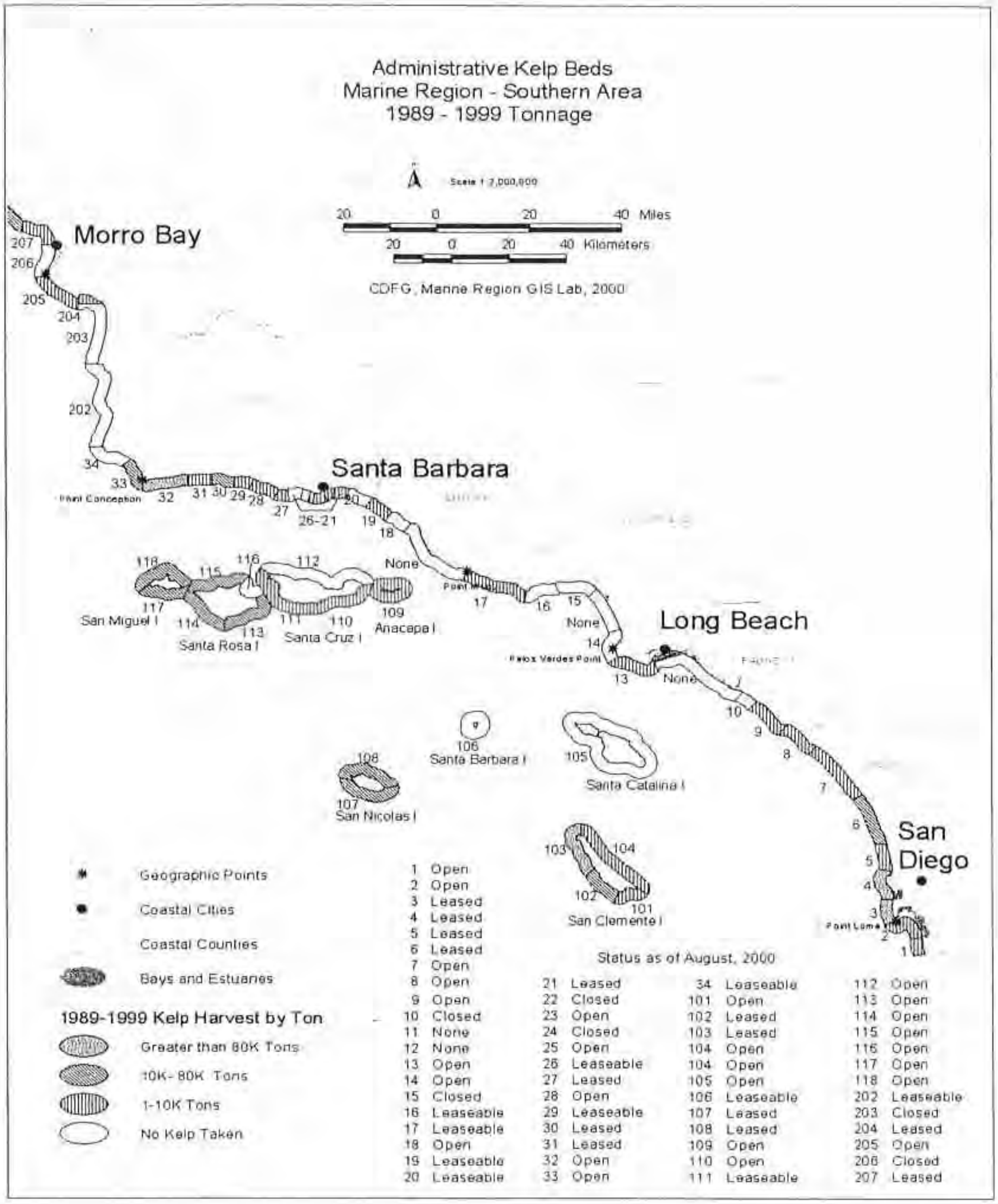


Figure 3-6a. Ten year kelp bed usage for beds from California-Mexican border to Morro Bay.

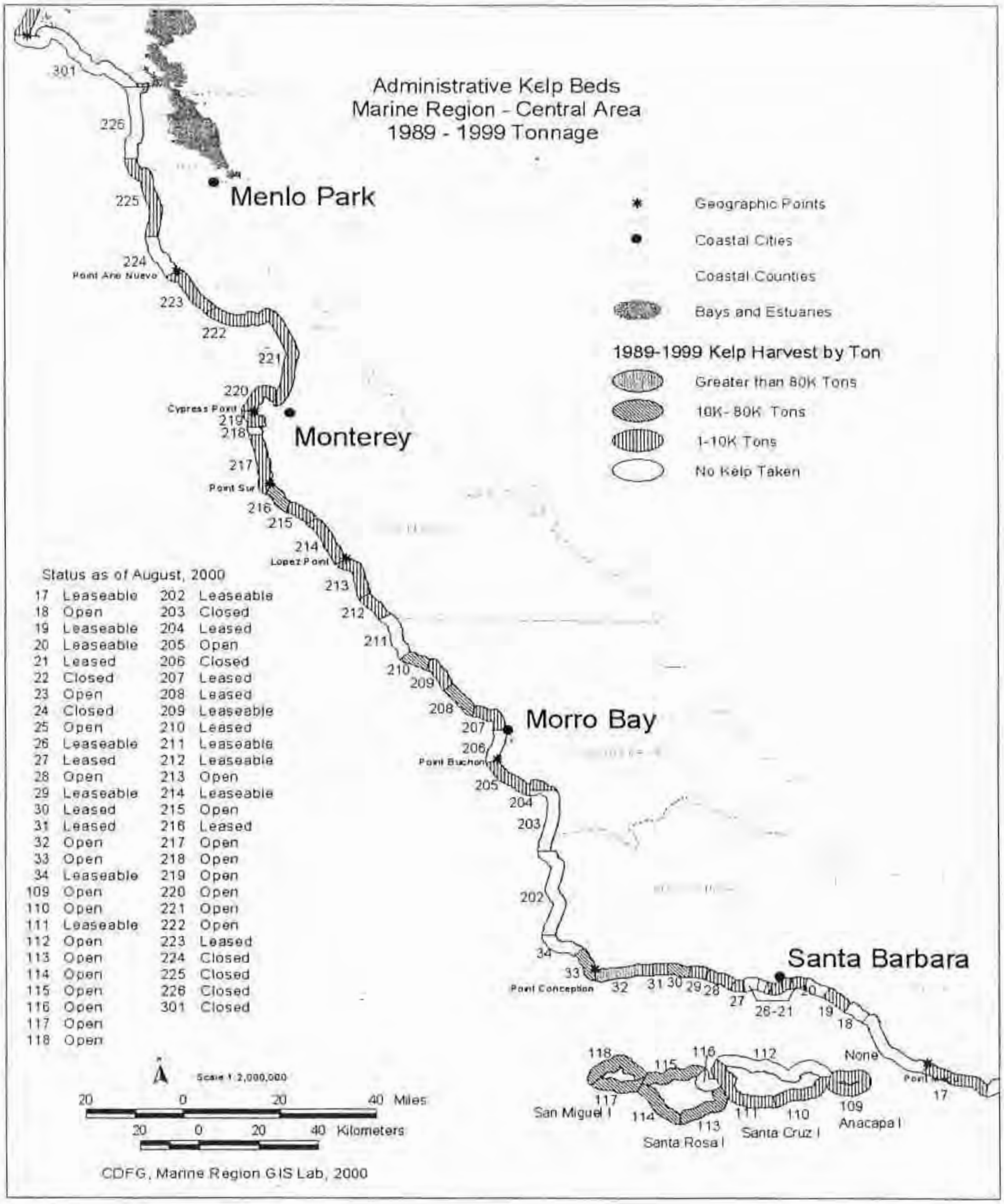


Figure 3-6b. Ten year kelp bed usage for beds from Morro Bay to San Francisco Bay.

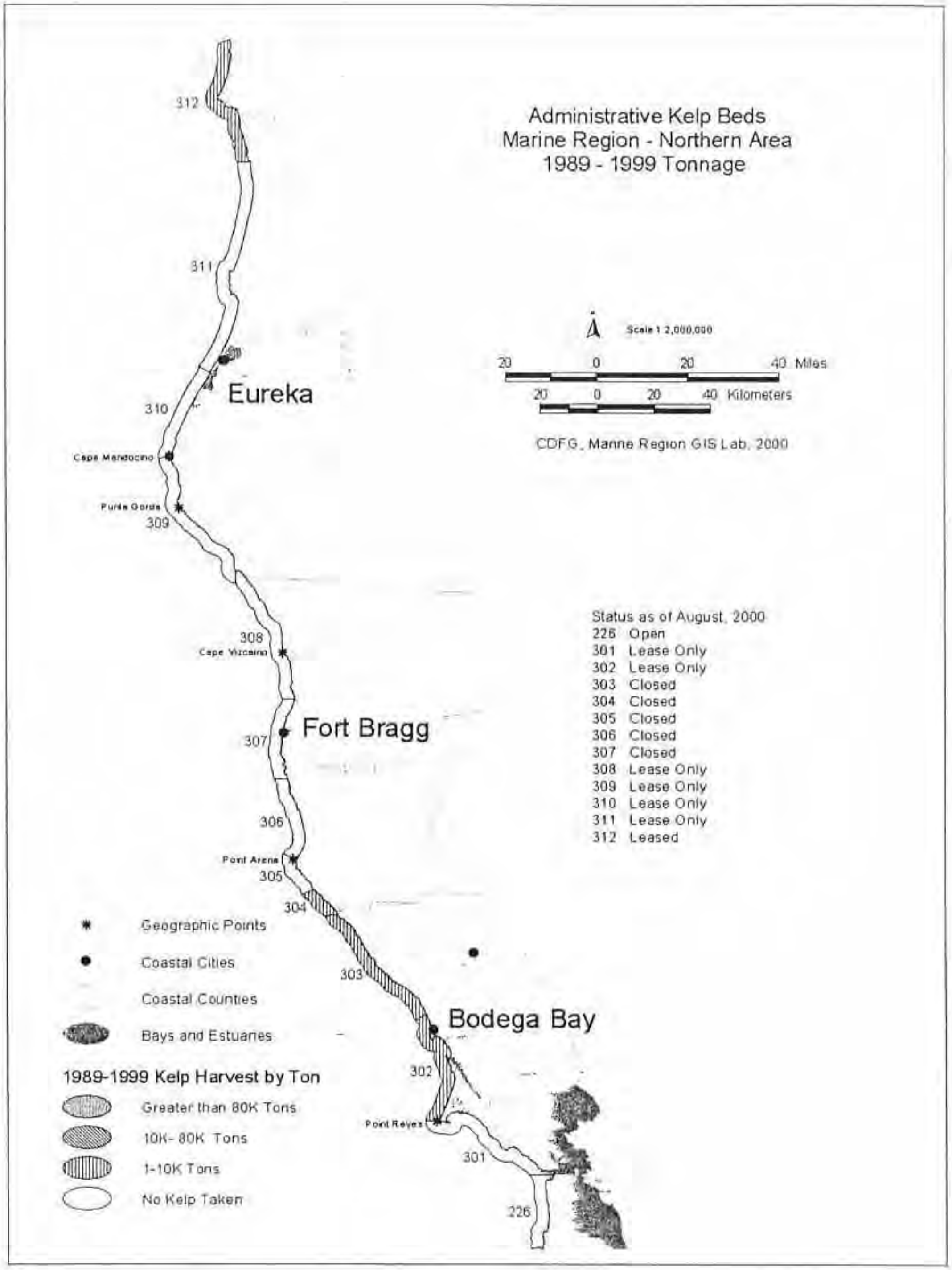


Figure 3-6c. Ten year kelp bed usage for beds from San Francisco Bay to the California-Oregon border.

3.3.1 North Coast

The kelp resources of the eastern Pacific coast were first mapped in 1911–1912. The survey extended from the Gulf of Alaska to Cedros Island, Baja California Sur. Since that time little work has been done along the north coast primarily due to the absence of *Macrocystis pyrifera* in this region. Current knowledge of the population levels of *Nereocystis* off the north coast is based on a 1989 survey of the California coast that extended at from Pt. Montara, San Mateo County to Shelter Cove, Humboldt County, a 1999 survey from Pt. Montara to the Oregon border, and information provided by a kelp harvester in Crescent City, California. Table 3-2 contains a summary of recent information.

Table 3-2. Comparison of historical and current areal levels of *Nereocystis* populations in northern California. Area measured in square statute miles.

Year	North coast	Crescent City	Shelter cove	Cape Viscaino	Fort Bragg	Point Arena	Fort Ross
1912	6.54[1]	0.08	N/D	0.04	0.66	2.98	0.11
1989	5.71[2]	0.75[3]	0.01	0.04	0.59	1.78	0.35
1999	3.29			0.38	0.46	1.90	0.55

[1] Survey conducted from Oregon–California border to Point Montara (Department of Agriculture, 1915).

[2] Survey conducted from Shelter Cove to Point Montara (Ecoscan, 1989).

[3] Estimate of *Nereocystis* beds, not included in 1989 totals for north coast (Van Hook, pers. comm.).

Table 3–2 indicates that the bull kelp resource has diminished about 13% between the 1912 survey and the 1989 survey. However, the 1989 survey did not include the area from Shelter Cove to the California/Oregon border. If the estimated areal extent of kelp from Cresent City is added, the north coast resource rises to 6.45 square miles. The 1999 survey, however, indicates about a 42% decline in kelp coverage in the Pt. Montara to Shelter Cover area. Despite the fact that in 1999, anecdotal observations along the Mendocino coast indicated one of the most extensive kelp canopies in the last decade (Kalvass, pers.comm.). One factor in this apparent decline is the fact that the 1999 survey was done after a major storm had already passed through the region and destroyed some of the kelp beds. Additionally, kelp beds are subject to high variability in coverage and density from year to year. And finally, the method used to interpret aerial photographs in 1999 resulted in a more precise representation of kelp beds, implying that the 1989 survey probably overestimated the true extent of the beds (Wright, pers.comm.).

Comparison of several areas along the north coast illustrates the variability that exists in this region. The fluctuations in *Nereocystis* biomass may be explained by a comment recorded during the 1912 survey. Captain John Olsen of the Point St. George Lighthouse reported that the kelp beds around the lighthouse were much sparser than in previous years. He remarked for several years he had difficulty rowing his boat to the lighthouse because the kelp was so thick (Crandall, 1915). Since year to year fluctuations are common, it is possible that the 1912 survey was conducted during a period of poor recruitment in the Crescent City area.

Barnes and Kalvass (1993) reported that the Fort Bragg area kelp beds appeared to increase in size and density between 1985 and 1988 based on aerial photographic surveys of the area. The *Nereocystis* beds were thought to have reached maximum potential in 1988. The increase was coincident with the removal of over 65 million pounds (27,000 metric tons) of red sea urchins (*S. franciscanus*) from Mendocino and Sonoma Counties by commercial divers, from 1985 to 1988. In 1992, the same beds showed delayed and reduced kelp recruitment and growth. The causes of the poor recruitment in 1992 may have been anomalously elevated nearshore water temperatures in coincident with reduced upwelling (Barnes and Kalvass, 1993). This example illustrates the kind of fluctuations that occur in the recruitment of bull kelp along the north coast and the factors which may play a role in the variability of this resource.

Another factor to consider is the estimate of potential areal coverage as it relates to bull kelp biomass. Ecoscan (1990) gave each bed a planimetric value which represents the sea surface that the canopy covers (Table 3–2). This value can also be thought of as the potential growing area. From their survey, it was determined that the bull kelp beds from Point Montara to Shelter Cove could cover an area of approximately 10 square miles. If the estimation of the available growing space for Crescent City is added the value increases to about 11 square miles. Thus in an optimal growing year, the bull kelp resources could increase about 44% above a typical year's coverage. This would still only represent 15% of the state's total kelp resources.

3.3.2 Central Coast

Giant Kelp

The kelp forests along the central coast have shifted from having fairly equal amounts of both giant and bull kelp from 1912 to 1967 to mostly *Macrocystis* in 1989. Crandall (1915) charted pure stands of *Macrocystis*, pure stands of *Nereocystis*, and mixed stands of the two species. He reported a total of 17.55 mi^2 of canopies in central California (Pt. Arguello to San Francisco): *Macrocystis* - 8.27 mi^2; *Nereocystis* - 6.61 mi^2; and mixed *Nereocystis* and *Macrocystis* - 2.67 mi^2. The 1967 survey by the California Department of Fish and Game charted 16.00 mi^2 from Point Arguello, Santa Barbara County to Point Montara, San Mateo County (Beds 202-225). The 1989 survey revealed 28.60 mi^2 of canopy along the central coast, a significant increase in kelp area compared to 1967.

The significant increase in kelp coverage in central California may be associated with changes in the abundance and distribution of sea otters (Sec. 3.2.9.1). Van Blaricom (1984) compared canopy distribution data from the early 1900s (when sea otters were essentially absent) with surveys in the 1980s (when sea otters were present). He suggested that *Macrocystis* canopies have increased in central California in recent years while *Nereocystis* has decreased as an indirect result of sea urchin removal by the expanding population of sea otters. Van Blaricom (1984) suggested that bull kelp in central California first colonizes areas where sea otters remove sea urchins because this species of kelp is initially more abundant where sea urchins exist. *Macrocystis* then gradually invades the *Nereocystis*. The canopy of giant kelp reduces light to the bull kelp restricting recruitment of the later species.

There have also been historical changes in the relative abundance of *M. pyrifera* and *N. luetkeana* in central California with sites changing completely or partially from one species to the other and vice versa (Yellin et al., 1977; Van Blaricom, 1984). Severe storms can cause a shift by removing *Macrocystis*, which is replaced by *Nereocystis* (Foster, 1982; Van Blaricom, 1984).

Bull Kelp

The distribution of bull kelp along this section of the coast is largely restricted to areas unsuitable for giant kelp (Burge and Schultz, 1973). Thus bull kelp is found skirting the outer edge of *Macrocystis* beds, inshore of the *Macrocystis* beds within the surge zone, or occurs as pure stands in areas of high disturbance such as Año Nuevo and Diablo Cove.

In 1912, the bull kelp beds represented approximately 32% of the kelp available in central California (Crandall, 1915). During the 1967 and 1989 kelp canopy surveys, no differentiation was made between *Macrocystis* and *Nereocystis* beds, therefore, no estimation of the amount of *Nereocystis* present could be made; only changes in relative abundance of kelp canopy were assessed. Our knowledge of what has been happening to the *Nereocystis* population along the central coast comes from long term studies conducted by the Department and Pacific Gas and Electric (PG&E). Together these organizations have documented the changes in *Nereocystis* abundance from 1969 to 1986.

From 1969 to 1977, Pacific Gas and Electric conducted aerial surveys between Point Buchon and Point San Luis (Bed 205). Within this area, *Nereocystis* is the dominant canopy–forming kelp. The survey area was divided into 3 segments: north (Point Buchon to Lion Rock), central (Lion Rock to one–quarter mile south of South Cove), south (southern boundary of central segment to Point San Luis). Within each of the segments, annual changes were variable (Figure 3–7).

For the 9–year period surveyed, the total canopy coverage fluctuated from a low of 0.16 mi^2 in 1969 to a high of 2.03 mi^2 in 1975. In 1976, the standing crop was approximately half of the previous year and continued to decline to 0.37 mi^2 in 1977 (Stephans, 1979). In 1989, the canopy cover equaled 0.64 mi^2 for the Point Buchon to Point San Luis area (Ecoscan, 1989).

Co–incidental to the aerial surveys, the Department conducted subtidal and shore–based visual surveys in Diablo Cove from 1970 to 1982 (Gotshall et al., 1986). For the first six years of the baseline study, there was a significant increase in the size and density of the bull kelp beds. By 1975, the beds were so thick the shore census could not be conducted because the overlapping blades and pnuematocysts would have rendered a count useless. The 1975 subtidal survey produced a count of over 400,000 bull kelp sporophytes in the cove. The apparent increase in bull kelp abundance was attributed to the reduction of the sea urchin population by sea otters, which moved into the area in 1973. By 1976, the bull kelp in Diablo Cove began to

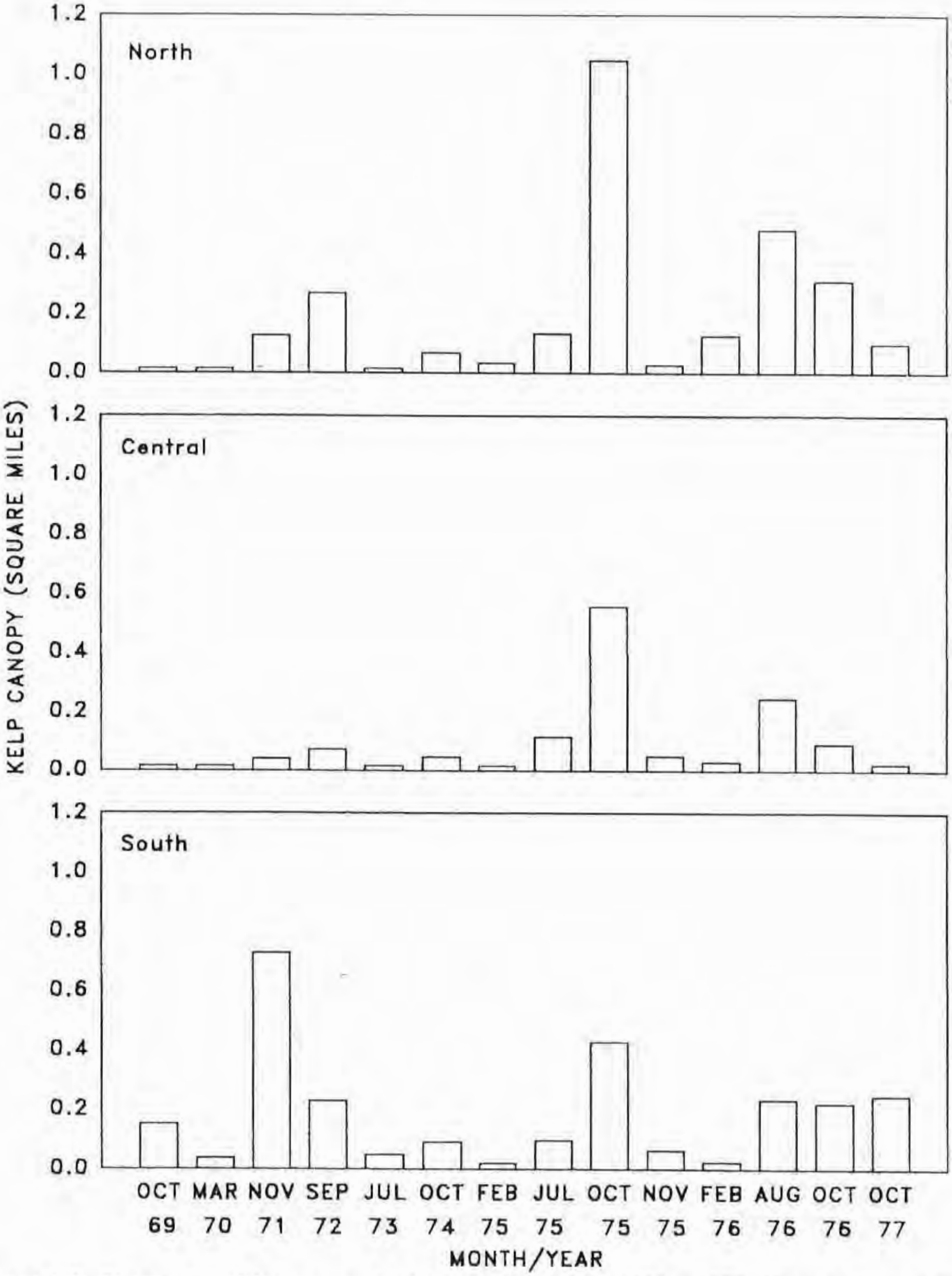


Figure 3-7. Changes in bull kelp canopy in Kelp bed no. 205 from 1969 to 1977. (Source - Stephans, 1979)

decline reaching a low of 1,127 plants in 1982 (Gotshall et al., 1986). The decline was probably due to the increase of the perennials *Laminaria dentigera* and *Pterygophora californica*. The removal of sea urchin grazing pressure allowed these subsurface canopy–forming species to subsequently invade areas once occupied by the annual *Nereocystis*. Once established, *Nereocystis* was unable to compete for space and light (Dayton et. al., 1984). In addition to the competition between *Nereocystis* and the other two brown algae, the coast was experiencing the effects of an El Niño. Thus the increase of water temperatures and decrease in nutrient levels probably aided the decline of the bull kelp at Diablo Cove and other locations (Jackson, 1977).

In 1982, PG&E took over the subtidal and intertidal surveys of Diablo Cove (PG&E, 1987). The shore survey of 1983 produced a count of approximately 10,000 plants in the cove. However, the surface survey for the next three years had counts averaging less than 1,000 plants per year.

The decline in plant numbers in 1985 and 1986 were the result of the increase in water temperature in the cove caused by Diablo Canyon Power Plant. They found that bull kelp sporophytes developed normally until their blades reached the sea surface and contacted the thermal plume. Premature blade loss followed in summer, which led to early degeneration of remaining tissue. This senescence does not normally occur until the late fall and winter (Burge and Schultz, 1973). In areas where the plants were protected from the plume, growth was normal. Despite the early loss of plants in 1985, during the spring of 1986 approximately 50,000 plants reached the sea surface but died back in the areas of thermal plume contact (PG&E, 1987).

3.3.3 Southern Coast

Crandall (1915) reported 100.17 mi^2 of *Macrocystis* canopy in southern California during the 1911-1912 survey. More recent one–time surveys reveal a 40% to 46% decrease in canopy since Crandall's survey (Table 3–3). The 1967 survey by the California Department of Fish and Game charted 53.86 mi^2 of *Macrocystis* in south coast kelp beds: 21.24 mi^2 around the Channel islands (Beds 101-118) and 32.62 mi^2 along the mainland (Beds 1-34). The 1989 survey of kelp beds along the south coast (Ecoscan, 1989) revealed 39.70 mi^2 of kelp; a decrease of 14.16 mi^2 or 26% compared to the 1967 survey. Most of this decrease (11.8 mi^2 or 22%) occurred in the Santa Barbara area where forests of giant kelp living on soft sediment were destroyed by the 1982-1984 El Niño and associated storms. Most of the beds growing on sand near Santa Barbara had not returned.

Table 3-3. California coastal kelp resources - kelp canopy area survey (square statute miles).

	1911/1912* survey	1967 survey**	1989 survey**	1999 survey***
north coast	6.54	N/A	9.89	3.36
central coast	17.55	16.00	28.60	3.02
south coast	100.17	53.86	39.70	11.38
Total	124.26	69.86	78.19	17.76

*Crandall, 1915; ** Ecoscan, 1989 *** CDFG, 1999

One of the most detailed studies of the variation in *Macrocystis* canopy coverage was done by North et al. (1993). During a 25–year period from 1967 through 1991, they used infrared aerial photography to study *Macrocystis* canopies along nearly 90 miles of southern California coastline. The aerial photographic surveys were flown several times each year (minimum: 2 flights in 1970; maximum: 35 flights in 1973). Twenty beds (patches) of giant kelp were followed along the Orange and San Diego County coastlines. The areal data reported by North et al. (1993) represented approximately the maximal value measured for each bed during a given year. The 25-year study period included: the wettest year of the century (1978), the largest El Niño (1982-84), a significant La Niña, a period of lower than average water temperatures and high nutrient levels, (1989), and a "200-year" storm (1988). North et al. (1993) noted that about half the beds displayed no canopy for at least one year of the study period.

Ten out of 15 beds in existence during the early 1980s displayed their lowest areas during the 1982-84 El Niño, while 12 of 20 beds in existence at the end of the 1980s displayed either their highest or next-to-highest areas during the 1989 La Niña (North et al., 1993). The large fluctuations in kelp bed sizes in Orange and San Diego Counties during the 1980s probably resulted from the combined effect of water temperature and nutrient availability (North et al., 1993).

The long-term records of canopy coverage among kelp beds of San Diego and Orange Counties indicated some common trends, representing responses to broad scale phenomena such as El Niño/La Niña and major storms. *Macrocystis* canopies were fairly stable from 1967 through 1979 and averaged around 2.3 mi^2 in size. The decade of the 1980s, however, was not stable and was marked by wide fluctuations in canopy coverage. Most of the fluctuations were associated with the 1982-84 El Niño or the 1988-90 La Niña. Canopies dropped to a low of 0.3 mi^2 during 1983-84, while a maximum of 5.8 mi^2 was reached in 1990.

The southern region has historically had the highest levels of kelp canopy when compared to both the central and northern regions (Table 3–3). The abundance of *Macrocystis* is largely due to the favorable environmental conditions: periodic upwelling, the presence of a broad, shallow continental shelf, availability of good bottom substrate, and the protection provided by Point Conception to the north and the Channel Islands to the west which lessens the impact of offshore winds and storms. However, the El Niños of 1982–84, 1992-93 and 1997-98 had a far greater impact on the southern kelp beds than on the central and northern beds.

3.4 Socioeconomic Environment

The kelp community along the California coast contributes to human society in both goods and services. Twenty-five fish and invertebrate species are harvested directly from the kelp by commercial and sport fishermen. These nearshore fisheries supply state, national and international markets. In addition, nearly 120,000 tons of kelp have been harvested in the past decade for direct or indirect human consumption. *Ecosystem services* are the conditions and processes through which natural ecosystems, and their component species, sustain and fulfill human life (Daily, 1997). Kelp provides direct services to humans through recreation and tourism. Healthy kelp communities provide indirect services to humans by sustaining the nearshore food-web that makes fisheries products available for exploitation.

3.4.1 Commercial Kelp Harvesting Industry

Giant Kelp

Giant kelp was first harvested along the California coast during the early 1900's. Scofield (1959) provides a thorough description of the early history of kelp harvesting in California. Many small harvesting companies began operating along the coast from San Diego to Santa Barbara, beginning in 1911. One large company, the Hercules Powder Company, opened in 1916 and operated harvesters from San Diego. The early companies primarily extracted potash and acetone from kelp for use in the manufacture of explosives during World War I (Scofield, 1959; McPeak and Glantz, 1984; Neushul, 1987; Tarpley and Glantz, 1992). Harvesting of giant kelp stopped shortly after the signing of the armistice in November, 1918 and did not resume until the early 1920s.

Giant kelp was again harvested off the California coast beginning in the late 1920's. Philip R. Park, Inc., of San Pedro, began harvesting kelp in 1928 to provide ingredients for livestock and poultry food, while the Kelco Company of San Diego (now ISP Alginates Inc., a Division of International Specialty Products.) began harvesting and processing giant kelp in 1929 for the extraction of algin (Tarpley and Glantz, 1992).

ISP Alginates Inc and the Algin Industry

Kelco Alginates, now known as ISP Alginates, has harvested and processed giant kelp since 1929 and has developed many applications for the unique natural compound, algin, which is found in the cell walls of the plant. Algin is valuable as an efficient thickening, stabilizing, suspending, and gelling agent. It is used in a wide range of food applications including desserts, gels, dairy products, in salad dressings, beer, and in canned foods. It is also important in industrial applications and is used in paper coating and sizing, textile printing, and welding-rod coatings. Algin also has pharmaceutical, cosmetic, and dental applications. The annual sales of algin products manufactured in California in the late 1990's was $40 million.

Initially, ISP Alginates harvested only the kelp beds near San Diego. As production needs increased, or giant kelp productivity decreased due to oceanographic conditions near San Diego, it became necessary for ISP Alginates to harvest distant beds. Currently, ISP Alginates leases 15 kelp beds from Monterey Bay to Imperial Beach, near the U.S.-Mexico border, covering approximately 28.4 square miles. Their harvest accounts for 95% of all kelp harvested in the state. During the past 70 years, ISP Alginates has developed a canopy-harvest strategy based on the economics of the algin business and kelp biology. ISP Alginates maintains a resource assessment division with staff biologists to manage the harvest of the leased and open beds they utilize.

Kelp is a resource whose annual productivity is determined by changes in nutrient levels, water temperature, weather and other geophysical conditions. Storms and expanding urchin populations are two primary reasons why a kelp bed can have high productivity one year and low the next. Seasonally, as water temperatures warm or as nutrient levels change, the canopy sloughs. If storms persist, the canopy is torn from the kelp holdfast and stipes. Therefore, the decision to harvest a particular bed must be made by ISP Alginates on a monthly - or sometimes weekly - basis, after evaluating the productivity of the bed. Unproductive beds are uneconomical to harvest.

ISP Alginates prefers to harvest the beds nearest San Diego harbor, specifically beds 2,3 and 4. (Glantz, pers. comm.). The closeness of these beds makes their harvest most economical. Moreover, these beds - as well as other beds in the Southern California Bight - commonly experience high nitrification associated with a cool upwelling in the summer. With a mild winter, these highly productive beds can grow up to 30 tons of kelp per acre annually and sustain 2 or 3 canopy harvests per year. If ISP Alginates can meet its harvest quota from beds 2, 3 and 4, it may not need to harvest from any other beds. For the same biological and economic reasons, ISP Alginates prefers to purchase kelp harvested from beds along coast of Baja California Sur, Mexico. The Mexican kelp is harvested primarily by Productos del Pacifico, an Ensenada-based company that holds concessions on the kelp beds from the U.S. border to the Sacramento Reef, near El Rosario, Baja California Sur.

Most years, however, there are biological, geographic and economical reasons that require ISP Alginates to harvest beds further from home, either around the southern Channel Islands or along the Central California coast. Consequently, ISP Alginates continues to lease beds which it infrequently uses.

Having kelp beds available for harvest over a wide geographic range allows for utilization of the most mature canopies, allowing younger canopies time to develop (Glantz, pers. comm.). For example, bed 216, south of Monterey, is a large, broadly dispersed, deep-water kelp bed with high productivity during the summer and early fall. The outer canopy can be harvested safely by ISP Alginates's large harvesting vessel while the portion of the bed located in shallower water is never harvested by them. Beds 102 and 103 on the west side of San Clemente Island are highly productive in years with light storm activity and significant upwelling. In high storms or warm water years, it is not economically feasible to harvest any kelp from these beds. Similarly, beds 107 and 108 at San Nicolas Island can be the most productive beds of the entire Bight in a year with calm seas and strong upwellings. Since 1989, these two beds have suffered from two major El Niño events and the development of a large urchin population. Given the current condition of the beds, it is not economically or biologically realistic to harvest these beds and may not be for many years to come. Accordingly, to maintain an efficient and consistent harvesting operation, and to utilize the resource according to its level of productivity, it is necessary to be able to harvest kelp beds in different locations along the California coast (Conner and McPeak, 1982).

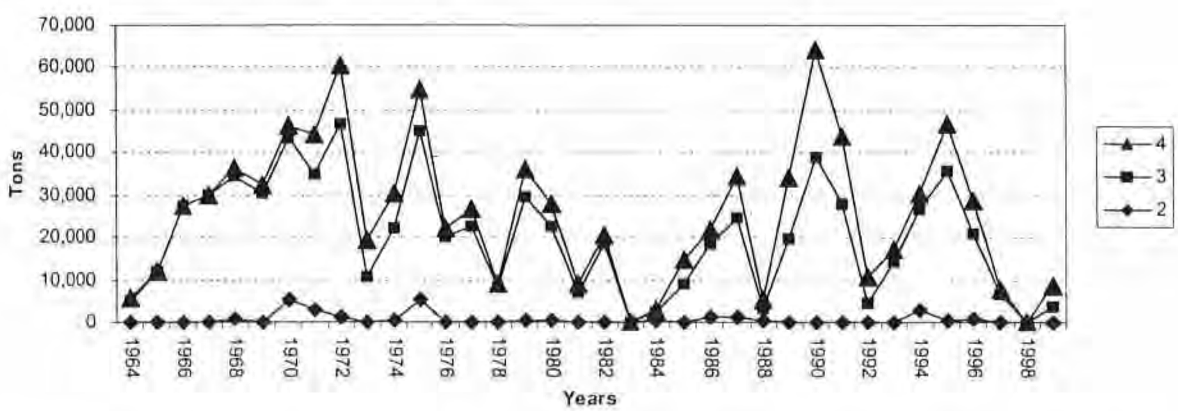


Figure 3-8. Fluctuations in harvest tons for beds 2, 3, and 4. (Data compliments of ISP Alginates Inc., 2000)

The Figure 3-8 shows harvest fluctuations in kelp beds 2-4 that reflect kelp bed productivity. That productivity may be a result of storm events, water temperature, nutrients, grazing or human impact. Beds with low productivity are uneconomical to harvest; thus, from the perspective of this resource use, the harvest appears to be self-regulating.

Beds 30-32, located north of the San Diego and offshore island beds, provided productive kelp canopy for harvest during periods when ISP Alginates experienced low harvest in its preferred beds 2-4 (compare Figure 3-9 to Figure 3-8). From 1974 -1980, beds 30-32 provided high yields, but they were impacted by the 1983-84 El Niño and nearly destroyed by the 1988 '200 year storm.' In addition, the kelp in bed 30 underwent a habitat and general location change. Prior to the storm of 1988, the kelp in bed 30 grew on an offshore sandy substrate. The storm cleared the sand off of a shallower rocky substrate. After a period of 8 years, a new rock-based kelp community developed. Bed 31 never recovered from the El Niño and subsequent storm, possibly because of the difficulty kelp has developing on sandy substrate. Today bed 31 produces no harvestable kelp.

Severe storms and El Niños can have a significant impact on the commercial

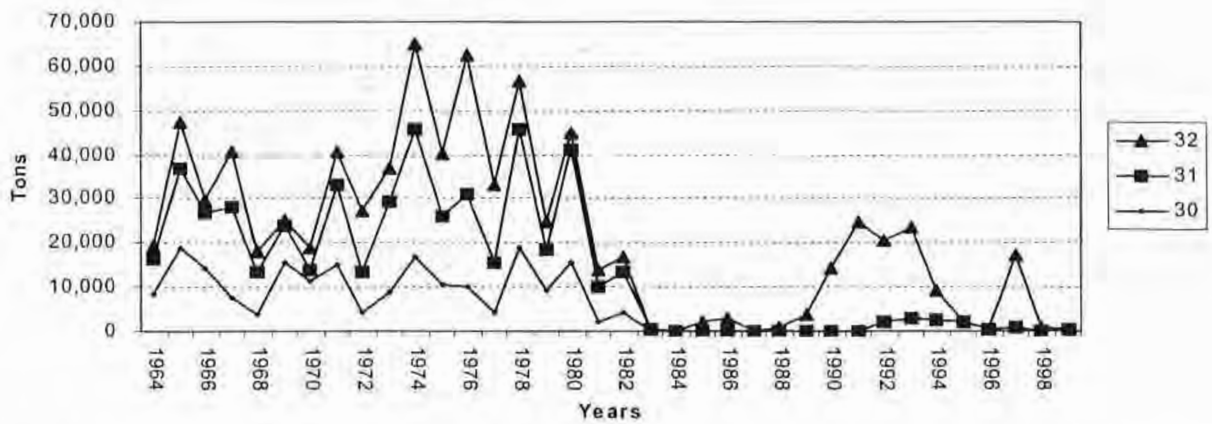


Figure 3-9. Fluctuations in harvest tons for beds 30, 31, and 32. (Data compliments of ISP Alginates Inc., 2000)

kelp harvesting operation. The January, 1988 a "200 year storm" virtually destroyed all harvestable kelp canopies in California overnight (McPeak, pers. com). Plants were uprooted, set adrift, and cast ashore during this violent storm. It was several months before processors were able to harvest canopies of giant kelp in southern California. The 1982-1984 El Niño was the strongest on record (Sec. 3.2.12). The El Niño and associated storms devastated the kelp beds. The effects of El Niño on *Macrocystis* are apparent in the harvest records; in 1982, ISP Alginates harvested 75% of its long-term average at Point Loma, but nothing was harvested in 1983, and only 9% in 1984, all at the beginning of the year.

The 1998 El Niño caused a greater than 66% drop in ISP Alginates harvest from 1997. Kelp productivity coastwide increased by approximately 30% in 1999. During the El Niño, some of the most productive beds (e.g. beds 3, 4, and 103) fell to zero harvestable kelp canopy. Due to localized cool water upwellings, beds 117 and 114 produced the best yields during this period, although those yields were significantly less than in the previous 2 years. These beds are located on the far western and south-western sides of the Channel Islands. Both bed 114 and 117 are somewhat protected from wind and high swells because of their geographic location. The additional time and expense required to harvest these beds make them a less attractive economic option, but during the 1998 El Niño, they provided the greatest yield.

Beds 3, 4, and 103 are highly productive under normal weather patterns. During the 1998 El Niño, they produced no harvestable kelp. Other beds provided minimal amounts of harvestable canopy at considerable time and cost (Figure 3-10).

During the 1998 El Niño, ISP Alginates harvested 25% of its annual kelp quota from leased beds off the coast of Baja California. As in California, certain beds in Mexico were devastated by the warm El Niño waters and others experienced remarkable growth due to steady upwelling and nitrification. In the 1999 recovery

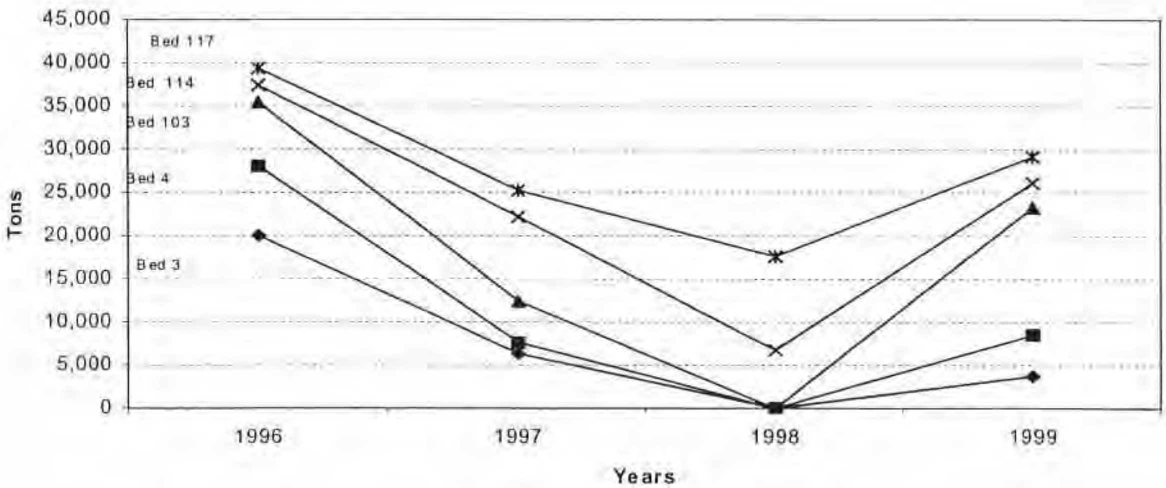


Figure 3-10. Comparison of high yield beds during the 1998 El Niño. (Data compliments of ISP Alginates Inc., 2000.)

period, California kelp provided 50% of ISP Alginates' harvest requirement and the beds off of Baja provided much of the balance. At times, when fresh *Macrocystis* is unavailable from California or Mexico, expensive dry seaweeds imported from Chile and other parts of the world are used for algin extraction (Glantz, ISP Alginates, pers. comm.).

Giant kelp grows exceedingly well during La Niña conditions when ocean temperatures are cool and nutrient levels are high (North, et al., 1993). A significant La Niña occurred in southern California during 1990. Kelp has been maximally harvested in San Diego County since the late 1930s. The kelp harvest in San Diego County in 1990 was the best ever by ISP Alginates, since their operation began in 1929.

Over the past decade, ISP Alginates has reduced its kelp harvest by 50% due to business decisions (Figures 3-11 and 3-12). The international sodium alginate market has become more competitive, with overseas harvesters and producers bringing cheaper labor and manufacturing costs to the market. ISP Alginates now concentrates on processing high quality algin for foods, beverages and pharmaceuticals. Since 1993, the company has changed its production strategy to stabilize and streamline the processing of algin from wet kelp. As a result, ISP Alginates is harvesting less kelp annually. They try to avoid the seasonal influence of kelp productivity by obtaining approximately 6,000 to 7,000 tons per month from whichever Mexican or California beds are most productive.

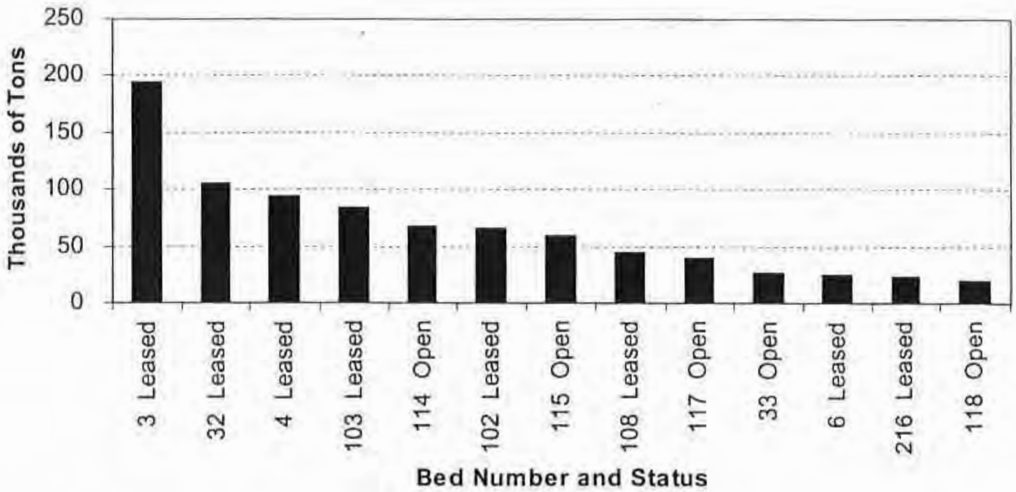


Figure 3-11. High use kelp beds, 1989-1999.

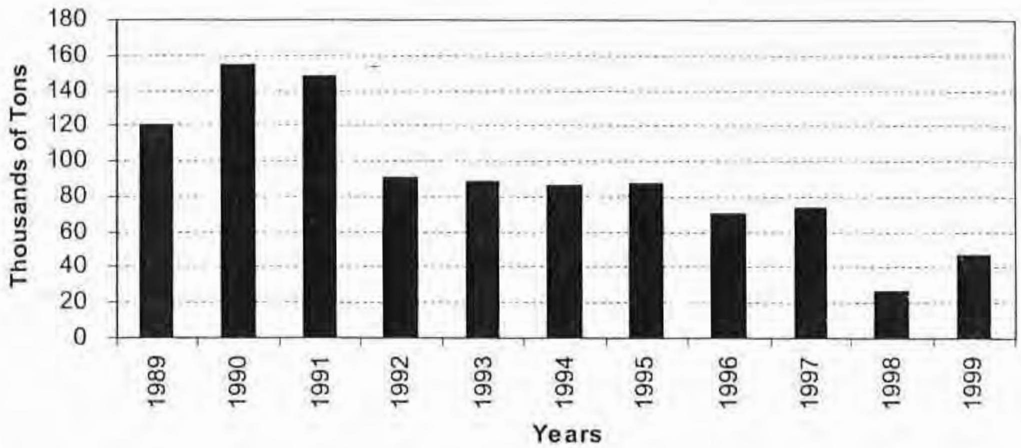


Figure 3-12. Coastwide kelp harvest, 1989-1999.

ISP Alginates Harvest Techniques

The vessels used for harvesting by ISP Alginates are specially designed and range in length from 140 to 180 feet. The majority of the length of the vessel is taken up by the bin, the area that holds the cut kelp. The harvesters have reciprocating blades (the cutting mechanism) mounted at the base of a conveyer system (drapers) located on the stern of the vessel. The harvester usually arrives at the kelp bed shortly after daylight. The main engines are secured, drapers are lowered into the water to a depth of 3 feet, and a bow propeller is engaged that pushes the harvester stern-first through the kelp bed. Kelp is cut, brought aboard on the drapers, and deposited in the ship's bin. The wheelhouse, from where the captain operates the harvester, is located directly over the drapers and the cutting mechanism. The captain, therefore, has an excellent view of the operation while the harvester moves slowly through the kelp bed at a speed of about 1.5 kts. Modern harvesters carry as much a 600 tons of *Macrocystis* collected during a day of harvesting.

The large harvesters have a draft of about 12 feet and must avoid pinnacles and rock hazards in the kelp beds. The harvesters work in water depths no shallower than about 30 feet. For all practical purposes, these large vessels are only able to harvest about 50% of the canopies within a given kelp bed. The remaining 50% is not harvested.

Giant kelp is especially suitable for mechanical harvesting because: 1) the deep-water habitat allows for use of the large harvesting vessels; 2) photosynthesis, growth, and buoyancy are distributed along the entire length of the plant and, therefore, are not eliminated when the surface portion of the frond is removed; and, 3) surface canopy is regenerated by younger fronds that are growing beneath the surface (Clendenning, 1971).

The Marine Resource Department at ISP Alginates regularly conducts aerial surveys to assess *Macrocystis* resources throughout California. These surveys entail low-level flights over the kelp beds to determine abundance, condition, maturity, and harvestability of the resource. Beds of *Macrocystis* in southern California are usually surveyed once a month; occasionally more often. The central California resource, from Cayucos to Monterey, is usually surveyed about four times a year, since harvestable canopies are virtually nonexistent during the winter and early spring months (Glantz, pers. comm.). Information from the surveys is used by the Harvesting Department to schedule vessels to the most mature canopies, allowing younger canopies time to develop. There are important advantages to harvesting only mature canopies. The older fronds, prior to sloughing and being lost to natural causes, have a higher algin content and provide more biomass per area. The harvesting operation to obtain kelp for algin extraction is a year-round operation when resource is available.

Mariculture Industry

Giant kelp is also harvested commercially in California to supply mariculture companies with food for rearing abalone. Although each company maintains its unique business objectives, many of them serve the high demand for abalone found in restaurants responding to the coastal tourist trade. There are also state, national and international markets for cultured pearls, abalone meat, shells and, potentially, abalone viscera (for fertilizer, among other products). Abalone aquaculture businesses along the coast range economically from large companies to small hobby operations. As of the end of 1999, the combined abalone farmers account for less than 1.7% of the annual kelp harvest. This figure may increase as the international supply of wild abalone is exhausted and farmed abalone gains market importance.

The Cultured Abalone leases bed 27, north of Santa Barbara. Since 1996, their kelp harvest has increased by approximately 15% annually, in response to a growing abalone market. During the 1998 El Niño, they entered a co-lease with ISP Alginates for bed 208, which is located north of Morro Bay. The Cultured Abalone contracts the harvest of the shallow inshore kelp, and when necessary, Kelco harvests the outer margin, beyond the 6 fathom line of bed 208. The Cultured Abalone harvested approximately 560 tons of kelp in 1999, and they expect to increase their kelp requirement by 15% annually over the next 5 years.

The four abalone growers, Pacific Mariculture, US Abalone, Monterey Abalone, and Pacific Abalone, along with a herring eggs-on-kelp business (Grillo Enterprises) formed the Monterey Bay CO-OP in response to concerns raised over harvesting of kelp along Cannery Row. The issue of kelp harvesting along Cannery Row came to the forefront during the formation of the Ed Ricketts Underwater Park by the City of Monterey. An underwater park that was conceptually developed by a grass roots movement where citizens expressed concern for the environment. The area of the underwater park extends from the Breakwater to Lover's Cove, an area within the boundaries of Bed 220. The CO-OP was developed to deal with kelp-related issues in the Ed Ricketts Underwater Park. The remainder of Bed 220, and Beds 221 and 222 have not had the user conflicts that have occurred within the area of the underwater park.

The two main kelp harvesters in Bed 220 are Monterey Abalone Company and Pacific Abalone. Herring-egg-on-kelp fishing is a seasonal activity that takes place during the winter. Other user groups include scientific collectors for public aquariums and university researchers. US Abalone mainly harvests in Bed 221 and when sea conditions permit, Bed 222. US Abalone on occasion, usually during extended severe winter conditions, also harvests Bed 220. The area of the underwater park is important to US Abalone during extended southernly winter storms when sea conditions make operating out of Santa Cruz Harbor hazardous. The combined kelp needs of the two Monterey abalone growers utilizing Bed 220 is less than 250 tons annually. The estimated needs of US Abalone is 420 tons with an annual increase expected in response to increased demand for abalone pearls, meat, and shells.

A study by Coastal Solutions Group was stimulated by concerns over the possible negative biological effects of kelp harvesting by local aquaculture firms on giant kelp, rockfish, and sea otter populations (Donnellan and Foster 1998). The impacts analysis of the study proved ambiguous because of insufficient data on the long-term spatial and temporal nature of Bed 220. The study did, however, highlight the importance of considering scale in determining harvest impact. The average annual harvest of kelp canopy from Bed 220 over the past decade has been less than 400 tons, but a rough estimate of drift kelp produced from Bed 220 is 200,000 tons per year. The current harvest, therefore, is less than 1% of the estimated drift kelp available from this bed.

Other Bed 220 users, such as divers, kayakers, boaters, and sport fishermen may also have impacts on the kelp bed and kelp dependent fisheries there. In a separate study by Coastal Solutions Group, it was estimated that over 60,000 divers use Bed 220. This study concluded that in large concentration, divers may permanently alter the community structure of this kelp bed.

Bed 220 is an open bed that can be harvested by anyone with a valid kelp harvesting license. In the past decade, ISP Alginates, Pacific Mariculture, and other members of the Monterey Kelp CO-OP, the Monterey Bay Aquarium, scientific researchers, and herring fishermen have all harvested kelp from this bed. Currently it is harvested only by small-scale hand-harvesters.

The Abalone Farm leases beds 204 and 207 near Morro Bay. Over the past 6 years, they have also harvested from several open beds as far south as Santa Monica (bed 17) and as far north as Santa Cruz (bed 222). They harvest an average of 1,800 tons per year using a small, shallow mechanical harvester. Their operation runs at full capacity with 4 million abalone, and they do not anticipate expansion over the next 5 years.

Twenty other kelp harvesters hold current licenses to take kelp from open beds coastwide. Their combined harvest has traditionally been less than 2% of the total annual kelp harvest. Two of the larger harvesters, Sea Farms and Pacific Mariculture, are no longer in business. Consequently, the harvest from these licensees is expected to drop below 1% beginning in 2000.

Kelp Harvest Techniques for Abalone Aquaculturists

Kelp harvest vessels used by abalone aquaculturists are smaller than those used by ISP Alginates. Many harvesters use modified Navy landing craft, approximately 60 feet in length, to harvest giant kelp. These harvesters are capable of working in relatively shallow water because of their shallow draft. They have the cutting blades mounted on the bow and carry between 15 and 25 tons of kelp. The small harvesters have been used primarily in the Pismo Beach to Point Estero area and near Santa Cruz. One of the harvesters was also used in southern California in 1993 and 1994 when the giant kelp resource was poor in central California.

Kelp is also harvested by hand to supply abalone being cultured in southern California. The Ab Lab, located in Port Hueneme, harvests kelp from small boats (usually less than 30 feet in length) from kelp beds north west of Point Dume and at Santa Cruz Island. Kelp is either cut at the surface, using a knife attached to a pole, or the person harvesting the kelp enters the water directly to cut the surface canopy. The cut fronds are bundled together and pulled aboard the boat by hand.

Historical Kelp Harvest Information

Kelp harvest fluctuates for reasons that include oceanographic change, weather patterns, water temperature, and nutrient levels. It also changes when the kelp industry's harvest requirements change. The following Tables of total harvest by year and total harvest by bed reflect a combination of both natural and anthropogenic harvest variables.

Bull Kelp

Until the late 1980s there was little targeted harvest of bull kelp in California, except as a small component of the localized edible seaweed industry. In central California, *Nereocystis* is often in mixed beds with *Macrocystis* and would have been incidentally taken in those operations, but not recorded separately on harvest records. Department records indicate about 19 tons of kelp, probably a mixture of *Macrocystis* and *Nereocystis*, were harvested from what is presently bed 302 off the Bodega Bay, Tomales Bay area between 1993 and 1999. All of this kelp would have been used by local abalone mariculturists. A local Fort Bragg firm, 'Pickles from the Sea' harvested bull kelp under the authority of CCR 165(e)2, which allowed them to take up to 2 tons per year within closed beds 303-307.

The mariculture firm Abalone International in Crescent City, Del Norte County harvests *Nereocystis* for abalone food from their leased bed 312, obtained in 1997. This company has been in operation since 1988, and has been harvesting bull kelp from Point Saint George to Crescent City harbor since that time. In order to follow their own harvesting patterns, and because designated kelp beds did not exist in northern California, the company established 13 unofficial beds in the area in 1988. From 1990-1994, Abalone International and the Department began working together to determine the possible effects of small scale harvesting on *Nereocystis* populations (Kalvass, pers. comm.) (Table 3-4).

Since the operation began, the amount of kelp harvested annually has increased substantially. In the first year about six tons of bull kelp were harvested, even though the kelp was abundant, and in 1996, 132 tons were taken. The initial increases in take were due to additions to the abalone stock held by the company and later due to the feed requirements of abalone growing in size (Van Hook, pers. comm.). While the harvest levels have increased, the actual harvesting operations have become more efficient and effort had remained fairly low (less than 100 hrs per year) through 1994. In 1990, approximately half a ton could be harvested in one hour, while in 1994, 1.2 tons could be harvested in the same time

Table 3-4. Total annual *Nereocystis* harvest, number of months harvesting occurred, average weight harvested per trip, and annual effort in Crescent City, 1988-1994.

Year	Total Weight (tons)	No. of Months Harvest Occurred	Average Weight/Trip (pounds)	Annual Effort (hours)
1988	6	6	500	12
1989	8	N/A	500	16
1990	12.6	7	622	28
1991	33.4	11	1261	53.5
1992	91	9	3974	49
1993	149	12	4585	87.5
1994	101	9	5315	81.3

N/A - Information not available

Abalone International's harvest operation consists of one 17–foot Boston Whaler, or 19–foot skiff when available, which they use to transport the kelp from the beds to their facility in the harbor and two people who cut the kelp. The kelp is hand–harvested to a depth of about 2.5 ft below the surface which allows the take of the upper portion of the stipe, the pnuematocyst and all the fronds. Typically harvest takes place when the canopy is at the point of highest tonnage per acre (60 to 80 tons per acre) and the fronds have turned a rich copper brown color. The company rotates harvest among the beds based on the availability of mature (post–sori release) canopy.

Kelp harvesting can occur throughout the year in Crescent City because the coastal topography (broad, flat promontory) of the area creates a storm shadow similar to the one created by Point Conception. Storms from the northwest often damage the exposed beds near Point Saint George but have little effect on the *Nereocystis* beds in the lee of the promontory. Occasionally, storms will track in from the south and then the reverse is true (Van Hook, pers, comm.).

Abalone International's 1997 bid application for the lease of bed 312 required a kelp bed biomass estimate in accordance with CCR 165.5 b(5). They estimated an area of 205 acres of kelp beds in the area between Pt. St. George and Whaler Island within bed 312. Their November 1996 survey yielded a point estimate of 5475 tons (no confidence limits provided) of bull kelp within those 205 acres, at 27 tons per acre. Based on that survey their annual harvest would be limited to 15% of that estimate, equivalent to 821 tons. While their harvest up to that time was only 132 tons (in 1996), or 16% of their allowance, their bid application projected steady harvest increases through 2001 peaking at a 500 ton projected harvest.

3.4.2 Commercial Fisheries Harvest

Many commercial fisheries utilize the kelp beds due to the large number of fish and invertebrates that inhabit them (Section 3.2.9). In several instances, harvesting takes place within the kelp beds (i.e. lobster and sheephead trapping) or adjacent to them (i.e. set longlines). In the herring-egg-on-kelp (HEOK) fishery, kelp is harvested, strung on lines, and floated in San Francisco Bay to attract Pacific herring. This fishery is different from the others because it actually uses kelp to attract herring and as part of the harvested product. The following paragraphs give an overview of a few of the fisheries that target kelp forest populations (Table 3–5).

Table 3-5. Total commercial pounds landed of key species harvested from kelp beds, 1995 to 1999.

Species	1995	1996	1997	1998	1999*
California sheephead	253,800	252,300	366,400	261,200	129,900
Sea Cucumber	156,800	387,900	381,200	615,800	458,800
Wavy Turban Snail	0	700	2,400	65,600	24,300
Red abalone	65,500	62,400	33,300	closed	closed
California spiny lobster	616,400	669,500	914,200	735,700	494,000
Rock crab	935,400	1,040,800	1,181,200	1,231,800	788,500
Red sea urchin	22,259,000	20,074,500	18,013,900	10,550,400	14,130,000

*Preliminary

Nearshore Finfishes

The Nearshore Fisheries Management portion of the MLMA of 1998 defined nearshore finfish species as rockfish (genus *Sebastes)*, California sheephead *(Semicossyphus pulcher*), greenlings (genus *Hexagrammos*), cabezon (*Scorpaenichthys marmoratus*), and other species found primarily in rocky reef or kelp habitat in nearshore waters. Since the early 90's greater emphasis has been placed on identifying individual fish species harvested from this group and avoiding market categories that combine multiple species. The Department has established a dockside sampling program that reinforces the importance of tracking the harvest intensity of this developing fishery. Data for this analysis has been drawn from the sampled and sorted market category for each species and the nominal categories for non-specific catch.

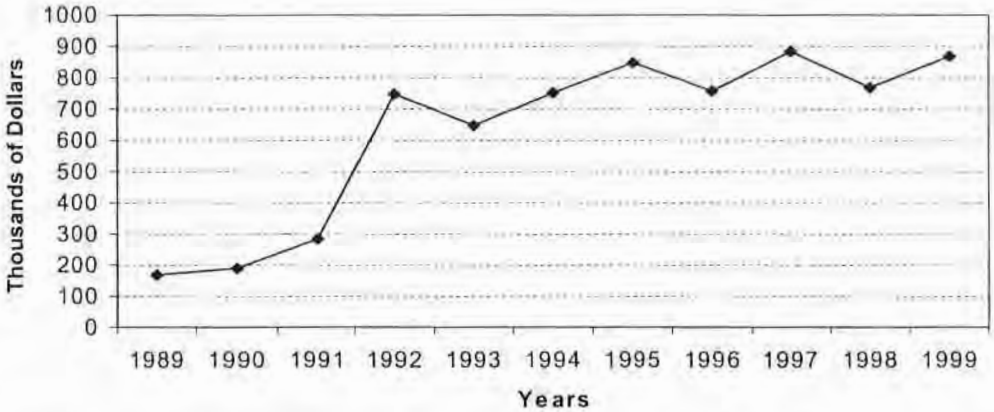


Figure 3-13. Changes in total ex-vessel revenue in the live finfish fishery, 1989-1999.

Table 3-6. Annual Price Per Pound for kelp-reef related fish, 1989- 1999.

	Blue Rockfish	Black Rockfish	Olive Rockfish	Copper Rockfish	Gopher Rockfish	Kelp Rockfish	Black& Yellow	Kelp Greenling	Treefish
989	0.37	0.36	0.47	0.74	1.15	-	1.30	0.41	-
990	0.38	0.37	0.45	0.58	1.00	-	-	0.54	-
991	0.48	0.37	0.50	0.73	0.75	0.53	0.85	1.00	-
992	0.45	0.57	1.65	0.69	1.40	0.48	1.36	0.89	-
993	0.58	0.43	2.00	0.72	1.45	1.02	1.54	1.42	-
994	0.49	0.46	-	1.26	1.57	1.33	1.38	1.86	-
995	0.51	0.50	0.31	1.17	1.88	1.05	1.72	1.62	-
996	0.49	0.54	-	1.27	1.94	1.31	1.73	2.11	1.74
997	0.46	0.52	0.52	1.31	2.45	2.03	2.09	2.56	3.01
998	0.59	1.02	-	1.54	2.35	1.62	2.24	3.05	2.33
999	0.79	0.90	1.20	1.42	2.54	2.81	3.30	3.47	

The principal goal of this nontraditional fishery is to deliver fish live to the consumer in as timely a manner as possible. Trucks or vans equipped with aerated tanks are used to transport fish directly to buyers. This fishery has increased substantially since 1988, and it continues to supply communities with live and premium quality fishes. The impetus of this fishery is the unprecedented and increasing high price paid for live fish (Figure 3-13, Table 3-6) (Pattison, 1999).

Sea urchin. One of the most important shellfish fisheries in California is the red sea urchin (*Strongylocentrotus franciscanus*) fishery. The red sea urchin is a keystone herbivore of kelp forest communities throughout the nearshore waters of California (Kato and Schroeter, 1985). As mention in Section 3.2.7.3, sea urchins, as the top grazer of kelp, play a role in its distribution and recruitment within the subtidal environment.

Red sea urchins are harvested by divers who generally use surface supplied air delivered through a hose (hooka gear) instead of self contained underwater breathing apparatus (SCUBA). Hooka gear consists of a low–pressure air compressor which feeds air through a hose to the diver's regulator. The hose is fed out from a reel so the diver has more maneuverability underwater. The urchins are gathered with a rake or hook and placed into large mesh bags which when full are lifted to the surface. Occasionally the bags, hoseline, and even the diver have to be freed from entangling kelp by cutting or breaking away stipes.

The sea urchin fishery is managed by the Department, which uses a combination of size limit, limited entry, and seasons in its efforts to maintain adequate population levels in the State (Kalvass and Hendrix, 1997).

Rock crab. The rock crab fishery is made up of three species: the yellow rock crab (*Cancer anthonyi*), the brown rock crab (*C. antennarius*), and the red rock crab (*C. productus*). Approximately 95% of the landings in this fishery come from southern California, although rock crabs inhabit the nearshore waters of the entire state (Parker, 1993).

The three species are commonly found on sand near rocky reefs and within kelp beds around the holdfasts of kelp plants, where they prey on a variety of invertebrates. Rock crabs, along with several species of fish, are considered large predators associated with kelp but the exact nature of the role that crabs play in kelp forest community dynamics is unknown (Foster and Scheil, 1985).

Rock crabs are harvested using baited traps. The traps are set and buoyed either singly or as part of a string (two or more traps tied together). Trap designs and materials vary but most employ single chamber, rectangular traps of 2X4– or 2X2–inch wire mesh. Once set, the traps are left in place for 48 to 96 hours before being checked. A single harvester may use 200 or more traps at one time. Fishermen tend to replace their traps in the same location until fishing in that area diminishes. This creates pathways in the kelp canopy because of the passage of the boats along the same course. The kelp that is cut loose will either fall to the bottom to be eaten by sea urchins and other herbivores, drift out to sea, or become part of the beach litter, or a combination of these events may occur (Larson pers. comm.).

California Spiny Lobster. The commercial fishery for California spiny lobster (*Pandulirus interruptus*) is small in total tons landed when compared to sea urchin landings (Table 3–5) but is among the top ten species of highest commercial value. Lobster fishermen received an average of $6.00 per pound for legal size lobster in 1999. The commercial fishery for lobster occurs from Point Conception south to the U.S.–Mexico border and includes islands and banks off southern California.

The range of California spiny lobster is from Monterey Bay south to Manzanillo, Mexico. Spiny lobsters are found primarily from the intertidal zone to 43 fathoms, in mussel beds and rocky areas with crevices, often in kelp beds. They generally hide in crevices and holes during the day and may be found on sandy bottoms at night. *Macrocystis* and other algal species, invertebrates, and small fish are preyed upon by lobster. Like rock crabs, lobster are a part of the kelp forest community but their role is still undefined.

Commercial harvesters may only use traps to take spiny lobster. The Fish and Game Commission regulates the take of lobster and harvesters must obtain a permit from the Commission. Lobster of at least 3.25 inches in carapace length may be taken during the season. The season begins on the first Wednesday in October and ends the first Wednesday after March 15th. All traps must be labeled with the fisherman identification number, the traps must be emptied at least every 96 hrs, weather permitting, and the traps must contain escape ports (Schultz, 1992). The number of traps used by a single fisherman is not restricted and several harvesters have been known to use as many as 500 traps during peak season. Like the crab fishery, lobster harvesters will use the same locations repeatedly until landings fall. Repeated running from trap to trap in the kelp beds causes the canopy to be cut away by the boat's propeller and creates pathways into and throughout the beds. This phenomenon was photographed by North (1969).

Sea Cucumber. About 460,000 pounds of sea cucumbers were harvested from California waters in 1999 by commercial divers, representing a 25% decrease from the previous year's total. Most of the catch is taken in southern California waters, with divers almost exclusively harvesting the warty sea cucumber (*Parastichopus parvimensis*) while trawlers primarily take the giant red sea cucumber (*P. californicus*). Divers take their sea cucumbers as far south as San Diego, but most of the catch is taken off the four northern Channel Islands in depths of 6-20 fm. The sea cucumber catch summarized in Table 3-5 is for those taken by divers in habitats more likely to be associated with kelp beds than those taken by trawlers. There are about 102 sea cucumber dive permittees in California out of 130 total cucumber permits (CDFG, 2000).

Abalone. There are three species of abalone that were harvested commercially in California prior to 1997: red abalone (*Haliotis rufescens*), pink abalone (*H. corrugata*), and green abalone (*H. fulgens*). In 1997, the area from San Francisco Bay to the California-Mexican border was closed to commercial and recreational harvest of abalone. The Department determined that these species had suffered stock collapse due to overfishing. Prior to 1992, the commercial fishery for black abalone (*H. cracherodii*) was second in pounds landed to red abalone. However, this species suffered significant stock declines due to a condition called "Withering Foot Syndrome" and the fishery was closed in 1992 (Karpov, et. al, in press).

Abalone are found in the intertidal and subtidal zones of California. Their distribution by species is tied to water temperature and depth. Red abalone are distributed throughout the state but are more prominent in the shallow subtidal than the intertidal, and in southern California, are found subtidally near upwelling centers along the coast and at the Channel Islands. The other two species of abalone (pinks and greens) occur south of Point Conception in the subtidal zone (Karpov and Tegner, 1992).

In order to protect northern California stocks from overharvest, abalone north of San Francisco Bay can only be harvested by recreational free divers, diving without the aid of SCUBA. A sport abalone stamp is required to take abalone and in 1998, the first year of this regulation, 32,000 stamps were sold, with 35,000 sold in 1999. Abalone divers are limited to 4 abalone per day and in possession (Karpov, pers. comm).

California Sheephead. There has been a small fishery (averaging about 10,000 pounds) for California sheephead (*Semicossyphus pulcher*) since the 1800's. In the last decade, however, sheephead landings have increased dramatically reaching a high of approximately 234,000 pounds in 1993 then falling substantially to 129,900 pounds in 1999. The renewed interest stems from the demand for fresh, live fish to supply Asian seafood restaurants. Commercial fishermen received about $2.64 per pound of live sheephead in 1998.

California sheephead range from the Gulf of California to Monterey, but are rarely found north of Point Conception. This species frequents rocky areas and kelp beds from the surface to 150 feet and deeper; females are usually found in shallower depths than the males. Typical food items are sea urchins, crabs, sand dollars, mussels, abalone and bryozoans (Feder et. al.,1974). While sheephead are most often observed in kelp beds and are known to venture farther from the bottom in the presence of kelp, the exact role that sheephead play, if any, in the kelp forest community is unclear (Feder et. al., 1974).

The live sheephead fishery uses baited wire traps to capture small females. These traps are similar in design as those used by crab harvesters. The basic design is a 3'x2'x1.5', double compartment trap with two entrance funnels. Traps are usually constructed of 2"x2" wire mesh (Palmer–Zwahlen, et. al., 1993). Since sheephead inhabit *Macrocystis* beds, harvesters will set out traps adjacent to and within the kelp beds, along the southern California coast and around the Channel Islands. The activity of setting the traps and checking them causes a small amount of damage to the kelp canopy and may result occasionally in the removal or damage of holdfasts by the movement of the traps during storm surge.

The livefish trap fishery is a limited entry fishery in California south of Point Arguello. Among other limitations, all participants in the fishery are required to purchase a finfish trap permit. Those participants that fish along the mainland may use no more that 50 traps. All traps are required to be marked with the fisherman's identification number. If left in the water overnight, each trap is required to be open and unbaited (CDFG 2000).

Pacific Herring. Pacific herring *(Clupea pallasi)* utilize San Francisco Bay as a spawning ground during the winter months (November through March). Pacific herring are demersal spawners, attaching their eggs to intertidal or subtidal vegetation, or any vertical surface free of silt and algal growth (Blaxter and Holliday 1963, Stacy and Hourston 1982, Haegele and Schweigert 1985). These surfaces include pier pilings, rock walls and several species of native vegetation, such as seagrass *(Zostera* sp.) and the red algae (*Gracilaria* sp.)

Commercial harvest of herring eggs on native vegetation began in Tomales Bay in 1965, and in 1966 the Fish and Game Commission accepted sealed bids for the opportunity to take 5 tons of eggs-on-seaweed in San Francisco Bay (Spratt 1981). The eggs-on-seaweed were harvested by divers, with *Gracilaria* and *Laminaria* being preferred by the export market to Japan (Moore and Reilly 1989). During 1985-86 herring spawning season, eggs were harvested using giant kelp, *Macrocystis* sp., which was suspended in the water from a log raft (Moore and Reilly 1989). Since 1989, the commercial harvest of herring eggs on kelp in San Francisco Bay has been restricted to the use of *Macrocystis*, and the herring eggs on kelp (HEOK) fishery (also referred to as the spawn on kelp or roe on kelp fishery) has operated using a fishing method known as the open pound method. Currently, there is no commercial HEOK fishery in Tomales Bay.

In the open pound fishing method, weighted lengths of kelp are suspended from floating rafts (Figures 3-14) or lines in areas where spawning activity is known to occur.

The rafts, or pounds, are constructed of metal, wood or plastic and measure approximately 2500 square feet, and approximately 1 ton of kelp is suspended per raft. Kelp is harvested from either Monterey or the Channel Islands (Table 3-7), and the useable portion (Figure 3-15) is trucked to San Francisco and suspended as close to the beginning of a spawning event as possible to insure freshness and quality of product. The rafts are towed to probably spawning locations within the bay and anchored. The kelp and herring roe are harvested once a spawning event has ended.

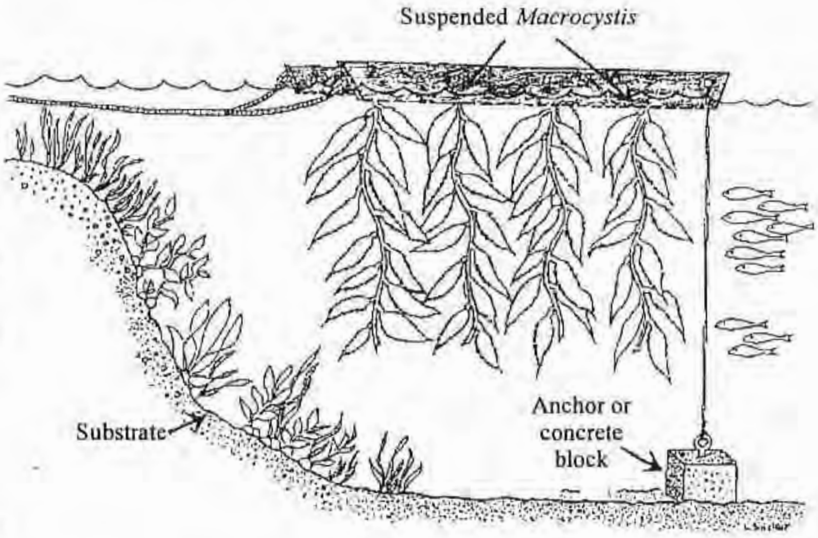


Figure 3-14. Illustration of a typical open pound (Shields et. al., 1985).

Participants in the HEOK fishery must possess a herring permit for the limited entry commercial herring fishery in San Francisco Bay, and they must waive their fishing privileges for the gill net fishery to obtain a herring eggs on kelp permit. There has been an average of ten permits issued per season over the past eleven years. The quota for the HEOK fishery is part of the total allowable whole fish quota for San Francisco Bay, and each herring eggs on kelp quota allocation is equivalent to the permittee's individual share in whole fish based on a conversion factor of 0.2237. Current regulations allow permittees to suspend kelp as many times as necessary per season in order to fill their herring eggs on kelp quota. Permittees are limited to two rafts and/or lines per permit.

Quotas for the San Francisco Bay commercial herring fishery are set according to annual biomass estimates of the spawning population, and are limited to a total commercial catch of not more than 20 percent of the spawning biomass from the previous season. As the herring population has fluctuated over the years, so has the total allowable quota. Since 1989, the HEOK quota has ranged from a high of 286 (1996-97) to a low of 35 tons (1993-94) (Table 3- 7). Although the quota has a direct influence on the total landings of HEOK product per season, several environmental factors during the

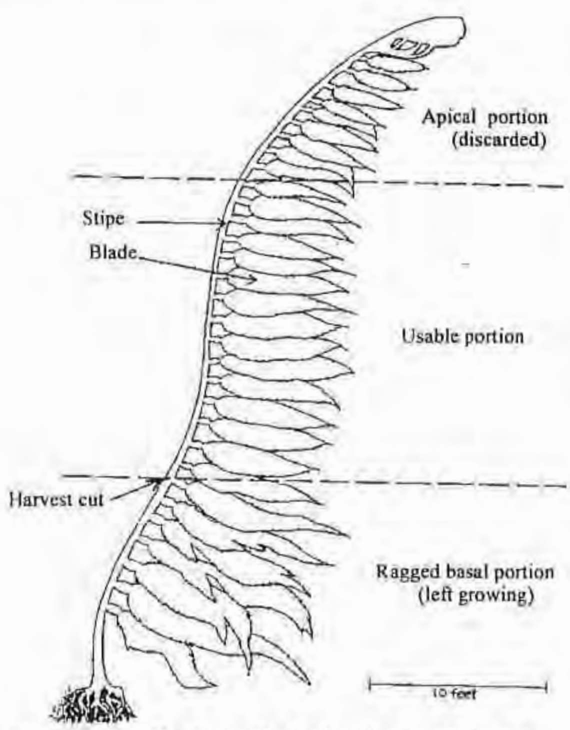


Figure 3-15. Portion of a kelp plant used on a pound.

season also affect the success of landing marketable (i.e., 3 or more layers of eggs on each side of the kelp blade) herring eggs on kelp product. For example, temperature and salinity can effect kelp condition. *Macrocystis* grows along the Pacific coast, but is not found growing in San Francisco Bay. The different salinity and temperature characteristics found in the more estuarine water of the bay may cause *Macrocystis* to deteriorate (Lobban et al. 1985). During seasons of heavy rainfall, coordinating kelp suspension and spawning events is crucial and much of the suspended kelp can deteriorate before a marketable product can be successfully harvested. This situation is illustrated in the recorded landings for the 1997-98 season (Table 3.8), when El Niño conditions (heavy rainfall and relatively warm water) resulted in the rapid deterioration of much of the kelp suspended for harvest.

Herring eggs on kelp is a relatively high priced product sold primarily for export to Japan. Product is graded according to the number of layers of eggs on both sides of the kelp blade, and the higher the product grade (i.e., more layers of eggs, even coverage on both sides of the blade) the higher the market price. However, price can fluctuate widely from year to year. For example, the highest product grade of herring eggs on kelp has ranged from $5/pound to $20/pound ($10,000/ton to $40,000/ton). Estimates of price paid to British Columbia producers have declined from a high of $45/pound in the mid-1990's to less than $10/pound in 1999 (Department of Fisheries and Oceans 2000). Price depends upon factors such as: the comparative value of the U.S. dollar and the Japanese yen; the herring catch quotas in Canada, Alaska and the Kamchatka Region of the former Soviet Union; the amount of herring eggs on kelp in cold storage from previous seasons; and the outlook for the Japanese economy.

Table 3-7. Quotas, landings and number of permits for the herring-eggs-on-kelp fishery in San Francisco Bay, 1989-90 season through 1999-2000 season.

Season	Quota (Tons)	Total Landings (Tons)	Percent of Quota Landed	Number of Permits
1989-90	110.0	107.1	97.4	8
1990-91	144.0	47.0	32.6	10
1991-92	114.0	84.2	73.8	10
1992-93	84.5	47.4	56.1	10
1993-94	35.1	35.0	99.7	10
1994-95	85.0	13.1	15.4	10
1995-96	106.5	106.8	100+	10
1996-97	286.0	185.7	64.9	11
1997-98	209.0	36.4	17.4	11
1998-99	54.4	31.7	58.3	11
1999-2000	99.2	31	31.3	1
Average (11 yrs.)	120.7	65.9	58.8	10

Table 3-8. Number of herring eggs-on-kelp permits, tons of kelp harvested for the open pound method, tons of eggs-on-kelp harvested, and quota allocation by season in San Francisco Bay.

Season	No. of Permittees	Estimated Raw Kelp Harvested[1]	Eggs-on-kelp Harvested	Quota
1986-87	1	n/a[2]	n/a[2]	7.5
1987-88	1	17.5	19.7	20.0
1988-89	5	87.5	47.1	64.0
1989-90	8	140	107.1	110.0
1990-91	10	175	47	144.0
1991-92	10	175	84.2	114.0
1992-93	10	175	47.4	84.5
1993-94	10	n/a[2]	35	35.1
1994-95	10	117.6[3]	13.1	85.0
1995-96	10	43.1[3]	106.8	106.5
1996-97	11	96[3]	185.7	286
1997-98	11	58.8[3]	36.4	209
1998-99	11	72.5[3]	31.7	54.4
1999-2000	11	123.5[3]	31	99.2

[1]Estimated maximum amount of raw kelp harvested by all permittees from Monterey Bay and/or the Channel Islands. The Department estimates that 20% of the total raw kelp used annually in the eggs on kelp fishery is harvested from Monterey Bay.
[2]n/a – Information not available
[3]Prior to the 1993-94 season, eggs on kelp permittees were required to provide invoice information regarding the amount of raw kelp harvested. This regulation was eliminated prior to the 1993-94 season. Raw kelp estimates from 1994 through 2000 were calculated by estimating the number of spawns per season for which each permittee suspended kelp. The amount of kelp used per suspension was calculated by multiplying 0.98 tons (i.e., the capacity for kelp suspended on one raft estimated by Moore and Reilly 1985) by two (i.e., the maximum number of rafts allowed per permittee).

3.4.3 Sport Harvest of Kelp

Very little information exists on the amount of kelp harvested for recreational purposes. It is known that several of the coastal native American Indian tribes and some immigrants, especially those from southeast Asian countries, do utilize fresh kelp for food (Kalvass, pers. comm.). The kelp taken is usually drift kelp that has washed up onto the beach. Occasionally, fresh kelp will be harvested from intertidal and shallow subtidal beds at low tide. In addition, kelp is used as an ingredient in at least one form of ceramic art called Sagger firing (Ramos, pers. comm.). Orchardists and gardeners also collect kelp beach wrack for use as compost (Kalvass, pers.comm.)

An estimation, based on a survey of the Department's staff, suggests that less than 25 tons is collected annually by recreational users (Crooke, pers. comm.).

3.4.4 Recreational Utilization of Kelp Beds

The kelp beds are utilized not only by commercial interests but by the sportfishing industry as well. As stated in Section 3.2.9, a variety fish and invertebrates inhabit all levels of the kelp beds; some species are true kelp–bed residents and others are occasional visitors. It is this abundance and variety that attract fishermen and sport divers.

The sportfishing industry in California is composed of commercial passenger fishing vessels (CPFV), private boats, and shore anglers. The CPFV's take groups of anglers out on 1/2–day, 3/4–day, full day, and multiday trips. The majority of 1/2– and 3/4–day trips fish within or near the kelp beds except in the summer when California barracuda (*Sphyraena argentea*) and Pacific bonito (*Sarda chiliensis*) are present (Crooke, pers comm.). For the period 1987 to 1989, the number of CPFV's fishing adjacent to the kelp from Orange, Los Angeles, and Santa Barbara Counties averaged 2,225 boats having anywhere from 5 to 50 passengers (CDFG, unpublished data). A partial list of fish species that were taken during these trips includes kelp bass (*Paralabrax clatharus*), cabezon (*Scorpaenicthys marmoratus*); lingcod (*Ophiodon elongatus*), Sheephead (*Semicossyphus pulcher*), blue rockfish (*Sebastes mystinus*), black rockfish (*S. melanops*), and kelp rockfish (*S. atrovirens*).

Data from the Marine Recreational Fisheries Statistics Survey (MRFSS) is broader in scope, taking into account CPFV, private boats, and shore based anglers. This database is composed of fishermen interview data collected between 1987 and 1989. For the period surveyed, on average 24 million fish were landed by about 1.8 million California resident anglers annually when fishing in territorial waters (3 miles or less) was the target location (Witzig et. al., 1992).

In northern California, on average, 72% of the total marine recreational catch during 1987 to 1989 was caught by shore and private/rental boat anglers fishing in inland waters or within 3 miles of shore. Of this, approximately 40% of angling occurred within marine nearshore waters (Witzig et. al., 1992). In 1992 and 1993, the percentage of CPFV fishing activity along the central/northern coast, where fishing activity occurred in the kelp was: Fort Bragg/Bodega Bay – <20%, Halfmoon Bay/San Francisco – 5%, Monterey – 10%, and Morro Bay – 40%. The majority of skiff (private boats/rental boats) activity along the central and northern coast took place adjacent to kelp beds (Wilson-Vandenberg, pers. comm.).

Off of southern California, 63% to 82% of all fishing activity occurred within 3 miles or less of the shore for the same period. All modes were represented equally for this period. Approximately one-half of the angling activity targeted on kelp bed related species (Crooke, pers. comm.).

In addition to sport anglers, there are a large number of sport divers (both free divers and SCUBA divers) who spearfish for many of the species caught by hook and line, as well as, hunt for abalone, rock scallops, and spiny lobster. In addition, there are divers who enjoy nonconsumptive use of the underwater environment through such activities as underwater photography.

No estimate of the number of people who dive in California's ocean waters exists; however, in 1992 approximately 134,287 SCUBA divers participated in chartered boat dive trips. Of this number, 99% visited the Channel Islands and dove in or near the *Macrocystis* beds that surround the islands. The residual dove in nearshore kelp beds from Monterey to San Diego or at the offshore banks (Tanner Bank, Cortez Bank). From these dive trips, a total of 64,847 fish and invertebrates were taken (CDFG unpublished data). The top five species taken were: scallops (*Pecten* spp.; *Hinnites* sp.), 24,942; rockfish (*Sebastes* spp.), 8,527; Sheephead, 3,641; abalone, 8,409; and California spiny lobster, 7,867. All these species are kelp bed residents during all or part of the year (Smith and Carlton, 1975; Miller and Lea, 1972). Although the number of divers who went on commercial dive trips is large, it is probably only one–quarter of the total number of divers who have access to our coastal waters.

Combined telephone and field surveys of sport abalone harvesters in California were used from 1985 to 1989 to estimate total take in northern and central California (Tegner et al. 1992). Estimates of total weight landed averaged 2.028 million pounds (920 MT) from 1986 to 1989 (Karpov et al. In Press).

There are no estimates of the number of people who kayak in California's ocean waters. However, the commercial rental of kayaks is a growing industry with business located near many central and southern California coastal cities. The presence of kelp bed canopy and canopy inhabiting species act as strong attractantors for many recreational kayaking enthusiasts. In addition to enjoying kelp canopy communities, kayakers also rely on the canopy to reduce wave energy and use the canopy as a safe haven.

3.5 Regulatory/Management Environment

3.5.1 Responsible Agency

The California Department of Fish and Game, within the Resources Agency, is the lead state agency responsible for managing kelp (*Macrocystis pyrifera* and *Nereocystis luetkeana*) and other aquatic plant resources.

3.5.2 Management Concepts and Tools

The management strategy for the state's kelp resources has been based largely on a 'reactive, points of concern' approach, similar to many of California's state-managed fisheries (Hilborn and Walters 1992, Kalvass and Hendrix 1997). The Fish and Game code section 6654 gives the Fish and Game Commission authority to close a kelp bed to harvest for up to one year if they determine that damage to the bed is occurring. However, the information necessary for sustained yield management based on formal stock assessment of the state's kelp resources is unavailable and costly to collect. Kelp beds have an intrinsic value as habitat in the nearshore ecosystem as well as having commercial and recreational value as a harvestable resource, therefore the concept of MSY cannot be applied to their management in the traditional sense. Because of these multiple values, kelp management is much more complex than that of most single species.

In 1996, the Fish and Game Commission, with the recommendation of the Department, and in anticipation of increasing interest in large-scale harvest of the northern California bull kelp resource, acted proactively by setting aside beds 303-307 from commercial harvest. In addition the remaining beds in the 300 series were limited to a maximum harvest of 15% of the biomass revealed by a Department approved annual survey conducted by the lessee (CCR 1999).

3.5.3 Resource Assessment Methods

3.5.3.1 Monitoring Programs

Commercial kelp landings have been monitored since 1915, four years after kelp harvesting began in California (Tarpley and Glantz, 1992). Monitoring consists of both fishery dependent and independent data collection. Dependent data is in the form of landing records indicating the weight and location of kelp harvested and is required to be maintained by harvesters and submitted to the Department on a monthly basis (CCR 1999). Fishery independent data has originated from 3 sources: the Department and other agencies, the kelp harvesters, and academia. ISP alginates (formerly Kelco) is the primary kelp harvester in California, taking mostly *Macrocystis*. They have been conducting regular resource aerial surveys over the years, but much of their data has been proprietary and unavailable to the public until recently. Department monitoring has been intermittent, relying mostly on occasional aerial photographic monitoring.

The sport fishery is not formally monitored because the take is so small. The Marine Recreational Fisheries Statistics Survey, which collects data on sport caught fish, reported only one incidence of the take of kelp by a recreational fisherman prior to 1995 (Hernandez, pers. comm.).

3.5.3.2 Harvest and Landing Records

Harvesters are required by the Commission to keep harvest records and to turn in landing records to the Department. The harvest records must contain information on the category of plant landed (i.e. agar–bearing, edible seaweed, kelp), the number of pounds or tons landed, and the name and address of the person or firm to whom the plants were sold. These records are to be available for inspection by the Department. In addition to harvest records, landing records must be submitted to the Department. The landing record must show the wet weight of all aquatic plants harvested, name of harvester, Department kelp harvester number, date of landing or delivery, Department origin or kelp bed number where plants were harvested, and any other statistical information the Department may require (§165(b)(1) and (2) Title 14, CCR, Appendix 1).

The landing record information is processed to report California annual commercial landings of kelp (Appendix 3). Also, the data is essential for monitoring trends in landings as well as fluctuations in harvest from specific beds.

3.5.3.3 Surveys

The Department uses aerial surveys to assess the state's kelp resources. The extent of the giant kelp and bull kelp resource is determined by measurement of the kelp bed's surface canopy on aerial photographs. These numbers are expressed in square miles. The last survey of all the designated beds was done in 1999.

CHAPTER 4 ENVIRONMENTAL IMPACTS

Monitoring studies of relatively long-lived organisms (including many fish and invertebrate species) will often have low statistical power to detect ecologically significant changes in density. Changes in natural populations on the order of 50% will often go undetected (Schroeter et al. 1993). With this caveat in mind, the following sections discuss the effects of the proposed project on the existing environment described in Chapter 3. An analysis of the cumulative impacts will be presented at the end of the chapter.

4.1 Effect of Kelp Harvest on Finfish Populations

Giant Kelp

The relationship between fish populations and *Macrocystis* harvesting in southern California was reported in the State of California Fish Bulletin 139 (North and Hubbs, 1968). There were three approaches used to study this relationship: a qualitative study by Limbaugh (1955), a quantitative study by Quast (1968d), and a statistical analysis of sportfishing in kelp beds and kelp harvesting by Davies (1968). All three investigators arrived at the same conclusion, namely that "no evidence has been obtained that kelp harvesting has a measurable effect on the fish populations." However, researchers in central California found that kelp harvesting affected the distribution of fishes associated with kelp forests, especially juvenile rockfishes, in that they tended to move either vertically or horizontally away from the impacted area. The removal of canopy cover may also contribute to greater predator success in harvested versus control areas (Miller and Geibel 1973, Houk and McCleneghan 1993).

Limbaugh's (1955) qualitative study was conducted throughout kelp beds from Monterey, California to Baja California, Mexico from 1948 to 1954. Limbaugh dived and observed kelp harvesting operations as related to fishes and ecology of the kelp forests. He also tagged kelp bass and followed their movement relative to harvested and unharvested areas of the kelp forest. Limbaugh (1955) concluded that harvesting did not impact populations of fishes in kelp forests and nearby coastal areas.

Quast (1968a, b, c, d) conducted his quantitative analysis of the standing crop and food of kelp bed fishes, and the effects of kelp harvesting on these fishes in the kelp forests of southern California. Quast (1968d) also considered the question of whether kelp harvesting destroyed significant amounts of eggs and larval fish species of sport value. He noted that tiny kelp clingfish and larger kelpfish attached their eggs to giant kelp and other objects, but found no eggs of sportfish attached to the kelp. Larvae of fishes may occasionally reach high concentrations in the kelp canopy. Quast (1968d) reported that a minimal fraction of the larval fish population was taken aboard the harvester because the forward motion of the vessel creates currents and eddies, sweeping most of the larvae away from the kelp as it is brought aboard. Quast (1968d) concluded that kelp harvesting had minimal effect on fish populations living in forests of giant kelp.

Davies (1968) used a statistical analysis to evaluate the relation between kelp harvesting and sportfishing in southern California kelp beds during a ten year period (1947-1956). He found no correlation between kelp harvesting and sport fishing success and noted that the catch per unit effort increased from 4.51 to 7.00 during the 10 years, while harvesting was 1.5 times greater in 1956 than at the beginning of the study in 1947. Sportfishing success, expressed as catch per unit effort, increased while kelp harvesting increased. These data also indicate that kelp harvesting had no measurable effect on sportfish populations.

Recreational anglers in private vessels as well as commercial passenger fishing vessels (CPFV) will follow behind the harvesters during cutting. Large numbers of fish move up from the bottom enticed by the presence of small fish, invertebrates, and bits of algae shaken loose from the kelp as it is moved onto the harvester. Recreational fishermen utilize their knowledge of this fish attraction to their advantage by moving into these just harvested areas. In addition, kelp harvesters open up lanes in the canopy that allows CPFV's access to areas that were previously closed due to the density of the kelp (CDFG 1995). Thus, by creating easier access to interior portions of a bed, kelp harvesting can indirectly increase fishing related mortality.

Miller and Geibel (1973) conducted experimental harvesting of *Macrocystis* canopies in central California to determine if there were any measurable impacts of harvesting on fishes. They recognized that studies had been done in southern California by Quast (1968a, b, c, d) but felt that the central California kelp habitat and suite of fishes were very different. Miller and Geibel (1973) noted that southern California kelp beds are less turbid, less turbulent, and tend to maintain some kelp canopy throughout the year compared to central California. There is a wider range of canopies in central California from almost none in winter to dense in summer. Kelp beds in southern California are typified by kelp bass, blacksmith, California sheephead, rock wrasse, señorita, black surfperch, topsmelt, and kelp surfperch. Kelp beds in central California are dominated by blue rockfish, striped surfperch, olive rockfish, and kelp surfperch in the canopy and midlevel area. There are also dense concentrations of juvenile rockfish in the kelp beds in central California from April through November each year. The juveniles were observed throughout the kelp forest; at times associated with shallow rockweed growth, rocks, the holdfast area, and at other times they were densely aggregated in the canopy and midwater zones (Miller and Geibel, 1973). Similar "swarms" of juvenile rockfishes are not encountered in southern California (Quast, 1968b).

Miller and Geibel (1973) evaluated underwater transects in an unharvested control area and a harvested experimental area to determine if harvesting impacted fish populations in the *Macrocystis* forest off Point Cabrillo, in Monterey Bay. They cut the canopy five times during the study that lasted a little longer than a year. They compared fish counts from along the transects following four of the five experimental cuttings.

Miller and Geibel (1973) found that analysis of transect data, to disclose effects of canopy removal on fish populations, was difficult because of the high variability between seasons and particular niche preference for each species. If only minimal effects occurred, they may have been masked by multiple natural changes affecting each species. Best results were obtained studying striped perch and juvenile rockfishes. Miller and Geibel (1973) found that striped perch were not affected by experimental cutting. Counts of juvenile rockfishes were quite similar in canopy and at the bottom in the control area where the canopy was not harvested experimentally. The data in the harvested area suggested that juvenile rockfishes went down to the bottom after the harvest rather than move horizontally to the nearby uncut surface fronds. As canopies reformed in the harvested area, juvenile rockfishes would reappear.

Miller and Geibel (1973) also conducted small-scale harvest experiments to evaluate the macro-organisms that exist in the canopy and might be taken aboard a kelp harvester. Several species of fishes were collected in the canopy, including: kelpfishes (genus *Gibbonsia*), penpoint gunnel, kelp gunnel, rockweed gunnel, kelp clingfish, and saddleback sculpin. The same species were taken in samples from the commercial harvest of kelp off Granite Canyon and Carmel Bay. The northern clingfish, tidepool snailfish, and manacled sculpin were taken aboard the harvester but not taken during the experimental harvest. Miller and Geibel (1973) noted that the more mobile schooling rockfish and surfperch did not show up in experimental harvests. These fishes were abundant near the canopy but were apparently frightened by the divers during the experimental hand-harvesting. Some juvenile rockfishes and surfperches are taken aboard the kelp harvester during routine commercial operations in central California (McPeak, pers. obs.).

Miller and Geibel (1973) concluded that adult fishes are probably not affected by the canopy removal. A similar conclusion was reached by Quast (1968d) for southern California kelp beds. Miller and Geibel (1973) did suggest that there is some concern about the environmental changes of a large commercial operation possibly adversely affecting summertime juvenile fish concentrations in central California.

Houk and McCleneghan (1993) continued the California Department of Fish and Game research in central California and reported the results of a 1977 study on the effects of canopy removal on young-of-the-year (YOY) blue rockfishes and bocaccio. They used two methods to census YOY rockfishes in experimentally harvested, unharvested, and control *Macrocystis* beds; fish transects by divers and capture/recapture techniques. They evaluated the fish population along transects within 2 m of the bottom and 2 m of the surface (i.e.. canopy). Young-of-the-year blue rockfish were by far the most numerous, followed by bocaccio. Houk and McCleneghan (1993) found a significant reduction in fish populations in the harvested area following the harvest, as well as a significant reduction in the fish population in the unharvested area. The reductions were not significantly different between the areas. The large reduction in the fish population in the harvested area occurred when fish moved into the unharvested area. The large, unexpected reduction in fish numbers in the unharvested area occurred when larger predatory YOY bocaccio moved into the control area as the experimental area was being harvested. The bocaccio removed in excess of 20% of the biomass of YOY blue rockfish, which was composed of resident fish and recently migrated fish from the harvested kelp bed. Predation on YOY blue rockfish was also noted in the harvested area.

Houk and McCleneghan (1993) noted that any substantial change in fish populations that might have occurred between the harvested and unharvested areas was masked by the immigration of significant numbers of larger predatory YOY bocaccio which reduced the number of YOY blue rockfish in all three areas. Research by Houk and McCleneghan (1993) indicates that YOY rockfishes associated with the canopy are able to move to nearby unharvested areas rather than down to the bottom as suggested by Miller and Geibel (1973).

In conclusion, it appears that populations of fishes in southern and central California may be displaced for a time following harvesting. Harvesting of canopies may open some areas to predation by fishes that otherwise would not feed in the area, and potentially increases the fishing mortality for some fish species due to easier access to those species.

Bull Kelp

The effect of *Nereocystis* harvest on finfish populations has had limited study. Leaman (1980) conducted a harvest experiment in British Columbia using a patch harvest method. He removed 100 m^2 patches from three different parts of a bull kelp bed: exposed outer edge, middle of the bed, inshore edge of the bed. Gillnet operations and diving surveys were conducted to identify fish prior to and following canopy removal. It is important to remember when evaluating impacts, that commercial harvest of *Macrocystis* involves removal of the upper 4 feet or so of canopy, leaving the rest of the plant essentially intact. On the other hand, *Nereocystis* harvest results in the loss of the entire canopy as the single surface float is removed causing the entire plant to eventually sink to the bottom

Leaman (1980) found differing effects, depending on the area of harvest. Thus, when harvesting occurred at the outer edge of the bed, there was no appreciable effect on benthic species diversity and abundance but a negative effect on neritic fishes. By contrast, when canopy removal occurred in the middle or inner areas, there was a significant reduction in the species diversity and abundance of benthic fish but a positive effect on the neritic species. The clearing of the canopy in the inner portion of the bed allowed plankton to aggregate, thus creating a feeding environment for inner neritic residents. The opening allowed these fish to feed without the associated predation pressure that exists in the outer areas of the bed. The effect of canopy removal on resident fish populations lasted about 25 days in this experiment (Leaman, 1980). Therefore, this experiment showed harvesting had both positive and negative short term effects.

Leaman (1980) was not able to identify any effects of canopy removal on associated and transient species. However, he felt that disturbances to the kelp bed ecosystem could extend beyond the boundaries of the kelp bed through possible effects on these species.

Effects of harvest may be highly site–specific. Leaman (1980) recommended that limited harvesting be allowed in conjunction with experiments designed to evaluate the effects of canopy removal on kelp bed fish species. He also stated that determining the optimal time of harvest would minimize any possible impacts of canopy removal on fish reproduction and recruitment.

At this time, too little research has been done on the effect of bull kelp harvest on fish and until more information is gathered, it is impossible to tell whether the impacts are significant or not. Therefore, a precautionary approach, adopting a risk-averse strategy, is included in existing regulations which close beds 303-307 to harvest and set a maximum harvest rate of 15% on the remaining 300 series beds (CCR 165(c)5(A) and 165.5(b)5).

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. While there is some uncertainty over potential impacts from the harvest of bull kelp on finfish populations, the precautionary approach taken with existing regulation has been enhanced, particularly with regard to the harvest of bull kelp. Given the enhanced safeguards and a lack of apparent impact under the existing regulatory strategy, any impacts from the proposed project on finfish populations is considered to be short-term and less than significant.

4.2 Effect of Kelp Harvest on Invertebrate Populations

Giant Kelp

Macrocystis canopies are rich in motile and sessile invertebrates (see section 3.2.9.1). Bryozoans and hydroids are the most abundant sessile animals (Bernstein and Jung, 1979), while crustaceans and molluscs are the most abundant motile animals in the canopy (Coyer, 1984, 1986). At times, the tiny motile animals associated with encrusted fronds of giant kelp number more than 100,000 per m^2 of plant tissue (Wing and Clendenning, 1971). These, mostly small creatures, are consumed by various species of fishes and invertebrates in the kelp community.

Kelp harvesting obviously removes the sessile animals that are attached to the fronds. These animals, however, have evolved to reproduce rapidly in the ephemeral kelp canopy environment. Many of the sessile animals in the canopy produce offspring within days or weeks of settling. Since mature fronds are preferred for harvesting, sessile animals have usually reproduced before the fronds are removed by harvesting.

Quast (1968d) noted that the forward motion of the harvesting vessel creates strong currents and eddies around the kelp being harvested, and these forces sweep a major portion of the motile invertebrates from the blades and stipes. Also the kelp drains as it is being loaded, giving the animals a second chance to escape. Quast (1968d) also noted that some canopy is usually missed by the harvesters, and some new canopy appears in the wake of the harvester because freshly cut fronds are less bent by the pull of the surface currents. Both the kelp that remains or appears on the surface and the fronds that are just beneath the surface are available as refuge for the displaced motile animals.

Wing and Clendenning (1971) estimated that about 1/3 of the motile invertebrates in the kelp canopy are taken aboard the kelp harvester during harvesting, while Quast (1968d) suggested that the figure was closer to 1/4 or less when all forage animals were considered. Quast (1968d) considered the reconstitution of the canopy population and calculated the annual loss of motile invertebrates through harvesting at about 11%.

Limbaugh (1955) and Quast (1968d) considered the question of whether the amount of invertebrates removed during kelp harvesting was a significant amount of food for fishes. They concluded that fishes were not being impacted by the small amount of invertebrates being taken during harvesting.

There are several species of benthic invertebrates that inhabit forests of giant kelp and are being harvested commercially and by sportsmen: sea urchins, *Strongylocentrotus franciscanus*, and to a less extent, *S. purpuratus*; California spiny lobster, *Panulirus interruptus*; abalone, *Haliotis* spp.; and sea cucumbers, *Parastichopus parvimensus*. All of these species produce planktonic larvae that drift in the water for anywhere from a week (abalone) to a year (lobster). The larvae are not associated with the canopy of *Macrocystis* and therefore should not be affected by kelp harvesting.

Miller and Geibel (1973) conducted an experiment in central California to determine or estimate the amount of macro-organisms (larger than about 10 mm in length) per acre of kelp canopy. They considered the canopy to extend to a depth of 10 ft. (six feet deeper than is allowed by commercial kelp harvesting). They cut similar-sized areas of canopy by hand at a depth of 10 ft. in experimental and control areas three times (February 4-9, April 30, and August 5, 1970) and compared the number of macro-organisms. The animals were sampled by taking the mass of cut kelp and floating it over a 20 x 30 ft. (6 x 9 m) burlap blanket. One side of the blanket was attached to the boat, while the other three sides were held out of the water by poles. The fronds were selected one by one and the animals enumerated.

The isopod, *Idotea resecata*, far outnumbered all other macroorganisms, but molluscs as a group made up the largest bulk of the invertebrates. *Tegula* and *Calliostoma* (6 species) were the most abundant molluscs encountered in the canopy.

Miller and Geibel (1973) noted that there were significant differences in the estimates or organisms in the cut and uncut areas. For instance, they estimated more than 13,000 *Idotea resecata* per acre in the cut area following the second harvest (April 30) compared to only 420 per acre in the uncut area. They believed the differences were due to methodology and natural fluctuations of the density of invertebrates rather than to the effects of cutting. All of the cut samples were taken from the same part of the bed during early morning calm conditions, while the uncut samples were taken from different areas of the kelp bed and during windy conditions.

Miller and Geibel (1973) recognized that there were some problems with the methodology of the study but concluded that canopy removal did not permanently reduce the kinds and numbers of invertebrate species. They did suggest that a commercial operation would remove a larger segment of canopy and were concerned about certain invertebrate species moving into the cut area from the adjoining uncut canopy as the new canopy reformed.

While the harvest of kelp does incidentally remove some sessile and motile invertebrates, the overall effect on invertebrate populations does not appear to be significant.

Bull Kelp

Andrew (1925) found 40 species of invertebrates colonizing the holdfasts of bull kelp, consisting in some cases of up to 2600 individuals. Harvesting of bull kelp results in eventual loss of the entire plant, including the holdfast, with impacts to the holdfast-dwelling organisms.

Fewer invertebrates colonize bull kelp blades than those of *Macrocystis* because of natural fluctuations in abundance of bull kelp and the usually limited availability of the canopy (3 to 4 months). The sessile animals that do inhabit the canopy have evolved lifespans that are short in duration and produce large numbers of offspring (Andrew, 1925; 1945). Motile invertebrates (amphipods, shrimp, trochid snails) opportunistically move into and out of the canopy depending on availability. During an eight–year span of harvesting *Nereocystis* in Port Orford, Oregon, the only macro-invertebrate commonly encountered in the canopy was the kelp crab (*Pugettia producta*). This species appeared for a two-month period and was easily removed and returned to the water during hand–harvesting operations (Fanning, pers. comm.).

When the blades and pnuematocyst are removed during harvest, the stipe may sink to the seafloor or become tangled with the stipes of other plants. The decaying stipe provides a food source for diatoms, bacteria and fungi as well as benthic invertebrates such as sea urchins, abalone, chitons and crabs (Burge and Schultz, 1973; Albright et. al., 1982). Under normal circumstances, this tissue is not available until late in the season or after storms. Therefore, there does not appear to be a significant effect on invertebrate populations as a result of the harvest of bull kelp.

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. Given the characterization of general harvest impacts provided above and recognizing the conservative orientation of the proposed changes, any impacts from the proposed project on invertebrate populations is considered to be short-term and less than significant.

4.3 Effect of Kelp Harvest on Bird Populations

Giant Kelp

Marine birds frequently forage adjacent to and within *Macrocystis* beds or rest on these beds in southern and central California (Conner and McPeak, 1982). These birds use the food web in the upper layer of the ocean and are not specifically tied to forests of giant kelp (Anderson et al., 1992). Though there has not been a study to specifically look at the effect of kelp harvesting on bird populations, it does not appear that birds are adversely affected by the periodic removal of canopy.

One of the richest areas for marine birds in California is the Channel Islands of southern California. These islands support breeding colonies of 11 species of marine birds (Hunt et al., 1980). Kelp has been harvested from around the islands since the early 1940's. At times, the marine birds around the Channel Islands even use the harvester to their advantage in feeding. Terns and gulls frequently follow the harvester and dive into the wake after the canopy has been cut (McPeak, pers. obs.). These birds feed on crustaceans and small fishes that are exposed by the kelp harvester.

Stalking birds, such as great blue herons and common egrets, occasionally perch on canopies of giant kelp while searching for prey. These birds fly to nearby areas to forage as the kelp harvester approaches. Diving birds, such as cormorants, also fly to nearby open water to forage if approached by a kelp harvester.

While it is recognized that numerous species of birds utilize the kelp forests, the effect of canopy removal and kelp harvesting operations on bird populations is not significant.

Bull Kelp

Seabird feeding ecology studies indicate that the major components of a number of their diets are fish and invertebrates associated with kelp beds (Ch.3). As stated previously, the harvest of bull kelp kills the entire plant, thus creating a complete absence of canopy, the size of which would be dependent on the amount and location of the harvest. Existing regulations limit series 300 beds to a maximum of 15% harvest, which should help to mitigate any adverse impacts to bird populations. However, should 15% of a bed be taken from one localized area, e.g. near a breeding colony of pigeon guillemots, adverse impacts might be sustained. Bull kelp beds in central California are not protected in the same manner as the 300 series and their susceptibility to overharvest could impact bird populations in that area. Several of the measure suggested in the proposed project are intended to reduce the potential for overharvest of bull kelp in central California. With these measures in place, the effect of canopy removal and kelp harvesting operations on bird populations is not significant.

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. Given the characterization of general harvest impacts provided above and recognizing the conservative orientation of the proposed changes, any impacts from the proposed project on bird populations is considered to be short-term and less than significant.

4.4 Effect of Kelp Harvest on Marine Mammal Populations

Giant Kelp

Sea otters, pinnipeds (seals and sea lions), and occasionally gray whales are observed in beds of *Macrocystis* in California.

The sea otter, *Enhydra lutris*, is a threatened species that is protected by Federal and State laws and regulations. Sea otters have the closest association of all marine mammals with canopies of giant kelp. They can be seen rafting, resting, or foraging in forests of giant kelp and are easily observed while at the surface from kelp harvesting vessels.

Macrocystis has regularly been harvested within the sea otter range since 1970. The larger vessels, associated with the algin industry, generally work within the sea otter range from Cayucos to the Monterey Peninsula from June through October or November, depending upon the growth and condition of kelp canopies in both southern and central California (See section 3.4.1 for more information on harvesting vessels). Very little *Macrocystis* is harvested in central California for algin production if ample canopies exist in southern California to satisfy production needs. On rare occasions, canopies develop early in central California and may be harvested for algin beginning in late April or early May.

Smaller harvesters, used by the aquaculture industry, have worked within the range of sea otters since the 1970s. These harvesters have concentrated their effort from Pismo Beach to Santa Cruz. Despite the sea otter's mobility, the scoping sessions identified a concern with regard to harvesting impacts on this species. Larger harvesters, used by the algin industry, have worked in kelp beds within the sea otter's range over 600 times since 1970 (Glantz, pers. comm.). The kelp harvesting operation has never injured an otter during the 30 years of operation within the sea otter's range. The kelp harvesters only move at about 1.5 knots through the kelp bed during harvesting. Sea otters seem to react to these harvesters much like they would any other vessel. They hear and see the harvester well before it approaches and move to nearby canopy as the kelp harvester passes (Glantz, pers. comm.).

While the quantity or availability of kelp canopy has not been identified as a population limiting factor, the removal of canopy could impact individual sea otters by requiring them to shift rafting or foraging locations. The individuals most likely to be impacted would be those that have developed foraging tactics that focus on prey found with the canopy. Included within this group would be some female otters that are caring for dependent pups. Under most conditions, those individuals would likely respond to the removal of canopy by shifting foraging locations. However, under adverse weather conditions, anything that affects food availability could impact an otter that is food stressed.

Two factors tend to minimize the potential impacts to levels that are less than significant. First, the quantity of invertebrates prey that are removed is likely small (Limbaugh 1955 and Quast 1968b). Second, most harvesting occurs during good weather windows when food availability is not an issue.

Some harvesting does occur during poor weather to meet aquaculture needs and it can be concentrated within localized areas that are protected. The Department has proposed a closure within specific portions of bed 220 near Monterey to address resource use conflicts. That closure will also tend to minimize any potential for adverse impacts to individual otters by providing protected canopy for foraging.

Pinnipeds (seals and sea lions) are frequently seen in forests of giant kelp. Harbor seals are frequently seen resting in canopies of giant kelp. Both harbor seals and sea lions forage within kelp forests and in deeper water for a variety of prey items. Elephant seals usually forage in very deep water at night, offshore of kelp beds. They may be seen passing through forests of giant kelp on their way to the offshore feeding grounds.

Despite ongoing harvesting of kelp, these seal and sea lion populations continue to expand at 6 to 12% per year. Consequently, impacts from harvesting are considered to be less than significant.

Gray whales, which occasionally come into forests of giant kelp, also appear not to be bothered or harmed by kelp harvesters. Gray whales occasionally feed on small crustaceans that live in forests of giant kelp (Wellington and Anderson, 1978). Harvest captains have reported gray whales spending the entire day in a kelp bed being harvested. On one occasion, a gray whale followed a harvesting vessel as it cut canopies near Point Conception (Scott, pers. comm.).

Based on a review of available information, kelp harvesting activities have little to no effect on marine mammals utilizing the kelp forests.

Bull Kelp

There have been no studies on the effect of *Nereocystis* harvest on marine mammals. However, the harvest of bull kelp has been underway for 5 years in the Crescent City area and there have been no reports of negative interactions between the harvester and pinnipeds (Van Hook, Hook, pers. comm.). With one exception, it is probable that the harvest of bull kelp does not significantly affect the marine mammal populations in California.

In central California within mixed beds, sea otters will preferentially raft and forage in *Macrocystis* canopy (Wendell pers comm). Consequently, the harvest of *Nereocystis* within those beds will tend to have limited impact on resident or transient otters. If the harvest occurs within pure *Nereocystis* beds, otters will lose the benefit of the canopy as a resting and foraging area. Since the status of California's sea otter population is uncertain, the impacts to sea otters that are resident in those beds could be significant if the availability of resting or foraging habitat is a limiting factor. While most research is focused on other potential limiting factors, it would be prudent to limit harvesting of *Nereocystis*.

Several measures in the proposed project are intended to limit the harvest impacts associated with harvesting bull kelp. With these measures in place, the effect of kelp harvesting on marine mammals is considered to be short-term and less than significant.

4.5 Effect of Kelp Harvest on Biological Communities That Use Drift Kelp

Drift kelp, plants that are not attached, contribute their energy to a number of communities. Two such communities, kelp wrack (Section 3.2.9.5) and deep water communities, rely heavily on drift kelp as an energy source. The kelp wrack community is almost entirely dependent on the shoreline deposition of drift kelp. While not as apparent, deep water communities may also rely heavily on drift kelp or on breakdown products as an energy source. The potential impact of human harvest on these communities will focus of the beach wrack community since it shows the greatest reliance on drift kelp, and consequently is likely to have the greatest potential for showing impacts indirectly resulting from human harvest of kelp.

4.5.1 Effect of Kelp Harvest on Beach Wrack Communities

Kelp wrack provides a distinctive habitat for many invertebrates including small crustaceans such as shore crabs, beach hoppers (talitrid amphipods) and sand flies. These in turn provide forage for many shore birds. Eventually kelp wrack is broken down by detritivores and recycled into the food web with nutrients recycled on shore or returned to the marine environment.

Commercial kelp harvesting techniques prior to 1920 increased the amount of kelp deposited on beaches, whereas present harvest techniques may lead to a reduction of kelp available to beach wrack communities (ZoBell, 1971). However, Zobell (1971) found no positive correlation between the quantity of kelp on beaches and the operation of kelp harvesters in nearby kelp beds. Since only a small portion of the total coast-wide canopy area is harvested during any given period, indirect impacts from harvesting on beach wrack communities tend to be localized. Recreational harvesters and some abalone culturing businesses also impact kelp wrack communities by directly removing drift kelp from the shoreline. The low recreational daily bag limit (10 pounds wet weight) and limited commercial interest in drift kelp combined suggest that the impact on beach wrack communities associated with these uses are less than significant. Further, the harvest of beach wrack by abalone culture businesses spreads potential harvest impacts across communities that rely on attached kelp or on drift kelp.

Because of safety concerns, large mechanical harvesters do not operate in waters less than 30 feet. This practice leaves a large proportion (from 25-90%) of most beds unharvested and potentially available to kelp wrack communities (Wright, pers. comm.). In addition, the ability of kelp to replace harvested fronds with new growth helps to ensure that harvest related losses to the system are temporary. Further, other non-harvested algal species are also important contributors to kelp wrack communities. ZoBell (1971) found that non-harvested algal species comprise 40% of the total drift algae along San Diego Counties beaches.

The kelp wrack community naturally experience wide variations in the amount of available kelp. For example, urchin grazing or unusual oceanographic conditions such as El Niño have lead to the loss of entire kelp beds and a corresponding reduction in the amount of kelp potentially available to these communities. Adaptations to handle these variations would tend to buffer potential impacts from human harvest.

Bull Kelp

Bull kelp is an important component of kelp wrack in northern California and parts of central California. There have been no studies on the effect of bull kelp harvest on kelp wrack communities. Harvesting bull kelp can impact wrack communities by reducing the amount of kelp biomass that can potentially reach the shoreline. The loss of further production from individual bull kelp plants resulting from harvest can exacerbate those potential impacts. However, the potential effects are offset to some extent by the lack of focused harvest pressure. That is, the proportion of total bull kelp biomass available to the wrack community after harvesting is proportionally larger than that available after harvesting of giant kelp.

The potential impacts from the harvest of kelp on kelp wrack communities is considered to be short-term and less than significant for the following reasons: 1) the kelp wrack community had adapted to large fluctuations in availability of kelp; 2) human uses tend to leave large proportions of kelp beds available as potential contributors to this community; and 3) non-harvested kelp provide a significant component of the kelp wrack.

4.6 Land Use

The harvest of kelp, whether for commercial or recreational use, does not have a significant negative impact on land use. Commercial harvest operations are conducted far enough from shore that they do not interfere with various land–based activities such as beachcombing or surf–fishing. Recreational harvesters generally collect fresh drift kelp off beaches or from the shallow subtidal beds that are reachable during low tides. These activities are hardly noticed by other beachgoers as the quantities taken are small. In some cases, removal of drift kelp by the public is welcomed by nearby residents who object to naturally occurring beach litter for aesthetic reasons.

If kelp harvesting activities influence whether entire plants remain attached to the substrate within the bed, harvesting could indirectly affect the amount of drift kelp that reaches land. Drift kelp can accumulate to the point where it can influence land uses and some municipalities actually incur the costs of removal. Unfortunately, research does not offer clarity as to the influence that harvesting can have on accumulation. That ambiguity suggests that harvesting can cause kelp plants to break free of the substrate in some circumstances and the opposite in other circumstances.

Consequently, the impacts on land use from harvesting of giant and bull kelp appears to be less than significant.

4.7 Scenic, Recreation and Noise Impacts

The removal of portions of the kelp beds by commercial harvesters can temporarily affect the scenic quality of an area depending on the size of the harvesting operation and the harvesting vessel. Aquaculturists who hand harvest generally collect small amounts of *Macrocystis* and have had no appreciable visual effect on the canopy. Mechanized harvesters, such as those used by ISP Alginates, have a large load capacity and can cause the disappearance of the surface canopy from a significant portion of some kelp beds . However, the harvesters try to remove only canopy that has reached maturity, is near its natural sloughing point, and has the highest algin content. This kelp is generally ragged–looking, and if left alone (not harvested), large portions of the beds would disappear naturally. Cut canopy will be restored from young fronds beneath the surface. The restoration will be quick (a few weeks) during good growing conditions and slow (several months) during poor growing conditions. The rates of recovery also appear to be slower in central California compared to southern California. Recognizing these differences, commercial harvest of kelp does not significantly effect the scenic value of the coastline in most locations.

Generally, kelp harvesting operations have no significant effect on the recreational use of the nearshore environment. However, in localized areas, such as near the city of Monterey, kelp harvest has been in conflict with some recreational users. The preferred alternative seeks to reduce that conflict by closing a portion of bed 220 to commercial harvest.

While some recreational users are temporarily displaced by harvesting operations, they also receive some benefits as well. Recreational anglers in private vessels as well as commercial passenger fishing vessels (CPFV) will follow behind the harvesters during cutting. Large numbers of fish move up from the bottom enticed by the presence of small fish, invertebrates, and bits of algae shaken loose from the kelp as it is moved onto the harvester. The recreation anglers use their knowledge of this fish attraction to their advantage by moving into these just harvested areas. In addition, kelp harvesters open up lanes in the canopy that allows CPFV's access to areas that were previously closed due to the density of the kelp. Even non–consumptive users such as kayakers, and underwater photographers may benefit from harvesting operations. The harvesters open lanes in the canopy that allows passage through dense beds and more light to penetrate and lighten the subsurface areas.

Whether kelp harvesting occurs from a small boat or one of the large harvesters, a certain amount of noise will be produced. The extent of this noise will be dependent on the activity of the harvester (i.e. traveling to a site vs harvesting), distance, and background noise (i.e. surf, traffic). Surf noise was measured on a moderately windy day (10 kts) and the levels recorded at 3 ft and 650 ft were 88dB and 67dB, respectively (Johnson et. al., 1989).

When kelp harvesting vessels are in transit, the amount of engine noise generated is higher than during harvesting. This is due to the vessels traveling at a faster speed. However, during transit, the distance from shore is greater, which allows vessels to take the most direct route to a harvest site. Thus, the amount of noise perceived by a person onshore would not be audible, or at most, be barely audible.

During harvesting, the distance from shore is reduced (about one–half mile to a mile and a half) but the engines are either off, set in idle, or traveling at a speed of less than 2 knots depending on the harvesting operator (ISP Alginates, Abalone Farms, or Abalone International). Thus the engine noise is reduced and would not be noticeable from land (Johnson et. al., 1989; Drown, pers. comm.). Table 4–1 contains a list of the noise levels of various ocean going vessels and detection levels at various distances.

Table 4-1. Representative uncontrolled operation noise.					
Noise source	Engine type[a]	Power rating (hp)	dBA at 50 feet	Distance to sensitive location[b]	dBA at sensitive location
Generator	P	200	78	500	36
Tanker	T	10,800	80	3,500	44
Launch	D	400	76	3,000	41
Boom boat	D	235	76	3,000	41
Kelco Harvester-Kelstar	D	500/375[c]	76	>2,640	pending
Abalone Farms, Inc	D	671	76	2,640	pending
Abalone Inter.	G	40	N/D	2,640	N/D

[a]D=Diesel, G=Gasoline, T=Turbine, P=Propane
[b]Sensitive locations, points where noise levels can have significant impacts, the adjacent coastline for offshore sources.
[c]Engine used during harvesting.
N/D – noise levels not detectable over ambient noise.
Source: SBCRMD, 1992; Drown, pers. comm.; Van Hook, pers. comm.

From the table, it is apparent that the noise generated by kelp harvesting vessels is comparable to other types of marine vessel traffic and with distance, noise attenuates. Based on the 65dBA significance threshold, the noise impact of kelp operations is not significant. Example: A vessel 1.75 mi from shore with a noise level of 37 dBA, under certain atmospheric conditions and during times of minimal background noise, would be comparable to a soft whisper heard from a distance of three feet (SBCRMD, 1992).

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. Given the characterization of general harvest impacts provided above and recognizing the conservative orientation of the proposed changes, any impacts from the proposed project from noise levels, recreational uses, or scenic quality are considered to be short-term and less than significant.

4.8 Air Quality and Fuel Use

The state has adopted air quality standards that are as stringent as federal standards (Aspen Environmental Group, 1992). While kelp harvesting operations occur along the entire coast and the offshore islands, the impacts to air quality are of greater concern in highly urbanized areas due to the existence of long-term land–based impacts.

Air quality is affected by local climatic and meteorological conditions. Therefore in an area like the Los Angeles basin, where there are persistent temperature inversions, predominant onshore winds, long periods of sunlight, and topography that traps wind currents, the effects of pollutants would be more severe than along the central California coast where one or more of these components is missing.

Air quality is determined by measuring ambient concentrations of pollutants that are known to have deleterious effects. The degree of air quality degradation is then compared to health–based standards such as the California ambient air quality standards (CAAQS) and the National ambient air quality standards (NAAQS). A summary of the emissions generated by three representative harvesters using gas or diesel engines in commercial kelp harvesting vessels is provided in Table 4–2, 4–3, and 4–4.

The calculation of emissions from kelp harvester was based on the following emission factors for diesel fuel and gasoline:

Diesel

Carbon Monoxide (CO) = 110 lb/1000 gal fuel
Hydrocarbons (HC) = 50 lb/1000 gal fuel
Nitrogen Oxides (NO_x) = 270 lb/1000 gal fuel
Sulfur Oxides (SO_x) = 27 lb/1000 gal fuel

Gasoline

Carbon Monoxide (CO) = 1,822 lb/1000 gal fuel
Hydrocarbons (HC) = 11 lb/1000 gal fuel

Nitrogen Oxides (NO_x) = 96 lb/1000 gal fuel
Sulfur Oxides (SO_x) = 6 lb/1000 gal fuel

Table 4–2. Daily emission rates from Kelco harvesting vessels (Tons/Day) in comparison with statewide fishing vessel emission rates and statewide emission rates from all sources.

Pollutant	Emission Rate	Daily Emission Rates for Fishing Vessels	% of F.V. Rate	Daily Emission Rates - All Sources
CO	0.005	20.54	0.02	19,000
HC	0.004	7.91	0.05	7,300
NO_x	0.021	100.19	0.02	3,500

SO_x	0.002	37.33	0.01	400

Table 4–3. Daily emission rates from Abalone Farms, Inc. harvesting vessel (Tons/Day) in comparison with statewide fishing vessel emission rates and statewide emission rates from all sources.				
Pollutant	Emission Rate	Daily Emission Rates for Fishing Vessels	% of F.V. Rate	Daily Emission Rates - All Sources
CO	0.002	20.54	0.01	19,000
HC	0.001	7.91	0.01	7,300
NO_x	0.005	100.19	0.004	3,500
SO_x	0.001	37.33	0.003	400

Table 4–4. Daily emission rates from Abalone International, Inc. harvesting vessel (Tons/Day) in comparison with statewide fishing vessel emission rates and statewide emission rates from all sources.				
Pollutant	Emission Rate	Daily Emission Rates for Fishing Vessels	% of F.V. Rate	Daily Emission Rates - All Sources
CO	0.01	20.54	0.05	19,000
HC	0.0001	7.91	0.001	7,300
NO_x	0.001	100.19	0.001	3,500
SO_x	0.0001	37.33	<0.001	400

The daily pollutant output from kelp harvesting vessels is relatively low, representing less than 1% of the total fishing vessel daily emission rates for the state. Additionally, overall fishing operations are responsible for less than 1% of the daily emissions from all sources (mobile and nonmobile) in California (CARB, 1989; CARB, 1991; CARB, 1994). The emission levels from harvesting vessels are low due primarily to operating method and location. Kelp vessels, unlike other commercial operations, do not operate in the same locations at the same time but rather harvest kelp from distant locations on different timelines. Thus, several harvesting vessels are not working close together at one time, which would lead to higher emission levels. Also, there are only a handful of harvesters, who operate between 130 to 150 days per year depending on weather and the condition of the kelp beds. For comparison, the daily emission rate for the commercial herring fishery in San Francisco Bay produces 100 times the emission levels of the kelp harvesting vessels. The herring fishery was determined to have a less than significant impact on air quality (CDFG, 1993).

The pollution emissions released when vessels are underway are influenced by a variety of factors including power source, engine size, fuel use, operating speed, and load. The emission factors can only provide a rough approximation of daily emission rates.

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. Given the characterization of general harvest impacts provided above and recognizing the conservative orientation of the proposed changes, the operation of kelp harvester vessels in state waters under the proposed project would only have a localized, short-term effect and no significant long term effect on air quality.

4.9 Cumulative Effects

The current status of kelp resources in California was discussed in detail in Chapter 3. A variety of factors have the capacity to influence the future abundances of giant and bull kelp in addition to the proposed project or the alternatives. The factors with the greatest potential include continued commercial harvest of kelp, commercial and recreational fishing, waste disposal, water quality and unusual weather events. For example, California has experienced 3 major El Nino events since 1982, and some of the impacted kelp beds have not yet recovered, especially in localized areas of the mainland southern California coast, and along the San Mateo county coast. As beds which are commercially harvested become impacted by multiple factors, harvest pressure can increase either on these 'stressed' beds and/or shift to other healthier beds as demand for product remains static or increases relative to the available kelp, resulting in a condition of overharvest.

4.9.1 Effects of Kelp Harvest on Giant and Bull Kelp

Giant Kelp

The effects of harvesting on giant kelp have been studied since harvesting began in the early 1900s. Researchers have studied the effects of harvesting on frond growth and regeneration, holdfast development, survivorship of plants, and survivorship of populations of plants (Cameron, 1915; Crandall, 1915; Brandt, 1923; Limbaugh, 1955; Clendenning, 1968a; North, 1968b; Barilotti, et. al., 1985; Miller and Geibel, 1973; McCleneghan and Houk, 1985; Barilotti and Zertuche, 1990).

While kelp utilization was being developed in California (1912-1915) almost every possible method of harvesting was tried (Scofield, 1959). Some of the early methods were either destructive or caused excessive beach litter. One method involved cutting the kelp from a skiff and letting the kelp drift ashore where it was collected. Another method entailed encircling a portion of the bed with a cable and power pulling the plants into a bundle where they were cut. Many of the plants were uprooted by this process.

A mechanical method of harvesting, very much like that being used today, was developed in the early 1900s. Information presented in the remainder of this section relates to mechanical harvesting where canopies are cut no deeper than 4 feet or the evaluation of mechanical harvesting through experimental hand harvesting at various depths.

Crandall (1915) and Brandt (1923), who conducted their research in southern California, recognized that cut fronds grew very little after harvesting and regeneration of the beds following harvesting was mainly from growth of new fronds from below. Brandt (1923) recommended that three to four months be used between harvesting to allow regrowth of the canopies.

The effect of harvesting surface canopy on the *Macrocystis* plant depends on a variety of factors, including, the length and maturity of surface fronds, turbidity of the water, length of submerged fronds, etc. Kelp canopies, under certain conditions, nourish underlying tissues more than they starve them by self-shading; under other conditions the shading factor predominates.

The *Macrocystis* harvest consists mainly of mature fronds that have completed their growth (Clendenning, 1968a). With increasing time at the surface, sloughing and encrustation increases on these mature fronds, and photosynthesis gradually declines. The harvest of these mature and senescent fronds takes up to 2/3 of the blade supply, photosynthetic capacity, and organic matter content of the frond (Clendenning, 1968a). Photosynthesis suffices for maintenance of the cut frond at best. Harvesting canopy affects submerged fronds by allowing more light to reach these fronds and decreasing translocation (Clendenning, 1968a). Removal of the canopy eliminates the harvested canopy as a source of food, but this may be balanced by the increased light. The effect of cutting the canopy depends on the length of the submerged fronds and the turbidity of the water. Canopy rapidly regenerates if growing fronds are near the surface (Clendenning, 1968a). Harvesting may also be beneficial to juvenile sporophytes by allowing more light to penetrate the water.

North (1968b) developed a mathematical model that formulated the photosynthetic capability of a kelp plant in terms of seven variables. The model was tested using several canopy cutting experiments off La Jolla, California. In the first two experiments, there was no significant difference between the means of the standard growth rate of young fronds of cut plants and uncut controls. The amount of material removed in these experiments was small. In two subsequent experiments, up to 55% of the plant's biomass was removed in the harvest and the mean growth rates were significantly retarded up to one month after the harvest.

The results of harvesting experiments using a commercial harvester (F/V Elwood) agreed with North's previous experimental work (North, 1968b). There was an initial retardation in the mean growth rate, but within a month, the cut plants did not differ significantly from the controls. North (1968b) concluded that "the model predicts, and experiments amply confirm, that canopy cutting can stimulate kelp growth or retard it, depending on circumstances during and after cutting." Harvesters try to take mature canopies. That is, they harvest under conditions where canopy removal favors kelp growth or at least does not have seriously adverse effects. In natural situations, where heavy canopies are shading plants, harvesting probably temporarily reduces growth of the large plants and stimulates the growth of smaller plants. This could lead to an increase in survival rates by lowering interspecific competition (North, 1968b).

Rosenthal et.al. (1974) reported a single incidence of plants being uprooted during kelp harvesting in southern California. Other researchers suggested that kelp harvesting may reduce the number of plants being uprooted by storms because harvesting removes the canopy and associated drag (Brandt, 1923; Guzman del Proo et al., 1971).

Research has also been conducted in southern California to determine if there is a relationship between kelp harvesting and the amount of beach litter. ZoBell (1971) made nearly 10,000 observations on 49 beaches in San Diego and Orange Counties, during a twelve-year period, to determine whether kelp harvesting contributed significantly to beach litter. ZoBell (1971) identified more than 100 species of seaweed in the drift on beaches and noted that little more than half of the biomass of beached seaweeds was contributed by giant kelp. He determined that the major causes of seaweeds being set adrift were storms, boring and chewing animals, microbial parasites, and other natural causes. ZoBell (1971) concluded that there was no evidence that kelp harvesting, as currently practiced, significantly contributed to beach litter. He suggested that harvesting may actually reduce beach litter because mature canopies, that would otherwise slough and breakaway, are collected by the harvester.

The above reported studies were all done in southern California. Miller and Geibel (1973) recognized that forests of *Macrocystis* in central California were different than forests in southern California since canopies virtually disappeared during late fall and winter each year in central California, but not in southern California. They conducted frond growth studies in central California during 1969-1970 in an experimentally harvested area and an unharvested control area. Plants were cut five times in a 408-day period at or below four feet (the depth permitted by California law). Growth rates in the cut area followed the same general pattern as those in the control area. Growth rates varied considerably during the study, but, in general, fronds grew fastest in the spring, summer, and early fall months and slowest in late fall and winter. Fastest growth rates were obtained in April. Miller and Geibel (1973) concluded that "overall, there appeared to be little difference in the growth rate of *Macrocystis* in the cut or uncut areas."

In March 1971, following the growth studies, Miller and Geibel returned to the study site in central California to discover that plants had been lost during the winter in the experimentally harvested area but not in the unharvested control. They theorized that continuous harvesting (five times in a 408-day period) removed fronds of older plants, resulted in reduced translocation to the holdfast, reduced hapteral growth, and weakening of holdfast attachment to the substrate. Miller and Geibel (1973) suggested that holdfasts of older, cut *Macrocystis* plants became relatively less efficient than those of mature plants in the uncut area, and during winter storms these weakened holdfasts were more readily torn from the substrate.

A short-term study was initiated in 1971 to test whether hapteral growth was impacted by harvesting (Miller and Geibel, 1973). Growth of haptera and the addition of new fronds was studied on five harvested and five unharvested control plants. Miller and Geibel (1973) reported a significant retardation of hapteral growth in the cut plants but not in the uncut controls. The number of fronds per cut plant also remained significantly lower each month after harvesting than in the uncut series. In October, however, cut plants had as many new fronds 1-5 feet long as did uncut plants. Miller and Geibel (1973) concluded that harvesting of kelp canopy as done in their experiments could result in: l) lower yield because less biomass is produced, and 2) premature loss of plants because of decreased holdfast efficiency. The studies by Miller and Geibel (1973) raised concerns that harvesting could adversely affect the survival of *Macrocystis* in central California. As a result, a series of studies were initiated to determine the effects of harvesting on survivorship of plants in central California kelp beds (Barilotti et. al. 1985, and Zertuche, 1990). McCleneghan and Houk (1985), on the basis of a one year study, concluded that haptera branching was significantly lower in plants that were experimentally harvested compared to unharvested controls. In contrast, during a three-year study of hapteral elongation and branching, there was no conclusion regarding the impact of commercial harvesting on hapteral elongation and branching (Barilotti, et al., 1985). Hapteral branching was extremely variable, significantly lower in harvested areas relative to controls one year, significantly higher in the harvested area in another year, and not significantly different the third year (Barilotti et al., 1985).

A survivorship study in a commercially harvested kelp bed, in central California, was done in Carmel Bay from 1978 through 1982 (Barilotti and Zertuche-Gonzalez, 1990). The Carmel Bay kelp bed was harvested commercially each year to obtain kelp for algin extraction. The study was designed to determine if there was an immediate loss of plants by uprooting, or a longer-term loss of plants during the winter months. Barilotti and Zertuche-Gonzalez (1990) tagged a total of nearly 400 plants in harvested and control areas and found that plants were not pulled free by the harvester as reported by Rosenthal el al. (1974) on one occasion in southern California. There were also no longer-term effects where more plants were lost in the harvested area during winter months than in the unharvested area. They concluded that there was no significant statistical difference in survivorship between harvested and unharvested areas during routine commercial harvesting in Carmel Bay.

Miller and Geibel (1973) also reported that a dense growth of red algae inhibited recruitment of *Macrocystis* in the area where kelp was lost due to overharvesting. However, neither the persistence nor the long-term ecological effects of the dense red algae were followed by these authors. Studies in Carmel Bay in commercially harvested areas revealed no increase in the abundance of red algae as a result of harvesting (Kimura and Foster, 1984).

North (1968c) stated that "in summary, predictions from the model, the cutting experiments, and physiological and ecological evidence combine to indicate that kelp harvesting as currently practiced causes very little damage to kelp beds and under certain circumstances may be beneficial. Such a conclusion is further supported by Clendenning's findings that the beds harvested most heavily showed no tendency to decrease their yields."

North (1968c) also indicates that his results do not mean that harvesting cannot harm plants. He notes that there have been instances where cutting has been excessive and damaging. A strip of kelp, for example, continuously cut by small boat traffic at Paradise Cove displayed a smaller standing crop of tissue than the surrounding bed (North, 1957). Beds harvested four times per year showed a decreasing yield in contrast to beds harvested less frequently (Brandt, 1923).

In conclusion, research in both southern and central California suggests that kelp harvesting can, in some instances, impact populations of *Macrocystis* resulting in loss of plants and reduced production of biomass. Most of the research, though limited, seems to indicate that there are not problems associated with harvesting of the type practiced by ISP Alginates, whereby plants are harvested a maximum of three times per year. However, there are presently no specific regulations limiting the number of times a bed can be harvested in a year, nor the areal extent of the harvest on a particular bed. Fish and Game Code section 6654 does give the Fish and Game Commission authority to close a bed for up to one year if they determine that harvesting is having a detrimental impact .

Bull Kelp

Studies of the effects of harvesting on *Nereocystis* have been conducted in California and in British Columbia (Nicholson, 1970; Leaman, 1980; Foreman, 1984; Roland, 1984). However, the most intensive studies on the effects of harvesting on *Nereocystis* were done in Barkley Sound, British Columbia. In these studies, a variety of harvest methods were evaluated including hand–harvesting, strip harvesting, patch harvesting (Foreman, 1984) and lamina harvesting (Roland, 1984). It is important to remember that bull kelp, unlike giant kelp, has only one pnuematocyst per plant and that reproductive sori are produced on the blades. Therefore, any activity that removes the pnuematocyst and blades results in the death of that plant as well as loss of regenerative and reproductive material.

In the study conducted by Foreman (1984), 100 M^2 plots were harvested over a three-year period (1978 to 1980). The canopy within the harvested plots was removed using a mechanical harvester, which cut to a depth of 1 m below the surface. All harvesting occurred in late August or early September (Foreman, 1984). The results of this investigation revealed that there were no detectable harvesting impacts on plant density between the control and harvest plots. In addition, comparison of mean plant biomass for harvested and control plots also failed to show significant differences. The main conclusion from this study was that natural year–to–year variability in high density *Nereocystis* beds is greater than harvesting–induced variability, conditioned on controlling the areal extent and timing of the harvest (Foreman, 1984).

Foreman noted that if sustained harvesting were to be achieved, consideration must be given to harvesting after spore production has occurred or in a manner that leaves sufficient plants to insure adequate recruitment in the following year. One way to harvest bull kelp throughout the year and still sustain recruitment potential in the next would be to hand–harvest or to use the strip method. Harvesting *Nereocystis* by hand allows for selective removal of post–sori released plants. Additionally, the quantities removed by this method are small and have no visible impact on bull kelp beds (Foreman, pers. comm.). The second method recommended by Foreman was strip harvesting. This method involves removing the entire canopy in a given width, perpendicular to the prevalent water current and down current from a strip of equal or greater width. He also suggested that harvest be limited to 20% of the bed or that about 4 times the harvest width be left undisturbed. By using this harvest technique, large quantities could by harvested at one time while upcurrent plants would be available to release sori into the cleared area. However, the second method should only be used on high to moderately dense beds (Foreman, pers. comm.).

Roland (1984) examined the effect of partial blade removal as a harvest method of bull kelp. In this study, all but 30 cm of the blades were removed to allow continued blade and plant growth. Plants were either treated to single or multiple harvests. Overall survival of plants was not affected by the two treatments when compared to control plants. However, the lamina growth rates and production of sori for the single and multiple cut plants were significantly reduced. Total plant biomass (wet kg per plant) of the single and multiple cuts was 50% lower than the control. Work conducted by Nicholson (1970) in California supports these findings.

Roland (1984) concluded that use of this method would not affect the overall recruitment and sustained yield of *Nereocystis* beds, particularly if the harvest method was staggered between different plants. However, the multiple harvest of lamina was inefficient in view of the low yield relative to initial crops.

Currently, targeted bull kelp harvesting takes place in Crescent City for use in an abalone mariculture operation (Sec. 3.4.1.). To date there has been no evidence that harvesting causes significant effects on the *Nereocystis* population in this state. However, as mentioned in section 4.3, bull kelp beds in central California are not protected in the same manner as the 300 series in northern California and their susceptibility to overharvest is a concern.

Bull kelp is also harvested in British Columbia on a limited basis (Hodgson, pers. comm.). In the waters off British Columbia, the kelp forests are composed of 80% *Nereocystis luetkeana* and 20% *Macrocystis integrifolia*. The Ministry of Agriculture, Fisheries and Food for British Columbia allows harvest of only 20% of the standing stock of bull kelp per year with the following constraints: 1) only the frond may be cut and the cut must be at least 4 inches from the bulb, allowing the blade to continue to grow; 2) harvest time is limited by the time of herring spawn within an area; in most cases the harvest season is between June and October; 3) all licenses are issued annually (Hodgson, pers. comm.).

The restrictions placed on bull kelp harvest are not based on concern that harvesting will adversely impact the kelp forests of the Province, but based on the concerns of commercial herring fishermen that harvesting will affect their fishery because the herring lay their eggs on the blades of bull and giant kelp. The Ministry considers the Pacific herring fishery, which exists in provincial waters, to be more economically valuable than any potential kelp harvesting industry could be (Hodgson, pers. comm).

The proposed project and suggested alternatives would shift the existing management strategy in a conservative direction. Given the characterization of general harvest impacts provided above and recognizing the conservative orientation of the proposed changes, any impacts from the proposed project on kelp is considered to be short-term and less than significant.

4.9.2 Effect of Commercial Fishing on Kelp Resources

Commercial fishing activities can affect giant and bull kelp in a similar manner. Commercial fishermen, who transit into the kelp to check their gear, cause some damage to the kelp canopy. As they pass through the kelp, the propeller cuts the blades and stipes. The use of certain fishing gear, such as crab pots, lobster traps, live fish traps, and gillnets, occasionally cause breakage of stipes and fronds as well as periodically pull up holdfasts when the gear is being set and retrieved. Repeated travel into the kelp and usage of the same area can result in cleared passageways and spots devoid of surface canopy. None of these activities make appreciable additions to the mass of kelp being continuously sloughed off through natural causes (Feder et. al., 1974).

The most damage occurs through the removal of the top kelp forest predators such as sheephead and lobster. The removal of sheephead has resulted in the expansion of purple sea urchins (*Strongylocentrotus purpuratus*) populations in southern California. Sheephead and lobster are such important predators of sea urchins that they help to regulate urchin densities (Tegner and Dayton, 1981). The large–scale removal of sheephead may allow the aggregation of sea urchins which would be detrimental to the kelp beds.

The removal of red sea urchins and abalone has caused reductions in the bull kelp beds in California. These species graze on the gametophytes and young sporophytes of competitive algal species (Dayton et. al., 1984). By harvesting these algivores, turf community species such as coralline algae, foliose reds (*Botryoglossum farlowianum*, *Polyneura latissima*), and midwater canopy species (*Laminaria* spp., *Pterygophora californica*, *Eisenia arborea*) can develop under *Nereocystis* canopies. Once in place, these species can prevent the recruitment of bull kelp (Paine and Vadas, 1969; Duggins, 1980; Dayton et. al., 1984).

This phenomenon has been observed in Carmel following the mass mortality of sea urchins, in Torch Bay and Surge Bay, Alaska following the introduction of sea otters, in Diablo Cove after sea otters moved into the area in the mid-1970s and removed the large macro–herbivores, and in Fort Bragg where the commercial fishery for red sea urchins has been occurring since 1985 (Pearse and Hines, 1979; Duggins, 1980; Gotshall et. al., 1984; Estes and Duggins 1995; Karpov et. al. In Press).

The removal of top grazer species is beneficial for bull kelp in areas of heavy scour and unstable substrates. Periodic scouring of the substrate removes competitive algal species. The resulting open spaces can be rapidly colonized by bull kelp. Duggins (1980) reported that *Nereocystis* was unable to compete with perennial brown algae, *Laminaria* spp. following urchin removal except in areas of deep water or unstable substrate.

Thus commercial fishing can significantly effect the kelp forests through the removal of predator species that are known to influence kelp communities.

4.9.3 Effect of Sportfishing on Kelp Resources

All motorized boat activities in the kelp beds, whether fishing, pleasure or other purposes, will result in a certain amount of kelp damage due to cutting by propellers. Frequently, vessels will "back down" while traveling through the kelp canopy. This practice involves putting the engine in reverse when the propeller becomes fouled with kelp. This not only frees the entangled kelp but also cuts more of the canopy. Kelp plants can also be uprooted when commercial passenger fishing vessels and private boats anchor in kelp beds. Plants are frequently pulled up when the anchor is retrieved. However, these losses of kelp canopy and plants appear to have no lasting effect on the kelp beds as a whole (Feder et. al., 1974).

Recreational fishing can also affect the kelp forests. Species such as sheephead, cabezon, lingcod, and lobster are popular with recreational harvesters. The indirect effect on kelp abundance by removing kelp forest associated predators was discussed in section 4.6. However, recreational fishing also removes "nibblers". These are species that pick off invertebrates on the kelp or graze on the fronds and stipes such as surfperch, señorita, and blacksmith and which can cause substantial damage to the kelp forests (McPeak et. al., 1988).

In general, the removal of fish and invertebrates from kelp forests can cause significant changes but the extent of these changes has not been quantified.

4.9.4 Effect of Waste Disposal on Kelp Resources

As California's population and industry base grew during the early part of last century, our capacity to deal with human and industrial waste was stretched beyond the breaking point. Thus ocean disposal was felt to be the answer to our waste problems until the effects of this type of disposal were exhibited by changes in the nearshore ecosystems (Foster, 1986). The discharge of human and industrial wastes containing bacteria, phosphates, heavy metals went unchecked for 25 years. Associated with this discharge was an increase in water turbidity, sedimentation and an overall reduction in light penetration (Meistrell and Montagne, 1983). These factors, in conjunction with natural environmental changes (warm water events), lead to the disappearance of kelp. The most notable loss was that of the giant kelp beds off of Palos Verdes and Point Loma in the 40's and 50's. Changes in Federal and State water quality laws and improvements in waste treatment methodology have resulted in improved water quality and the return of kelp growth near these outfalls, but there remain problem areas near

California's coastal metropolitan areas. Because, while human and industrial waste treatment systems have improved in some areas, untreated storm drain discharges and their associated turbidity have increased with burgeoning human populations in southern and central California.

A second type of ocean waste that adversely effects kelp communities is warm water discharge, usually associated with nuclear power plants like Diablo Canyon and San Onofre. As discussed in Sections 3.2.10 and 3.2.12, the increase of ambient water temperature can cause serious damage to giant and bull kelp forests through loss of adult tissue and early death as well as retardation of gametophytic and sporophytic development.

4.9.5 Effect of Coastal Development on Kelp Resources

The tremendous population growth that southern California has experienced during the past 50 years has greatly changed the coastal landscape. Runoff from coastal development activities has introduced sediment into nearshore waters. As discussed in Section 3.2.10.1, introduced sediment can negatively effect kelp growth by decreasing water clarity. Introduced sediment can also reduce kelp recruitment by covering reef habitat. Construction of harbors and marinas have also effect kelp by physically disturbing plants and reef habitat, increasing water turbidity levels, increasing sedimentation, and changing current patterns (Foster and Schiel, 1985).

Modern conservation techniques have reduced the effects of coastal development on nearshore reef habitat when applied. For example, barriers have been used to catch sediment before it enters culverts. Planting or covering exposed hillsides has also been used to prevent soil erosion.

The impacts from coastal development on kelp tend to be localized in nature and to some extent mimic natural sedimentation processes. The same processes that move naturally occurring sediment will, in many instances, also move development induced sedimentation.

4.9.6 Water Quality

The physical act of harvesting giant and bull kelp does have a small localized effect on water quality. The extent of the effect is dependent on the size of the operation. For instance, hand–harvesting of *Nereocystis* results in a less than noticeable change in the local water quality due to the small amount of kelp harvested at any one time (4 tons maximum). During large–scale harvesting operations, invertebrates, fish, and bits of kelp are shaken loose as the kelp is moved up the conveyor belt and into the ship. Typically, the loosened material falls through the conveyor and into the water. Department biologists reported that 2 hours after a harvesting operation occurred offshore of Big Creek, Monterey County, the water quality was back to normal (Van Tresca, pers. comm.). They also reported that kelp litter covered the bottom. However, the biologists did not feel this presented a ecological problem as most of the pieces would probably be consumed by benthic herbivores.

Recognizing that kelp harvesting does change local water quality conditions, the effect is short–term and does not present a significant environmental problem.

4.9.7 Unusual Weather Events

The occurrence of unusual weather events such as the El Niños of 1982-83, 1992-93, 1997-98, severe winter storms, and the 200–year storm have had significant influence on the relative abundance of kelp resources in California as outlined in Sections 3.2.7.1 and 3.2.12. Whether these events happen separately or in concert, as was the case in 1982–83, the stress resulting from these disturbances causes the loss of whole beds as well as canopy reduction in other areas. This in turn affects the nearshore fish and invertebrate communities that depend on the kelp forests for food and shelter. Commercial kelp harvesting and aquaculture operations also suffer from unusual meteorological events. Reduced and patchy kelp canopies mean that it is not economically feasible to harvest and kelp must be purchased from other sources to keep their businesses in operation (Glantz,, pers. comm.; Van Hook, pers. comm.). This condition also puts stress on remaining kelp beds to make up the shortfall. The depletion of kelp resources is also felt by the commercial fishing industry and recreational user groups who discover that finfish and shellfish abundances are greatly reduced following unusual weather events.

The kelp bed community has shown considerable resilience in recovering from impacts associated with unusual weather events in the past. At present the cumulative effect of these events is considered to be short-term and less than significant. However, global warming could change those patterns to the extent that past recovery patterns do not reasonably predict future responses. Under those conditions, this factor alone could have a significant and long-term effect on kelp bed communities. Ongoing monitoring of physical oceanographic conditions and periodic review of kelp management regulations provide a reasonable opportunity to adjust should unusual weather patterns occur more frequently.

Cumulative effects, under existing impact levels, suggest that a prudent, conservative approach to consumptive use of kelp is warranted. However, those impact levels are not sufficient to warrant a prohibition on consumptive uses. At present, the cumulative impacts combined are considered to be localized, short-term, and less than significant.

Chapter 5. MITIGATION

The regulatory actions proposed in this document are self–mitigating. The only alternatives to regulating the take of kelp would be to allow harvest without restriction or to prohibit consumptive uses of these resources. Unrestricted harvest could be detrimental to the kelp resources given the lack of regulatory safeguards. Prohibiting consumptive use of kelp is not warranted given the effectiveness of existing safeguards.

The proposed project is also self-mitigating because it provides for a more conservative set of safeguards than are provided under the existing regulatory framework. The existing regulatory framework and suggested modifications are designed to assure that harvesting will be maintained at a level that is below the population's sustained yield capabilities. These provisions allow for the conservation and maintenance of giant and bull kelp populations, provide a benefit to society through consumptive and non-consumptive use, and minimize indirect impacts on associated species to a level the is considered to less than significant.

Chapter 6. ALTERNATIVES

The Department recommends that the Commission adopt the proposed project. Specifically, the Department recommends a suite of changes to the existing management regulatory processes that became effective May 9, 1984 and March 26, 1996 (Sections 30 to 30.10 and Sections 165 and 165.5, Title 14, CCR, respectively) (Appendix 1). The recommended changes include: 1) an amendment to that clarifies what weighting methods are acceptable to determine the weight of kelp being landed; 2) an amendment that clarifies what information is required in landing records and what processes are to be followed in submitting reports (§ 165(b)); 3) amendments that further restricts harvest methods and seasons for bull kelp near the southern limit of that species geographical range; 4) amendments that increase the number of kelp beds that are closed to harvest (§165(c)) to prevent focused or repeated harvest and limit risk of resource damage in those beds where there has historically been little kelp resource; 5) an amendment that specifically addresses resource use conflicts in bed 220 near Monterey by closing a portion of the bed; 6) an amendment that provides a mechanism for restricting harvest by explicitly allowing imposition of temporary harvest controls in beds or portions of beds where necessary for resource protection; and 7) an amendment that provides an easy method for interested parties to determine which kelp beds are currently available for leasing (§165.5 (b)). More information on the preferred alternative can be found in Chapter 2 (2.1 Proposed Project).

The amendments identified in the preferred alternative will aid in the effective management and control of the commercial harvest of the giant and bull kelp resources within state waters while ensuring further protection and conservation of these important resources. The proposed project reflects both Department and public recommendations for amendment, change, or additions to existing regulations to meet the State's policy for managing kelp resources.

In developing the preferred alternative to address resource use conflicts in the Monterey bay area (Bed 220) (mentioned above), the Department evaluated several approaches and alternatives. The Monterey Bay National Marine Sanctuary (Sanctuary) submitted recommendations (Figure 6.1) that ultimately formed the basis for the recommended alternative. The Sanctuary recommended two closures near the City of Monterey. One closure was intended to limit resource use conflicts between consumptive and recreational users of the kelp beds. The other was intended to provide an area free of harvest as a control area to facilitate research. The preferred alternative modified the Sanctuary recommendations by creating a single larger area closed to commercial harvest of kelp. No research had been identified for the control area and the expanded closure was located to minimize resource use conflict and to provide the kelp harvesters with a closure boundary that was more readily identified from the water.

In addition to the proposed project, or preferred alternative, the Department is providing the Commission with an additional alternative that would also attain the project objectives. This alternative still provides harvest opportunities as an element of kelp resource management but further restricts the amount of kelp that could be cut from a kelp bed annually. The three alternatives, including the no-action (status-quo) alternative required under CEQA guidelines, were selected to provide the Commission with a range of alternatives. The no-action alternative would involve continuation of the existing commercial and sport regulations for the harvest of kelp resources within State waters.

6.1 Alternative 1 (Statewide Harvest Controls)

This alternative suggests expanding the suite of amendments in the proposed alternative to include a provision for limiting the amount of kelp that can be removed from each kelp bed (leased, available for lease, and open beds). The amendment would limit the amount of kelp that could be removed from each bed as a precautionary measure to prevent over-harvest. In response to public input, the Department considered several approaches, including limiting harvest to no more than 50 percent of that available in each bed during peak canopy production. Depending upon inter-annual variation and geographical differences in canopy production, this type of broad harvest control would tend to impact harvest patterns in southern California to a greater extent than in central or northern California. Most lease beds in southern California, with higher productivity, are now harvested two or three times each year.

Selection of this alternative would be expected to: 1) allow most beds in southern California to develop and slough naturally to a greater extent than occurs under existing uses; 2) provide more unharvested canopy in many southern California beds, resulting in less displacement of juvenile fish; 3) provide more unharvested canopy in many southern California beds, resulting in less disruption of sea otters in occupied beds; 4) reduce the harvest of giant kelp in southern California to levels appreciably lower than normal; 5) reduce the revenues to local and regional economies derived from the commercial harvest of giant kelp; 6) reduce revenues to the Department of Fish and Game from harvesting of kelp; 7) impact the algin and abalone aquaculture industry; and 8) increase the amount of kelp wrack on some beaches.

As stated above, the alternative would allow more kelp to develop and slough naturally, particularly in southern California. With that recognition and concern over the potential for over harvest prompted the general interest in this alternative. The additional canopy would provide more habitat for those species at various life stages that occupy the kelp canopy. It would also provide more kelp productivity in support of other marine communities such as those that use beach wrack. However, data presented in Chapter 4 of this document suggests that the ecological gains would not be significant for kelp plants or associated biota in most geographical areas.

The Department does see a benefit in developing a precautionary approach that limits or prevents an escalation of harvest to levels that can potentially cause significant impacts. However, establishing a biologically tenable threshold value beyond which one could reasonably expect a significant biological impact is problematic. At this point, establishing a specific harvest control level would be highly subjective. Further, establishing a management process based on a kelp bed by kelp bed quota system would be complex and require a significant staff commitment when existing management processes appear to be efficacious.

A statewide harvest control would impact the California algin industry. The only California producer of algin began production in 1929. One reason the industry survived for seventy years is the ample kelp supply that is generally available in southern California. Adoption of this alternative would take some of that production out of service and result in significant scheduling problems, and cause a significant increase in the cost of manufacturing algin because the raw material (kelp) would necessarily be harvested from more distant beds. This could translate to an increase in harvest pressure in less productive open beds in central California.

In conclusion, this alternative is not the preferred alternative because the benefit gained through implementation of a precautionary approach is not warranted given: 1) potential impacts to the algin industry and local economies; 2) no ecological benefits to populations of giant kelp or the marine biota associated with those beds; and 3) the potential for a shift in harvest pressure from southern California to less productive kelp beds in central California.

In lieu of this approach, the preferred alternative provides a mechanism for establishing harvest controls for specific kelp beds on a case by case basis for specified time periods.

6.2 No Action

If selected by the Commission, the no action alternative essentially means no change would occur to existing regulations. The Commission and the Department have been given broad authority over the management of the state's kelp resources through statute (§6650-6751, §8596-8598.6 and, §7050-7090 Fish and Game Code) as expressed in regulation (§30, §165, and §165.5 Title 14, CCR). All relevant statue and regulation are presented in Appendix 1). These regulations have evolved to provide for the efficient management and harvest of kelp.

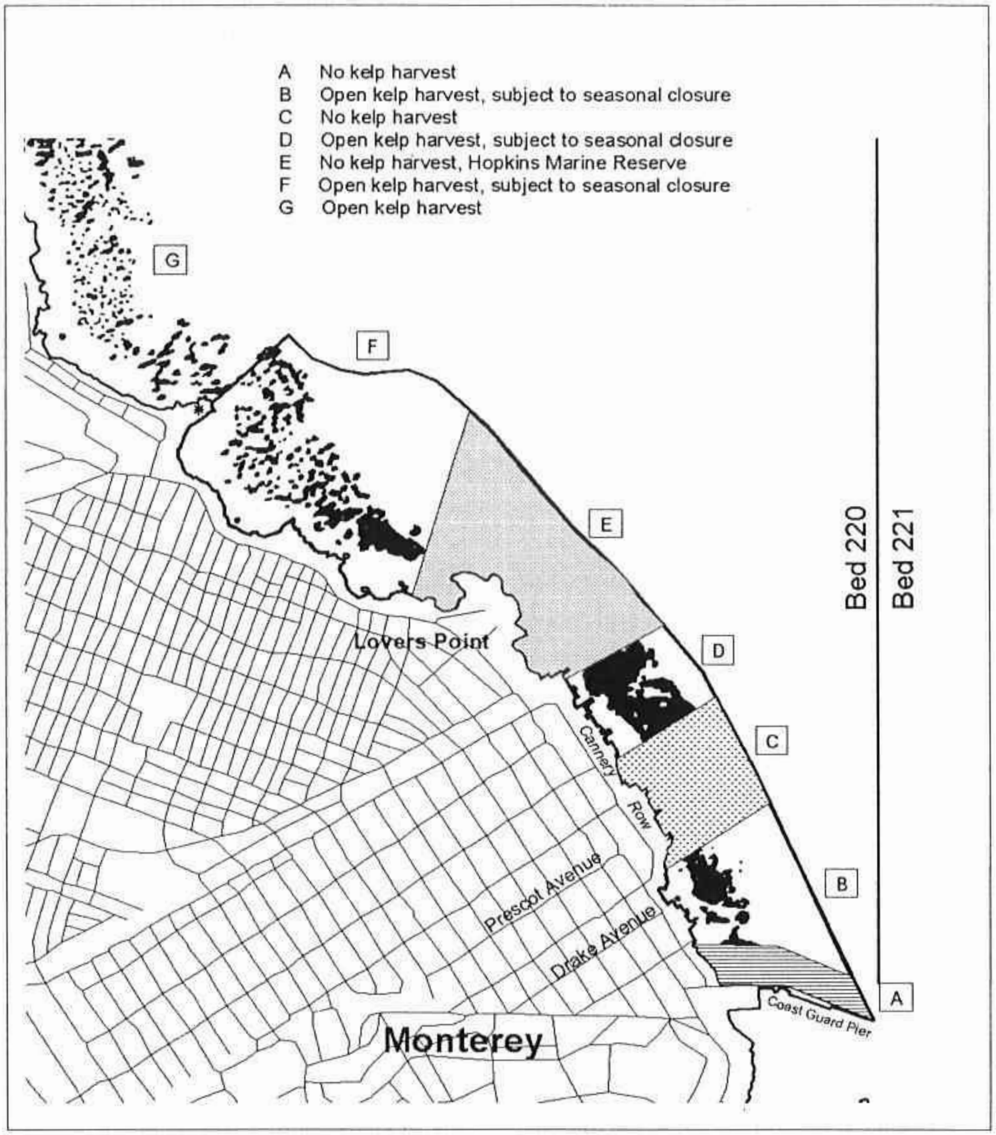


Figure 6-1. Map of Monterey Bay National Marine Sanctuary recommended regulations for bed 220.

CHAPTER 7 CONSULTATION

An integral part of all the Department's fisheries management programs is consultation with other agencies, qualified professionals in the fisheries management field, and interested individuals. To this end, Department staff involved with fisheries management are continually in contact with other agencies and professional biologists involved with all aspects of fisheries management.

The Department's fisheries management staff works closely with local commercial harvesters, recreational user groups, and with State, Federal, and local agencies with land and water management interests that can affect or be affected by the harvest of kelp resources in State waters.

In addition to maintaining close informal contact with personnel from other agencies involved with fisheries and wildlife management, Department personnel also maintain formal contact with personnel representing fisheries management agencies, universities, and the private sector by attending professional fisheries management workshops, conferences, and seminars. Such activities provide for regular, up-to-date interchange of ideas and findings between Department personnel and other professionals.

Prior to preparing this environmental document, the Department issued a Notice of Preparation (NOP). The notice was provided to individuals and organizations that have expressed prior interest in Commission regulatory actions. The NOP was also submitted to the State Clearinghouse for distribution to appropriate responsible and trustee agencies for their input and comments.

Every effort has been made to consider relevant issues brought fourth in response to the NOP in this environmental document, including the development of alternatives to the proposed project.

CHAPTER 8 RESPONSE TO COMMENTS

8.1 List of Comments Received

A total of 31 communications were received by the Department regarding the draft environmental document (DED) during or shortly after the review period which ended on February 15, 2001 at 5:00 p.m. The actual communications follow the Department's response to the comments.

KELP CEQA COMMENT LOG

#	Name	Date	Comment Source
1	Chris Van Hook Abalone International	05Jan01	E-mail
2	Gary Russell Pacific Abalone Farms	17Jan01	E-mail
3	Jenny Pursell Salinas, CA	23Jan01	FAX
4	Ray Fields The Abalone Farm, Inc	24Jan01	Letter
5	David Ebert US Abalone	02Feb01	Letter
6	William Douros Monterey Bay National Marine Sanctuary	02Feb01	Letter
7	Justin Malan California Aquaculture Association	02Feb01	Verbal - Commission meeting
8	Dave Ebert US Abalone	02Feb01	Verbal - Commission meeting
9	Ray Fields The Abalone Farm	02Feb01	Verbal - Commission meeting
10	Aaron King Monterey Bay National Marine Sanctuary	02Feb01	Verbal - Commission meeting
11	Art Seavey Monterey Abalone Farm	02Feb01	Verbal - Commission meeting
12	Gary Russell Pacific Abalone Farm	02Feb01	Verbal - Commission meeting
13	Art Seavey Monterey Abalone Farm	15Feb01	Letter via e-mail to Commission
14	David Dilworth Helping Our Peninsula's Environment	13Feb01	FAX to Commission

15	David Dilworth Responsible Consumers of the Monterey Peninsula	15Feb01	FAX to Commission
16	Doug Obegi Center for Marine Conservation and Joe Geever American Oceans Campaign	15Feb01	Letter via e-mail
17	Justin Malan California Aquaculture Association	13Feb01	Letter via FAX
18	John O'Connor Bolinas, CA	15Feb01	E-mail
19	Chris Van Hook Abalone International	15Feb01	FAX of Letter
20	Richard Todd, Salinas, CA	16Feb01	Letter
21	Sandra Koffman City of Pacific Grove	14Feb01	Letter
22	Patrick Lovejoy Santa Cruz, CA	13Feb01	Letter
23	Marc Shargel Felton, CA	13Feb01	Letter
24	Jim Curland Defenders of Wildlife	15Feb01	FAX
25	Ed Cooper Pacific Grove, CA	13Feb01	Letter
26	Jim Thompson, Gayle Todd, Charlene Mitchell Friends of Edward F. Ricketts Marine Park	Received 15Feb01	Letter
27	Chuck Davis Pacific Grove, CA	14Feb01	Letter
28	Berkley White Monterey, CA	Received 15Feb01	Letter
29	Jessica Wheeler Monterey, CA	Recieved 15Feb01	Letter
30	Gregory D'Ambrosio City of Carmel-By-The-Sea	02Feb01	Letter
31	Vicky Nichols Save Our Shores	30Jan01	Letter
32	Stephen Campi Central California Council of Diving Clubs	13Feb01	Letter
33	Dale Glantz ISP Alginates, Inc.	25Jan01	Letter

8.2 Summary of Comments

The following summary is intended only to help guide interested readers to related comments by placing comments in broad categories and associating related responses through use of a code. The code combines a number (the logged comment number provided in Section 8.1) and a letter that identifies the specific response to a comment. Neither the categories provided here nor the summarized comments provided at the beginning of each response are intended to capture the full content of those comments. For that, the reader is directed to the specific comment letters.

1. Comment on Section 165(b)(1) - weighing of kelp
   - wording is vague - 2a
   - availability of harvest records - 29g
   - impact from inaccurate weighing - 25o, 27f, 29e
2. Comment on Section 165(c)(4) - Commission may limit or prohibit ...
   - wording is vague - 4f, 5f, 13a, 17d, 19d
3. Comment on Section 165(c)(4)(A) - Hand harvest of bull kelp north of line ....
   - option considered and rejected by Sanctuary Advisory Council - 5a
   - document fails to establish scientific need - 5b, 19b
4. Comment on Section 165(c)(4)(B) - Seasonal closure on harvest of bull kelp ....
   - abalone aquaculturists need to use drift bull kelp - 4k, 5c, 12a
   - bull kelp is buried on beaches during proposed seasonal closure
   - proposed change ok - 6d, 26e
   - option considered and rejected by Sanctuary Advisory Council - 4a
   - regulation not needed - 17e, 19b
   - season shorter than Sanctuary recommendation - 20e, 20j, 27g, 28n
5. Comment of Section 165(c)(4)(C) - Harvest Plan for use of mechanical harvester
   - wording is vague / criteria needed - 2b, 4m, 17c
   - regulation not needed - 4l, 19e
   - regulation ok - 6c
   - option considered and rejected by Sanctuary Advisory council - 5h
   - regulation redundant - 17f
   - regulation should prohibit mechanical harvesting area - 20o, 20i, 26d, 28m
6. Comment on Section 165(c)(4)(D) - partial bed closure (bed 220)
   - object to regulation but understand - 2d
   - regulation not needed - no scientific basis - 19b
   - safety issue - harvesters need access - 12b
   - only used to address user conflict - 13b
   - expand closure - 6b, 20f, 20h, 20l, 22d, 23d, 24u, 25f, 26a, 27c, 28b, 28e, 29a, 32a
   - closure needs seaward boundary - 13c

7. Comment on Section 165(c)(4)(E) - temporary harvest controls
    wording is vague / criteria needed - 2c, 4o, 4q, 4i, 5e, 13a, 17c, 17g, 19c, 19f b
    regulation not needed - 4i, 19b
    only used to address user conflict - 4p
8. Comment on Section 165(c)(5) - bed closures
    regulation ok - 20k, 28o
    regulation ok but expand closures - 6f
9. General comments
    proposed regulations ok - 1a
    no change needed - 4b, 4d, 4e, 5j, 11a, 17b
    proposed changes favor harvesters - 22a, 22f, 23a
    proposed changes impact harvesters - 4a, 4c, 4q, 17a, 19a
    no harvest should be allowed - 14l, 14cc, 25a, 27a
    adopt Sanctuary's recommendations - 6e, 31a
    precautionary approach needed - 3e, 3d, 16i, 22c, 24i, 24q, 26g, 28a
    alternatives inadequate - 14ff, 14gg, 16g, 24f, 25c, 25r, 28l, 29d
    information dated / studies lacking - 3b, 14c, 18b, 21a, 24b, 24j, 24k, 24l, 25b, 27b, 29h
    proposed changes will be used in user conflict - 4h, 4n
    not just conflict - ecosystem concerns - 3a, 14d, 14o, 20a, 22b
    goals not clearly stated - 14e
    fee structure needs review - 6a, 2og, 22e, 23c, 25d, 26c, 27e, 29i
    research not adequately analyzed - 14g, 14m
    cited study flawed - 20c, 25l
    leases are too long - 15b, 15c
    notification for comment inadequate - 16h
    drift and wrack communities are important - 21b
    do not consider economic impacts - 24d
    users need to grow their own kelp - 25q, 28k
    harvesting in sanctuary may be prohibited - 24o
    involve all stakeholders in development of master plan - 24r
    retain wording in code - 29f
    define 'harvest' as 'take' - 6g
10. Comments specific to threatened or endangered species
    consultation or biological opinion needed - 14b, 14aa, 14bb
    document overlooks impacts to Stellar sea lion or white abalone - 14h, 25s
    sea otter assessment - 14z, 16e, 24c, 24e, 24n, 26f, 28f, 29b
    sea otters important to tourism - 24h
    assessments of impacts inadequate - 23e, 24a,
11. Impacts not analyzed or insufficiently analyzed
    impacts on water temperature - 14i
    impacts on abalone - 14j
    impacts on kelp from multiple harvests - 14q, 25u
    impacts from increased edge effect - 14r, 14s, 14t
    impacts from noise - 14u

impacts from shallow water harvest - 14v
effects of harvesting on critical habitat - 14y, 15a
effects from sewage spills - 14ee, 28g
impacts on fish - 18a
impacts from new harvest techniques - 23b
impacts from ecosystem services lost - 14dd, 25e, 27d, 28c
effects from loss of habitat - 16f, 24t
impacts on beach erosion - 25k, 30a, 30b
impacts on mysids - 25n
cummulative impacts from scientific collecting - 28p
detrimental impacts from artificial reefs - 24s
need to identify reserves - 24p, 25t
safety impacts - 25m
impact analysis generally inadequate - 16b, 16d

12. Informational Errors
kelp growth processes - 14k
sea otter population decline - 24g
sea otter legal protection - 24m
list of kelp cooperative participants - 25i
visual impacts from harvest - 28h, 29k
harvest benefits - underwater photography - 28j, 29l

Note: remainder of comments were considered editorial in nature

8.3 Department's Response to Comments

1. <u>Chris Van Hook, Abalone International, Crescent City</u>

Comment 1: After initial review, the document contains nothing offensive.

Response 1: In general, the Department feels that the existing regulatory framework for managing the commercial harvest of kelp is functioning well. The majority of the proposed changes focus on precautionary measures to limit the potential for resource damage in central California where dominant southern and northern canopy forming kelp species are near their distribution limits. No substantive changes are recommended that would affect commercial harvest in lease beds near Crescent City.

2. <u>Gary Russell, Pacific Abalone Farms, Monterey</u>

Comment 2a: The criteria for Department approval of weighing methods needs to be clarified.

Response 2a: Existing regulations provide for the weighing of kelp by any method approved by the Department. The proposed regulation change effectively restricts acceptable weighing methods to either direct weighing or a volume conversion that has been approved by the Department. The necessity for approval of a volume conversion is not a new requirement.

However, insuring consistency in the approach to converting a volume measure to weight is important since the weight of harvested kelp provides a key data source for management and is required for accurate reporting and payment of harvesting royalties. Given the wide range in the volume of kelp that is harvested, the only reasonable criterion that can be employed is accuracy.

Comment 2b: What criteria will the Commission use to determine whether approval of a kelp harvesting plan is in the public's best interest.

Response 2b: The Commission will consider all relevant resource information and base their decision on the best scientific information available at the time the plan is presented for approval. Approval will hinge on whether the plan reasonably identifies an approach that limits the potential for mechanical harvest related impacts on sensitive resources in the area affected by the regulation (central California north of Santa Rosa Creek). The Environmental Document identified resource concerns associated with harvesting bull kelp in central California (page 4-21). The document also identified a potential for large-scale harvesting practices to impact the most sensitive component of the sea otter population (females with dependent pups within well-established sea otter range) in central California (page 4-9). A harvest plan would, for example, identify measures to avoid use of mechanical harvesters in kelp beds or portions of kelp beds that have mixed canopies (giant kelp and bull kelp). The plan would also identify measures to avoid use of mechanical harvesters in the vicinity of well recognized sea otter rafting sites occupied by large numbers of females with dependent pups. The intent of the proposed regulation change is to provide a method that will allow the ongoing use of mechanical harvesters in an area where taking a precautionary approach is deemed appropriate. Limiting the criteria at the inception of this regulation change does not provide the flexibility needed to achieve that intent.

Comment 2c: What criteria will the Commission use to determine whether imposition of harvest controls under emergency regulation would be in the public's best interest.

Response 2c: While the proposed regulations do not identify specific criteria to be used in determining whether harvest controls are appropriate, the basis for deciding that harvest controls are necessary to protect the state's resources will not be subjective. The Commission will consider all relevant resource information and base their decision on the best scientific information available at the time a proposal is brought to their attention. Since the use of harvest controls will be imposed under emergency regulation, their effect will be time limited. The intent of the proposed regulation change is to provide the Commission with a rapid response management tool that is less onerous than the only approach currently available. Under existing regulation, the only approach available to the Commission to address short-term resource concerns is a complete closure. The criteria identified in the Fish and Game Code (Section 6654) to be used to impose a closure are a finding "that harvesting of kelp will tend to destroy or impair any kelp bed or beds, or parts thereof, or tend to impair or destroy the supply of any food for fish. The foundation or basis for imposing harvest controls should be similarly based.

Comment 2d: "Although I object to the closure of the area between the breakwater and Drake for the purpose of throwing the environmentalists a bone, I understand it."

Response 2d: The closure identified in subsection 165(c)(4)(D) of the proposed regulations was intended to prevent focused harvest on the relatively few giant kelp plants located in that portion of bed 220 closest to Monterey Harbor. The Environmental Document described the damage that repeated harvesting can have on individual plants subject to repeated harvesting (page 4-20). The closure forces harvest pressure into the adjacent unprotected area that has a much higher density of giant kelp. As a consequence, harvest pressure is spread across more individual plants and the potential negative effect on haptera growth is significantly reduced. A secondary benefit is that the closure would tend to minimize or eliminate a resource-use conflict that had developed in the local area between consumptive and non-consumptive users of the kelp canopy.

3. Jenny Pursell, Salinas

Comment 3a: "First of all kelp should be managed to maintain its health and viability for all of the natural ocean systems that depend on it. Once that criteria is met, then we can manage it for harvesting."

Response 3a: The Department agrees with the expressed philosophical basis for managing kelp. It parallels the Legislative intent expressed in Section 1700(a) and Section 7056(b) of the Fish and Game Code.

Comment 3b: "... we need to have the most current scientific knowledge and research to assess what comprises a viable ecosystem. Mr. North's study which was comprised in 1968 is absolutely not adequate to use as an assessment today."

Response 3b: The Department agrees with the view that management needs to be based on the most current scientific knowledge and research. While the Evironmental Document found Dr. North's research to still be relevant, the information basis for evaluating management practices and for formulating proposed regulatory changes was based on a review of over 400 cited documents.

Comment 3c: " ... kelp harvesters themselves should not be able to regulate themselves, ..."

Response 3c: The proposed regulation changes are intended to improve on a management framework previously approved by the Fish and Game Commission and enforced by the Department. That framework imposes government control over the commercial harvest of the state's kelp resources. The only area within the management framework where kelp harvesters can be viewed as regulating themselves might be in some decisions related to harvesting of kelp from leased kelp beds. However, even in that structure, the kelp harvesting practices are constrained by regulation and lease agreement that are intended to insure the continued viability of the state's kelp resources.

Comment 3d: "... the entire coast of California should be regulated not just our local area."

Response 3d: The proposed regulation changes include provisions that affect both statewide and regional harvest practices. However, the Environmental Document did identify a potential for harvest impacts on the state's resources in central California (see Response to Comment 2b for an expanded discussion) that are not present in southern or northern California. Most of the concern over harvest impacts on kelp in central California can be traced to the area being a transition zone between kelp communities dominated by different types of canopy forming kelps. As a result, many of the proposed regulation changes focused on developing a precautionary approach to harvesting in that area. It is the Department's view that kelp harvesting practices in southern and northern California are already being effectively managed.

Comment 3e: "I do not support a no action approach to mange this profoundly important resource."

Response 3e: Comment noted. The Department agrees with the perspective.

4. Ray Fields, The Abalone Farm, Inc., Cayucos

Comment 4a: "It appears to me that the proposed changes in the regulations are directed at the kelp harvesting activities of the abalone growers ... ".

Response 4a: The proposed regulation changes are not directed at the harvesting activities of any particular consumptive user group. A number of the proposed changes do have a geographical component that could affect harvesting activity within central California. However, all typical uses of kelp (aquaculture, herring-eggs-on-kelp, and sodium alginate) have been met by harvesting kelp from central California. A precautionary approach to managing the harvest of kelp in central California is deemed necessary to insure that those activities can be sustained without damaging kelp resources. The Environmental Document identified resource concerns associated with harvesting bull kelp in central California (page 4-21). The document identified a potential for large-scale harvesting practices to impact the most sensitive component of the sea otter population (females with dependent pups within well-established sea otter range) in central California (page 4-9). While influenced by a number of factors, the document also noted that the growth characteristics of giant kelp were such that individual plants cannot support multiple harvests in central California where plants in southern California can (page 4-19). The intent of the proposed regulatory changes is to guide harvesting in that area to insure that the potential for negative impact is minimized. Since California's kelp resources have recently reached their lowest abundance levels, it is prudent to expand existing management measures to insure that the kelp is not damaged by harvest activity. That precautionary approach is most reasonably applied in central California given the discussion provided in the Environmental Document and referenced above.

Comment 4b: "The current regulations have served the state well for many years. In fact, I believe the Department could point to kelp harvesting as an example of one of their best managed fisheries, with sustained harvests for many, many years with no negative impacts on the resource."

Response 4b: The Department agrees that the existing suite of management measures has been effective. However, the Department cannot assert that there have been no negative harvest-related resource impacts on any scale. The large natural fluctuations in canopy biomass that occur through natural causes over very short time periods limits our ability to detect cause-and-affect relationships on short-term scales. The environmental document assertion that the current low biomass was not caused by harvest activity is based on an evaluation that considers long-term changes in canopy biomass changes in both harvest and non-harvest areas.

Comment 4c: "... these proposed changes could have noticeable negative impacts on the abalone aquaculturists who have built their business and invested tremendous amounts of money based on the current regulations and the assumptions that kelp harvesting would remain a legal activity for many years to come."

Response 4c: Nothing in the proposed regulations would result in kelp harvesting becoming an illegal activity. The proposed changes are intended to meet the Commission's policy of providing a supply of kelp for all interested harvesters that can be sustained in ways that are in the best interest of fish and wildlife resources. The proposed regulations should not have a negative impact on abalone aquaculturists, the intent is not to prevent harvest but to employ a precautionary approach where it is most needed to guide that harvest in a resource sensitive way.

Comment 4d: "I don't believe the Department should be proposing actions detrimental to aquaculture when there is no danger to the natural resources."

Response 4d: The Department agrees with the comment. However, the Department cannot assert that there is no danger to the natural resources. As indicated above, it is difficult to detect short-term negative impacts to kelp. Since, kelp resources are at their lowest biomass levels and the environmental document identified concerns over potential impacts to bull kelp and to sensitive components of the sea otter population, it is prudent to adopt a precautionary approach, particularly in central California. That approach is intended to minimize the potential for negative impacts while still allowing harvest activities to continue.

Comment 4e: "Given this downward trend in harvesting, I don't understand the need for more restrictive regulations."

Response 4e: The assertion that there is a downward trend in harvesting is correct. In fact, the 1999 harvest total was the third lowest recorded since 1925. However, that does not mean that the proposed regulation changes are unnecessary. The environmental document also noted that canopy biomass is at an all-time low. The focus of the proposed changes was on minimizing potential for impacts over smaller geographic distances than those reflected by statewide harvest totals. They focus on those areas deemed to be most sensitive to potential for harvest-related impacts and reflect the view that a precautionary approach is prudent under existing circumstances (See response 4a).

Comment 4f: In reference to proposed regulation change Section 165(c)(4) - "What does this mean (properly harvested), and what is the intended purpose? It seems to me that if you are harvesting kelp in compliance with the state's regulations, you are by definition 'properly harvesting'."

Response 4f: The term 'properly harvested' is not used in a legal sense as the comment would suggest. Rather, it is used to reflect the intent to develop a set of regulations that meet both the Commission's and the Legislature's policy guidelines for harvesting kelp. Those policy guidelines can be found in Commission policy published pursuant to Section 703 of the Fish and Game Code and in Section's 1700 and 7050 of the Fish and Game Code. Existing regulations provide the Commission with processes for <u>prohibiting</u> the harvest of kelp. The proposed language in this subsection reflects the fact that a following subsection (subsection 165(c)(4)(E)) provides the Commission with a process for <u>limiting</u> the harvest of kelp. It is the

Department's view that the addition of a less onerous response to resource concerns (limiting rather than prohibiting harvest) would be a valuable addition to the Commission's range of management options.

Comment 4g: "What criteria would be evaluated in the decision to close a bed? Who is responsible for bringing this data to the commission"

Response 4g: While not part of the proposed regulatory changes, the criteria for bed closure can be found in Section 6654 of the Fish and Game Code states "If, at any time, the commission find that the harvesting of kelp will tend to destroy or impair any kelp bed or beds, or parts thereof, or tend to impair or destroy the supply of any food for fish, the department shall serve notice ..." A request to impose a closure can come to the Commission from anyone. The Department anticipates that most requests would come from affected parties, other responsible agencies, or the Department.

Comment 4h: "I am afraid that certain parties or individuals will use this regulation to petition the commission for closure of beds or areas of beds on a regular basis, ... "

Response 4h: There is nothing in existing regulation to prevent anyone from making repeated requests for bed or area closures. However, that possibility has not been realized. If it becomes an issue that is brought repeatedly to the Commission without merit, the Commission has the ability to respond in ways that would not necessitate an ongoing or repeated response to the request from the aquaculture industry.

Comment 4i: "This section [note subsection 165(c)(4)] also appears to be redundant with Section (c)(4)(E).

Response 4i: In drafting the proposed regulation changes, the Department intended to use subsections 165(c)(4)(A) through 165(c)(4)(E) to identify in specific terms how the Commission would implement the general provision provided in 165(c)(4). In that sense there is some redundancy. The regulations have been modified to clarify that intent.

Comment 4j: "The dates [for a bull kelp harvest closure within the Monterey Bay National Marine Sanctuary] need to be clarified.

Response 4j: The environmental document text (pg 2-3) is incorrect and will be modified to reflect the dates that are provided in the proposed regulation changes.

Comment 4k: " ... but either way this regulation is counter-productive, as it limits an abalone grower's ability to use drift bull kelp. I would think that the state and the MNMS would rather have the grower using drift kelp that is already technically dead as opposed to harvesting growing Macrocystis. I would propose that at the least the wording be changed to "*no harvesting of <u>attached</u> Nereocystis plants from the period*". ... , so what is being accomplished with this additional regulation."

Response 4k: The comment suggests that including drift bull kelp in the seasonal/area prohibition on harvest of that species (subsection 165(c)(4)(B)) would be counterproductive because it would focus harvest pressure on attached or drift giant kelp. The seasonal closure, initially requested by the Monterey Bay National Marine Sanctuary (MBNMS), provides a mechanism to limit harvest pressure on bull kelp near the southern limits of that species's range (where it is considered to be stressed) by imposing a closure during a time frame where the plants are at a reproductive peak (see pg 3-8). Including drift bull kelp in the closure is necessary for several reasons: 1) plants that drift may live for several months and can become an important kelp dispersal agent (pg 3-47); and 2) allowing possession of drift bull kelp would make the closure largely unenforceable because it is very difficult or impossible (depending on how long a plant has been drifiting) for enforcement staff to determine whether the plant was attached at the time of harvest. While the amount of bull kelp that is harvested in the area is currently limited, the Department and the MBNMS believe that a precautionary approach to harvesting bull kelp is warranted in that area. Shifting harvest demand to attached or drift giant kelp during that seasonal time frame is a reasonable and resource sensitive way to meet existing and future demand for kelp.

Comment 4l: What is the regulation [comment refers to proposed regulation change subsection 165(c)(4)(C)] trying to accomplish? .... The Department is potentially restricting mechanical harvesting of giant kelp from almost half of the California coastline."

Response 4l: See response to comment 2b that identifies what the proposed change is intended to accomplish. Existing regulations prohibit the use of mechanical harvesters in the area north of Point Montera, San Mateo county. With implementation of the proposed regulation change, mechanical harvesting techniques could be used to harvest giant kelp along more of the California coast line rather than less.

Comment 4m: "What constitutes a valid plan that would be approved by the commission? How long will it take to get approval? How long will commission approval remain in effect, ... ? I can tell you our plan right now - Drive boat to kelp bed, harvest kelp, return to port. .... Is this an approvable plan?"

Response 4m: The Department would work with individual harvesters to develop a plan that allowed the use of mechanical harvesters to harvest giant kelp in a resource sensitive way in the area affected by the proposed regulation change. A valid plan would address resource concerns, particularly those identified in the environmental document (see response to comment 2b). The proposed regulations did not identify specific resource issues in order to allow the Commission, the Department, and the affected users the flexibility to address unanticipated problems through a cooperative process. It is similar to many management approaches currently in use where maintaining flexibility is desirable (permitting process and Compliance Agreements, for example). Approval of a harvest plan would require one Commission meeting and might never need to be changed. That is, it would remain in effect until environmental changes necessitated review. For example, one intended purpose of the harvest plan would be to insure that mechanical harvesters avoided kelp beds with a canopy that was formed by significant amounts of bull kelp as well as giant kelp. While there has been long-term consistency in the relative composition of most beds, there are changes in composition (presence or mixture of bull kelp) in some beds. A prohibition on the use of mechanical harvesters in any bed with a mixture of bull kelp would be unreasonably prohibitive. The use of a plan would allow flexibility that can achieve a reasoned balance. A good plan would, for example, identify the kelp beds proposed for harvest and provide an alternative bed for harvesting if notified by the Department that the composition of the preferred bed had changed significantly. Another example might help clarify. A good harvest plan would allow the Department to identify rafting sites that have frequently been used by large numbers of female sea otters with dependent pups and provide a plan for harvesting that would avoid their immediate vicinity. That would allow the removal of larger quantities of giant kelp from a kelp bed in a way that would not have an effect on the foraging or resting strategies used by this sensitive component of the otter population. The alternative, in this instance, would be to impose a regulatory restriction on the use of mechanical harvesters on a kelp bed by kelp bed basis. At issue here is not whether some constraint is warranted to address resource concerns, but rather how to achieve Commission and Legislative policy in a way that minimizes the impacts to consumptive users of kelp. It is the Departments belief that the development of strict criteria in regulation would result in more restrictive regulation without additionAL benefit to the resource.

Comment 4n: 'I have serious concerns about how this regulation [comment referring to proposed regulation change subsection 165(c)(4)(E)] would be implemented. ..., who presents the information to the commission? ... How does the commission decide if a control area is needed. How do they set weekly limits?

Response 4n: The request to impose an area closure under emergency regulation could come from the public, affected users, responsible agencies, or the Department. The Commission would take both public comment and recommendations from the Department as to the necessity for imposing a short-term control on harvest. The basis for a determination that a control on harvesting was warranted and what cumulative individual harvest limit was appropriate would be based on the best available scientific information. The Commission would rely on both public comment and Department recommendation in the process of reaching a decision. The Department's recommendations would be based on the relationship between available kelp canopy biomass in the general area, general kelp growth characteristics for that area, and anticipated local demand for kelp. The goal would be to achieve Commission and Legislative policy while minimizing the impact to all likely consumptive users. For example, if the Commission were convinced that current demand for kelp in an area was likely to exceed the ability of the kelp in that area to meet the demand without significant risk of damage, they would parcel what can safely be provided (given local kelp growth characteristics) across all users to minimize the impact to businesses that are dependent on that kelp.

It is reasonable to add a mechanism for a removal of the control should kelp growth characteristics exceed that anticipated when the duration of the control was initially established. The Department feels that the language can be added to the specified control period by the Commission as a routine provision that allows the Department to remove the controls as soon as possible recognizing that the controls are not to extend beyond the period approved by the Commission. The Department does not anticipate frivolous or frequent use of this mechanism. However, interest in its application in some areas will depend on the compatibility of consumptive and non-consumptive uses of the kelp. If requests repetitively came before the Commission for action under emergency regulation, the Department would seek other less-flexible solutions.

Comment 4o: " ... the Department is not noted for keeping up to date information on their web page - in mid 1999 I was reading all about the S. California sport abalone regulations, despite the fact that all abalone harvest was curtailed in mid 1997. Now they are proposing to gather information from all kelp harvesters and post it on the web on a daily basis?

Response 4o: The Department recognizes that it can improve its communication with constituents and is committed to doing so. However, the comparison provided in the comment is not directly applicable in this instance. Responsibility for updating the information on the web page to help insure compliance will be assigned to one individual that has a focus on kelp management processes.

The comments suggest some confusion as to the process being proposed. The cumulative tonnage limit within any consecutive 7-day period will be applied to individual harvesters and not a cumulative limit for all harvesters combined. The Department does not plan on capturing and posting information on the web about individual harvest activities. Enforcement of individual harvest controls will be based on landing records. The only information that will be posted on the web will relate to the Commission's decision - where they have imposed a harvest control, how long the control will last, and the individual harvest limits that cannot be exceeded by a harvester during any consecutive 7-day period. That information will only be posted once - immediately after the Commission reaches a decision.

Comment 4p: "If this is the Department's solution to the user conflicts occurring in Bed 220, then I believe it is not a solution at all, but will merely exacerbate the problem and prolong the conflict. ... I can easily see them using this new regulation to attempt to limit or eliminate kelp harvesting in other portions of Bed 220 and beyond."

Response 4p: The proposed regulation has no geographical limitations on its application. However, it potentially could be used to limit harvest in Bed 220 and non-consumptive users could bring the issue to the Commission's attention. However, the Department would oppose the imposition of harvest controls as an indirect method for addressing a user conflict by eliminating consumptive use of kelp in areas of social conflict. It would not achieve Commission or Legislative policy on human use of kelp. The intent of the proposed regulation is to provide a strategy for addressing resource concerns in a less burdensome way than can be achieved with existing regulations. Under existing regulations, the same non-consumptive interests could approach the Commission and express concerns over the potential for impacts to the kelp resource from harvest. However, under existing regulations, the Commissions only response, should they determine that a resource concern exists, is to close the bed to harvesting.

Comment 4q: "Again, I feel these proposed changes to the regulations are strongly biased against the abalone growers, and could have potentially devastating impacts. .... The abalone growers, on the other hand, are dependent upon a few kelp beds close to harbors."

Response 4q: The Department recognizes the abalone aquaculture industry's dependence on a safe and dependable local source of kelp. That recognition helped guide the development of the proposed changes that address the resource concerns in central California in a way that would allow those business activities to continue. The proposed regulation changes do not express a Department bias against abalone growers. The Department and Commission are mandated to encourage the development of aquaculture, including abalone aquaculture. Absent legislative change, those mandates will continue to guide all current and future Department and Commission decisions with regard to these issues.

5. Dr. David Ebert, US Abalone. Davenport

Comment 5a: Amendment 3 was considered and rejected by the Monterey Bay National Marine Sanctuary Advisory Council. This Council represents a cross-section of the community.

Response 5a: The comment refers to item number 3 in Chapter 2, subsection 2.1 Proposed Project. That item states "Regulations controlling the commercial harvest of bull kelp (section 165(c)) should be amended to restrict acceptable harvest methods and seasons to protect that species near the southern limits of its geographic distribution;" As such, it is a general statement reflecting the Department's belief that changes to current methods for regulating the harvest of bull kelp near the species southern range limits are warranted. The specific changes suggested to meet that goal are found in subsections 4(A) and 4(B) of proposed regulations. Subsection 4(A) suggests moving a current boundary restriction that requires hand harvesting of bull kelp in nonleased kelp beds north of Point Montera, San Mateo County to Santa Rosa Creek, San Luis Obispo County. Subsection 4(B) suggests imposing a seasonal closure on the harvest of bull kelp in nonleased beds within the Monterey Bay National Marine Sanctuary. The Sanctuary provided the Department with a matrix that showed the Sanctuary's draft recommendations, the Advisory Council's resolution on each recommendation, and the Sanctuary's final recommendation. When reviewed, it is apparent that the Advisory Council never considered seasonal closures. The seasonal closure was the final Sanctuary recommendation that started as a draft recommendation to prohibit hand harvesting of bull kelp within the Sanctuary. The Advisory Council's resolution recommending excluding draft recommendation #5 only referred to the prohibition on hand harvesting. The Department has not recommended prohibiting hand harvesting of bull kelp. Consequently, the assertion that the proposed regulation changes had been considered and rejected by the Sanctuary's Advisory Council is not correct.

Regardless of the differences noted above, the Department's evaluation suggested that further controls on the harvesting of bull kelp in Central California were warranted. The Department felt that hand harvesting of bull kelp could reasonably meet Commission's policy to insure a supply of kelp for all interested harvesters in a way that would not impact that resource or the system of which it is a part. The Department's decision to include a seasonal closure as a proposed regulatory change was based on the Sanctuary's recommendations and was made in recognition of the Sanctuary's authority to regulate kelp harvesting within the Sanctuary's boundaries. It also reflected the Department's view that implementation would provide an opportunity to evaluate an alternative method for controlling harvest of bull kelp in this sensitive area.

Comment 5b: "... bull kelp beds only start in Bed #224 which is approximately 15 miles north of Santa Cruz. There are no bull kelp beds in the areas where kelp is harvested. The bull kelp that is taken is either drift or beach wrack, neither of which is reproductively viable. This recommendation does not appear to have any resource or scientific basis, nor does it appear to have any bearing on the user conflict along Cannery Row."

Response 5b: The proposed regulation changes that would guide the harvesting of bull kelp were not developed to address user conflict. They were developed in recognition of the potential for harvest pressure to impact this species in an area where it is already stressed. The characterization that the species is stressed in central California reflects the view that all species are stressed near the geographical limits of their distribtution. Central California is near the bull kelp's southern distribution limit. The comment is incorrect is the characterization of the spatial distribution of bull kelp in central California. Both mixed beds (beds with giant and bull kelp) and pure bull kelp beds are found within the Sanctuary's boundary south of Monterey. For example, the kelp bed at Beckett's Reef near Ragged Point is almost a pure bull kelp bed.

The Department has clarified its proposed regulations based on public comment. The proposed modification clarifies that the seasonal closure on the harvest of bull kelp does not prohibit the removal of kelp from beaches. However, the resource and scientific basis for the proposed regulations does extend to regulating the use of drift bull kelp. The prohibition on the use of drift kelp during the closure is necessary for enforcement purposes. Enforcement staff could not differentiate hand-harvested kelp from drift kelp once it is on board a vessel. The prohibition also recognizes that drift bull kelp is reproductively viable (contrary to the assertion made in the comment). The timing of the seasonal closure was chosen to limit harvest impacts during a reproductive peak period. Drift bull kelp acts as an effective dispersal mechanism for the species and has a role in the maintenance of the species in this area.

Comment 5c: "The importance of bull kelp to my operation is vital as during the fall through spring months, during periods of inclement weather we use the drift kelp to sustain our abalone. If we are unable to collect bull kelp as beach wrack or drift in the months of September through April it would mean ... "

Response 5c: The seasonal closure identified in the proposed regulations would not affect use of drift kelp or beach wrack from September through February. The Department has modified its proposed regulations to recognize that removal of bull kelp that is part of the beach wrack is not prohibited during the closure period. Consequently, bull kelp would be available for consumptive uses during the entire closure period, including April. The only proposed regulation that would affect this operation is the requirement to hand harvest bull kelp in the area used by US Abalone.

Comment 5d: "... the Cities of Monterey and Santa Cruz annually bury ... If this recommendation were to pass as proposed, the burying of bull kelp by these Cities would in effect be a violation of the law during the closed months."

Response 5d: The removal of beach wrack by Cities are not activities conducted under the authority of a kelp harvesting permit. Consequently, the would not be affected by the proposed regulations. However, as indicated in Response 5b above, the Department has clarified its regulations to allow use of beach wrack during the time period and within the area affected by the seasonal closure. That change was made in recognition that bull kelp in beach wrack can no longer contribute to the species reproductive processes and will soon contribute only organic material as a breakdown product.

Comment 5e: "This regulation is vague and does not indicate or specify how a closure would be determined. As kelp beds are highly variable, changing quite rapidly in a very short time frame, this proposed amendment as stated could severely impact businesses, such as abalone farmers, who depend on kelp for survival."

Response 5e: The comment refers to item number 6 is Chapter 2, subsection 2.1 Proposed Regulations and is a general summary statement that reflects the proposed change found in subsection (c)(4)(E) that provide for imposition of harvest controls under emergency regulation to address short-term but significant resource concerns. The intent of the regulation change is to propose another management process that is less burdensome to consumptive users than the only process currently available to the Fish and Game Commission to address resource concerns associated with harvesting of kelp. Under existing law (Fish and Game Code Section 6654), the Commission can close beds if the Commission finds that harvesting of kelp will tend to destroy or impair any kelp bed, or parts thereof, or tend to impair or destroy the supply of any food for fish. The proposed change, if implemented, would allow the Commission to also consider limiting harvest to achieve the same goal. The Department has clarified the intent of that proposed regulation change by adding clarifying language to reflect legislative intent. The clarifying language is expanded to include concerns over impacts to marine mammals based on the potential for impact to sensitive components of the sea otter population in central California.

Comment 5f: The reasons for the proposed regulation change (subsection (c)(4)) is unclear. Harvesting that is conducted as required by regulation is properly harvested.

Response 5f: It is apparent that the use of the term 'properly harvested' has been interpreted from a legal perspective when the intent was to express Legislative intent. To clarify, the Department has modified the subject subsection to directly reflect that intent. The modification eliminates use of the term 'properly harvested' and inserts Legislative intent with the following language "If, at any time, the commission finds that the harvesting of kelp will tend to destroy or impair any kelp bed or beds, or parts thereof, or tend to impair or destroy the supply of food for fish or marine mammals, the commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time." With that intent clarified, the proposed regulation only offers the Commission a process that would be a less burdensome solution for consumptive users than that which is currently available to address resource concerns.

Comment 5g: See comments under Amendment #3 (comment 5a in this Chapter)

Response 5g: See response to comment 5a.

Comment 5h: The Commission is urged to reject proposed amendment (c)(4)(C). It was considered and rejected by the Monterey Bay National Marine Sanctuary's Advisory Council. Mechanical harvesting was not a subject of comment in the Department's 1995 review of kelp management practices and limiting the use of mechanical harvesters does not address the real issue which is the controversy over harvesting along Cannery Row.

Comment 5h: In reviewing the matrix identified in response 5a, the only mention of mechanical harvesting is found in recommendation 3 that suggests use of a special permit to hand harvest kelp in beds north of bed 218. The Department's proposed regulation change does not prohibit use of mechanical harvesters to harvest giant kelp anywhere within the Sanctuary. Thus, the Advisory Council's rejection of the subject recommendation does not reflect an evaluation of Department's proposed regulation change. The Department sees an advantage in allowing the use of mechanical harvesters to harvest giant kelp within the central California area. However, the Department also recognized the potential for resource impacts from larger-scale harvesting within this sensitive area. See response to comment 4m for a discussion of the resource concerns. Those concerns formed the foundation or basis for the recommended change. This proposed change was not recommended to address controversy over harvesting along Cannery Row.

The Department's intent in recommending this change was to develop a pro active process that would guide the use of mechanical harvesters away from resource sensitive areas. In addition to recognizing the resource concerns mentioned above, the Department was aware of the potential for growth in the use of mechanical harvesters within the central California area. The Department has clarified the proposed regulation to identify the elements that would need to be addressed in a harvest plan in order to obtain Commission approval. That clarification largely limits the concerns over subjectivity in the Commission's approval or rejection of harvest plans and links appoval to achieving Legislative intent.

Comment 5i: The Commission is urged to reject proposed amendment (c)(4)(E). The language is vague and the intent is not clear. Data provided with the comment letter indicates that kelp harvesters remove a very small proportion of total biomass available within beds 220, 221, and 222.

Response 5i: Amendment (c)(4)(E) recommends establishing a process for imposing harvest controls for limited periods of time under emergency regulation to address short-term resource concerns. Without evaluating the accuracy of the figures presented in the comment letter, the Department accepts that the current kelp harvesting practices within the beds mentioned and within the state on average take a very small proportion of average available kelp biomass. However, in order for those proportional relationships to have relevance, kelp harvesting activity would have to be distributed evenly throughout kelp beds and it is not. Existing harvest practice can focus harvest pressure in a localized area and result in repeated harvesting of relatively few plants. That practice was evident in bed 220 in the Monterey area and research has suggested that it could impact the viability of individual plants within the localized area by affecting haptera growth. The implementation of this proposed change allows the Commission to reduce potential harvest related impacts to less-than-significant levels in a less burdensome way than through the total closure of an area to harvesting.

Comment 5j: " ... the main flaw with the Report is that it never clarified why any regulatory changes are needed or what these changes will accomplish. To the contrary the Report states that the proposed changes will have no significant effect on the kelp resources, but will impact the abalone growers who account for 1.7% of the kelp harvested statewide."

Response 5j: Chapter 4 of the Environmental Document identified concerns over potential harvest impacts to giant and bull kelp in the central California area. That Chapter also identified potential indirect harvest impacts to a sensitive component of the sea otter population. Many of the proposed regulation changes were intended to reduce the potential for these impacts to be realized while still providing for kelp harvest opportunities.

The California Environmental Quality Act requires an evaluation of potential project impacts. The conclusion reached in the Environmental Document is that the proposed project (a suite of regulatory changes) would have no <u>negative</u> effect on kelp resources. Through implementation of the proposed changes to augment existing regulations, commercial harvest of kelp can contribute to the State's economy without impact to the State's resources. The last portion of the comment (... but will impact the abalone growers who ...) was not an assertion made in the Environmental Document. It appears to be a conclusion reached by Dr. Ebert. The Department believes the proposed regulations can be implemented in a way that will have no negative effects those business activities.

6. William Douros, Superintendent, Monterey Bay National Marine Sanctuary

Comment 6a: The Environmental Document does not analyze the revenues generated from kelp harvesting activities and the costs of kelp resource management in the State's draft document. The MBNMS requests that the Commission direct the Department to add this analysis to the final CEQA document.

Response 6a: Existing law (Fish and Game Code Section 6680) requires the collection of royalties as prescribed by the Commission. However, their distribution for expenditure is based on the appropriation process and is not linked by statute to kelp management. To be linked, the revenues generated from permit fees and royalties from harvesting kelp would have to go to a dedicated account for kelp management and that account has not been created through the Legislative process. The Department's Marine Region budget allocation comes from a variety of funding sources. The Marine Region then goes through a priority setting exercise to insure that available funds are directed toward priority resource issues, including kelp management. Flexibility in those distributions allows the Marine Region to respond with maximum efficiency at any given funding level. Given that appropriation process, providing the analysis does not provide insight into the efficacy of the Department's kelp management processes or its evaluation of the proposed project.

Comment 6b: The MBNMS urges the State to adopt the Charthouse restaurant as the northern end point of the no-harvest area in bed 220 to reflect a compromise reached by the Sanctuary's Advisory Council from competing alternatives.

Response 6b: The Department appreciates the extensive public involvement process used by the Sanctuary and the Sanctuary's Advisory Council to develop their recommendations and recognizes that their recommendation reflects the best compromise boundary location. The Department selected a different location because the compromise boundary location recommended by the Sanctuary was not easily enforced. In order to enforce a closure, the Department's enforcement staff and harvesters need to know exactly where the boundary line is located under a variety of viewing conditions. The Department selected a location that allows a visual extension of a line from land (a prominent street) across the kelp bed that clearly establishes location under good viewing conditions. No such line can be visually drawn using the Charthouse as a boundary marker. The selected location also has a prominent change in the configuration of the kelp canopy that can guide harvesters to the open area even when the shore line is not visible. That feature is not available if the Sanctuary's recommended boundary location is used.

Comment 6c: The Sanctuary believes the less restrictive strategy proposed by the Department would be acceptable. It is more consistent with the recommendation of the Sanctuary's Advisory Council that there be no restriction on mechanical harvesting.

Response 6c; The Department appreciates the Sanctuary's concurrence with the proposed regulation. In the Department's view the proposed regulation is neither more or less restrictive than the Sanctuary's recommendation. It is an adaptive management strategy that can have varying results depending on how harvest practices develop in the future.

Comment 6d: The Sanctuary is pleased to see its recommendation for seasonal restriction of bull kelp included in the proposed regulations.

Response 6d: Comment noted.

Comment 6e: While not requiring regulatory change, the Sanctuary would like to see an endorsement of the concepts proposed in their recommendations regarding enhancement, enforcement, and educational activities (recommendations # 7, # 9, and # 10 in their attached list) by the Commission and incorporated into the CEQA document.

Response 6e: These recommendations differ slightly in numbering from those provided in a matrix provided by the Sanctuary. In the matrix, recommendation # 9 recommends closure of specific beds in central California which would require a regulatory change. The Department concurs that making data on kelp harvesting available to the public and discussions on enhancement or the efficacy of monitoring and enforcement do not require regulatory changes. The Department is willing to engage in discussion on these issues but would prefer to keep them separate from a process that is focused on regulation change. The type of acknowledgment sought in the comment might best be achieved through a Memorandum of Understanding.

Comment 6f: The Sanctuary endorses the criteria method used to close specific beds that have historically had little kelp canopy. However, a small bed may have just enough kelp to warrant opening under this process. The Sanctuary would like to have beds that have between ½ and 1 square mile of canopy defined automatically as harvest control areas.

Response 6f: The proposed regulatory change that would provide for imposition of harvest control areas was intended to address unforeseeable short-term resource issues. Under existing regulations the only response available to the Commission is a bed closure. Implementation of harvest controls would occur through emergency regulation and would, as a result, be limited in duration. Consequently, this process would not work as a long-term solution to limit harvest within beds that have a canopy size just beyond that which was used to shift beds into a closure status. The beds proposed for closure in these regulation changes have had little canopy in every statewide survey conducted by the Department. In the situation of concern to the Sanctuary, the Commission can either: 1) impose a bed closure if harvest pressure places resources at risk, or 2) impose harvest controls under the same circumstances through emergency regulation while formal regulation changes were pursued.

Comment 6g: The Sanctuary requests that the Commission endorse the notion that the definition of the term "take" includes plants such as kelp.

Response 6g: The request is beyond the scope of this CEQA document and has been conveyed to the Commission.

NOTE: verbal comments captured from notes and expressed in responses below

7. <u>Justin Malan, California Aquaculture Association - Verbal Comments Presented at 2 February 2001 Fish and Game Commision Meeting in Sacramento</u>

Comments / Responses: Note: all comments were also presented in written form - please see response to comments # 17.

8. Dr David Ebert, US Abalone - Verbal Comments Presented at 2 February 2001 Fish and Game Commission Meeting in Sacramento

Comments / Responses: Note: all comments were also presented in written form - please see response to comments # 5.

9. Ray Fields, The Abalone Farm - Verbal Comments Presented at 2 February 2001 Fish and Game Commission Meeting in Sacramento

Comments / Responses: Note: all comments were also presented in written form - please see response to comments # 4.

10. Aaron King, Monterey Bay National Marine Sanctuary - Verbal Comments Presented at 2 February 2001 Fish and Game Commission Meeting in Sacramento

Comments / Responses: Note: all comments were also presented in written form - please see response to comments # 6.

11. Arthur Seavey, Monterey Abalone Company - Verbal Comments Presented at 2 February 2001 Fish and Game Commission Meeting in Sacramento

Comment 11a: There is no evidence to demonstrate that harvesting practices are having an impact on kelp resources.

Response 11a: The natural highly variable nature of kelp canopy abundance makes it virtually impossible to establish a cause and effect relationship between kelp harvesting practices and changes in kelp abundance. It is the Department's view that a precautionary approach is warranted in certain areas (specifically central California), particularly since kelp is currently in low abundance as a result of El Nino related changes. The assessment that a precautionary approach is warranted is based on research results that suggest that certain harvest practices could cause damage to kelp beds or associated organisms. Please see response to comments 4a, 4d, and 5j.

Comments / Responses:Note: all other comments were also presented in written form - please see respone to comments #13.

12. Gary Russell, Pacific Abalone Farm - Verbal Comments Presented at 2 February 2001 Fish and Game Commission Meeting in Sacramento

Comment 12a: I need access to drift bull kelp between November and April. I have no other alternative for abalone feed.

Response 12a: Nothing in the proposed regulations would prevent the use of drift bull kelp between November and April. Based on public comment, the proposed regulations have been clarified to make it clear that the seasonal closure does not restrict use of beach wrack during the seasonal closure on harvest of attached or drift bull kelp (April 1 - July 31).

Comment 12b: Given safety concerns related to weather changes, I would like to have access to the closure. I prefer the Drakes Street boundary for the closure over that proposed by the Sanctuary.

Response 12b: The Department recognized the safety concerns and did not see the necessity of imposing a closure that would force harvesters into unsafe areas. The area west of Drake Street (which remains open) has equal protection from inclement weather.

Comments / Responses: Note: all other comments were also presented in written form - please see response to comments #2.

13. <u>Arthur Seavey and Joseph Cavanaugh, Monterey Abalone Farm</u>

Comment 13a: We feel that the wording of subsection (c)(4) and (c)(4)(E) is vague and should be stricken or restructured to provide more precise language.

Response 13a: In response to public comment the Department has clarified those subsections. Please see response to comments 2c, 4f, 4n, 5e, 5f, and 5i.

Comment 13b: A portion of bed 220 was establish as a no-kelp-harvest area a couple of years ago to use it as a control in a study of effects of kelp harvesting. No studies have been conducted. It is now proposed as a way to separate user groups. Although there is little or no interaction between user groups in that, or other areas.

Response 13b: The Department did not establish a no-kelp-harvest area and did not commit to a study using this area as a control. Any limitations on harvest were self-imposed and conducted under guidelines of a cooperative effort. In the Department's view the proposed closure addresses a resource issue. Resolution of a user conflict is a secondary consideration. Please see response to comments 2d and 6b.

Comment 13c: A seaward boundary of the no-harvest area needs to be established. The comment letter suggests a boundary location and suggests use of bouys. The comment addresses a Sanctuary recommendation for a closure out to the 100 foot contour and points out safety and enforcement concerns.

Response 13c: The Department appreciates the careful consideration given to this issue. In considering how to structure the regulation for effective enforcement, the Department determined that a seaward boundary would be problematic. Kelp bed configuration changes through time. A seaward boundary could, as a result, end up being within the kelp canopy in years when canopy distribution spread into deeper water. Without a seaward boundary, the closure would be enforceable under any changes in canopy depth distribution.

Comment 13d: It should be noted that an educational effort to inform the public about the positive impacts of regulated kelp harvesting would help avoid user conflict. Signs explaining how and what harvested kelp is used for would be an inexpensive and effective way to educate the public about the benefits derived from kelp harvesting.

Response 13d: The comment is noted; however, it goes beyond the scope of a CEQA evaluation of the proposed project (regulation change).

14. <u>David Dilworth, Helping Our Peninsula's Environment</u>

Comment 14a: The collapse of animals interdependent upon kelp forests should be a red flag. Kelp extraction impacts are preventable and add to cumulative damage. As such, it is time to stop man-made damage until we begin to reverse the impacts.

Response 14a: The Department agrees that kelp harvest impacts are preventable. The assessment presented in the Environmental Document indicates that, on a large statewide scale, existing regulations are adequate to prevent harvest pressures from contributing to the cumulative impacts described in the comment. The suggested suite of regulatory changes proposed by the Department take a precautionary approach in addressing a recognized potential for localized impacts. Combined, they can guide harvest activities in a way that provides economic benefit without adding to the cumulative damage of concern to all.

Comment 14b: The Environmental Document would be improved through consultation with federal experts and with the addition of their Biological Opinions regarding potential impacts to marine mammals and endangered species.

Response 14b: The Department worked closely with the Monterey Bay National Marine Sanctuary staff in the development of the recommended regulatory changes. Neither that federal agency nor the Department felt that there was a need or a requirement to obtain a formal Biological Opinion. However, the Department did feel that a precautionary approach to harvesting in central California was warranted. One of the benefits of the suggested approach would be the development of harvest plans that would guide harvesting pressure away from kelp-canopy habitat used by the most sensitive component of the California sea otter population.

Comment 14c: There is little quantification of potentially significant environmental impacts. Please disclose all quantitative criteria used.

Response 14c: The Environmental Document provides all the quantitative criteria used in assessing potential environmental impacts. Most of the potentially significant impacts were those related to biological resources. While based on the best scientific information available, many of those assessments also had a significant subjective element. They combined results from focused research on potential harvest impacts with a subjective evaluation of general harvest practices to determine whether regulatory changes were warranted. Recognizing the lack of a quantitative assessment in every area of concern, the Department took a precautionary approach in developing proposed regulation changes. The Department also developed certain regulations that could be adaptive in nature to respond to resource problems should harvest practices change in the future.

Comment 14d: This controversy is not simply a user conflict. There is a concern over the removal of any large areas of critical habitat.

Response 14d: The Department agrees with this assessment and believes the cited section (p 6-1) is taken out of context. That section referred to one of the elements considered (user conflict) in developing proposed regulation changes. All of the proposed regulation changes, including the proposed closure of a portion of bed 220, were developed to reduce potentially significant biological impacts to a less-than-significant level. In this case, the same proposed regulation change addressed both the user conflict and the potential for harvest practices to damage the local kelp community. With the proposed regulation change, the potential for harvesting activity to result in the loss of critical habitat is reduced to less-than-significant levels even on the scale of individual plants. The Department does not view the temporary removal of a small portion of kelp canopy as a loss of critical habitat.

Comment 14e: "The DEIR purpose (p 2-4) related to protecting natural phenomena is only stated in the negative - it does not state positively or clearly what the goal is."

Response 14e: The purpose and goal of Environmental Document are clearly stated. The Department's regulatory authority with regard to meeting its stewardship responsibility in this specific can only be expressed through regulations that control the human harvest of kelp. That intent is clearly stated in Section 2-1 and 2-2.

Comment 14f: "One-fourth ... shall remain unleased ..." yet that fourth is available for new commercial use. One can't have both - a fourth either remains open or is used."

Response 14f: Without a page reference, the Department cannot determine the source of the quote to offer further clarification. However, it is clear that there is some confusion over the use of the term 'leased', 'open', and 'used' . Fish and Game Commission policy requires that approximately one-fourth of the total area of the state's kelp beds, as designated by the Department, shall remain unleased and thus open to any licensed harvester.

Comment 14g: "The DEIR" often analyzes only what is restricted - not on what is allowed. ... The "No action" alternative uses this novel view and implies it is the same as a no-project Alternative. This in not correct. ... The baseline also improperly attempts to sell this concept. Since the Agency has the authority to prevent all kelp extraction, the baseline is not continued kelp extraction, it is zero kelp extraction"

Response 14g: The Legislature (Fish and Game Code Chapter 6) clearly provides for human harvest of kelp. That Chapter provides the Commission with the authority to regulate that harvest as may be necessary to insure the proper harvesting of kelp and other aquatic plants. Commission policy provides for the human harvest of kelp (see Response to Comment 14f). From that perspective, the focus of the Environmental Document - what is currently restricted and what should be restricted - is appropriate. A No action alternative, (no change) is not the same as a no-project alternative because there is already an existing suite of law and regulation that authorizes the commercial harvest of kelp. This Environmental Document only evaluates potential impacts associated with making changes to those regulations. With no action, harvesting would continue under existing regulation. The Department does not feel that a zero kelp harvest policy is warranted. Much of the analysis provided in Chapter 4 speak to that issue.

Comment 14h: The Environmental Document overlooked the Stellar Sea Lion.

Comment 14h: The Stellar Sea Lion is not a recognized component of the kelp bed community. Kelp harvesting activity would not impact preferred habitat or the Stellar Sea Lion's prey base. Kelp harvesting activity would not impact the Stellar Sea Lion's use of the Monterey Coast Guard pier as a haul-out site. However, the proposed closure of that portion of bed 220 nearest the breakwater would reduce human activity, including boating activity, in the vicinity by a very small percentage.

Comment 14i: "Removal of kelp canopy can change the water temperature by changing sunlight reaching the mid and bottom seawater column, decreased insulation that kelp provides, and allowing increased surface disturbance by wind."

Response 14i: The comment does not reflect information provided in the Environmental Document. Its intent appears to be to provide fact without supporting foundation. While the Department questions the assertion that removal of kelp canopy can change water temperature or the implied benefit of insulation for sea otters, removal of canopy can cause increased surface disturbance by wind.

Comment 14j: The decline of abalone correlates with kelp harvesting. These parallel declines may be a coincidence, but it is possible that the extraction of kelp plays a significant role is the cause of abalone decline.

Response 14j: The comment recognizes a correlation and suggests a cause-and-effect relationship. The Environmental Document focused on impacts to invertebrate species that use attached canopy as either habitat or forage. That analysis failed to demonstrate a significant harvest related impact. The only impact to benthic herbivores would come through starvation where kelp or other marine plants were not available in adequate concentrations. The number of abalone showing signs of starvation (shrunken foot) observed by the Department during abalone field surveys has been very small (n=37 out of almost 14,000 observed abalone - all showed clinical signs of Withering Syndrome), even during surveys conducted during El Nino periods when kelp canopy biomass was at it's lowest level. That data alone would argue against there being a cause-and-effect relationship. The potential for a kelp harvest related impact on abalone is further reduced if one recognizes that harvesting removes a very small proportion of the total biomass produced by giant kelp (much less than one percent in areas where comparisons have been made). Canopy forming kelps comprise only one group of marine plants that are used by these herbivores. Other non-harvested species (understory brown algae and red algae) are also available as forage.

Comment 14k: "But the claim "Cut canopy will be restored from young fronds beneath the surface" (p 4-12) is misleading at best, false at worse. Kelp grows up from the ocean bottom, it does not grow from the top. Cut kelp might as well have been cut from the bottom as it essentially kills that 30 to 60 to 100 foot frond."

Response 14k: Elements of the comment are correct. Giant kelp does grow from the apical meristem located at the top of the frond. Individual fronds that are cut before reaching maturity do lose the apical meristem (see Section 3.2.3.1) which results in the loss of further blade production from that frond. However, the statement quoted from the Environmental Document is correct. The bulk of blade formation is completed before the top of the frond reaches the surface. Apical meristematic activity at the surface produces only a small part of total surface blades. The ability of giant kelp to regenerate its canopy rapidly is due to the continuous production of new fronds by established holdfast and the intercalary growth mechanism. Young fronds that have not reached the surface will still have their apical meristem and new fronts will continue to be produced by the basal meristems. Fronds that are cut are not dead. They continue to take up nutrients and are photosynthetically active.

Comment 14l: "It seems highly wise and reasonable to restrict extraction of all species which are closely interdependent until threatened and endangered species (e.g. Abalone, Sea Otters, Stellar Sea Lions) are clearly recovering."

Response 14l: Neither white abalone nor the Stellar sea lion are dependent upon kelp canopy. Pink, green, and white abalones favor other species of algae and therefore the harvesting impacts of *Macrocystis* on these species diets is negligible. Food habits of adult pink, green, and white abalones were studied by Tuschulte (1976), and Tuschulte and Connell (1988). Both pink and green abalone will eat red and brown algae. However, green abalone specifically prefer fleshy red algae. This specificity may limit the distribution and abundance of green abalone. Pink abalone will consume both red and brown algae in the proportions that they occur in the drift, but they prefer the brown alga, Eisenia, and the red alga, Plocamium, over Macrocystis, which is only a supplemental drift food item in their diet. White abalone may occasionally feed on drift *Macrocystis* when available, but their primary diet consists exclusively of attached leafy brown algae such as *Agarum fimbriatum* or *Laminaria farlowii*, which are found at the deeper depths where whites occur.

While not an essential habitat, sea otters do prefer giant kelp canopy as both a rafting location and, for some otters, as a foraging site. In developing their Biological Opinion, the U.S. Fish and Wildlife Service did not identify the temporary loss of some canopy as a biologically significant issue. However, the Department cannot discount the possibility that the removal of kelp canopy could add stress to the most sensitive component of the sea otter population (female sea otters with large dependent pups). Consequently, the Department has taken the proactive position that kelp harvesters should avoid harvesting in the vicinity of large rafts occupied by female sea otters with dependent pups. While there is some consistency in the location of those raft sites, the use of a harvest plan will allow the Department and harvesters to use an adaptive management approach to minimize any impact to less-than-significant levels.

Comment 14m: "Page 4-19 says "... plants had been lost during the winter in the experimentally harvested area but not in the unharvested control." Didn't this kelp cutting impair a Giant kelp bed?"

Comment 14m: The next sentence indicates that the researchers felt that continuous harvesting removed fronds of older plants, resulted in reduced translocation to the holdfast, reduced hapteral growth, and weakening of holdfast attachment to the substrate. If harvest activity occurred at the rate suggested in this research (five harvests on the same plant within a 408-day period), that portion of the kelp bed would be impaired. Harvest activity in bed 220 was focused to the point that individual plants could be receiving that kind of harvest pressure. That was the primary reason from suggesting the closure of the bed nearest the Monterey harbor. If implemented it would force harvest pressure into the adjacent, higher density, canopy. With that one exception, harvest pressure does not approach the intensity used to demonstrate potential impact in the research described on page 4-19 of the Environmental Document. If fact, the document indicates that in some circumstance, harvesting can enhance kelp health (page 4-18).

Comment 14n: "Page 4-21 says "... any activity that removes the pneumatocysts and blades results in the death of that [Bull Kelp] plant as well as loss of regenerative and reproductive material." Doesn't this mean kelp cutting impairs a Bull kelp bed?

Response 14n: Harvesting the pneumatocyst and blades kills bull kelp as indicated. However, if harvested after plants have released their sori (reproductive bodies), harvesting does not impair the long-term viability of the bull kelp bed. Allowing a harvest recognizes that bull kelp are a annual plant that will die regardless of harvesting activity. Consequently, regulations, including the proposed regulations, are structured to insure that harvest pressure does not impair bull kelp recruitment.

Comment 14o: "This action would allow a huge permanent and irrevocable statewide loss of Kelp Biomass. It is a colossal loss of biomass in a fragile ecotone. There is abundantly officially-recognized evidence of the ecological collapse of the kelp ecosystem."

Response 14o: The proposed project modifies an existing suite of regulations that control the harvest of giant and bull kelp. Those modifications will cause neither an increase or a decrease in the amount of biomass that is harvested. It will insure that the removal occurs in a way that provides for a sustainable resource and sustainable harvest. That biomass which is harvested is a very small proportion of the total biomass produced by these species. The operating concept behind consumptive use of these species is that the resource is renewable. That is, the harvest of kelp does not result in a permanent and irrevocable loss of kelp to the system. Recognized fishery management problems do not equate to ecological collapse of the kelp ecosystem.

Comment 14p: "Please prepare a regulation trigger at that level of biomass to stop all further harvesting that year."

Response 14p: The Department considered and rejected use of a cumulative biomass trigger. Please see discussion of Alternative (Section 6.1).

Comment 14q: "Please create a regulation to prohibit multiple kelp cutting extractions per year."

Response 14q: Kelp beds in southern California have growth characteristics that allow them to withstand multiple kelp harvest. Giant kelp in central California do not have those growth characteristics. That is why the Department proposed use of a kelp harvest plan and the closure of a part of bed 220. In the course of developing and approving a harvest plan, the Department and the harvesters (mechanical harvesters) can work cooperatively to avoid repeated harvesting in the same area as suggested.

Comment 14r: "Kelp Extractions is admittedly designed to cause kelp forest fragmentation and increase edge effect impacts."

Response 14r: Kelp harvest regulations are not designed to cause kelp forest fragmentation. The primary intent is to provide for a long-term sustainable resource that can provide societal benefit and as well as resource benefit. Any increased edge effect is short-term. Those effects are not the same as edge effects in terrestrial habitats that are long-term in their impacts to system viability.

Comment 14s: ""Edge effect" describes how kelp at a newly cut edge of a forest are exposed to much higher wave surges - which can stress them prematurely, increase the number pulled out by storms, and cause the loss of marine wildlife and biodiversity necessary to sustain a healthy kelp forest.

Response 14s: Extensive literature review and direct observation by Department biologists fail to substantiate the assertion provided in this comment. There are no data to support the view that temporary removal of a portion of the canopy exposes adjacent plants to higher risk of being dislodged by waves. When looked at quantitatively, Roselthal et al (1974) found no statistical difference in survivorship between harvested and unharvested plants during the winter. Presence of a canopy will dampen the effects of wind generated waves. That influence is readily observed when one compares wind waves on the windward and leeward side of a canopy. However, wind waves are not recognized as being responsible for the removal of kelp plants let alone kelp beds. Both giant and bull kelp are adapted to withstand those wave conditions. Long-period waves (swell) can remove plants from their attachment. The presence of kelp canopy has a minimal effect on dampening this type of energy because it is expressed through a much broader portion of the water column. A given swell's energy diminishes with depth to some threshold depth were it is no longer measurable. The size and period of the swell, it corresponding threshold depth, the canopies width, and the bottom depth under the canopy are variables that influence how much energy is dampened. Narrow kelp beds and deeper kelp beds will have less effect that broader or shallower kelpbeds. In direct measurements, a swell with a 5-second period traveling through a 350 meter wide kelp bed lost five percent of its energy. Consequently, the influence of canopy in dampening of that type of wave energy is minimal. Where swell would have it's greatest influence would be under conditions where there are not kelp plants at all - under conditions where entire plants were removed. Beds dominated by either species have been completely removed by large swell generated by storms. The potential for removal is present throughout a bed regardless of the presence or absence of an edge. The Department is aware of research that suggests that multiple harvests of giant kelp in central California can weaken the plant's holdfast. A weakened holdfast will allow a plant to be removed by less swell energy than would ordinarily be required to remove the plant from its attachment point. The Department's proposed regulations are directed at preventing that type of harvest activity.

Comment 14t: "Kelp forests near induced edges, for example, may have a higher density but lower diversity of fish than the interior."

Response 14t: The presence or absence of kelp, including any temporary change in the amount of edge, will have highly variable influence on fish abundance (p 3-39). Consequently, the assertion made in the comment may be correct in some instances. However, the comment intent appears to suggest that the relationship is not one of many patterns that have been reported in the literature but a dominant relationship. If that is the correct intent, the Department is unaware of any literature or data to support the view.

Comment 14u: A more thorough analysis of noise impacts will identify potentially significant impacts from noise on listed species. If the underlying assumptions behind the analysis of noise impacts are incorrect, the analysis is flawed.

Response 14u: In the Department's view the underlying assumptions used in the analysis, are reasonable. While not exhaustive, the Department feels the Environmental Document's analysis of noise is adequate to characterize its level of significance from a CEQA perspective. Despite identifying several human related problems, the Department notes that the original listing and the 1992 Revised Southern Sea Otter Recovery Plan do not identify noise or kelp harvesting in their summary of problems leading to the listing or affecting the recovery of that species. Their analysis under National Environmental Protection Act guidelines was very thorough.

Comment 14v: Without a regulation restricting harvesting to deeper water, it would be legal to harvest kelp up to the shoreline.

Response 14v: The comment is correct to the extent that giant kelp and bull kelp can occur in water depths shallower than are typically harvested. Shallow depth has operated as a depth refuge from harvesting for many decades. Given existing harvest practices, a depth restriction would be an unnecessary regulation.

Comment 14w: The units of measure used in the analysis of potential impacts from air pollution are not as useful as other measures in understanding the data.

Response 14w: The Department appreciates that many units of measure are difficult to translate into familiar terms. However, the analysis is adequate to characterize the potential for adverse impact from a CEQA perspective because it provides measures in units that are well established and recognized.

Comment 14x: Please define haperal growth.

Response 14x: The term is described in Section 3.2.1 (Taxonomy and Morphology)

Comment 14y: The widespread removal of tens of square miles of kelp habitat for listed species is a legally mandated significant impact.

Response 14y: The basis for this assertion is the view that any reduction in a species range should result in a finding of significant environmental impact. The proposed project will not result in any change in the range of any listed species. While not range related, if harvesting resulted in the loss of critical habitat, mitigation would be required. However, the proposed project would not result in the loss of critical habitat. It would result in the better management of existing harvest practices; thus, minimizing the potential for any impact to listed species. Without the proposed changes, the harvesting of kelp would continue under existing regulation and law. As indicated in response to comment 14u, the responsible agency for listing and recovery of the Southern sea otter has not identified the short-term removal of kelp canopy for human use as loss of critical habitat or a factor in the listing. The 1992 Revised Southern Sea Otter Recovery Plan did not identify kelp harvesting as an issue that would affect sea otter recovery.

Comment 14z: The activity of kelp harvesters may disturb sea otters. That disturbance constitutes 'harassment' under the ESA and MMPA and should be considered a significant environmental impact.

Response 14z: By providing for the avoidance of female sea otters with large dependent pups (through development of kelp harvest plans to guide use of mechanical harvesters), the proposed regulations pro-actively guide kelp harvesting activity to the extent that there will be no biologically significant impacts on California's sea otter population. The interpretation of the term harassment as a form of take advocated in the comment has not been supported by the U.S. Fish and Wildlife Service in their enforcement of the ESA and MMPA with regard to sea otters. If that position were taken, it would effectively preclude any boat traffic in the vicinity of sea otters. The Department believes that an operational definition of harassment can best be determined by how it is enforced. In that light, harassment is an activity whose sole purpose is to disrupt the sea otter's activity. That definition does not include the incidental disturbance of otters in otherwise legal activity that might cause short-term movement.

Comment 14aa: " Please obtain a Biological Opinion on this project's impact on the potential take under the ESA and MMPA of the Southern Sea Otter ..."

Response 14aa: Please see Response to Comment 14u,14y and 14z.

Comment 14bb: The Depart should consult with NOAA on the regulation changes.

Response 14bb: The Department has worked closely with and have included staff from the Monterey Bay National Marine Sanctuary in the development of the proposed regulations.

Comment 14cc: "Even if kelp destruction plays a minor role in impacts on kelp dependent or inhabiting species kelp extraction contributes to this serious cumulative impact and must legally be analyzed in that context."

Response 14cc: If properly conducted, kelp harvesting does not cause kelp destruction. The Environmental Document has assessed the potential for impact of kelp harvesting on associated species through use of the best available scientific information. Based on that assessment, the impacts were considered to be short-term and less-than-significant.

Comment 14dd: "Please list and quantify the loss of ecosystem services due to this project."

Response 14dd: The requested analysis is beyond the scope of the best available scientific informaion.

Comment 14ee: "Please analyze the widespread cumulative impacts of sewage and chlorine on kelp forests. Please analyze the cumulative environmental impacts of all related activities on kelp as habitat. Please analyze the cumulative environmental impacts of all related activities on kelp related species."

Response 14ee: To the extent possible within the scope of CEQA, the requested assessment has been addressed in Section 4.9.4.

Comment 14ff: The alternatives to regulating kelp harvest identified in Chapter 5 - Mitigation are not correct.

Response 14ff: If the proposed regulation changes (the project) are not implemented, harvesting will continue under existing regulations. The prohibition of all harvesting is not warranted given the effectiveness of existing safeguards. Based on that assessment of the alternatives for managing the commercial harvest of kelp (the focus of these regulation changes), assessments of alternative sources to supply a demand for algin and abalone food would be made within the business environment. State law, regulation, and Commission policy encourages human uses of kelp as a sustainable use of a renewable resource.

Comment 14gg: "Please analyze an alternative which prohibits all extraction of all kelp beds in California. Clearly, this would be the environmentally preferred alternative."

Response 14gg: Please see Response 14ff.

15. David Dilworth, Responsible Consumers of the Monterey Peninsula

Comment 15a: "We urge redrafting the DEIR and regulations to fit the significant environmental impacts of removing significant critical biomass from habitat supporting several officially listed species in danger of extinction."

Response 15a:Please see Response to Comments 14b, 14h, 14j, 14l, 14u, 14v, 14z, and 14aa.

Comment 15b: The duration of leases is far too long. Please prepare regulations that reduces the lease duration to 2 years maximum.

Response 15b: Public law (Section 6703 Fish and Game Code) provides for leases not to exceed 20 years. Title 14 regulations (Section 165.5 (f)) provide for awarding of leases for a maximum of 20 years. Regulations could be amended to provide for shorter lease intervals. The Department will consider that recommendation during the next review of management regulation.

Comment 15c: "Please prepare a regulation that increases makes it a criminal act to violate kelp cutting guidelines lease suspension with no maximum. Please prepare a regulation that suspends lease time with no maximum number of years."

Comment 15c: The Department will consider the recommendation during the next review of management regulations.

Comment 15d: "Please explain all measurable criteria you are using to determine when the trigger point of ecosystem collapse could occur?"

Comment 15d: The scope of the requested analysis is beyond that required to evaluate human harvest impacts on kelp. The Department will consider developing a maximum harvest threshold value that can be reasonably implemented as a management tool. The development of that value was beyond the scope of this regulation change.

16. Doug Obegi, Center for Marine Conservation and Joe Geever, Amercian Oeans Campaign

Comment 16a: Why has the Department chosen to comply with CEQA by producing an Environmental Document rather than an Environmental Impact Report.

Response 16a: Section 2.3 indicates that the Environmental Document is the functional equivalent of an EIR. The Resource Agency certification process acknowledges that the Commission's and Department's regulatory process includes protection of the environmental as part of its program. The preparation of the Environmental Document is intended to provide the Commission with the level of information necessary to determine whether the proposed regulation changes are in the public's best interest. Since certification, the Department has always produced this type of document in lieu of an EIR/ND.

Comment 16b: We are concerned that the analysis provided in the Document may not adequately meet the legal requirement of utilizing the 'best available science'. We are unsure that the preferred alternative will effectively meet the Department's primary objective.

Response 16b: The Department recognized in the Document that there were many areas where focused research could improve our level of understanding. In that regard, the Department agrees with the comment. However, the Department is unaware of any scientific information regarding kelp harvesting impacts on the ecosystem that has not been considered in the Document. Consequently, the assessment was based on the best available science.

Comment 16c: The Department should incorporate its own recommendation to develop a biologically tenable threshold value beyond which the impacts of kelp harvesting count be anticipated.

Response 16c: The Department sees merit in developing a scientifically based threshold value and in evaluating its efficacy as a management tool. However, its development will require considerable research. Consequently, it is a long-term project. The Department sees no advantage and potential for resource harm by delaying reasonably management changes now.

Comment 16d: CEQA requires the analysis of indirect impacts [the comment sites a number of statements within the Document that identify potential negative indirect impacts associated with harvesting], and we urge the Department to ensure such indirect impacts are not significant.

Response 16d While the Document relied upon the scientific literature to support largely subjective appraisals, the indirect impacts of concern in the comment were assessed to the extend possible using the best available scientific information. The Document did find that those impacts were short-term and less-than-significant in their effect.

Comment 16e: Consideration of habitat impacts on the southern sea otter is important.

Response 16e: The Department agrees. Despite a lack of direct evidence of potential harm, the proposed regulations have taken an adaptive management position to minimize impacts to the most sensitive component of the sea otter population (development of harvest plans that would guide harvest activity away from rafting sites used by large numbers of females with dependent pups). Please see Response to Comments 14b, 14h, 14j, 14l, 14u, 14v, 14z, and 14aa. The Department will be in a better position to use adaptive management and to quickly incorporate new scientific information in future management decisions through the adoption of the proposed regulation changes

Comment 16f: CEQA guidelines require that a mandatory finding of significance by triggered if the project has the potential to substantially reduce the habitat of a fish or wildlife species.

Response 16f: The Department agrees. Kelp harvesting as practiced has not resulted in any long-term reduction of habitat. Harvesting only has a short-term effect which is not considered substantial. The proposed regulation changes would improve on the Department's and on the Commission's ability to effectively manage the commercial use of this renewable resource.

Comment 16g: A more substantial discussion of per-bed harvest limits should be provided.

Response 16g: Much of the assessment requested in this comment cannot be provided without substantial research. Please see Response to Comment 16c. The alternative was rejected without detailed analysis because of that lack and the recognition that a poorly crafted regulation of this magnitude (imposing per-bed harvest limits) might result in a shift of harvest pressure from areas that can more readily support harvest (southern California) to areas that cannot (central California). Please see Section 3.2.5 and 3.2.6 for a discussion of the differences in giant kelp growth characteristics by geographical area.

Comment 16h: The Department's notice and involvement of stakeholders could have been improved.

Response 16h: Comment noted. The Department did hold three scoping meetings and participated in three public forums that discussed kelp management and had the advantage of an extensive public involvement process employed by the Monterey Bay National Marine Sanctuary. As noted in the comment, the Department is attempting to improve its communication with its constituents. One such effort has resulted in the development of a 'keep me informed' opportunity on the Department's Marine Life Management Act webpage. Submission of contact information and an indication of the constituents areas of interest should help provide the desired improvement.

Comment 16i: In light of substantial scientific uncertainty a precautionary approach must be used.

Response 16i: The Department agrees. All of the substantive changes in the preferred alternative were adopted based on that principle.

17. <u>Justin Malan, California Aquaculture Association</u>

Comment 17a: The abalone aquaculture industry is responsible for a small fraction of kelp harvest in the State, yet the focus of the document deals with areas and harvesting practices of our growers. By the percentage of total commercial harvest, abalone aquaculture has a very small impact. The fact that kelp harvesting has declined in recent years provides us with even greater confidence that our kelp resources are safe.

Response 17a: The focus of the proposed regulation changes is on kelp harvesting activity that occurs within central California. Please see Response to Comments 4a, 4d, 4e, 5j, for a broader discussion of the Department's concerns and the necessity for the proposed changes. All commercial harvest interests are potentially influenced by the changes including both the abalone aquaculture industry and large-scale mechanical harvesting for sodium alginate. The Department does recognize certain elements in the proposed changes are more likely to affect the small harvesters like the abalone aquaculture industry. Those regulations are directed toward guiding small harvesting practices in more resource sensitive directions. While that industry takes a very small percentage of the total commercial harvest it can still have negative impacts on the resource if the harvesting is concentrated into small areas. That concentration has occurred in the Monterey area and resulted in our recommendation for a small area clsoure. The Department's review of kelp harvesting practices and kelp biology identified the potential for repeated harvest on individual plants to weaken the plants holdfast. That weakening can negatively impact the long-term sustainability of the kelp resource in those area (Please see Section 4.9.1 of the Document). Other proposed changes affect all harvest activities and are directed toward the resource concerns mentioned in the beginning of this response.

Comment 17b: The proposed change may impede the ability of the abalone culture industry to harvest kelp in certain times and in certain areas despite no evidence that the changes will enhance overall kelp resources. These changes may be addressing user conflict rather than kelp sustainability concerns.

Response 17b: The Department agrees that the proposed changes may impeded the industries ability to harvest kelp in certain areas and in certain times and agrees that the proposed changes may not enhance resource or provide for sustainable harvest of the resource. However, the intent of the proposed regulation change is to protect kelp communities while still providing for sustainable use of the resource for human uses by addressing potential for harvest related impacts. In that regard, the proposed regulation changes take a prudent pro-active position. The high degree of variation in kelp canopy abundance makes it very difficult to establish cause-and-effect relationships between changes in harvest practices and kelp abundance. Recognizing that, the Department has elected to evaluate kelp harvest practices in light of research results. Where research has suggested room for concern, the Department has proposed regulations to address those concerns. If the standard for necessity was the ability to demonstrate a cause-and-effect impact before changes were made, the result would be making management changes only after nearly catastrophic impacts had already been realized. That approach would not satisfy the Department's stewardship responsibility.

Comment 17c: CAA urges the Commission to consider recommendations made by the industry that seek greater regulatory clarification to provide for predictability in business.

Response 17c: The Department recognizes why the industry would want and needs a predictable regulatory environment and will provide that to the extent that it can while still meeting its pubic trust responsibility. The Department cannot predict: 1) how the industry's harvest practices will change; 2) when algal competitive interaction will favor bull kelp or giant kelp in a particular area, or 3) when preferred sea otter rafting sites will change. These are all area of concern that may warrant management attention. The Department proposed the use of harvest plans and harvest control areas as a way to be pro-active by recognizing that variability. Given this variability, it is difficult to provide the desired degree of predictability and still address concerns should they arise. The Department has modified the proposed regulations to clarify that the intent is to address resource concerns and not to address user conflicts.

Comment 17d: The phrase 'properly harvested' is not defined and is subject to differing interpretation. The regulations should provide clear criteria, such as an historical record showing a decline in the kelp resource to guide closures.

Response 17d: The Department has modified its regulatory language to eliminate that phrase and to indicate to the extent it can the criteria that will be used to guide approval of harvest plans or to impose harvest controls.

Comment 17e: The proposed restriction on harvesting *Nereocystis* (Section 165(c)(4)(B)) does not appear to be justified with the data provided. If justification can be provided, clarification is needed as to whether the restriction would apply to drift kelp.

Response 17e: The subject Section applies to the harvest of either attached or drift bull kelp harvest within an area of concern. Justification for the concern over harvest of bull kelp in central California can be found in Section 3.2.3.2 and 4.9.1. General concerns identified in those Sections are exacerbated by recognition that bull kelp in central California is already stressed by being near the southern limits of its range. The intent of the subject proposed regulation change is to control the commercial harvest of this species during its peak reproductive period. Drift kelp is reproductive and can play a significant role is dispersal of the species. Please see Response to Comments 5a for additional discussion. It was the Department's enforcement staff view that including drift kelp was necessary to make the regulation enforceable. The Department has clarified the regulation to indicate that the restriction does not prevent the harvest of bull kelp from the beach.

Comment 17f: The restrictions on mechanical harvesting under Section 165(c)(4)(C) appear redundant if the other harvesting limitations are in place.

Response 17f: The subject section has elements that are redundant in that several sub sections address concerns over the harvest of bull kelp. The development of a harvest plan would allow the Department to work with the harvester to ensure that a mechanical harvester does not operate within mixed canopy beds. It is the Department's view that hand harvesting can more easily operate within mixed beds without risk of removal of bull kelp. However, the use of an approved harvest plan addresses other resource concerns as well (repetitive harvest on individual giant kelp and disruption of sensitive components of the sea otter population). Proper use of the cooperative development and implementation of harvest plans will go a long way toward minimizing the need to impose stronger restriction such as harvest controls or bed closures.

Comment 17g: While we support an adaptive management approach, the industry needs better-defined criteria that may trigger the closure provided under Section 165(c)(4)(E).

Response 17g: The Department appreciates the industries support of an adaptive management approach. The Department has clarified its proposed regulations to identify the types of information that will be used to make recommendations to the Commission on the necessity for implementation of temporary harvest controls under emergency regulations. The subject subsection was clarified to reflect Legislative intent in identifying the types of criteria that would be considered in that determination.

18. John O'Connor, Bolinas, CA

Comment 18a: Kelp forests are an integral part of the nearshore area and kelp harvesting can impact the nearshore fishery. These interactions need to be evaluated in the Nearshore Management Plan.

Response 18a: The Department agrees that kelp harvesting should be evaluated in the development of the subject plan has forwarded your comment to the appropriate staff.

Comment 18b: The Environmental Document lacks timely studies and is therefore incomplete and in need of revision.

Response 18b: While further studies will always improve the foundation upon which management is based, the standard used in developing regulations in a manner that will comply with the California Environmental Quality Act (CEQA) is the use of the best available science. The Department conducted literature searches to ensure that the proposed regulations were based on the best available scientific information. While much of that literature was cited in that last CEQA review (5 years ago), the information content is still valuable in evaluating potential for environmental impact.

19. <u>Chris Van Hook, Abalone International Inc.</u>

Comment 19a: It seems that some of the proposed regulations will have a negative impact on abalone farmers without increasing the protection of the beds in any real scientific way.

Response 19a: The Department disagrees. Clarification will be provided in response to subsequent comments that identify specifics areas of concern.

Comment 19b: Subsections 165(c)(4)(A), (B),(C) (Referred to as Amendment 3 in the comment letter) has no resource or scientific basis since there are no bull kelp beds in the areas where kelp is harvested. The kelp that is taken is either drift or already up on the beach. The amount that is used in minuscule percentage of the drift/wrack kelp in the area's ecosystem and is important to the abalone aquaculture industry.

Response 19b: Pure beds of bull kelp can be found near Becketts reef just north of Ragged Point. Mixed beds (beds with both giant and bull kelp) are found commonly throughout the area subject to the proposed regulations. Please see Response to Comments 5b, 5d, for further discussion. The Department has clarified its regulations to indicate that the proposed seasonal restriction on the use of bull kelp does not apply to the use of beach wrack. Please see Response to Comment 17b for the reasons why the regulations apply to the use of drift kelp as well as to attached bull kelp.

Comment 19c: The proposed regulation that would impose harvest controls is vague and does not specify how the necessity for temporary harvest controls would be determined.

Response 19c: Please see Response to Comments 2c, 4n, 5e, 5i, for further discussion. The Department has clarified the conditions under which harvest controls would be considered that reflect Legislative intent.

Comment 19d: Use of the term 'properly harvested' is vague.

Response 19d: The Department has clarified the subject subsection by eliminating use of the term and inserting Legislative intent. Please see Response to Comments 4f and 5f for further discussion.

Comment 19e: The requirement to have a kelp harvest plan seems unduly burdensome on both the Commission and the kelp harvester. It could delay or stop harvesting for the season. It provides no added protection. The proposal to limit mechanical harvesting does not address the real issue (user conflict along Cannery Row).

Response 19e: Please see Response to Comment 5h for further discussion. The subject proposed regulation change is not intended to limit mechanical harvesting. The Department recognizes that the use of mechanical harvesters will spread harvest pressure across more resource. That will reduce the potential for any harvest related impacts associated with repetitive harvest on individual plants. Development of a harvest plant will augment that protection by considering all harvest plans and their cumulative interests. The intent is to ensure that mechanical harvesters are being used in a resource sensitive way in an area of concern. It is not being proposed to address user conflicts. Development of harvest plans can be completed before the subject regulations go into effect and should have no delaying effect.

Comment 19f: The language used in the subsection that authorizes implementation of temporary harvest controls is vague.

Response 19f: The Department has clarified the subject subsection to reflect Legislative intent in implementing temporary harvest controls. Please see Response to Comments 2c, 4n, 5e, and 5i for further discussion.

20. Richard Todd, Salinas, CA.

Comment 20a: The Department is urged to manage the kelp forest ecosystem in the Monterey area in a manner which fulfills public trust. The statement is made in the context of support for the Ed Ricketts Underwater Park.

Response 20a: It is the Department's intent to meet it's public trust responsibility. The Fish and Game Code provides legislative direction (mandate) as to state policy for the conservation of aquatic resources (Section 1700 of that Code). Under that broad policy umbrella, the Department has proposed a series of regulation changes that it feels will meet that mandate. The proposed regulation changes evaluated in the Kelp Environmental Document do not include a recommendation to implement reserves as a management tool to control the commercial harvest of canopy forming kelps. There are, however, a number of kelp beds that have been closed to commercial harvest for a variety of reasons. The criteria used to evaluate an area for closure are not satisfied by conditions in most of bed #220. The Department has recommended a small area closure near the breakwater (subsection 165(c)(4)9D)). The Department recognizes the potential value of reserves as a resource management tool to protect some areas from commercial take of the State's living resources. The suggestion to support the establishment of the subject park as a reserve will be forwarded to staff that are focused on these issues on a statewide basis.

Comment 20b: The Document is in error in claiming that local business owners developed the Underwater Park (Ed Ricketts Underwater Park). It was a broadly supported effort.

Response 20b: The Department recognizes that the concept was broadly supported. The referenced section (p 3-77) simply states that the concept originated within the business community. The Document will be changed to reflect origination of the concept as a grass roots movement expressing concern over the environment.

Comment 20c: The Document loses credibility by including a study (Donnellan and Foster 1998) that is an unsubstantiated smoke screen.

Response 20c: While not peer reviewed, the document is one of many that can provide insight into harvest related impacts. The fact that it highlighted the importance of scale in determining harvest impacts alone would warrant its inclusion. The Kelp Environmental Document did not discuss the other issues of concern related to diver impacts to the kelp ecosystem.

Comment 20d: The Department's proposed regulations could allow mechanical harvesters to operate within bed 220 and 221.

Response 20d: That is correct. Approval of kelp harvest plans will be based on potential for sustainable harvest without long-term resource impact. If those conditions are met, the Department would recommend approval of the proposed plan. However, the Department also recognizes that productivity in central California kelp beds is much lower than that found in southern California kelp beds. Consequently, focused or repetitive harvest within a limited area would be a point of concern. It is likely that hand harvesting alone will use available resource near the Monterey harbor. Safety concerns related to hand harvesting would suggest that larger harvest capability (mechanical harvesters) should be shifted further from the harbor. That is also the expressed intent of those harvesters that use or want to use mechanical harvesters in the near future.

Comment 20e: The Sanctuary recommendations for a seasonal closure (April 1 - August 31) are longer than that provided for in the proposed regulation changes (April 1 - July 31). There is no scientific basis for shortening the closure period.

Response 20e: Bull kelp does not have a distinct breeding season. The release of sorus (p 3-14) occurs in pulses but appears to peak in early July with a lesser peak in late July and subsequent decline through August. The selected period captures the peak reproduction and also corresponded to an earlier proposal made by the Sanctuary.

Comment 20f: Kelp harvest levels increase in the winter when kelp production is at its slowest and natural predation from abalone at a maximum. Otters retreat to more protected areas for refuge during this period. Bed 220 is already located in the Pacific Grove Marine Garden Fish Refuge. Let this area be a refuge for otters when it is most needed.

Response 20f: Please see Response to Comment 20a for a discussion on the use of refuges as a kelp management tool. Kelp harvest levels for abalone aquaculture are consistent throughout the year. However, harvest pressure along the protected portion of bed 220 does increase at time during the winter when conditions prevent harvesting in other areas. Concern over the potential for repeated harvest on individual plants during this type of event combined with ongoing local interest in harvesting the same area resulted in the Department recommending a small area closure near the breakwater. The intent of that closure was to spread harvest pressure across more plants to prevent small scale harvest related impacts. The Department has also recommended actions to limit potential for impact to sensitive components of the sea otter population in the longer-established portions of their range north of Santa Rosa Creek. This is a pro-active response designed to minimize the potential for impact to female sea otters that are tending dependent pups. It is the Department's view that these measure adequately address the potential for harvest related impacts and a complete closure would achieve little more at the cost of attendant economic hardship.

Comment 20g: "Royalties from kelp harvesting should be calculated, not on the market price of Alginic Acid, but the highest social use and economic value of each kelp forest *when living*.

Response 20g: There are no provisions in code or regulation that require linking the royalty to the market price of one related product. A policy to link the royalty rate on market price did translate into a set price identified in regulation that is dated (subsection 165(c)(6)). A change would require development of new regulations. The Department will consider this suggestion in its next review.

Comment 20h: The recommended closure in bed 220 is inadequate. A complete prohibition on all kelp harvesting in the entire Ed Ricketts Underwater Park should be included, reflecting its status as a park and refuge.

Response 20h. Comment noted. Please see Response to Comment 20a.

Comment 20i: All mechanical harvesters should be prohibited north of Santa Rosa Creek (bed 219 and northward).

Response 20i: The proposal is unnecessarily restrictive. If properly guided, use of mechanical harvesters can allow existing demand for kelp to be met with less risk to resource by spreading that demand across a much broader resource base. The Department intents to guide that activity through development of kelp harvest plans.

Comment 20j: Seasonal closure of all beds to harvesting should be during the entire biological reproductive cycle.

Response 20j: When one considers the staged nature of bull kelp reproduction, implementation of the comment suggestion would result in a complete closure to the harvest of bull kelp. The Department believes that the proposed regulation changes offer a reasonable level of protection. A complete closure would be unreasonably restrictive and is not supported by best available scientific information.

Comment 20k: Beds 224, 225, and 226 are too small and should be closed to harvesting.

Response 20k: The Department concurs and has suggested the closures in the proposed regulation changes.

Comment 20l: The area from Lovers Point to Hopkins Marine Station should be closed to harvesting in the winter to provide protection for sea otters.

Response 20l: In the Department's view a winter closure to kelp harvesting in this area to protect sea otters is not warranted. The result of such a closure would be to expose harvesters to unsafe conditions further from port and would simply translate the potential for impact to otters in the adjacent areas. The Department feels its more appropriate to address concerns by avoiding potential for harvest impacts throughout the otters range north of Santa Rosa Creek. That can be achieved through development of harvest plans to help guide mechanical harvesters away from the most sensitive elements of the sea otter's population.

21. <u>Sandra Koffman, City of Pacific Grove</u>

Comment 21a: There is a need for more and better research on the effects of kelp harvesting on certain components of the ecosystem. Of particular concers are the unstudied or little-studied effects of kelp harvesting on kelp canopy fishes, kelp canopy invertebrates, benthic invertebrates, birds, and sea otters. Important questions remain regarding both the effects on these animals of kelp habitat reduction and the direct mortality of many kelp canopy organisms though by-catch during kelp harvesting. Adequate quantification is particularly lacking. Researching these questions should be a high priority in managing kelp resources.

Response 21a: The Department agrees that more and better research on the effects of kelp harvesting would reduce much of the subjectivity in many of the assessments currently found in the Environmental Document and would encourage that type of research. To the extent it can, given competing priorities, the Department will participate in cooperative studies designed to add clarity to these issues.

Comment 21b: Both drift kelp and kelp wrack must continue to function in our region's marine and maritime ecosystems in sufficient quantities. Kelp management should always have goals of maintaining, as vital ecological resources, these three forms of kelp: the intact kelp forest, drift kelp, and beach kelp wrack.

Response 21b: The Department concurs with this perspective and would also encourage research to better understand drift kelp and kelp wrack community dynamics.

22. Patrick Lovejoy, Santa Cruz, CA.

Comment 22a: The Department's policy on kelp management is slanted in favor of commercial harvesters and does not recognize impacts to other uses that are affected by these policies.

Response 22a: The Department's policy on kelp management is provided in Section 1700 of the Fish and Game Code. Briefly summarized that policy requires the Department to conserve, maintain, and use living resources for the benefit of all the citizens of the state. Specific objectives include: a) maintaining sufficient populations of all species to insure their continued existence, b) recognizing aesthetic, educational, scientific, and nonextractive recreational uses, c) supporting reasonable sport use, d) encouraging growth of local fisheries when consistent with the uses mentioned above, e) managing on the basis of adequate scientific information, and f) encouraging the development of aquaculture.

In this instance, the Department is regulating the commercial harvest of kelp by proposing changes to specific sections of Title 14 that control that activity. The goal of those regulation changes is to achieve the policy mentioned above. That is, the proposed regulation changes limit commercial uses to levels that can still provide for the other benefits listed above. Regulating the other uses would be inappropriate since they do not have the same potential for resource impacts that are present in commercial harvest activities.

Comment 22b: "Additionally, given that there are only 74 acres of kelp forest in the entire state, there is a strong environmental reason to preserve some portion of this resource unblemished."

Response 22b: The amount of giant and bull kelp present at any given time is highly variable. However, even during the winter minimum canopy, there are many square miles of canopy distributed throughout the state. The Department does concur that there is strong environmental reason to preserve that resource. That is the intent of the proposed regulation changes. However, use of preserves or refuges is not considered to be a viable kelp management tool. It is being considered on a broader resource base. Please see Response to Comment 20a.

Comment 22c: Given the lack of information, a precautionary principle would require the Department to protect the resource until it can be demonstrated that harvesting is compatible with the goals of sustainable resource management.

Response 22c: The Department agrees with the perspective the a precautionary approach is warranted given the inability to quantify impacts. However, given the long history of harvesting without demonstrable impact to sustainable resources, a complete cessation of harvesting is not warranted. The Department has recommended regulation changes that appear to be warranted based on best available scientific information and application of the precautionary principle. Please see Response to Comments 4a, 4d, 4e, 5j, and 14a for further discussion.

Comment 22d: The users of the Ed Ricketts Underwater Park demand it be a fully protected MPA.

Response 22d: Comment noted. Please see Response to Comment 20a.

Comment 22e: The royalty fee is too low.

Response 22e: Comment notes. Please see Response to Comment 20g.

Comment 22f: "Can you give me a good reason why one small user group (kelp harvesters) should be given preferential treatment to a much larger group of citizens, to a larger economic resource, to new government policies on ocean management, and to the health of the marine environment?"

Response 22f: Kelp harvesters are not being given preferential treatment. Their use of a renewable resource is being managed to achieve a broader policy that considers all other extractive and nonextractive uses of that resource. Please see Response to Comment 22a for further discussion.

23. Marc Shargel, Felton, CA

Comment 23a: "My overall opinion is that the plan [note: MBNMS Final Kelp Management Report referenced in letter] permits overly aggressive harvests from an ecosystem management viewpoint, and tilts the balance between destructive users and non-destructive "users" inappropriately in favor of the kelp cutters."

Response 23a: Opinion noted. A more complete response will be provided to specific comments. Also please see Response to Comment 22a.

Comment 23b: Harvest of kelp deeper than the surface, especially by a tug and tear method must be banned.

Response 23b: The technique as described in the comment letter is illegal. The only approved technique for harvesting giant kelp or bull kelp (either mechanical or hand-harvesting) requires that the plant be cut at a depth no greater than 4 feet below the surface. If other techniques are used, the concerns raised in the comment letter would be valid. The Department would encourage the reporting of any observation of other techniques being employed to harvest kelp.

Comment 23c: The royalty fee is too low and does not reflect its true value.

Response 23c: Comment noted. Please see Response to Comments 20g. The price set in that subsection is not one of the proposed regulation changes considered in this Environmental Document.

Comment 23d: The size of the closure in bed 220 is too small. It is inadequate as a control for any scientific study. Turning the majority of a major offshore attraction and recreation area into an industrial resource available for the taking makes no sense.

Response 23d: The proposed closure is designed to shift harvest pressure into an area that will allow harvest needs to be met without that need being met by repetitive harvesting on individual plants. The closure was not intended as a study area control. It is the Department's view that kelp harvesting can be compatible with non extractive resource uses if it is properly managed. In that regard, the closure does provide an area that benefits only nonextractive uses and both nonextractive uses and extractive uses share the remaining portion of bed 220. The Department does not view the use of reserves as a viable management tool for managing kelp harvest. It does see benefit in that technique on a broader resource scale. The suggestion to include consideration of the Ed Ricketts Underwater Park in that process has been forwarded to Department staff considering reserves on a statewide scale.

Comment 23e: There is inadequate evidence of consideration for the effects on threatened species in this plan. There is inadequate scientific evidence in existence to show us that removal of this amount of habitat won't have grave impacts on endangered and threatened species.

Response 23e: Comment noted. Please see Response to Comments 14b, 14h, 14j, 14l, 14u, 14v, 14z, 14aa, and 16d for further discussion. The proposed regulations do provide a mechanism to address the only potential impact to a threatened species identified in the Environmental Document. The Environmental Document does use the best available scientific information which is the required standard for adequacy under CEQA.

24. <u>Jim Curland, Defenders of Wildlife</u>

Comment 24a: "Defenders is concerned with the inadequate discussion on sea otter-kelp harvesting issues, potential impacts of harvesting on the entire ecosystem, and the failure to adequately address legal issues.

Response 24a: The concern is noted. The Department will respond in greater detail to specific comments and concerns.

Comment 24b: "The Environmental Document fails to acknowledge that there is a significant **<u>lack of studies</u>** documenting impacts of kelp harvesting on local sea otters populations or other marine animals. Additionally, the Environmental Document falls short in making any research recommendations on how to mitigate kelp harvesting's impacts on sea otters."

Response 24b: The Department is unaware of any study that has documented an impact from kelp harvesting on sea otters or other marine mammals and could identify no impact that required mitigation. This is the case despite the fact that the California sea otter population is one of the most studied mammal populations in the world. The standard required by CEQA and applied by the Department in evaluating the potential for environmental impact from a project is the use of best available scientific information. Although it is a point of concern to the Department, developing a list of studies that have not been conducted is not required under CEQA. The Department notes that the USFWS has also failed to identify impact from harvest activities on sea otters in the development of Recovery Plans. Please see Response to Comments 14b, 14h, 14u, 14v, 14z, and 16d for further discussion. The Department has taken the proactive step of developing a process to encourage the use of mechanical harvester in ways that will avoid disturbing female sea otters with dependent pups (harvest plan). While developing a list of recommended studies was not an element of the Environmental Document, it would be a reasonable component in the development of a Management Plan. The Department is moving toward the development of those plans under the Marine Life Management Act. A priority list is currently being generated to guide the development of those plans.

Comment 24c: A Kelp Management Plan approved and implemented by CDFG must provide protection for sea otters within state waters.

Response 24c: The Department concurs with this perspective. No proposed regulation change considered in the Environmental Document will result in an activity that could cause entanglement or take of sea otters.

Comment 24d: "CDFG's CEQA process should address the environmental impacts associated with kelp harvesting, and economic and social impacts should only be considered or taken into account to assist in determining the significance of the environmental impacts.

Response 24d: The Environmental Document is intended to satisfy CEQA requirements for impact assessment. However, it also has another function that is satisfied by the inclusion of this information. Characterization of the social and economic background will help the Fish and Game Commission determine whether the proposed regulation change is in the public's best interest.

Comment 24e: "Simply because the proposed project provides for a more conservative set of safeguards than provided for under the existing regulations does not mean that the impacts to sea otters, and other marine life, are, in fact, mitigated. As the impacts to sea otters may be significant, the document must identify mitigation measure to reduce any such impacts to less than signficant.

Response 24e: The Environmental Document found the potential for impact to sea otters to be less than significant based on a lack of identifiable potential impact despite this population being one of the best studied mammal populations in the world. While not mitigation, the proposed regulations have taken a prudent precautionary approach to management by requiring development of harvest plans that will guide use of mechanical harvesters away from large rafting sites used by females with dependent pups.

Comment 24f: The Environmental Document fails to provide a range of reasonable alternatives to the proposed action. Any alternative needs to address resource conflict throughout the range of the sea otter, not just bed 220.

Response 24f: Comment noted. The Department did not identify other reasonable alternative than those discussed in the document. The reduction or closure to harvest as a protection for sea otters is not a reasonable alternative given the absence of identifiable harvest-related impact. Please see Response to Comments
14b, 14h, 14u, 14v, 14z, 6d, 24b, and 24e for further discussion. The Department concurs with the view that resource conflicts need to be addressed on as broad a geographic scale as dictated by the nature of the conflict.

Comment 24g: Comment on page 43 seems to suggest that the decline in the sea otter population is over.

Response 24g: The comment reflects the fact that the spring count suggested a substantial increase in numbers over the preceding count. That increase suggested uncertainty as to whether the decline would continue or not. From that perspective 'Until recently' is an appropriate phrase to denote uncertainty.

Comment 24h: "When the kelp forests are gone or decimated by winter storms and / or kelp harvesting activities, tourists and the public complain about the lack of sea otters and healthy kelp forests to view."

Response 24h: Comment noted. The Department recognizes that the sea otter has strong public appeal and that everyone enjoys viewing them in their natural environment.

Comment 24i: "Reactive" and crisis management has gotten the state of California and wildlife agencies into a lot of trouble (i.e., California condor). There must be foresight and the preemptive strategy of addressing concerns and issues before they reach a crisis level and require "reactive" management techniques."

Response 24i: The Department agrees with this perspective and has sought to implement that approach in the proposed regulation changes discussed here.

Comment 24j: Studies mentioned in the Environmental Document are outdated. Newer studies need to be developed.

Response 24j: The Department encourages research. However, the information provided by earlier research is not outdated simply because it occurred in the past. They still provide the building blocks upon which future studies can build. At this point, they provide the best available scientific information upon which to assess potential for their being harvest-related impacts.

Comment 24k: "A conclusion that states that, "the overall effect on invertebrate populations does not appear to be significant" is not taking into account that there are a lack of studies in order to determine "significance" of kelp harvesting impacts on invertebrate and microinvertebrate populations."

Response 24k: The Environmental Document does cite some studies that reflect the potential for environmental impact. Those studies suggest that the impacts are short-term and less-than-significant. Acknowledging that the basis for evaluation could be improved, an evaluation based on the best available information is the accepted standard for review under CEQA. More to the point, the evaluation only assesses the proposed project which has a conservative orientation. Combined with the evaluation of the scientific literature, the conclusion is warranted.

Comment 24l: The concerns mention with regard to invertebrates (comment 24k) apply to evaluations of harvest impacts on birds.

Response 24l: Please see Response to Comment 24k.

Comment 24m: "Sea otters are protected by not just state and federal regulation, but also by state law as a "fully protected mammal" (Fish and Game Code Section 4700), and federal law under the ESA and MMPA.

Response 24m: Correction noted and will be incorporated into the document.

Comment 24n: The section on sea otters is wholly inadequate in addressing biological and legal issues. If kelp harvesting has deleterious consequences in the sea otters' ability to use this habitat, the harvesting activity must have appropriate mitigation measures or be ceased, either temporarily or permanently.

Response 24n: Please see Response to Comments 14b, 14h, 14u, 14v, 14z, 6d, 24b, and 24e for further discussion.

Comment 24o: Harvesting within a nationally designated marine sanctuary that has designated reserves and refuges may qualify for not harvesting under protection provided by Section 30(b) of Title 14.

Response 24o: Section 30(b) of Title 14 applies to non-commercial use of marine plants. The Sanctuary was given authority to regulate the commercial harvesting of kelp in its implementing legislation. Consequently, the designation of an area as a Marine Sanctuary does not preclude commercial harvest of kelp.

Comment 24p: The designation of certain areas as sea life reserves (Sections 2850 and 2851) would seem to be applicable and is not considered in this document.

Response 24p: The use of reserves as a kelp harvest management tool was not considered viable. Please see Response to Comments 20a and 20f for further discussion.

Comment 24q: A much more conservative approach needs to be undertaken when looking at alternatives, when "scientific uncertainty" is quite prevalent.

Response 24q: The Department agrees that a conservative approach is particularly warranted in instances where there is scientific uncertainty and has adopted a precautionary approach in developing the proposed regulations.

Comment 24r: Development of a master plan must include representatives from all stakeholders

Response 24r: Comment noted. Response is beyond the scope of this document.

Comment 24s: Artificial reefs may cause detrimental impacts.

Response 24s: Comment noted. Development of artificial reefs was not within the scope of the proposed project.

Comment 24t: Section 165(c)(2) which requires cutting of kelp be restricted to a depth no greater that four feet below the surface does not address the effect of harvesting upon a rich and diverse canopy habitat.

Response 24t: This prohibition on cutting of kelp deeper than four feet is not one of the proposed regulation changes. That section was rewritten only to clarify that the prohibition applied to kelp harvesters (which was only implied in the existing regulations). The prohibition is designed to provided for sustainable use of kelp by ensuring that giant kelp plants remain viable after harvesting.

Comment 24u: The designated closure near the Monterey breakwater does not begin to taken into account the heavily transited, frequently used sea otter areas along the waterfront.

Response 24u: The subject subsection was designed to prevent repeated harvest on individual plants. That is, it was a measure designed to prevent potential for harvest impacts on a small scale on individual plants. It was not intended to address concerns over relationships between human activity and sea otters.

25. Capt, Ed Cooper, Pacific Grove, CA

Comment 25a: There is too little kelp resource and too much we don't know to allow the harvest of kelp without extensive study.

Response 25a: Both the Legislative intent (expressed in Section 1700 and in Chapter 6 of the Fish and Game Code) and the written policy of the Fish and Game Commission is to provide kelp for human use as a renewable resource. A good deal of research has also been done that suggests that kelp harvest can be managed as a sustainable and renewable resource. That research is supported by empirical evidence in the form of a harvest every year since 1916. While the Department agrees that more research can be done to guide management of this resource is does not agree with the view that further study is necessary in order to reasonably manage commercial use of this resource.

Comment 25b: the summary conclusion supported by a quote from Dr. North is not applicable now because of all of the new demands that are being placed on the nearshore resource.

Please provide a list of names and companies that have collection permits to take marine life from kelp forests.

Response 25b: While the Department recognizes that the states marine resources are subject to growing population pressures, the summary conclusions are still valid and supported by the best available scientific information. The requested list is not germane to the evaluation of potential cumulative impacts from the harvest of kelp. They could be viewed as a cumulative impact in regulations controlling the commercial or recreational harvest of collected species.

Comment 25c: The document does not provide a no-harvest alternative

Response 25c: The no project alternative is required to be evaluated under CEQA guidelines. In addition other reasonable alternatives are to be evaluated that reasonably achieve the project's goals. A no harvest alternative would not achieve the project's goals as provided by Legislative intent and Commission policy.

Comment 25d: Please analyze the State's costs in management, research, monitoring and enforcement to determine if licensing fees and royalties offset the costs to the people of the State of California.

Response 25d: A change in the fees and royalties are not part of the proposed project and are not a factor in an environmental analysis. The Department has committed to evaluating these fee structures in it's next review of kelp management regulations.

Comment 25e: Please provide a substantive analysis of potential costs to the diving industry and kayaking industry from kelp harvesting placing kelp canopies in jeopardy.

Response 25e: CEQA does not require cost analysis. CEQA guidelines do require an analysis of environmental impacts associated with the proposed project. Some economic information has been provided in the Environmental Document to help the Fish and Game Commission determine if approval of the proposed project is in the public's best interest. An assessment of the economic impact to small business is a required element of the Administrative Procedures Act process. That assessment looks at whether the proposed project would negatively impact business. Since the proposed project is more conservative than existing regulations there would be a net benefit to the business of concern in the comment.

Comment 25f: Kelp harvesting should not be allowed anywhere in the Ed Ricketts Park. The area comprises only 9.4% of kelp bed 220.

Response 25f: Please see Response to Comments 20a, 20f, and 23a. The Department does not view the use of reserves as a reasonable management tool to control the commercial harvest of kelp. The Department agrees that the area within the Ed Ricketts Park is a small subset of bed 220. However, access to resource by small vessels employing hard harvesting techniques during winter is a safety issue that needs to be considered.

Comment 25g: Page 2-4 has a word processing error.

Response 25g: Comment noted and the suggested change would add clarity. The Document will be corrected.

Comment 25h: Please change page 3-77 to reflect creation of the Ed Ricketts Park by a grass roots movement of concern for the environment.

Response 25h: Clarification will be made to the Document.

Comment 25i: Pacific Mariculture was a significant play in the Kelp Co-op and should be mentioned in the document on page 3-77.

Response 25i: Clarification will be made to the Document.

Comment 25j: Please provide a map that shows the entire area open to harvesting in bed 220. The map on page 2-9 only shows a portion of bed 220

Response 25j: The preceding page provides the requested map. The map on page 2-9 clearly indicates that it only shows the northern extent of that bed. The relative size of the closure was not an issue in the proposed regulation change. The intent of that change was to prevent past practice of harvesting very near the breatwater. That practice resulted in the repeated harvest on individual plants which could weaken holdfasts. The proposed regulation change shifts that harvest pressure into a denser portion of bed 220 that is still protected during winter storms.

Comment 25k: What is the effect of erosion and in-shore and subtidal habitat changes by removal of surface canopy?

Response 25k: The presence of kelp canopy has minimal effect on the dampening of the long-period swell that has the greatest effect on beach erosion or changes in shallower water habitat structure. Please see Response to Comment 14s and 30a for a discussion on a related concern. That discussion provides some quantitative measures to support the conclusion reached in this response.

Comment 25l: The studies by by Coastal Solutions Group are controversial and should not be used in this document.

Response 25l: The fact that the results of a study are controversial is not a factor in determining whether a study should be included in an environmental assessment. Much of the scientific literature is considered controversial by someone. Neither study mentioned in the comment was significant in the development of the recommended regulation changes nor did they play a significant role in the assessment of the potential environmental impacts associated with the possible implementation of those proposed changes. The Department sees no merit in expanding the discussion.

Comment 25m: Removal of canopy during kelp harvesting exposes others (divers, power boat and sailing enthusiasts, and kayakers) to potential accidents because the canopy cannot act as a safety barrier.

Response 25m: The Department recognizes that the presence of canopy can provide a barrier to wind-driven waves and an attached structure that can be used by kayaker's under very

strong wind conditions. The safety barrier provided by a canopy is not as clear for boating enthusiasts and divers. Even given benefit to all the user groups mentioned in the comment, the Department recognizes that those same activities occur throughout the state in areas subject to harvesting and in areas where no canopy exists at all. The long history of harvesting (much more intensive harvesting than occurs in Monterey) without incident suggests that harvesting and other on-water activities can be conducted safely in the same area. However, reasonable prudence is required of all users when engaged in on-water activities.
Comment 25n: The Environmental Document did not mention lost habitat for mysid shrimp. Harvesting has occurred often enough that there are not enough mysids to support toxicology tests using this species.

Response 25n: The Environmental Document did assess the potential impact on canopy dwelling motile crustaceans in Section 4.2. The Document cited research that quantified the loss of those organisms during harvesting. In evaluating the proposed project, those losses were considered less-than-significant because the general harvest impacts did not appear to be significant and the proposed changes took a conservative orientation. The Department is aware that many factors can influence the availability of an organisms and can find no support for the asserted cause-and-effect relationship mentioned in the comment.

Comment 25o: There is no method to ensure that harvested kelp is weighed correctly.

Response 25o: Both state law and regulation require the accurate weighing of kelp using approved methods. The presence of civil penalties and a credible threat that landings can be checks by enforcement staff provide a reasonable deterrent. Those are the same processes used to obtain accurate data in all commercial landings of the state's resources.

Comment 25p: If 50% of the bed's maximum area is allowed to be taken, there will be no canopy left [comment cites Section 2.5.1.3.1]. There are no mechanisms to adjust harvest based on seasonal changes or El Nino. What method was used to determine that 50% should be the percentage of a bed that can be taken?

Response 25p: The cited Section states that state law limits the amount of kelp beds that can be exclusively leased to no more than 25 square miles or 50 percent of the total areas of the kelp resource (whichever is greater). There are no provisions limiting the amount of kelp that can be removed from a kelp bed. Because of practical considerations (obstacles and vessel draft), large mechanical harvesters can remove no more than 50% of a bed during a harvest. Hand-harvesting and small mechanical harvesters remove far less. Those harvesting practices have had no discernable impact on kelp abundance and harvest demand has decreased significantly in recent years (please see Appendix A-3).

Comment 25q: We should encourage companies that use kelp to grow their own and not have them rely on wild stocks.

Response 25q: The abalone aquaculture industry is conducting research into alternative food sources. However, both Legislative intent expressed in law and Fish and Game Commission policy encourages the use of kelp as a renewable resource.

Comment 25r: There should be a limit on the amount of kelp that can be taken by one company, a limit to the number of permitted harvesters, and a seasonal limit on the amount of kelp that can be taken from each bed (based on winter minimum canopy size).

Response 25r: Please see Response to Comment 25p. The Department did consider developing a maximum amount of kelp that could be removed from any given bed on an annual basis as an Alternative. Please see Section 6.1 for a discussion. The Department did not consider developing a limited entry process. That process would be counter to existing Legislative intent and Commission policy.

Comment 25s: Section 3.2.9.4 does not mention the endangered Stellar Sea Lion which occasionally frequents our kelp forests and the Breakwater. Bed 220 may be critical habitat for the threatened sea otter and abalone.

Response 25s:Please see Response to Comments 2b, 4a, 4d, 4m, 5e, 5j, 14b, 14h, 14i, 14j, 14l, 14u, 14y, 14z, 14aa, 16d, 17c, 17f, 20f, 20l, 21a, 24b, 24c, 24e, 24f, 24h, 24m, 24n, and 24u for discussion of concerns related to threatened or endangered species.

Comment 25t: Pacific Grove Marine Gardens Fish Refuge has been identified as an area of special biological significance in other documents. Yet, it is not mentioned in this document.

Response 25t: Commercial harvest of kelp is not affected by the presence of this refuge. The refuge is not identified in Title 14, California Code of Regulations as a refuge from consumptive uses of the state's renewable resources. It is unclear how its presence would effect the results of the environmental assessment.

Comment 25u: There is no mention of kelp survivability due to frequent harvest. What percentage of the kelp beds are dedicated for viewing, diving, otter, fish, or other critical animal habitat?

Response 25u: Please read Section 4.9.1 for the requested discussion (particularly p 4-19). The proposed regulation changes are directed at ensuring that the commercial harvest of canopy forming kelps is conducted in a resource sensitive manner. In that regard, impacts on otters, fish, and critical animal habitat are considered. Allocation of certain kelp bed areas for exclusive use of non-consumptive viewing and diver use was not considered necessary to ensure that commercial harvest was conducted in a resource sensitive way.

26. <u>Jim Thompson, Gayle Todd, and Charlene Mitchell, Friends of the Edward F. Ricketts Marine Park</u>

Comment 26a: We recommend a prohibition on kelp harvesting in the entire Ed Ricketts Park out to a depth of 60 feet.

Response 26a: Please see Response to Comments 20a, 20h, 22d, 23d, and 25f for a discussion of the use of reserves as a kelp management tool.

Comment 26b: Please correct DEIR to reflect that the park was developed by local concerned citizens.

Response 26b: Comment noted. DEIR will be changed.

Comment 26c: Royalties for kelp harvesting should no longer reflect the world spot market price for Alginic Acid, but should reflect the highest social use and economic value of each kelp forest.

Response 26c: Comment noted. Changes to fee and royalty payments were not part of the proposed project. Please see Response to Comments 20g and 25d for further discussion.

Comment 26d: All mechanical harvesters should be prohibited from Bed 219 northward. If the proposed regulation is implemented what parameters will the Commission use to evaluate a mechanical kelp harvest plan?

Response 26d: The Department can see no biological tenable reason for the suggested restriction and it does not seem reasonable as a method for addressing user conflict. Restricting use of mechanical harvesters as proposed could have the negative effect of forcing harvest demand into protected areas such as the Ed Ricketts Underwater Park. Please see Response to Comments 2b, 4l, 4m, 5h, 6c, 14q, 14z, 17f, 19e, 20d, 20i, and 20l for further discussion on use of a harvest plan to guide use of mechanical harvesters in the area north of Santa Rosa Creek.

Comment 26e: We support the seasonal closure of all Nereocystis beds within the Sanctuary during their biological reproductive season. We support closure of beds 224, 225, and 226.

Response 26e: Comment noted. Please note that the seasonal closure affects the harvest of bull kelp not harvesting within bull kelp beds. The closure also affects harvesting of this species in mixed canopy beds. Please see Section 3.2.3.1 and 3.2.3.2 for clarification on bull kelp reproductive biology. While an annual, some bull kelp plants can release sorus at any time of the year. The closure protects the species during the peak period of sorus release. The proposed regulations suggest closing beds 224, 225, and 226.

Comment 26f: Kelp canopies in sheltered areas must be left intact to provide habitat for the threatened sea otter during its pupping season.

Response 26f: Please see Response to Comments 2b, 4a, 4d, 4m, 5e, 5j, 14b, 14h, 14i, 14j, 14l, 14u, 14y, 14z, 14aa, 16d, 17c, 17f, 20f, 20l, 21a, 24b, 24c, 24e, 24f, 24h, 24m, 24n, and 24u for discussion of concerns related to threatened or endangered species. Protected areas between Point Pinos and the Monterey breakwater are not critical to sea otter or sea otter pup survival. Females with pups are found throughout central California and the peak in pupping occurs in March.

Comment 26g: The Department should enforce existing laws. Laws that provide for emergency closures should be used on a precautionary basis.

Response 26g: Comment noted. The Department does see an advantage in the use of the precautionary principle. Application of that principle forms the basis for the proposal to include use of harvest controls in areas of uncertainty.

27. Chuck Davis, Pacific Grove, CA

Comment 27a: Rather than take the 'no action' stance, please implement tighter restrictions on kelp harvesting.

Response 27a: The Department rejected the 'no action' alternative. The Department's preferred alternative is a suite of regulation changes that would impose tighter control over harvesting.

Comment 27b: Have you conducted studies to examine giant kelp's roll in coastal ecosystems? How does the removal of harvested kelp affect the richness of the ecosystem? Allowing the harvest of kelp within a marine sanctuary is unconscionable.

Response 27b: The Department evaluated over 400 scientific publications evaluating interrelationships between kelp and the associated organisms that make up these ecosystems. Based on the best information available, kelp harvesting can be conducted in a manner that causes less-than-significant impacts to these systems. The Monterey Bay National Marine Sanctuary has chosen to meet their responsibility with regard to management of kelp harvesting by working cooperatively with the Department. The Department believes that Sanctuary finds the proposed regulation changes acceptable.

Comment 27c: The Department should set some areas within Monterey Bay as no-take reserves. The entire Ed Ricketts Park should be included in these areas.

Response 27c: Comment noted. Please see Response to Comments 20a, 20h, 22d, 23a, 23d, 25f and 26a for further discussion of the use of reserves as a kelp management tool.

Comment 27d: Has the Department ever conducted a study to evaluate the recreational, educational, and esthetic value of our kelp forests vs. the commercial harvesting value of the same?

Response 27d: The Department has not conducted the type of study mentioned in this comment. Legislative intent and Commission policy speak to these issues and guide the Department's development of recommended regulation changes.

Comment 27e: Please reevaluate the fee structure used for harvesting of kelp.

Response 27e: Changes to fee structure are not part of the proposed project. Please see Response to Comments 20g, and 25d for further discussion. The Department sees merit in evaluating the fee structure and will visit this issue during the next review.

Comment 27f: How does the Department monitor kelp landings. Is the procedure based on the honor system. How much product goes off to market as by-catch.

Response 27f: Please see Response to Comment 25o for a discussion on monitoring of landings. There are no marketable by-product associated with kelp harvesting.

Comment 27g: I support a closure of the Sanctuary to bull kelp harvest during the entire biological reproductive season. The Department should not shorten this season.

Response 27g:Comment noted. Please see Section 3.2.3.1 and 3.2.3.2 for clarification on bull kelp reproductive biology. While an annual, some bull kelp plants can release sorus at any time of the year. The closure protects the species during the peak period of sorus release.

28. Berkley White, Monterey, CA

Comment 28a: As a place of special social significance and heavy use, the kelp forests of Canner Row require use of precautionary management.

Response 28a The Department agrees. Many of the regulations changes the have been proposed that this approach.

Comment 28b: Do not allow kelp harvesting within the Edward F. Ricketts Underwater Park.

Resposne 28b:Comment noted. Please see Response to Comments 20a, 20h, 22d, 23a, 23d, 25f and 26a for further discussion of the use of reserves as a kelp management tool.

Comment 28c: The socio-economic value of kelp along Monterey must be quantified.

Response 28c: Comment noted. Please see Response to Comments 20g, 25d, 26a, and 27e for further discussion.

Comment 28d: The Department infrequently conducts aerial surveys and relies on data from harvesters. Closing beds once harvested to 50% of canopy requires monitoring of seasonal and large scale environmental changes. What data supports that a 50% trigger is adequate to close a bed to harvest?

Response 28d: Comment noted. Please see Response to Comment 25p. The Marine Region has purchased a multi-spectral digital camera and will be conducting more frequent statewide aerial surveys to improve the data base for making management decisions.

Comment 28e: Eliminating harvesting in the Rickett's Park will establish a rookery for juveniles and decrease potential predation.

Response 28e: Please see Response to Comment 28b. While beyond the scope of this CEQA evaluation, the scale of the proposed preserve limits its value as a protected area. The suggestion to consider the merits of the subject park as a marine protected area has been forwarded to staff focused on this issue for consideration.

Comment 28f: The kelp must be preserved as habitat for the threatened sea otter.

Response 28f:Comment noted. Please see Response to Comments 2b, 4a, 4d, 4m, 5e, 5j, 14b, 14h, 14i, 14j, 14l, 14u, 14y, 14z, 14aa, 16d, 17c, 17f, 20f, 20l, 21a, 24b, 24c, 24e, 24f, 24h, 24m, 24n, 24u, and 26f for a discussion of the relationship between kelp harvesting and threatened species.

Comment 28g: The Environmental Document should include an analysis of the number and level of historic local (Monterey area) sewage spills and an estimate of future spills.

Response 28g: The subject effects are discussed in Section 4.9.4 on a statewide basis. The requested analysis would add only insights into the potential for local impacts. The Document has already recognized that cumulative effects do suggest that a prudent conservative approach to consumptive use of kelp is warranted. The proposed regulation changes reflect that view.

Comment 28h: Page 4-12 states that hand harvesting has had "no appreciable visual effect on the canopy". That has not been the case along Cannery Row, please correct the document or justify its exclusion.

Response 28h: Comment noted. The Department sees no need to change the Document. The Document indicates that harvesting can temporarily affect the scenic quality of an area. When discussing aquaculture activity, the Document does indicate that aquaculturists <u>generally</u> collect small amounts of giant kelp. The Document goes on to indicate that there have been user conflicts and specifically mentions Cannery Row.

Comment 28i: The Ed Rickett's Under Water Park was developed by the community not just by business owners.

Response 28i: Comment noted. The Document will be changed to reflect a grass roots conservation oriented movement behind the development of the park concept.

Comment 28j: There are no benefits to underwater photography from 'opening lanes in the canopy'. The document should be corrected.

Response 28j: the subject section only mentions that non-consumptive users may benefit from harvest operations and does not expand on those benefits as they relate specifically to underwater photography. As an example, the Document mentions having access into thick canopy as a result of harvesting. That access and increased light penetration would be perceived as benefits to some non-consumptive users.

Comment 28k: Abalone aquaculturists should grow their own food.

Response 28k: Comment noted. Please see Response to Comment 14ff and 25q for a discussion.

Comment 28l: A moratorium should be placed on kelp harvesting permits

Response 28l: Suggestion noted. The Department sees no need to limit the number of kelp harvesting permits. Total kelp harvest is at its lowest point since 1925 as a result of changes in business practices. While the Department is concerned about impacts on a local scale, limiting access to the overall resource does not appear to be warranted. Many of the proposed changes address concerns over potential for small-scale impacts and develop a precautionary approach to address those potential impacts.

Comment 28m: No mechanical harvesting should be allowed north of bed 218.

Response 28m: Comment noted. Please see Response to Comments 2b, 4l, 4m, 5h, 6c, 14q, 14z, 17f, 19e, 20d, 20i, and 20l for discussion.

Comment 28n: The seasonal closure should be extended fro April 1 through August 31 as recommended by the Sanctuary.

Response 28n: Comment noted. Please see Section 3.2.3.1 and 3.2.3.2 for clarification on bull kelp reproductive biology. While an annual, some bull kelp plants can release sorus at any time of the year. The closure protects the species during the peak period of sorus release.

Comment 28o: Beds 224, 225, and 226 should be closed.

Response 28o: Those bed closures are part of the proposed regulation change.

Comment 28p: The collection of invertebrates for aquarium display and research has increased and could be affecting invertebrate populations.

Response 28p: The proposed analysis is beyond the scope of potential impacts from the proposed regulation changes. The resources used for those purposes are not typically associated with kelp canopies and are not a meaningful source of cumulative on kelp.

29. Jessica Wheeler, Monterey, CA

Comment 29a: The area closure in bed 220 should be expanded to include the Ed Ricketts Underwater Park.

Response 29a: Comment noted. Please see Response to Comments 20a, 20h, 22d, 23a, 23d, 25f, 26a, and 28b for further discussion of the use of reserves as a kelp management tool.

Comment 29b: Kelp beds are critical habitat for sea otters.

Response 29b: Comment noted. Please see Response to Comments 2b, 4a, 4d, 4m, 5e, 5j, 14b, 14h, 14i, 14j, 14l, 14u, 14y, 14z, 14aa, 16d, 17c, 17f, 20f, 20l, 21a, 24b, 24c, 24e, 24f, 24h, 24m, 24n, 24u, and 26f for a discussion of the relationship between kelp harvesting and threatened species (including sea otters).

Comment 29c: Please correct the map on page 2-9 to show the entire area of bed 220.

Response 29c: Please see Response to Comment 25j.

Comment 29d: Assessing seasonal capacity would require new surveys for base line information and would result in much lower winter quotas.

Response 29d: Imposition of a per-bed harvest limit is not one of the proposed regulation changes. The section referenced in the comment (Section 2.5.1.3.1) refers to a provision of law related to how much of the states total canopy can be leased by one company. Please see Response to Comment 25p for further discussion.

Comment 29e: Streamline enforcement potential by requiring kelp to be weighed at specific landing sites.

Response 29e: This recommendation sets a standard not applied in any other commercial fishery. Please see Response to Comment 25o.

Comment 29f: Retain wording in Section 10500(f)

Response: 29f: The proposed regulation changes do not and cannot change language found in law (Fish and Game Code Section 10500(f)).

Comment 29g: Data from kelp harvest should be available to the public.

Response 29g: The data can be made available upon request.

Comment 29h: The comment suggests a series of research issues

Response 29h: The suggested research will be considered with the development of a Kelp Managment Plan. Timing for the development of that Plan will depend on its priority in a list of plans being developed under the Marine Life Management Act.

Comment 29i: Kelp fees are too low and should be balanced with the socio-economic value of kelp.

Response 29i: Comment noted. Please see Response to Comments 20g, 25d, and 26a for a discussion of this suggestion.

Comment 29j: Change the inaccurate statement that the Ed Ricketts Underwater Park was created by business owners.

Response 29j: Comment noted. The Department will make the suggested change. Please see Response to Comment 28i

Comment 29k: Correct inaccurate statement on visual effects from harvesting. Cannery row was overharvested and it was visually obvious. Harvesting has no benefit to the underwater photographer.

Response 29k: Comment noted. Please see Response to Comments 28j.

Comment 29l: Please remove inaccurate comment (p4-13) regarding access lanes from kelp harvesting being a benefit to photographers.

Response 29l: Please see Response to Comment 28j.

30. <u>Gregory D'Ambrosio, Carmel-By-The-Sea</u>

Comment 30a: The City of Carmel is concerned about the impacts that large-scale kelp harvesting might have on shoreline erosion and recommends the Department better understand how kelp harvesting affects erosion before allowing further harvesting in kelp bed 219.

Response 30a: Concern noted. Please see Response to Comment 14s and 25k. The presence of a canopy will dampen the effects of waves. That influence is strongest on local wind generated waves and can readily be observed when one compares wind waves on the windward and leeward side of a canopy. However, wind waves are not recognized as contributing significantly to beach erosion processes. Long-period waves (swell) have a much greater influence on beach erosion processes and on kelp bed integrity. However, the presence of a kelp canopy or its short-term removal through harvesting will generally have a minimal effect on dampening this type of energy. Long-period wave energy is expressed through a much broader stretch of the water column. A given swell's energy diminishes with depth to some threshold depth were it is no longer measurable. The size and period of the swell, the canopy's width, and the bottom depth under the canopy are variables that influence how much energy is dampened. Narrow kelp beds and deeper kelp beds will have less of a dampening effect than broader or shallower kelp beds. In direct measurements, a swell with a 5-second period traveling through a 350 meter wide kelp bed lost five percent of its energy. While that data suggests that the influence of canopy removal on dampening long-period wave energy and on corresponding beach erosion processes is less-than-significant, its influence in any specific configuration is amenable to study. However, available data do not suggest that it is reasonably necessary to prohibit harvesting activity because of this concern.

Comment 30b: The City of Carmel hopes the kelp resource will be managed in such a way as to reduce or prevent detrimental effects on our shoreline.

Response 30b: The Department has proposed regulation changes that adopt a precautionary approach to harvesting to achieve the goal stated in the comment. Among other proposed changes, the Department has suggested developing harvest plans to help guide use of mechanical harvesters in ways that will achieve the City of Carmel's goal.

31. <u>Vicki Nichols, Save Our Shores</u>

Comment 31a: Save Our Shores' concerns regarding kelp harvesting were incorporated into the Monterey Bay National Marine Sanctuary's (MBNMS) recommendations. We request that these recommendations be included in the Department's management process.

Response 31a: The Department appreciates the active role taken by Save Our Shores in hosting public forums on kelp management. Department participation in those forums helped staff understand public concerns related to kelp harvesting. Please see Response to Comments on Comment #6 for the Department's response to MBNMS's recommendations.

32. <u>Stephen Campi, Central California Council of Diving Clubs, Inc.</u>

Comment 32a: The Council requests that the proposed closure in kelp bed 220 be increased in size from Drake Avenue (its current proposed location) to Prescott Avenue as a compromise to the preferred location near Lovers Point. The entire area is used extensively by recreational divers and the Council would like the kelp and associated environment kept lush for recreational use.

Response 32a: The closure of a portion of kelp bed 220 proposed by the Department was not intended to provide a harvest free area for recreational uses. While the Department recognizes that the closure might kelp minimize resource use conflict in the area, that benefit was a secondary consideration. The closure was proposed to limit the potential for small-scale harvest impacts on the giant kelp resource near the Monterey harbor. The intent was to guide harvest pressure into adjacent areas in bed 220 where more canopy was available. In that way, existing harvest pressure was spread across more plants reducing the potential for small-scale impacts on plants that had received repeated harvest pressure near the breakwater. The Department believes that extending the closure out to Prescott Avenue creates an enforcement problem because the configuration of the kelp bed in that location does not allow harvesters to identify the closed area under poor visibility. A closure out to Lovers Point would force smaller vessels used by hand harvesters into potentially unsafe waters without any recognizable resource benefit.

33. Dale Glantz, ISP Alginates, Inc.

Comment 33a: ISP Alginates strongly opposes Alternative 1, which would establish statewide harvest controls.

Response 33a: As the comment notes, the Department is not proposing this alternative. However, when priorities allow, the Department will be developing a Kelp Management Plan. The Department anticipates that this alternative will be more fully evaluated with a view to its efficacy in the course of developing that plan. The Department looks forward to working with ISP Alginates and other interested parties in the development of that Plan and the evaluation process.

Comment 33b: ISP Alginates agrees that all harvested kelp should be appropriately weighed. However, ISP Alginates is concerned that the proposed language does not clarify what methods are acceptable.

Response 33b: Existing regulations authorize the weighing of kelp by any method approved by the Department. The proposed regulatory language establishes that only two methods will be approved: 1) direct weighing, and 2) and approved volume to weight conversion. That is, the proposed regulatory language only eliminates the use of any other weighing method. Compliance with the existing regulation and the proposed regulatory language with regard to approval of a volume to weight conversion is the same. However, the Department will focus on consistency in application of a conversion to insure data quality and will work with harvesters toward that end.

Comment 33c: ISP Alginates supports the amendments that clarify harvest information requirements in landing records and processes to be followed in submitting reports.

Response 33c: Comment noted.

Comment 33d: While ISP Alginates attempts to avoid harvesting of bull kelp, incidental take cannot be completely avoided. If the intent of the department is to allow a small incidental take of bull kelp, we would support the amendments that restrict harvest methods and seasons for bull kelp. ISP Alginates strongly opposes the amendments at they are currently written since it would preclude our harvesting in much of central California.

Response 33d: The proposed regulation change that suggests moving the geographic boundary location requiring hand harvesting of kelp north of that location was intended to prevent impacts on bull kelp near the southern limit of its geographic range from large scale harvesting. As written, the proposed regulation would prohibit the landing of bull kelp harvested

8.4 Comment Letters

See Appendix 4: Public Responses to 2001 Kelp CEQA Document

Appendix 1. Current Kelp and Marine Aquatic Plant Laws

FISH AND GAME CODE

51. "Kelp" means kelp or other marine aquatic plants and the seeds thereof.

6650. Every person engaged in harvesting kelp or other aquatic plants for profit in the waters of this State shall have a license for that purpose.

6651. (a) A license granting the privilege to harvest kelp or other aquatic plants shall be issued upon application and the payment of a fee of one hundred dollars ($100) to the department. The license shall be valid from January 1 to December 31, inclusive, or, if issued after the beginning of that term, for the remainder thereof.
(b) This chapter does not apply to aquatic plants grown on private land or on state water bottoms leased pursuant to Division 12 (commencing with Section 15000).

6652. Every person engaged in harvesting kelp shall determine the weight by any method, including the displacement method, approved by the department of all wet kelp immediately after it is delivered to the licensee's place of business or elsewhere, and the weight shall be entered in a book to be kept by the licensee. The book shall be open at all times to the inspection of the department. Every person engaged in harvesting kelp shall, on or before 10 days after each month of the term of the license, render a statement of the weight of all wet kelp harvested during the preceding month.

6653. The commission may make such regulations as may be necessary to insure the proper harvesting of kelp and other aquatic plants.

6653.5. (a) The department may issue permits for the drying of agar-bearing marine plants subject to the regulations the commission may prescribe to provide for proper utilization of that resource.
(b) No person shall dry agar-bearing marine plants for profit unless the person has a permit issued under this section.

6654. If, at any time, the commission finds that the harvesting of kelp will tend to destroy or impair any kelp bed or beds, or parts thereof, or tend to impair or destroy the supply of any food for fish, the department shall serve on every person licensed to harvest kelp a written notice that the kelp bed or beds, or parts thereof, shall be closed to the harvesting of kelp for a period not to exceed one year.

6655. Within 10 days after the service of such a notice, the person upon whom notice is served may demand a hearing upon the necessity for the closing of the kelp bed or beds, or parts thereof. Upon such demand for a hearing, the commission shall fix a time and place for the taking of evidence upon the necessity for the closing, which time shall be not less than 10 days nor more than 30 days from the date of such demand. The department shall serve written notice of the time and place of the hearing upon the person demanding the hearing, at least 10 days before the day set for the hearing. If no demand is made for a hearing within the time prescribed the kelp bed or beds, or parts thereof, shall remain closed to the harvesting of kelp for the time mentioned in the order.

6656. The commission may revoke and prohibit reissuance for a period of not more than one year, the license of:

(a) Any person who harvests any kelp from a bed which is closed, between the time of service of notice upon him or her of the closing of the bed and the decision of the commission upon a hearing as to the necessity for the closing.

(b) Any person who violates any law or regulation of the commission relating to kelp.

The proceedings shall be conducted at one of the commission's regularly scheduled meetings.

6657. The commission may, subject to such regulations as it may deem proper, grant permits to any department of the United States Government or to any scientific or any educational institution, to harvest kelp at any time for scientific or experimental purposes without the payment of the kelp license or privilege tax imposed by this chapter.

6680. In addition to the license fee provided for in this chapter, every person harvesting kelp or other aquatic plants shall pay a royalty, as the commission may prescribe, of not less than five cents ($0.05) per ton of wet kelp or wet aquatic plants harvested. Any revenues derived from such royalties shall not be available for expenditures until appropriated.

6700. The commission may lease to any person the exclusive privilege to harvest kelp in any designated kelp bed, or part thereof, if the commission determines that the lease is in the public interest. The commission shall describe the kelp beds of the state and adopt regulations for the leasing of the beds.

6701. Persons wishing to lease the exclusive privilege to harvest kelp shall submit a written application to the commission. An application shall include all of the following, and any other information the commission may prescribe:

(a) The number of thekelp bed or beds to be leased.

(b) The designated number of square miles in each bed.

6701.5. A deposit of not less than forty dollars ($40) for each square mile, or fraction thereof, of the total area of the kelp bed or beds which are designated in the application shall be submitted with the application. The deposit shall be refunded to the person making the application unless a lease is executed.

6702. (a) If the commission finds that the kelp beds included in the application are available for lease and that the lease would be in the public interest, the commission shall publish a notice that the area is being considered for leasing.

(b) The commission shall have legal notices published in a newspaper of general circulation in each county where the kelp bed, or any part thereof, is located, describing the area to be leased and the type of operation to be conducted. Except as provided in this subdivision, the publication shall be made pursuant to Section 6066 of the Government Code.

(c) If the commission receives more than one application for the lease of a kelp bed or beds, it shall advertise for bids on the area being considered for leasing. The commission shall award the lease of that area to the highest qualified bidder.

6703. The initial term of a lease for the exclusive privilege of harvesting kelp shall not exceed 20 years. No lessee shall have an exclusive lease, excluding subleases, to an area in excess of 25 square miles or 50 percent of the total area of the kelp resource as shown on the maps of the resource prepared by the commission, whichever is greater.

6704. (a) Each kelp bed lease entered into or renewed, on and after January 1, 1985, shall specify a period prior to expiration when renewal of the lease may be requested by the lessee. If the commission determines that the lessee has complied with the terms of the lease, the lessee shall have a prior right to renew the lease on terms agreed upon between the commission and the lessee.

(b) If terms for a renewal of the lease are not agreed upon, or the commission determines that the lessee has not complied with the terms of the lease, the commission shall advertise for bids on the individual kelp beds comprising the lease.

(c) If a request for renewal is not made during the specified period by the lessee, the commission shall advertise for bids on the individual kelp beds comprising the lease.

(d) The duration of the term of any renewal of a lease shall not exceed 20 years.

6705. Notwithstanding Section 6704, with respect to any kelp lease in effect on January 1, 1983, the lessee shall have a prior right to renew the lease on terms agreed upon between the commission and the lessee. If the lessee does not renew the lease, or if terms are not agreed upon, the commission shall advertise for bids on the individual kelp beds comprising the lease. The term of any renewal of a lease shall not exceed 20 years. Any lease in effect on January 1, 1985, may be performed pursuant to its terms, notwithstanding this article, but any renewal of that lease is subject to this article.

6706. Notwithstanding Sections 6703 and 6704, at any time during the term of a lease, the commission and the lessee may negotiate and enter into a new lease on terms agreed upon between the two parties, if the commission determines that such a new lease would be in the best interest of the state. The initial term of the new lease shall not exceed 20 years.

6707. Each lease entered into, or renewed, on or after January 1, 1985, shall require, in addition to the license fee required by this chapter, a payment by the lessee or any sublessee of not less than the minimum royalty established under Article 2 (commencing with Section 6680), for all kelp harvested from the lease area, and shall provide for an annual advance payment of not less than forty dollars ($40) per square mile per year for the kelp bed leased, to be credited against the amount payable by the lessee, or sublessee, as the case may be, for each ton of kelp harvested during the ensuing year. The lease shall, in addition, include provisions for forfeiture of the lease if the annual payment is not made in advance.

6708. A lease may not be assigned, in whole or in part, by the lessee, either voluntarily or by operation of law, and no subleases or other rights may be granted thereunder by the lessee without the prior approval of the commission, subject to the conditions that the commission prescribes. The lease shall be forfeited in the event of a violation of this section. Each lease shall contain a statement of the contents of this section.

6709. A lease, or any renewal thereof, shall be submitted to, and approved by, the Department of General Services.

6710. When an exclusive privilege to harvest kelp has been granted by lease by the commission, the commission shall furnish a true copy thereof to the department. The department shall file a notice for record in the recorder's office of the county in which the kelp bed or beds, or part thereof, are located, setting forth the name of the person having the privilege, the description of the kelp bed or beds, or part thereof, and the time for which the privilege has been granted. The notice required to be filed for record under this section may be a copy of the executed lease.

6711. The department shall inform the State Lands Commission of all kelp bed leases executed pursuant to this chapter, and shall furnish the State Lands Commission with the information concerning these leases that it may require.

6750. The commission may regulate the taking, collecting, harvesting, gathering, or possession of kelp for purposes other than profit. 6751. The provisions of Article 1 (commencing with Section 6650), Article 2 (commencing with Section 6680), and Article 3 (commencing with Section 6700) of this chapter do not apply to the taking, collecting, harvesting, gathering, or possession of kelp under this article.

Title 14 - California Code of Regulations

Non-commercial Use of Marine Plants

30.00. Kelp General.

(a) Except as provided in this section and in Section 30.10 there is no closed season, closed hours or minimum size limit for any species of marine aquatic plant. The daily bag limit on all marine aquatic plants for which the take is authorized, except as provided in Section 28.60, is 10 pounds wet weight in the aggregate.

(b) Marine aquatic plants may not be cut or harvested in marine life refuges, marine reserves, ecological reserves, national parks or state underwater parks.

30.10. Prohibited Species. No eel grass *(Zostera)* surf grass *(Phyllospadix)* or sea palm *(Postelsia)* may be cut or disturbed.

Commercial Harvest

165. Harvesting of Kelp and Other Aquatic Plants.

(a) General License Provisions. Pursuant to the provisions of section 6651 of the Fish and Game Code, no kelp or other aquatic plants may be harvested for commercial purposes except under a revocable license issued by the department.

(1) Who Shall be Licensed. Each company or individual harvesting kelp and other aquatic plants for industrial, human consumption or aquaculture purposes shall apply each year for a license on forms provided by the department. Application forms and a list of laws and regulations governing the harvest of kelp and other aquatic plants are available on request from the department's Marine Resources Division, 1416 Ninth Street, Sacramento, CA 95814, and from the department's field offices in Eureka, Menlo Park, Monterey, Long Beach and San Diego.

(2) Cost of License. See Section 6651 of the Fish and Game Code.

(3) Where to Submit Applications. Application forms, together with the $100 license fee, shall be submitted to the department's Long Beach office, 330 Golden Shore, Suite 50, Long Beach, CA 90802.

(4) License Limitation. All provisions of sections 6650-6680 of the Fish and Game Code, and sections 165 and 165.5 of the commission regulations shall become a condition of all licenses issued under this section to be fully performed by the holders thereof, their agents, servants, employees or those acting under their direction or control.

(b) General Harvesting Provisions.

(1) Weighing of Kelp. All kelp and other aquatic plants shall be weighed upon landing or delivery by any method, including the displacement method, approved by the department. Plants weighed by a public weighmaster licensed as an individual under the laws of this state shall be verified by a receipt issued to the harvester.

(2) Harvesting Records. Every person harvesting kelp and other aquatic plants and licensed pursuant to section 6650 of the Fish and Game Code shall keep a book or books recording the following:

(A) Category of plants harvested as defined in sections 165(c), (d) and (e).

(B) The number of pounds or tons landed.

(C) Name and address of the person or firm to whom the plants are sold, unless utilized by the harvester. The book(s) shall be open at all times for inspection by the department.

(3) Landing Records. Records of landing shall be prepared by all harvesters licensed pursuant to section 6650 of the Fish and Game Code. Records of landing shall be made in duplicate on forms provided by the department. The landing records shall show:

(A) The wet weight of all aquatic plants harvested.

(B) Name of harvester.

(C) Department of Fish and Game kelp harvester number.

(D) Dates of landing or delivery.

(E) Department origin block or kelp bed number where the plants were harvested.

(F) Such other statistical information the department may require.

(G) The duplicate copy of the landing record shall be kept by the kelp harvester for a period of one year and shall be available for inspection at any time within that period by the department. The original copy shall be delivered to the department at the address indicated within 10 days after the close of each month, with the specified royalty required for all kelp and other aquatic plants harvested. Failure to submit the required landing record and royalty fees within the prescribed time limit are grounds for revocation of the harvester's license.

(4) No eel grass (*Zostera*) or surf grass (*Phyllospadix*) may be cut or disturbed.

(5) No seaweed may be harvested in marine life refuges or in specially designated aquatic parks as per section 10500(f) of the Fish and Game Code.

(6) It is unlawful to cause or permit any deterioration or waste of any kelp or other aquatic plants taken in the waters of this state or to take, receive or agree to receive more kelp or other aquatic plants than can be used without deterioration, waste or spoilage.

(c) Harvesting of *Macrocystis* and *Nereocystis* (giant and bull kelp).

(1) Such species taken must be harvested by cutting, except that drift or loose kelp may be picked up by the harvester. All kelp which is cut or removed from a bed must be taken from the water and removed to a plant for processing.

(2) No *Macrocystis* (giant kelp) or *Nereocystis* (bull kelp) shall be harvested at a depth of more than four feet below the surface of the water at time of cutting.

(3) No kelp received aboard a harvesting vessel shall be allowed to escape from the vessel or be deposited into the waters of this state.

(4) In beds north of Point Arguello the take of *Nereocystis* (bull kelp) may be limited to insure that the resource is not harmed.

(5) In beds north of Point Montera, *Nereocystis* (bull kelp) may only be taken by hand harvesting. No mechanical harvesters of any kind are allowed.

(A) The following beds may not be harvested at any time:

Bed No. Square Miles	
303	1.33
304	0.89
305	1.11
306	1.03
307	0.93
Total	5.29

(B) The following beds may not be harvested except by a lessee authorized by the commission.

Bed No.	Square Miles
301	0.00
302	0.00
308	0.20
309	0.14
310	0.00
311	0.00
312	0.20
Total	0.54

(6) Every person harvesting such kelp on nonleased beds shall, in addition to the license fee, pay a royalty of $1.71 per ton (2,000 lbs.) of wet kelp harvested.

(d) Harvesting of marine plants of the genera *Gelidium*, *Pterocladia*, *Gracilaria*, *Iridaea*, *Gloiopeltis* or *Gigartina* which are classified as agar-bearing plants.

(1) General Provisions.

(A) All agar-bearing plants must be harvested by cutting, except that drift or loose plants may be picked up by the harvester. Agar-bearing plants may be cut no closer than two inches to the holdfast and no holdfast may be removed or disturbed. All agar-bearing plants which are removed from a bed must be taken from the water for weighing and processing.

(B) While harvesting agar-bearing plants, it is unlawful to harvest abalone or to have abalone harvesting equipment in possession.

(C) License numbers of the harvesters will be displayed on both sides of the boat from which they are operating in 10-inch black numbers on a white background.

(D) A harvester may use conventional underwater diving gear or SCUBA when harvesting agar-bearing plants.

(2) Kelp Drying Permits. Pursuant to section 6653.5 of the Fish and Game Code, no company or individuals shall reduce the moisture content or otherwise dry agar-bearing plants harvested from waters of the state except under the authority of a kelp drying permit issued by the department. Drying permits shall be issued under the following conditions:

(A) Where Issued. Requests for kelp drying permits shall be submitted to the Department of Fish and Game at the address listed in section 165(a)(3).

(B) Cost of Permit. See subsection 699(b) of these regulations for the fee for this permit.

(C) Permit Review. The department shall return permit application forms to the applicant within three working days of receipt.

(D) Duration of Permits. Except as otherwise provided, kelp drying permits shall be valid for a term of one year from date of issue.

(E) Weighing of Kelp. All agar-bearing marine plants shall be weighed upon landing pursuant to the provisions of subsection (b)(1) of these regulations.

(F) Plant Delivery. Every person taking delivery of agar-bearing marine plants for drying purposes from persons licensed pursuant to section 6650 of the Fish and Game Code or harvesters drying their own plants shall keep a book or books recording the following:

1. A full and correct record of all agar-bearing plants received from other licensed agar harvesters or taken by permittee.

2. Names of the different species.

3. The number of pounds received.

4. Name, address and kelp harvester number of the person from whom the agar-bearing plants were received. The book(s) shall be open at all times for inspection by the department.

(G) Landing Receipts. Receipts shall be issued by all kelp drying permittees to harvesters licensed pursuant to subsection (b)(3) of these regulations and shall show:

1. Price paid.

2. Department origin block number where the agar-bearing plants were harvested.

3. Such other statistical information the department may require.

(H) The original signed copy of receipt shall be delivered to the agar harvester at the time of purchase or receipt of the agar-bearing plants. The duplicate copy shall be kept by the kelp drying permittee for a period of one year and shall be available for inspection at any time within that period by the department, and the triplicate shall be delivered to the department at the address indicated within 10 days after the close of each month, with a royalty of $17.00 per wet ton (2,000 lbs.) for all agar-bearing seaweed received. Failure to submit the required landing receipts and royalty fees within the prescribed time limit is grounds for revocation of the permittee's drying permit.

(e) Harvesting of marine plants, including the genera *Porphyra, Laminaria, Monostrema*, and other aquatic plants utilized fresh or preserved as human food and classified as edible seaweed.

(1) General Provisions.

(A) Edible varieties of marine plants must be harvested by cutting or picking, except that drift or loose plants may be picked up by the harvester. All harvested plants must be processed.

(B) Edible seaweed may be harvested from state waters throughout the year, except as provided under section 164.

(C) While harvesting edible seaweed, it is unlawful to harvest abalone or to have abalone harvesting equipment in possession.

(D) A harvester may use conventional underwater diving gear or SCUBA while harvesting edible seaweed.

(2) Harvest of Bull Kelp for Human Consumption. Notwithstanding subsection 165(c)(5)(A), persons operating under the authority of an edible seaweed harvesters license may take, not to exceed, 2 tons (4,000 lbs) of bull kelp per year. The entire plant may be harvested.

(3) Weighing of Edible Marine Plants. All edible marine plants shall be weighed pursuant to the provisions of subsection (b)(1) of these regulations and landing receipts in duplicate issued as per subsection (b)(3).

(4) The original copy of the receipt shall be delivered to the department at the address indicated within 10 days after the close of each month with a royalty of $24 per wet ton (2,000 lbs.) of edible marine plants harvested from state waters other than San Francisco Bay and Tomales Bay.

(f) All Other Species of Kelp.

(1) Applicant shall apply to the commission, outlining the species to be harvested, amount and location. The commission may set conditions and amount of royalty after review of the application.

165.5. Lease of Kelp Beds for Exclusive Harvest of *Macrocystis* and *Nereocystis*.

(a) The commission may lease to any person the exclusive privilege to harvest kelp in any designated kelp bed or beds, or part thereof described in subsection (j).

(b) Any person desiring to lease the exclusive privilege of harvesting kelp shall make a written application to the Fish and Game Commission, 1416 Ninth Street, Sacramento, CA 95814. The application for kelp bed lease shall include:

(1) The number of the designated bed or beds as shown in subsection (j), a description of the kelp bed or portion of the kelp bed requested and the designated number of square miles in each bed or portion thereof applied for.

(2) A minimum deposit of $2,565 per square mile for kelp beds lying south of Point Arguello and $1,368 per square mile for kelp beds lying north of Point Arguello. (The deposit shall be returned to the applicant if a lease is not executed.)

(3) A detailed development plan for the proposed kelp bed lease showing the intended use, the manner of harvesting and transporting the kelp and the amount of kelp the lessee proposes to harvest during each of the next five years.

(4) The financial capabilities of the lessee to carry out the proposed plan of development. The department shall evaluate the submitted plans, and provide its evaluation to the commission.

(5) Applicants for the lease of Kelp Beds 300-312 shall, in addition to the above requirements, submit evidence of a scientifically acceptable survey of the requested kelp bed, conducted within one year of the date of the application, showing the extent of the kelp bed and the quantity (biomass) of kelp present. Evidence of such a survey must be submitted annually prior to beginning harvest. Harvest of bull kelp from leased beds shall be limited to not more than 15 percent of the bull kelp biomass revealed by the survey.

(c) Kelp leases may be awarded to applicants determined by the commission to possess the capabilities to harvest and utilize kelp in a manner beneficial to the state.

(1) In case more than one application is received for the lease of a specified kelp bed or beds, the lease shall be awarded to the highest qualified bidder.

(2) Bids tendered for the exclusive right to harvest kelp from designated kelp beds will be for the dollar amount of royalty to be paid on each wet ton of kelp harvested. The minimum acceptable bid will be for a royalty rate of no less than $1.71 per wet ton of kelp harvested.

(3) The commission may reject any or all applications for the lease of the exclusive privilege to harvest kelp, if it deems the rejection to be in the public interest.

(d) If the specified kelp harvesting area applied for is found to be available for lease, and that the lease would be in the public interest, the commission shall have legal notices published in a newspaper of general circulation in each county where the kelp bed, or any part thereof, is located. The department shall, in addition, notify by mail all current holders of kelp harvesting licenses that a kelp lease is being considered.

(e) Upon termination of a kelp bed lease for any reason, the commission shall notify all current holders of kelp licenses of the availability of such bed(s) for lease.

(f) Kelp bed leases shall be awarded for a maximum term of 20 years.

(g) The royalty rate for kelp harvested from leased kelp beds shall be no less than $1.71 per wet ton of kelp harvested from such beds. A non-refundable advance payment computed on the basis of the harvest of 800 tons of kelp annually times the bid royalty rate per square mile for kelp beds located north of Point Arguello and the harvest of 1,500 tons of kelp annually times the bid royalty rate per square mile for beds lying south of that point is due and payable to the department on January 1 each year. Kelp harvested from each bed during the calendar year will be credited against the advance payment at the specified royalty rate until the deposit has been depleted. Kelp harvested from each bed in excess of the amount covered by the advance deposit shall be assessed at the basic royalty rate established by Section 165(c)(5).

(h) Each kelp lease shall specify a period prior to expiration when renewal of the lease may be requested by lessee. If during the notification period the lessee successfully demonstrates to the commission that all conditions of the lease have been met, the lessee shall have a prior right to renew the lease on terms agreed upon between the commission and the lessee. If terms of a lease renewal are not agreed upon prior to termination of a lease agreement, the commission shall advertise for bids on the individual kelp beds comprising the lease. If a request for renewal is not made during the specified period by the lessee, the commission shall advertise for bids on the individual kelp beds comprising the lease.

(i) Notwithstanding the provisions of subsections (f) and (h), at any time during the term of a lease, a lessee may notify the commission of its desire to enter into a new lease. If the lessee can successfully demonstrate to the commission that all conditions of its lease have been met and that a new lease would be in the best interest of the state, a new lease may be drawn on terms agreed upon between the two parties, provided a new lease is negotiated for an additional period not to exceed 20 years.

(j) There is established a "Revised Official Map and Description of Kelp Beds, Pt. Arguello to U.S.-Mexico Boundary" dated August 1, 1963 revised March 3, 1967, a new "Official Map and Description of Kelp Beds, Pt. Arguello to Pt. Montara" dated March 3, 1967, and a new map "Official Map and Description of Kelp Beds, Pt. Montara to California-Oregon Boundary" dated June 15, 1995. These maps are based upon U.S. Coast and Geodetic Survey Charts No. 5020, dated April 1961, No. 5302, dated October 12, 1964, and No. 5402, dated September 6, 1965, as filed with the Fish and Game Commission. Beds are described as follows: (all bearings are true bearings)

(1) Mainland Beds (Pt. Arguello to Mexico)

Bed 1. From a line drawn 264 from the U.S.A.-Mexico International Boundary to a line drawn 270 from the southern tip of San Diego Bay. 0.20 square miles.

Bed 2. From a line drawn 270 from the southern tip of San Diego Bay to a line drawn 259 from the southern tip of Point Loma. 0.10 square miles.

Bed 3. From a line drawn 259 from the southern tip of Point Loma to a line drawn 272 from the south jetty of Mission Bay. 2.58 square miles.

Bed 4. From a line drawn 272 from the south jetty of Mission Bay to a line drawn 283 from Scripps Pier. 2.53 square miles.

Bed 5. From a line drawn 283 from Scripps Pier to a line drawn 269 from the mouth of the San Dieguito River. 0.00 square miles.

Bed 6. From a line drawn 269 from the mouth of the San Dieguito River to a line drawn 236 from the middle of Loma Alta Lagoon (at South Oceanside). 1.52 square miles.

Bed 7. From a line drawn 236 from the middle of Loma Alta Lagoon to a line drawn 215 from the middle of the city of San Onofre. 0.66 square miles.

Bed 8. From a line drawn 215 from the middle of the city of San Onofre to a line drawn 219 from the middle of San Juan Creek. 1.53 square miles.

Bed 9. From a line drawn 219 from the middle of San Juan Creek to a line drawn 220 from Abalone Pt. 0.39 square miles.

Bed 10. From a line drawn 220 from Abalone Pt. to a line drawn 220 from the south jetty of Newport Bay. 0.00 square miles.

Bed 13. From a line drawn 156 from the San Pedro Breakwater Lighthouse to a line drawn 232 from Pt. Vicente. 0.54 square miles.

Bed 14. From a line drawn 232 from Pt. Vicente to a line drawn 256 from the southern tip of the Redondo Beach Breakwater. 0.74 square miles.

Bed 15. From a line drawn 223 from the Santa Monica Pier to a line drawn 156 from Malibu Pt. 0.04 square miles.

Bed 16. From a line drawn 156 from Malibu Pt. to a line drawn 185 from Pt. Dume. 0.21 square miles.

Bed 17. From a line drawn 185 from Pt. Dume to a line drawn 207 from Pt. Mugu. 0.62 square miles.

Bed 18. From a line drawn 217 from the middle of the mouth of Ventura River to a line drawn 214 from Pitas Pt. 0.14 square miles.

Bed 19. From a line drawn 214 from Pitas Pt. to a line drawn 218 from Rincon Pt. 0.05 square miles.

Bed 20. From a line drawn 218 from Rincon Pt. to a line drawn 198 from Loon Pt. 0.24 square miles.

Bed 21. From a line drawn 198 from Loon Pt. to a line drawn 184 from the eastern boundary of the Montecito Hotel (2.4 miles 072 from tip of S.B. Breakwater). 0.19 square miles.

Bed 22. From a line drawn 184 from the eastern boundary of the Montecito Hotel to a line drawn 166 from the tip of the Santa Barbara Breakwater. 0.05 square miles.

Bed 23. From a line drawn 166 from the tip of the Santa Barbara Breakwater to a line drawn 195 from the Santa Barbara Lighthouse. 0.10 square miles.

Bed 24. From a line drawn 195 from the Santa Barbara Lighthouse to a line drawn 197 from the middle of Rogue Creek (Arroyo Burro). 0.05 square miles.

Bed 25. From a line drawn 197 from the middle of Rogue Creek to a line drawn 185 from the middle of Hope Ranch Creek. 0.18 square miles.

Bed 26. From a line drawn 185 from the middle of Hope Ranch Creek to a line drawn 176 from Goleta Pt. 0.60 square miles.

Bed 27. From a line drawn 176 from Goleta Pt. to a line drawn 210 from Coal Oil Pt. 0.43 square miles.

Bed 28. From a line drawn 210 from Coal Oil Pt. to a line drawn 200 from the Middle of Gato Canyon (about 1.5 miles west of Naples). 0.60 square miles.

Bed 29. From a line drawn 200 from the middle of Gato Canyon to a line drawn 183 from the middle of Refugio Creek. 0.17 square miles.

Bed 30. From a line drawn 183 from the middle of Refugio Creek to a line drawn 180 from the middle of Canada de Molino (about 5 miles west of Refugio Creek). 0.39 square miles.

Bed 31. From a line drawn 180 from the middle of Canada de Molino to a line drawn 180 from the middle of Alegria Canyon (about 3.4 miles west of Gaviota). 0.16 square miles.

Bed 32. From a line drawn 180 from the middle of Alegria Canyon to a line drawn 180 from Pt. Conception. 2.76 square miles.

Bed 33. From a line drawn 180 from Pt. Conception to a line drawn 231 from Expada Bluff. 0.97 square miles.

Bed 34. From a line drawn 231 from Espada Bluff to a line drawn 270 from Pt. Arguello. 0.31 square miles.

Total Area Mainland Beds

(Pt. Arguello to Mexico) 19.05 square miles

(2) Island Beds

Bed 101. San Clemente Island. From a line drawn 120 from Pyramid Head to a line drawn 210 from China Pt. 0.66 square miles.

Bed 102. San Clemente Island. From a line drawn 210 from China Pt. to a line drawn 226 from Seal Cove. 2.39 square miles.

Bed 103. San Clemente Island. From a line drawn 226 from Seal Cove to a line drawn 0 from Northwest Harbor. 2.89 square miles.

Bed 104. San Clemente Island. From a line drawn 0 from Northwest Harbor to a line drawn 120 from Pyramid Head. 0.22 square miles.

Bed 105. Santa Catalina Island. Entire island. 0.75 square miles.

Bed 106. Santa Barbara Island. Entire island. 0.23 square miles.

Bed 107. San Nicolas Island. South of a line drawn 75 from the east end to a line drawn 283 from the west end. 1.15 square miles.

Bed 108. San Nicolas Island. North of a line drawn 283 from the west end to a line drawn 75 from the east end. 2.85 square miles.

Bed 109. Anacapa Islands. All islands. 0.32 square miles.

Bed 110. Santa Cruz Island. From a line drawn 86 from San Pedro Pt. to a line drawn 170 from Bowen Pt. 0.64 square miles.

Bed 111. Santa Cruz Island. From a line drawn 170 from Bowen Pt. to a line drawn 306 from West Pt. 0.61 square miles.

Bed 112. Santa Cruz Island. From a line drawn 306 from West Pt. to a line drawn 86 from San Pedro Pt. 0.11 square miles.

Bed 113. Santa Rosa Island. From a line drawn 61 from Skunk Pt. to a line drawn 180 from South Pt. 0.59 square miles.

Bed 114. Santa Rosa Island. From a line drawn 180 from South Pt. to a line drawn 285 from Sandy Pt. 2.17 square miles.

Bed 115. Santa Rosa Island. From a line drawn 285 from Sandy Pt. to a line drawn 45 from Carrington Pt. 1.59 square miles.

Bed 116. Santa Rosa Island. From a line drawn 45 from Carrington Pt. to a line drawn 61 from Skunk Pt. 0.62 square miles.

Bed 117. San Miguel Island. South of a line drawn 60 from Cardwell Pt. to a line drawn 231 from Pt. Bennett. 1.35 square miles.

Bed 118. San Miguel Island. North of a line drawn 231 from Pt. Bennett to a line drawn 60 from Cardwell Pt. 1.51 square miles.

Total Island Beds 20.65 square miles

(3) Mainland Beds (Pt. Arguello to Point Montara)

Bed 202. From a line drawn 270 from Pt. Arguello to a line drawn 270 from Point Sal. 0.10 square miles.

Bed 203. From a line drawn 270 from Point Sal to a line drawn 270 from Pismo Beach Pier. 0.00 square miles.

Bed 204. From a line drawn 270 from Pismo Beach Pier to a line drawn 180 from Point San Luis. 0.72 square miles.

Bed 205. From a line drawn 180 from Point San Luis to a line drawn 250 from Point Buchon. 0.64 square miles.

Bed 206. From a line drawn 250 from Point Buchon to a line drawn 270 from Morro Rock. 0.04 square miles.

Bed 207. From a line drawn 270 from Morro Rock to a line drawn 190 from Point Estero. 1.46 square miles.

Bed 208. From a line drawn 190 from Point Estero to a line drawn 230 from Von Helm Rock. 2.61 square miles.

Bed 209. From a line drawn 230 from Von Helm Rock to a line drawn 200 from San Simeon Point. 2.20 square miles.

Bed 210. From a line drawn 200 from San Simeon Point to a line drawn 230 from Point Piedras Blancas. 2.02 square miles.

Bed 211. From a line drawn 230 from Point Piedras Blancas to a line drawn 240 from Salmon Head. 1.50 square miles.

Bed 212. From a line drawn 240 from Salmon Head to a line drawn 240 from Cape San Martin. 1.26 square miles.

Bed 213. From a line drawn 240 from Cape San Martin to a line drawn 240 from Lopez

Point. 2.14 square miles.

Bed 214. From a line drawn 240 from Lopez Point to a line drawn 240 from Partington Point. 2.03 square miles.

Bed 215. From a line drawn 240 from Partington Point to a line drawn 200 from Pfeiffer Point. 0.80 square miles.

Bed 216. From a line drawn 200 from Pfeiffer Point to a line drawn 200 from Point Sur. 3.08 square miles.

Bed 217. From a line drawn 200 from Point Sur to a line drawn 270 from Yankee Point. 2.38 square miles.

Bed 218. From a line drawn 270 from Yankee Point to a line drawn 270 from Point Lobos. 0.50 square miles.

Bed 219. From a line drawn 270 from Point Lobos to a line drawn 270 from Point Cypress. 1.28 square miles.

Bed 220. From a line drawn 270 from Point Cypress to a line drawn 000 from Monterey Pier. 1.88 square miles.

Bed 221. From a line drawn 000 from Monterey Pier to a line drawn 180 from Santa Cruz Pier. 0.90 square miles.

Bed 222. From a line drawn 180 from Santa Cruz Pier to a line drawn 240 from Sand Hill Bluff. 0.81 square miles.

Bed 223. From a line drawn 240 from Sand Hill Bluff to a line drawn 240 from Point Ano Nuevo. 0.19 square miles.

Bed 224. From a line drawn 240 from Point Ano Nuevo to a line drawn 270 from Pescadero Point. 0.06 square miles.

Bed 225. From a line drawn 270 from Pescadero Point to a line drawn 270 from Point Montara. 0.00 square miles.

Total area of Mainland Beds

(Pt. Arguello to Point Montara) 28.60 square miles

(4) Mainland Beds (Point Montara to Oregon)

Bed 226. From a line drawn 270 from Point Montara to a line drawn 270 from Fort Point. 0.00 square miles.

Bed 301. From a line drawn 270 from Fort Point to a line drawn 270 from Point Reyes. 0.00 square miles.

Bed 302. From a line drawn 270 from Point Reyes to a line drawn 240 from Duncan's Point. 0.00 square miles.

Bed 303. From a line drawn 240 from Duncan's Point to a line drawn 270 from Gualala Point. 1.33 square miles.

Bed 304. From a line drawn 270 from Gualala Point to a line drawn 240 from Iverson Point 0.89 square miles.

Bed 305. From a line drawn 240 from Iverson Point to a line drawn 330 from Point Arena. 1.11 square miles.

Bed 306. From a line drawn 330 from Point Arena to a line drawn 270 from Stillwell Point. 1.03 square miles.

Bed 307. From a line drawn 270 from Stillwell Point to a line drawn 270 from the middle of Ten-mile River. 0.93 square miles.

Bed 308. From a line drawn 270 from the middle of Ten -mile River to a line drawn 180 from Point Delgada. 0.20 square miles.

Bed 309. From a line drawn 180 from Point Delgada to a line drawn 260 from Cape Mendocino. 0.14 square miles.

Bed 310. From a line drawn 260 from Cape Mendocino to a line drawn 300 from the South jetty of Humboldt Bay. 0.0 square miles.

Bed 311. From a line drawn 300 from the South jetty of Humboldt Bay to a line drawn 270 from the middle of the Klamath River. 0.00 square miles.

Bed 312. From a line drawn 270 from the middle of the Klamath River to a line drawn 250 from the California-Oregon Boundry. 0.20 square miles.

Total of mainland beds

Point Montera to Oregon Boundary 5.83 square miles

Grand Total 74.13 square miles

(k) Those beds not subject to lease are as follows:

Mainland Beds

(Pt. Arguello to Mexico)

Bed No.	Square Miles
1	0.20
2	0.10
7	0.66
8	1.53
9	0.39
10	0.00
13	0.54
14	0.74
15	0.04
18	0.15
22	0.05
23	0.10
24	0.05
25	0.18
28	0.60
33	0.97
Total	6.30

Mainland Beds

(Pt. Arguello to Pt. Montara)

Bed No.	Square Miles
205	0.64
206	0.04
213	2.14
215	0.80
217	2.38
218	0.49
219	1.28
220	1.88
221	0.90
222	0.81
224	0.06
225	0.00
Total	11.42

Mainland Beds

(Pt. Montara to California-Oregon Border)

Bed No.	Square Miles
303	1.33
304	0.89
305	1.11
306	1.03
307	0.93
Total	5.29

Island Beds

Bed No.	Square Miles
101	0.66
104	0.22
105	0.75
109	0.32
110	0.64
112	0.11
113	0.59
114	2.18
115	1.59
116	0.62
117	1.35
118	1.51
Total	10.54

<u>Fish and Game Code Sections that influence the management of kelp beds within California's coastal waters</u>:

2850. This chapter shall be known and may be cited as the Marine Life Protection Act.

2851. The Legislature finds and declares all of the following: (a) California's marine protected areas (MPAs) were established on a piecemeal basis rather than according to a coherent plan and sound scientific guidelines. Many of these MPAs lack clearly defined purposes, effective management measures and enforcement. As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat. (b) California's extraordinary marine biological diversity is a vital asset to the state and nation. The diversity of species and ecosystems found in the state's ocean waters is important to public health and well-being, ecological health, and ocean-dependent industry. (c) Coastal development, water pollution, and other human activities threaten the health of marine habitat and the biological diversity found in California's ocean waters. New technologies and demands have encouraged the expansion of fishing and other activities to formerly inaccessible marine areas that once recharged nearby fisheries. As a result, ecosystems throughout the state's ocean waters are being altered, often at a rapid rate. (d) Fish and other sea life are a sustainable resource, and fishing is an important community asset. MPAs and sound fishery management are complementary components of a comprehensive effort to sustain marine habitats and fisheries. (e) Understanding of the impacts of human activities and the processes required to sustain the abundance and diversity of marine life is limited. The designation of certain areas as sea life reserves can help expand our knowledge by providing baseline information and improving our understanding of ecosystems where minimal disturbance occurs. (f) Marine life reserves are an essential element of an MPA system because they protect habitat and ecosystems, conserve biological diversity, provide a sanctuary for fish and other sea life, enhance recreational and educational opportunities, provide a reference point against which scientists can measure changes elsewhere in the marine environment, and may help rebuild depleted fisheries. (g) Despite the demonstrated value of marine life reserves, only 14 of the 220,000 square miles of combined state and federal ocean water off California, or six-thousandths of 1 percent, are set aside as genuine no take areas. (h) For all of the above reasons, it is necessary to modify the existing collection of MPAs to ensure that they are designed and managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves.

2852. The following definitions govern the construction of this chapter: (a) "Adaptive management," with regard to marine protected areas, means a management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements within marine systems may be better understood. (b) "Biogeographical regions" refers to the following oceanic or near shore areas, seaward from the high tide line or the mouth of coastal rivers, with distinctive biological characteristics, unless the master plan team establishes an alternative set of boundaries: (1) The area extending south from Point Conception. (2) The area between Point Conception and Point Arena. (3) The area extending north from Point Arena. (c) "Marine protected area" (MPA) means a named, discrete geographic marine or estuarine area seaward of the high tide line or the mouth of a coastal river, including any area of intertidal or subtidal terrain, together with its overlying water and associated flora and fauna that has been designated by law, administrative action, or voter initiative to protect or conserve marine life and habitat. An MPA includes marine life reserves and other areas that allow for specified commercial and recreational activities, including fishing for certain species but not others, fishing with certain practices but not others, and kelp harvesting, provided that these activities are consistent with the objectives of the area and the goals and guidelines of this chapter. MPAs are primarily intended to protect or conserve marine life and habitat, and are therefore a subset of marine managed areas (MMAs), which are broader groups of named, discrete geographic areas along the coast that protect, conserve, or otherwise manage a variety of resources and uses, including living marine resources, cultural and historical resources, and recreational opportunities. (d) "Marine life reserve," for the purposes of this chapter, means a marine protected area in which all extractive activities, including the taking of marine species, and, at the discretion of the commission and within the authority of the commission, other activities that upset the natural ecological functions of the area, are prohibited. While, to the extent feasible, the area shall be open to the public for managed enjoyment and study, the area shall be maintained to the extent practicable in an undisturbed and unpolluted state.

2853. (a) The Legislature finds and declares that there is a need to reexamine and redesign California's MPA system to increase its coherence and its effectiveness at protecting the state's marine life, habitat, and ecosystems. (b) To improve the design and management of that system, the commission, pursuant to Section 2859, shall adopt a Marine Life Protection Program, which shall have all of the following goals: (1) To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems. (2) To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted. (3) To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity. (4) To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value. (5) To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines. (6) To ensure that the state's MPAs are designed and managed, to the extent possible, as a network. (c) The program may include areas with various levels of protection, and shall include all of the following elements: (1) An improved marine life reserve component consistent with the guidelines in subdivision (c) of Section 2857. (2) Specific identified objectives, and management and enforcement measures, for all MPAs in the system. (3) Provisions for monitoring, research, and evaluation at selected sites to facilitate adaptive management of MPAs and ensure that the system meets the goals stated in this chapter. (4) Provisions for educating the public about MPAs, and for administering and enforcing MPAs in a manner that encourages public participation. (5) A process for the establishment, modification, or abolishment of existing MPAs or new MPAs established pursuant to this program, that involves interested parties, consistent with paragraph (7) of subdivision (b) of Section 7050, and that facilitates the designation of MPAs consistent with the master plan adopted pursuant to Section 2855.

2854. Notwithstanding Section 7550.5 of the Government Code, the State Interagency Marine Managed Areas Workgroup established by the Resources Agency shall submit its final report to the Legislature and the commission by January 15, 2000. The workgroup shall, after appropriate consultation with members of the public, determine future actions for implementing the recommendations of its final report.

2855. (a) The commission shall adopt a master plan that guides the adoption and implementation of the Marine Life Protection Program adopted pursuant to Section 2853 and decisions regarding the siting of new MPAs and major modifications of existing MPAs. The plan shall be based on the best readily available science. (b) (1) The department shall prepare, or by contract shall cause to be prepared, a master plan in accordance with this subdivision. In order to take full advantage of scientific expertise on MPAs, the department shall convene a master plan team to advise and assist in the preparation of the master plan, or hire a contractor with relevant expertise to assist in convening such a team. (2) The team members convened pursuant to this subdivision shall have expertise in marine life protection and shall be knowledgeable about the use of protected areas as a marine ecosystem management tool. The members shall also be familiar with underwater ecosystems found in California waters, with the biology and habitat requirements of major species groups in the state's marine waters, and with water quality and related issues. (3) The team shall be composed of the following individuals: (A) Staff from the department, the Department of Parks and Recreation, and the State Water Resources Control Board, to be designated by each of those departments. (B) Five to seven members who shall be scientists, one of whom may have expertise in the economics and culture of California coastal communities. (C) One member, appointed from a list prepared by Sea Grant marine advisers, who shall have direct expertise with ocean habitat and sea life in California marine waters. (4) The master plan shall be prepared with the advice, assistance, and involvement of participants in the various fisheries and their representatives, marine conservationists, marine scientists, and other interested persons. In preparing the master plan, the department shall confer, to the extent feasible, with the commission, the Pacific Fishery Management Council, the National Marine Fisheries Service, the United States Navy, the United States Geological Survey's national biological survey, staff from national marine sanctuaries off California, Sea Grant researchers, marine advisers, and national parks personnel. (5) The department may engage other experts to contribute to the master plan, including scientists, geographic information system (GIS) experts, and commercial and recreational fishermen, divers, and other individuals knowledgeable about the state's underwater ecosystems, the history of fishing effort or MPA management, or other relevant subjects. (c) The department and team, in carrying out this chapter, shall take into account relevant information from local communities, and shall solicit comments and advice for the master plan from interested parties on issues including, but not necessarily limited to, each of the following: (1) Practical information on the marine environment and the relevant history of fishing and other resources use, areas where fishing is currently prohibited, and water pollution in the state's coastal waters. (2) Socioeconomic and environmental impacts of various alternatives. (3) Design of monitoring and evaluation activities. (4) Methods to encourage public participation in the stewardship of the state's MPAs.

2856. (a) (1) The department and team shall use the best readily available scientific information in preparing the master plan adopted pursuant to Section 2855, and shall organize the location-specific contents, where feasible, by biogeographical region. In preparing the plan, the department and team shall use and build upon the findings of the Sea Grant survey of protected areas in California waters, which is entitled "California's Marine Protected Areas," the report of the State Interagency Marine Managed Areas Workgroup, the Department of Parks and Recreation's planning information and documents regarding existing and potential underwater parks and reserves, maps and other information from the department's marine nearshore ecosystem mapping project, and other relevant planning and scientific materials. (2) The master plan shall include all of the following components: (A) Recommendations for the extent and types of habitat that should be represented in the MPA system and in marine life reserves. Habitat types described on maps shall include, to the extent possible using existing information, rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds. (B) An identification of select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae. (C) Recommendations to augment or modify the guidelines in subdivision (c) of Section 2857, if necessary to ensure that the guidelines reflect the most up-to-date science, including, for example, recommendations regarding the minimum size of individual marine life reserves needed to accomplish the various goals set forth in Section 2853. (D) Recommended alternative networks of MPAs, including marine life reserves in each biogeographical region that are capable of achieving the goals in Section 2853 and designed according to the guidelines in subdivision (c) of Section 2857. (E) A simplified classification system, which shall be consistent with the goals of Section 2853 and the guidelines in subdivision (c) of Section 2857, and which may include protections for specific habitats or species, if no system that meets these specifications has already been developed. (F) Recommendations for a preferred siting alternative for a network of MPAs that is consistent with the goals in Section 2853 and the guidelines in subdivision (c) of Section 2857. (G) An analysis of the state's current MPAs, based on the preferred siting alternative, and recommendations as to whether any specific MPAs should be consolidated, expanded, abolished, reclassified, or managed differently so that, taken as a group, the MPAs best achieve the goals of Section 2853 and conform to the guidelines in subdivision (c) of Section 2857. (H) Recommendations for monitoring, research, and evaluation in selected areas of the preferred alternative, including existing and long-established MPAs, to assist in adaptive management of the MPA network, taking into account existing and planned research and evaluation efforts. (I) Recommendations for management and enforcement measures for the preferred alternative that apply systemwide or to specific types of sites and that would achieve the goals of this chapter. (J) Recommendations for improving the effectiveness of enforcement practices, including, to the extent practicable, the increased use of advanced technology surveillance systems. (K) Recommendations for funding sources to ensure all MPA management activities are carried out and the Marine Life Protection Program is implemented. (b) The team shall, as necessary, identify and define additional appropriate components of the master plan as soon as possible after enactment of this section.

2857. (a) On or before July 1, 2001, the department shall convene, in each biogeographical region and to the extent practicable near major working harbors, siting workshops, composed of interested parties, to review the alternatives for MPA networks and to provide advice on a preferred siting alternative. The department and team shall develop a preferred siting alternative that incorporates information and views provided by people who live in the area and other interested parties, including economic information, to the extent possible while maintaining consistency with the goals of Section 2853 and guidelines in subdivision (c) of this section. (b) The preferred alternative may include MPAs that will achieve either or both of the following objectives: (1) Protection of habitat by prohibiting potentially damaging fishing practices or other activities that upset the natural ecological functions of the area. (2) Enhancement of a particular species or group of species, by prohibiting or restricting fishing for that species or group within the MPA boundary. (c) The preferred siting alternative shall include MPA networks with an improved marine life reserve component, and shall be designed according to each of the following guidelines: (1) Each MPA shall have identified goals and objectives. Individual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of this chapter. (2) Marine life reserves in each bioregion shall encompass a representative variety of marine habitat types and communities, across a range of depths and environmental conditions. (3) Similar types of marine habitats and communities shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region. (4) Marine life reserves shall be designed, to the extent practicable, to ensure that activities that upset the natural ecological functions of the area are avoided. (5) The MPA network and individual MPAs shall be of adequate size, number, type of protection, and location to ensure that each MPA meets its objectives and that the network as a whole meets the goals and guidelines of this chapter. (d) The department and team, in developing the preferred siting alternative, shall take into account the existence and location of commercial kelp beds. (e) The department and team may provide recommendations for phasing in the new MPAs in the preferred siting alternative.

2858. The department shall establish a process for external peer review of the scientific basis for the master plan prepared pursuant to Section 2855. The peer review process may be based, to the extent practicable, on the peer review process described in Section 7062.

2859.(a) On or before January 1, 2002, the department shall submit to the commission a draft of the master plan prepared pursuant to this chapter.
(b) On or before April 1, 2002, after public review, not less than three public meetings, and appropriate modifications of the draft plan, the department shall submit a proposed final master plan to the commission. On or before July 1, 2002, the commission shall adopt a final master plan and a Marine Life Protection Program based on the plan and shall implement the program, to the extent funds are available. The commission's adoption of the plan and a program based on the plan shall not trigger an additional review under the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code).
(c) The commission shall hold at least two public hearings on the master plan and the Marine Life Protection Program prior to adopting the plan and program. The commission may adopt the plan and the program immediately following the second public hearing or at any duly noticed subsequent meeting.
(d) Notwithstanding Section 7550.5 of the Government Code, upon the commission's adoption of the program, the commission shall submit the master plan and program description, including marine life reserve and other MPA designations, to the Joint Committee on Fisheries and Aquaculture for review and comment. Upon receipt of the plan, the joint committee shall have 60 days to review the plan and to submit written recommendations to the commission regarding the plan and program. The joint committee shall only submit a recommendation to the commission if a majority of the members agree to that recommendation. The commission shall consider all recommendations submitted by the joint committee, and may amend the program to incorporate the recommendations. If the commission does not incorporate any recommendations submitted by the joint committee, the commission shall set forth, in writing, its reasons for not incorporating that recommendation.

2860. (a) The commission may regulate commercial and recreational fishing and any other taking of marine species in MPAs. (b) Notwithstanding any other provision of this code, the taking of a marine species in a marine life reserve is prohibited for any purpose, including recreational and commercial fishing, except that the commission may authorize the taking of a marine species for scientific purposes, consistent with the purposes of this chapter, under a scientific collecting permit issued by the department.

2861. (a) The commission shall, annually until the master plan is adopted and thereafter at least every three years, receive, consider, and promptly act upon petitions from the department or any other interested party, to add, delete, or modify MPAs, favoring those petitions that are compatible with the goals and guidelines of this chapter. (b) Notwithstanding Section 7550.5 of the Government Code, prior to the adoption of a new MPA or the modification of an existing MPA that would make inoperative a statute, the commission shall provide a copy of the proposed MPA to the Legislature for review by the Joint Committee on Fisheries and Aquaculture or, if there is no such committee, to the appropriate policy committee in each house of the Legislature. (c) Nothing in this chapter shall restrict any existing authority of the department or the commission to make changes to improve the management or design of existing MPAs or designate new MPAs prior to the completion of the master plan. The commission may abbreviate the master plan process to account for equivalent activities that have taken place before enactment of this chapter, providing that those activities are consistent with this chapter.

2862. The department, in evaluating proposed projects with potential adverse impacts on marine life and habitat in MPAs, shall highlight those impacts in its analysis and comments related to the project and shall recommend measures to avoid or fully mitigate any impacts that are inconsistent with the goals and guidelines of this chapter or the objectives of the MPA.

2863. The department shall confer as necessary with the United States Navy regarding issues related to its activities.

6420. The Legislature finds and declares all of the following: (a) Declines in various southern California marine species of fish have adversely affected the sport and commercial fishing industry. (b) Efforts to enhance these species through the placement of artificial reefs need to be investigated. (c) A program of artificial reef research and development, including reef design, placement, and monitoring, is in the public interest and can best be accomplished under the administration of the department with the cooperation and assistance of the University of California, the California State University, other established, appropriate academic institutions, and other organizations with demonstrated expertise in the field. (d) A state artificial reef research and construction program under the administration of the department is necessary to coordinate ongoing studies and construction of artificial reefs in waters of the state.

6421. For purposes of this article, the following terms have the following meaning: (a) "Artificial reef" means manmade or natural objects intentionally placed in selected areas of the marine environment to duplicate those conditions that induce production of fish and invertebrates on natural reefs and rough bottoms, and that stimulate the growth of kelp or other midwater plant life which creates natural habitat for those species. (b) "Production" means increases in the biomass of a species or number of species. (c) "Program" means the California Artificial Reef Program.

6422. The department shall administer the California Artificial Reef Program.

6423. The program shall include all of the following: (a) The placement of artificial reefs in state waters. (b) A study of existing successful reefs and all new reefs placed by the program to determine the design criteria needed to construct artificial reefs capable of increasing fish and invertebrate production in waters of the state. (c) A determination of the requirements for reef siting and placement.

15000. (a) The business of aquaculture is governed by this division and is exempt from Part 3 (commencing with Section 7600) of Division 6 and any other provision of this code relating to commercial fishing, harvesting, processing, and marketing. (b) Except as provided in Sections 15005, 15200, 15201, and 15202, the business of aquaculture processing, distribution, and marketing is administered by the Secretary of Food and Agriculture. (c) The director may enter into an agreement with the Secretary of Food and Agriculture for the resolution of any conflict that arises under subdivision (b). (d) Any costs incurred by the department in implementing Sections 15005, 15200, 15201, and 15202 shall be recovered pursuant to this division.

15001. The cultured progeny of wild plants and animals lawfully obtained under Section 15300 are the exclusive property of that person who cultured them or that person's successor in interest.

15002. Any person who takes aquaculture products without lawful entitlement is subject to prosecution for theft.

15003. (a) The department may assess a fee on persons growing aquaculture products on public lands and in public waters based on the price per pound of the products sold. The fees, if imposed, shall be set at amounts necessary to defray the costs of the commission and the department in administering this division. However, the fees if any, may not exceed the tax rates as provided in Section 8051. (b) The price per pound for these taxation purposes shall be based on the whole product weight or its equivalent as taken by the lessee. (c) The privilege tax imposed by this section shall be paid monthly to the department within 30 days after the close of each month. If not paid within 60 days after the close of the month in which it is due, a 10 percent penalty shall be paid.

15004. (a) Commencing in 1992, the department shall, at least once every five years, analyze the fees and taxes authorized by this division to ensure that the amount of the appropriate fee or tax is sufficient to fully fund the aquaculture program. (b) The department shall, as appropriate, recommend fee or tax changes to the Legislature or the commission. (c) Aquaculturists operating under this division shall pay all costs incurred by the department when conducting any inspections of plants, animals, facilities, or culture areas required by this division, or by regulations adopted pursuant to this division, when requested by the aquaculturists.

15005. (a) When necessary for the protection of native wildlife, the commission may regulate the transportation, purchase, possession, and sale of specific aquaculture products as provided for in this section. (b) The commission may determine that aquaculture products shall be accompanied by a document containing any of the following information: (1) The name, address, and registration number of the aquaculture producer. (2) The species. (3) The weight, volume or count within the container. (4) The date of the shipment. (5) The name and address of the intended receiver. (c) The commission may require that certain aquaculture products shall be additionally identified as being aquaculture produced, except for the following: (1) Trout. (2) Catfish. (3) Kelp and aquatic plants. (4) Frogs and amphibia. (5) All bivalve mollusks (except little neck clams). (6) All members of the family Centrarchidae. (7) Crayfish. (8) Sea urchins. (9) Shrimp and fresh water prawns. (10) Crab.

15006. Nothing in this division applies to authorized species of ornamental marine or freshwater plants and animals not utilized for human consumption or bait purposes that are maintained in closed systems for personal, pet industry, or hobby purposes.

15007. Except as specifically authorized in Chapter 10 (commencing with Section 15900), nothing in this division permits ocean ranching.

Appendix 2
Proposed Regulatory Changes
Sections 165 and 165.5, Title 14, CCR

165. Harvesting of Kelp and Other Aquatic Plants.

(a) General License Provisions. Pursuant to the provisions of section 6651 of the Fish and Game Code, no kelp or other aquatic plants may be harvested for commercial purposes except under a revocable license issued by the department.

(1) Who Shall be Licensed. Each company or individual harvesting kelp and other aquatic plants for industrial, human consumption or aquaculture purposes shall apply each year for a license on forms provided by the department. Application forms and a list of laws and regulations governing the harvest of kelp and other aquatic plants are available on request from the department's ~~Marine Resources Division, 1416 Ninth Street, Sacramento, CA 95814~~ Marine Region, 20 Lower Ragsdale Drive, Monterey CA 93940, and from the department's field offices in Eureka, Menlo Park, ~~Monterey, Long Beach~~ Los Alamitos, and San Diego.

(2) Cost of License. See Section 6651 of the Fish and Game Code.

(3) Where to Submit Applications. Application forms, together with the $100 license fee, shall be submitted to the department's Los Alamitos office at 4665 Lampson Avenue, Suite C, Los Alamitos, CA 90720. ~~Long Beach office, 330 Golden Shore, Suite 50, Long Beach, CA 90802.~~

(4) License Limitation. All provisions of sections 6650-6680 of the Fish and Game Code, and sections 165 and 165.5 of the commission regulations shall become a condition of all licenses issued under this section to be fully performed by the holders thereof, their agents, servants, employees or those acting under their direction or control.

(b) General Harvesting Provisions.

(1) Weighing of Kelp. ~~All kelp and other aquatic plants shall be weighed upon landing or delivery by any method, including the displacement method, approved by the department. Plants weighed by a public weighmaster licensed as an individual under the laws of this state shall be verified by a receipt issued to the harvester.~~ A kelp harvester shall determine the weight of harvested kelp or other aquatic plants upon landing or delivery to the harvester's place of business. The harvester may determine the weight of harvested kelp or other aquatic plants using either direct weighing or a volume conversion that has been approved by the department. If the weight is determined by a public weigh master, the harvester shall obtain a receipt and maintain the receipt in the landing record required under subsection (b)(3).

(2) Harvesting Records. Every person harvesting kelp and other aquatic plants and licensed pursuant to section 6650 of the Fish and Game Code shall keep a book or books recording the following:

(A) Category of plants harvested as defined in sections 165(c), (d) and (e).

(B) ~~The number of pounds or tons landed~~ The wet weight of harvested kelp or other aquatic plants recorded in pounds or tons (1 ton = 2000 pounds).

(C) Name and address of the person or firm to whom the plants are sold, unless utilized by the harvester. The book(s) shall be open at all times for inspection by the department.

(3) Landing Records. Records of landing shall be prepared by all harvesters licensed pursuant to section 6650 of the Fish and Game Code. Records of landing shall be made in ~~duplicate~~ triplicate ~~on~~ using forms FG 113 (Rev 1/97) and FG 114 (Rev 1/97) ~~and provided by the department~~. The landing records shall show:

(A) The wet weight of all aquatic plants harvested in units as defined in subsection (b)(2)(B).

(B) Name of harvester.

(C) Department of Fish and Game kelp harvester number.

(D) Dates of landing ~~or delivery~~.

(E) ~~Department origin block or kelp bed number where the plants were harvested~~ Kelp bed number or harvest control area where plants were harvested.

~~(F) Such other statistical information the department may require.~~

(G) ~~The~~ A duplicate copy of the landing record shall be kept by ~~the~~ a kelp harvester for a period of one year and shall be available for inspection at any time within that period by the department. A kelp harvester that harvests kelp from a harvest control area established under subsection (c)(4)(E) shall maintain a copy of the landing record on board the harvest vessel for all harvesting conducted during a harvest control period. The original and one copy of the record shall be delivered to the department at the address indicated within 10 days after the close of each month, with the specified royalty required for all kelp and other aquatic plants harvested. Failure to submit the required landing record and royalty fees within the prescribed time limit are grounds for revocation of the harvester's license.

(4) No eel grass (*Zostera*) or surf grass (*Phyllospadix*) may be cut or disturbed.

(5) No kelp or other aquatic plant ~~seaweed~~ may be harvested in a marine life refuges ~~or in specially designated aquatic parks~~ as per section 10500(f) of the Fish and Game Code.

(6) It is unlawful to cause or permit ~~any deterioration or~~ waste of any kelp or other aquatic plants taken in the waters of this state or to take, receive or agree to receive more kelp or other aquatic plants than can be used without ~~deterioration,~~ waste or spoilage.

(c) Harvesting of *Macrocystis* and *Nereocystis* (giant and bull kelp). In this subsection, kelp means both giant and bull kelp.

(1) ~~Such species taken must be harvested by cutting, except that drift or loose kelp may be picked up by the harvester. All kelp which is cut or removed from a bed must be taken from the water and removed to a plant for processing.~~ A kelp harvester may harvest kelp by cutting and removing portions of attached kelp or by collecting unattached kelp.

(2) ~~No *Macrocystis* (giant kelp) or *Nereocystis* (bull kelp) shall be harvested at a depth of more than four feet below the surface of the water at time of cutting~~. A kelp harvester may not cut attached kelp at a depth greater than four feet below the surface

of the water at the time of cutting.

(3) No kelp received aboard a harvesting vessel shall be allowed to escape from the vessel or be deposited into the waters of this state.

(4) ~~In beds north of Point Arguello the take of *Nereocystis* (bull kelp) may be limited to insure that the resource is not harmed.~~ The commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested.

(~~5~~ A) ~~In beds north of Point Montera, *Nereocystis* (bull kelp) may only be taken by hand harvesting. No mechanical harvesters of any kind are allowed.~~ In a nonleased kelp bed north of Santa Rosa Creek, San Luis Obispo County, a kelp harvester may harvest ~~kelp~~ attached bull kelp using only hand held cutting devices.

(B) Between April 1 and July 31, a kelp harvester may not harvest bull kelp from a nonleased kelp bed that lies partially or totally within the boundary of the Monterey Bay National Marine Sanctuary extending from Santa Rosa Creek, San Luis Obispo County northward to Rocky Point, Marin County. (Figure 2-1)

(C) Prior commission approval of a kelp harvest plan is necessary before a kelp harvester may use a mechanical harvester to harvest giant kelp in a nonleased kelp bed in the area north of Santa Rosa Creek.

(D) A kelp harvester may not harvest kelp in that portion of kelpbed 220 in Monterey County that lies between the tip of the Monterey breakwater and a line created by a seaward extension running 40^0magnetic north from the terminus of the west side of Drake Avenue in the City of Monterey. (Figure 2-2)

(E) The commission may designate, through emergency regulation, a nonleased kelp bed or portion of a bed as a harvest control area for a specified period of time. The commission shall set a cumulative harvest tonnage limit that may not be exceeded by a kelp harvester while harvesting within the control area during any consecutive 7-day period. The department shall maintain a list of active harvest control areas, their effective time period, and their cumulative harvest tonnage limit on its web page (www.dfg.ca.gov). The same information may be obtained by contacting the Marine Region headquarters at 20 Lower Ragsdale Drive, Monterey, CA 93940.

(~~A~~ 5) ~~The following beds may not be harvested at any time~~ A kelp harvester may not harvest kelp from the following kelp beds:

Bed No.	Square Miles	Bed No.	Square Miles
10	0.00	301	0.00
15	0.04	302	0.00
22	0.05	303	1.33
24	0.05	304	0.89
203	0.00	305	1.11
206	0.04	306	1.03
224	0.06	307	0.93
225	0.00	310	0.00
226	0.00	311	0.00
Total Square Miles			5.53

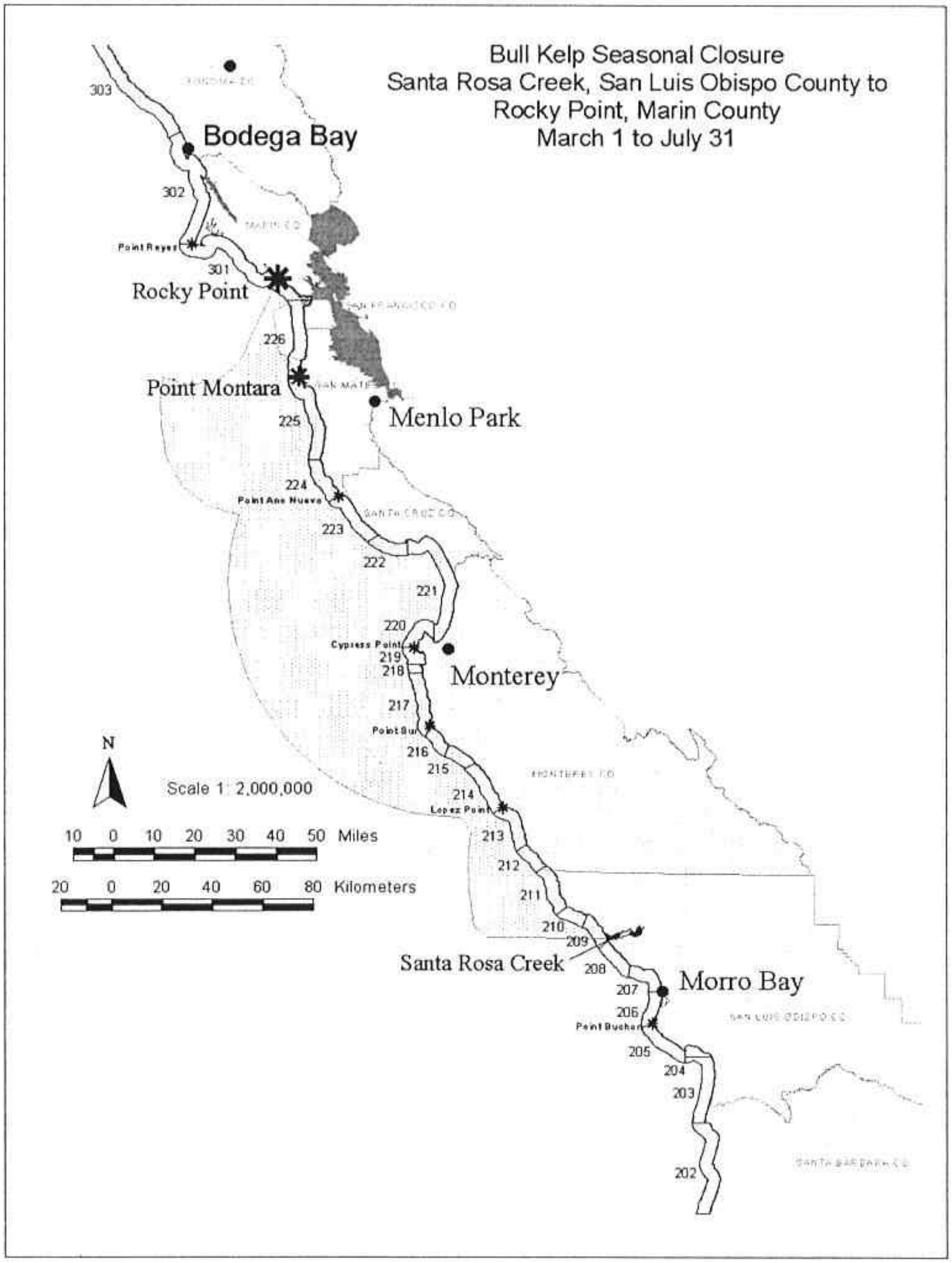


Figure Appendix 2-1. Bull Kelp Regulations

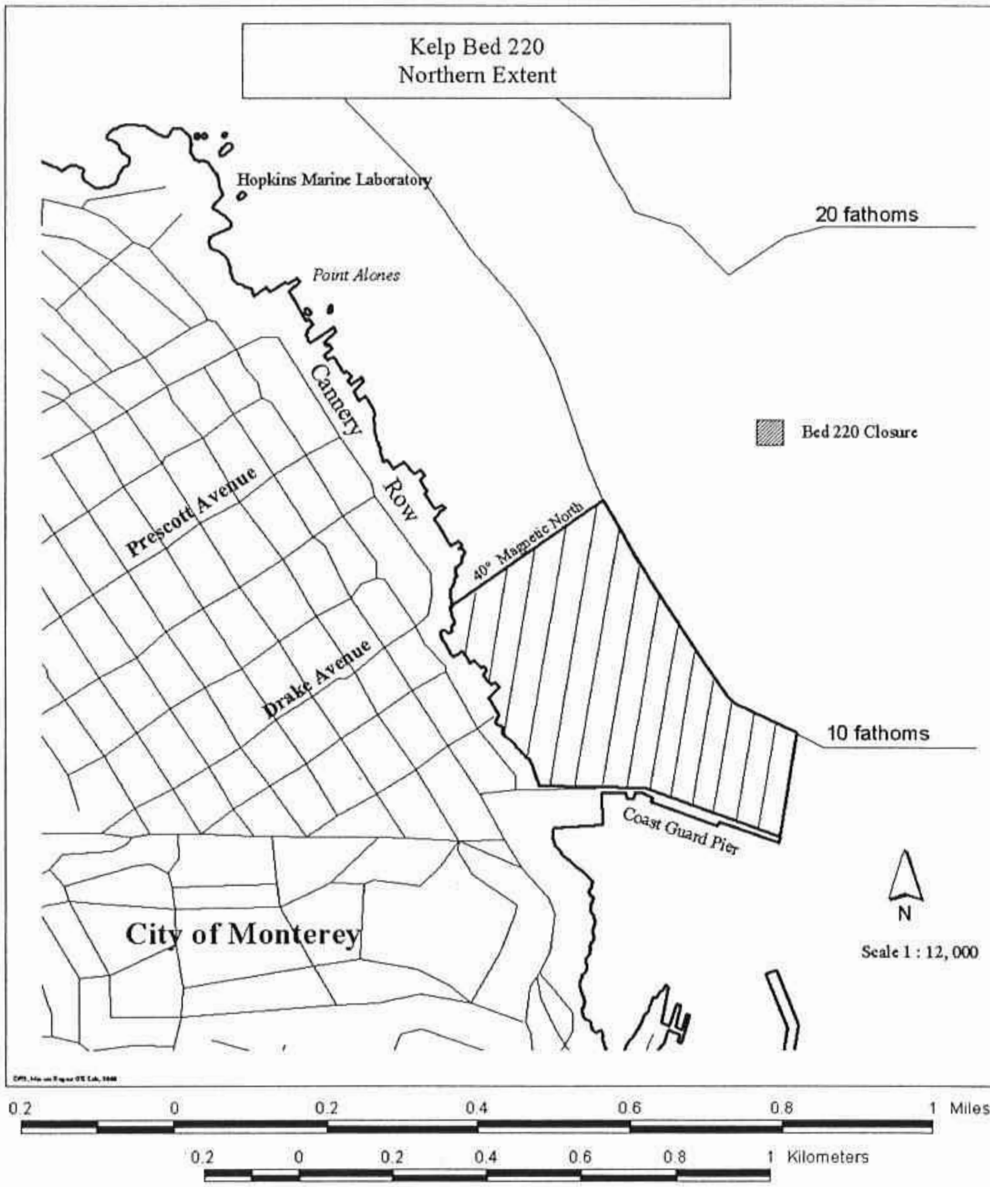


Figure Appendix 2 - 2. Bed 220 harvest restriction area.

(~~B~~ 6) ~~The following beds may not be harvested except by a lessee authorized by the commission.~~ Only a lessee authorized by the commission may harvest kelp from the following kelp beds:

Bed No.	Square Miles
~~301~~	~~0.00~~
~~302~~	~~0.00~~
308	0.20
309	0.14
~~310~~	~~0.00~~
~~311~~	~~0.00~~
312	0.20
Total	0.54

(6 7) ~~Every person harvesting such kelp on nonleased beds shall, in addition to the license fee, pay a royalty of $1.71 per ton (2,000 lbs.) of wet kelp harvested~~ In addition to the license fee, a kelp harvester shall pay a royalty of $1.71 for each ton (2,000 pounds) of wet kelp harvested from a nonleased bed..

NOTE

Authority cited: Sections 6653 and 6653.5, Fish and Game Code. Reference: Sections 6650-6680, Fish and Game Code.

165.5. Lease of Kelp Beds for Exclusive Harvest of *Macrocystis* and *Nereocystis* (giant and bull kelp).

(a) The commission may lease to any person the exclusive privilege to harvest kelp in any designated kelp bed or beds, or part thereof described in subsection (j). In section, kelp means both giant and bullkelp.

(b) A current list of designated beds considered by the Fish and Game Commission to be available for leasing can be obtained through written request to the department's Marine Region headquarters at 20 Lower Ragsdale Drive, Monterey, CA 93940. Any person desiring to lease the exclusive privilege of harvesting kelp shall make a written application to the Fish and Game Commission, 1416 Ninth Street, Sacramento, CA 95814. The application for kelp bed lease shall include:

(1) The number of the designated bed or beds as shown in subsection (j), a description of the kelp bed or portion of the kelp bed requested and the designated number of square miles in each bed or portion thereof applied for.

(2) A minimum deposit of $2,565 per square mile for kelp beds lying south of Point Arguello and $1,368 per square mile for kelp beds lying north of Point Arguello. (The deposit shall be returned to the applicant if a lease is not executed.)

(3) A detailed development plan for the proposed kelp bed lease showing the intended use, the manner of harvesting and transporting the kelp and the amount of kelp the lessee proposes to harvest during each of the next five years.

(4) The financial capabilities of the lessee to carry out the proposed plan of development. The department shall evaluate the submitted plans, and provide its evaluation to the commission.

(5) Applicants for the lease of Kelp Beds 300-312 shall, in addition to the above requirements, submit evidence of a scientifically acceptable survey of the requested kelp bed, conducted within one year of the date of the application, showing the extent of the kelp bed and the quantity (biomass) of kelp present. Evidence of such a survey must be submitted annually prior to beginning harvest. Harvest of bull kelp from leased beds shall be limited to not more than 15 percent of the bull kelp biomass revealed by the survey.

(c) Kelp leases may be awarded to applicants determined by the commission to possess the capabilities to harvest and utilize kelp in a manner beneficial to the state.

(1) In case more than one application is received for the lease of a specified kelp bed or beds, the lease shall be awarded to the highest qualified bidder.

(2) Bids tendered for the exclusive right to harvest kelp from designated kelp beds will be for the dollar amount of royalty to be paid on each wet ton of kelp harvested. The minimum acceptable bid will be for a royalty rate of no less than $1.71 per wet ton of kelp harvested.

(3) The commission may reject any or all applications for the lease of the exclusive privilege to harvest kelp, if it deems the rejection to be in the public interest.

(d) If the specified kelp harvesting area applied for is found to be available for lease, and that the lease would be in the public interest, the commission shall have legal notices published in a newspaper of general circulation in each county where the kelp bed, or any part thereof, is located. The department shall, in addition, notify by mail all current holders of kelp harvesting licenses that a kelp lease is being considered.

(e) Upon termination of a kelp bed lease for any reason, the commission shall notify all current holders of kelp licenses of the availability of such bed(s) for lease.

(f) Kelp bed leases shall be awarded for a maximum term of 20 years.

(g) The royalty rate for kelp harvested from leased kelp beds shall be no less than $1.71 per wet ton of kelp harvested from such beds. A non-refundable advance payment computed on the basis of the harvest of 800 tons of kelp annually times the bid royalty rate per square mile for kelp beds located north of Point Arguello and the harvest of 1,500 tons of kelp annually times the bid royalty rate per square mile for beds lying south of that point is due and payable to the department on January 1 each year. Kelp harvested from each bed during the calendar year will be credited against the advance payment at the specified royalty rate until the deposit has been depleted. Kelp harvested from each bed in excess of the amount covered by the advance deposit shall be assessed at the basic royalty rate established by Section 165(c)(5).

(h) Each kelp lease shall specify a period prior to expiration when renewal of the lease may be requested by lessee. If during the notification period the lessee successfully demonstrates to the commission that all conditions of the lease have been met, the lessee shall have a prior right to renew the lease on terms agreed upon between the commission and the lessee. If terms of a lease renewal are not agreed upon prior to termination of a lease agreement, the commission shall advertise for bids on the individual kelp beds comprising the lease. If a request for renewal is not made during the specified period by the lessee, the commission shall advertise for bids on the individual kelp beds comprising the lease.

(i) Notwithstanding the provisions of subsections (f) and (h), at any time during the term of a lease, a lessee may notify the commission of its desire to enter into a new lease. If the lessee can successfully demonstrate to the commission that all conditions of its lease have been met and that a new lease would be in the best interest of the state, a new lease may be drawn on terms agreed upon between the two parties, provided a new lease is negotiated for an additional period not to exceed 20 years.

(j) There is established a "Revised Official Map and Description of Kelp Beds, Pt. Arguello to U.S.-Mexico Boundary" dated August 1, 1963 revised March 3, 1967, a new "Official Map and Description of Kelp Beds, Pt. Arguello to Pt. Montara" dated March 3, 1967, and a new map "Official Map and Description of Kelp Beds, Pt. Montara to California-Oregon Boundary" dated June 15, 1995. These maps are based upon U.S. Coast and Geodetic Survey Charts No. 5020, dated April 1961, No. 5302, dated October 12, 1964, and No. 5402, dated September 6, 1965, as filed with the Fish and Game Commission. Beds are described as follows: (all bearings are true bearings)

(1) Mainland Beds (Pt. Arguello to Mexico)

Bed 1. From a line drawn 264° from the U.S.A.-Mexico International Boundary to a line drawn 270° from the southern tip of San Diego Bay. 0.20 square miles.

Bed 2. From a line drawn 270° from the southern tip of San Diego Bay to a line drawn 259° from the southern tip of Point Loma. 0.10 square miles.

Bed 3. From a line drawn 259° from the southern tip of Point Loma to a line drawn 272° from the south jetty of Mission Bay. 2.58 square miles.

Bed 4. From a line drawn 272° from the south jetty of Mission Bay to a line drawn 283° from Scripps Pier. 2.53 square miles.

Bed 5. From a line drawn 283° from Scripps Pier to a line drawn 269° from the mouth of the San Dieguito River. 0.00 square miles.

Bed 6. From a line drawn 269° from the mouth of the San Dieguito River to a line drawn 236° from the middle of Loma Alta Lagoon (at South Oceanside). 1.52 square miles.

Bed 7. From a line drawn 236° from the middle of Loma Alta Lagoon to a line drawn 215° from the middle of the city of San Onofre. 0.66 square miles.

Bed 8. From a line drawn 215° from the middle of the city of San Onofre to a line drawn 219° from the middle of San Juan Creek. 1.53 square miles.

Bed 9. From a line drawn 219° from the middle of San Juan Creek to a line drawn 220° from Abalone Pt. 0.39 square miles.

Bed 10. From a line drawn 220° from Abalone Pt. to a line drawn 220° from the south jetty of Newport Bay. 0.00 square miles.

Bed 13. From a line drawn 156° from the San Pedro Breakwater Lighthouse to a line drawn 232° from Pt. Vicente. 0.54 square miles.

Bed 14. From a line drawn 232° from Pt. Vicente to a line drawn 256° from the southern tip of the Redondo Beach Breakwater. 0.74 square miles.

Bed 15. From a line drawn 223° from the Santa Monica Pier to a line drawn 156° from Malibu Pt. 0.04 square miles.

Bed 16. From a line drawn 156° from Malibu Pt. to a line drawn 185° from Pt. Dume. 0.21 square miles.

Bed 17. From a line drawn 185° from Pt. Dume to a line drawn 207° from Pt. Mugu. 0.62 square miles.

Bed 18. From a line drawn 217° from the middle of the mouth of Ventura River to a line drawn 214° from Pitas Pt. 0.14 square miles.

Bed 19. From a line drawn 214° from Pitas Pt. to a line drawn 218° from Rincon Pt. 0.05 square miles.

Bed 20. From a line drawn 218° from Rincon Pt. to a line drawn 198° from Loon Pt. 0.24 square miles.

Bed 21. From a line drawn 198° from Loon Pt. to a line drawn 184° from the eastern boundary of the Montecito Hotel (2.4 miles 072° from tip of S.B. Breakwater). 0.19 square miles.

Bed 22. From a line drawn 184° from the eastern boundary of the Montecito Hotel to a line drawn 166° from the tip of the Santa Barbara Breakwater. 0.05 square miles.

Bed 23. From a line drawn 166° from the tip of the Santa Barbara Breakwater to a line drawn 195° from the Santa Barbara Lighthouse. 0.10 square miles.

Bed 24. From a line drawn 195° from the Santa Barbara Lighthouse to a line drawn 197° from the middle of Rogue Creek (Arroyo Burro). 0.05 square miles.

Bed 25. From a line drawn 197° from the middle of Rogue Creek to a line drawn 185° from the middle of Hope Ranch Creek. 0.18 square miles.

Bed 26. From a line drawn 185° from the middle of Hope Ranch Creek to a line drawn 176° from Goleta Pt. 0.60 square miles.

Bed 27. From a line drawn 176° from Goleta Pt. to a line drawn 210° from Coal Oil Pt. 0.43 square miles.

Bed 28. From a line drawn 210° from Coal Oil Pt. to a line drawn 200° from the Middle of Gato Canyon (about 1.5 miles west of Naples). 0.60 square miles.

Bed 29. From a line drawn 200° from the middle of Gato Canyon to a line drawn 183° from the middle of Refugio Creek. 0.17 square miles.

Bed 30. From a line drawn 183° from the middle of Refugio Creek to a line drawn 180° from the middle of Canada de Molino (about 5 miles west of Refugio Creek). 0.39 square miles.

Bed 31. From a line drawn 180° from the middle of Canada de Molino to a line drawn 180° from the middle of Alegria Canyon (about 3.4 miles west of Gaviota). 0.16 square miles.

Bed 32. From a line drawn 180° from the middle of Alegria Canyon to a line drawn 180° from Pt. Conception. 2.76 square miles.

Bed 33. From a line drawn 180° from Pt. Conception to a line drawn 231° from Expada Bluff. 0.97 square miles.

Bed 34. From a line drawn 231° from Espada Bluff to a line drawn 270° from Pt. Arguello. 0.31 square miles.

Total Area Mainland Beds

(Pt. Arguello to Mexico) . . . . 19.05 square miles

(2) Island Beds

Bed 101. San Clemente Island. From a line drawn 120° from Pyramid Head to a line drawn 210° from China Pt. 0.66 square miles.

Bed 102. San Clemente Island. From a line drawn 210° from China Pt. to a line drawn 226° from Seal Cove. 2.39 square miles.

Bed 103. San Clemente Island. From a line drawn 226° from Seal Cove to a line drawn 0° from Northwest Harbor. 2.89 square miles.

Bed 104. San Clemente Island. From a line drawn 0° from Northwest Harbor to a line drawn 120° from Pyramid Head. 0.22 square miles.

Bed 105. Santa Catalina Island. Entire island. 0.75 square miles.

Bed 106. Santa Barbara Island. Entire island. 0.23 square miles.

Bed 107. San Nicolas Island. South of a line drawn 75° from the east end to a line drawn 283° from the west end. 1.15 square miles.

Bed 108. San Nicolas Island. North of a line drawn 283° from the west end to a line drawn 75° from the east end. 2.85 square miles.

Bed 109. Anacapa Islands. All islands. 0.32 square miles.

Bed 110. Santa Cruz Island. From a line drawn 86° from San Pedro Pt. to a line drawn 170° from Bowen Pt. 0.64 square miles.

Bed 111. Santa Cruz Island. From a line drawn 170° from Bowen Pt. to a line drawn 306° from West Pt. 0.61 square miles.

Bed 112. Santa Cruz Island. From a line drawn 306° from West Pt. to a line drawn 86° from San Pedro Pt. 0.11 square miles.

Bed 113. Santa Rosa Island. From a line drawn 61° from Skunk Pt. to a line drawn 180° from South Pt. 0.59 square miles.

Bed 114. Santa Rosa Island. From a line drawn 180° from South Pt. to a line drawn 285° from Sandy Pt. 2.17 square miles.

Bed 115. Santa Rosa Island. From a line drawn 285° from Sandy Pt. to a line drawn 45° from Carrington Pt. 1.59 square miles.

Bed 116. Santa Rosa Island. From a line drawn 45° from Carrington Pt. to a line drawn 61° from Skunk Pt. 0.62 square miles.

Bed 117. San Miguel Island. South of a line drawn 60° from Cardwell Pt. to a line drawn 231° from Pt. Bennett. 1.35 square miles.

Bed 118. San Miguel Island. North of a line drawn 231° from Pt. Bennett to a line drawn 60° from Cardwell Pt. 1.51 square miles.

Total Island Beds . . . . 20.65 square miles

(3) Mainland Beds (Pt. Arguello to Point Montara)

Bed 202. From a line drawn 270° from Pt. Arguello to a line drawn 270° from Point Sal. 0.10 square miles.

Bed 203. From a line drawn 270° from Point Sal to a line drawn 270° from Pismo Beach Pier. 0.00 square miles.

Bed 204. From a line drawn 270° from Pismo Beach Pier to a line drawn 180° from Point San Luis. 0.72 square miles.
Bed 205. From a line drawn 180° from Point San Luis to a line drawn 250° from Point Buchon. 0.64 square miles.
Bed 206. From a line drawn 250° from Point Buchon to a line drawn 270° from Morro Rock. 0.04 square miles.
Bed 207. From a line drawn 270° from Morro Rock to a line drawn 190° from Point Estero. 1.46 square miles.
Bed 208. From a line drawn 190° from Point Estero to a line drawn 230° from Von Helm Rock. 2.61 square miles.
Bed 209. From a line drawn 230° from Von Helm Rock to a line drawn 200° from San Simeon Point. 2.20 square miles.
Bed 210. From a line drawn 200° from San Simeon Point to a line drawn 230° from Point Piedras Blancas. 2.02 square miles.
Bed 211. From a line drawn 230° from Point Piedras Blancas to a line drawn 240° from Salmon Head. 1.50 square miles.
Bed 212. From a line drawn 240° from Salmon Head to a line drawn 240° from Cape San Martin. 1.26 square miles.
Bed 213. From a line drawn 240° from Cape San Martin to a line drawn 240° from Lopez Point. 2.14 square miles.
Bed 214. From a line drawn 240° from Lopez Point to a line drawn 240° from Partington Point. 2.03 square miles.
Bed 215. From a line drawn 240° from Partington Point to a line drawn 200° from Pfeiffer Point. 0.80 square miles.
Bed 216. From a line drawn 200° from Pfeiffer Point to a line drawn 200° from Point Sur. 3.08 square miles.
Bed 217. From a line drawn 200° from Point Sur to a line drawn 270° from Yankee Point. 2.38 square miles.
Bed 218. From a line drawn 270° from Yankee Point to a line drawn 270° from Point Lobos. 0.50 square miles.
Bed 219. From a line drawn 270° from Point Lobos to a line drawn 270° from Point Cypress. 1.28 square miles.
Bed 220. From a line drawn 270° from Point Cypress to a line drawn 000° from Monterey Pier. 1.88 square miles.
Bed 221. From a line drawn 000° from Monterey Pier to a line drawn 180° from Santa Cruz Pier. 0.90 square miles.
Bed 222. From a line drawn 180° from Santa Cruz Pier to a line drawn 240° from Sand Hill Bluff. 0.81 square miles.
Bed 223. From a line drawn 240° from Sand Hill Bluff to a line drawn 240° from Point Ano Nuevo. 0.19 square miles.
Bed 224. From a line drawn 240° from Point Ano Nuevo to a line drawn 270° from Pescadero Point. 0.06 square miles.
Bed 225. From a line drawn 270° from Pescadero Point to a line drawn 270° from Point Montara. 0.00 square miles.

Total area of Mainland Beds

(Pt. Arguello to Point Montara) . . . . 28.60 square miles

(4) Mainland Beds (Point Montara to Oregon)

Bed 226. From a line drawn 270° from Point Montara to a line drawn 270° from Fort Point. 0.00 square miles.

Bed 301. From a line drawn 270° from Fort Point to a line drawn 270° from Point Reyes. 0.00 square miles.

Bed 302. From a line drawn 270° from Point Reyes to a line drawn 240° from Duncan's Point. 0.00 square miles.

Bed 303. From a line drawn 240° from Duncan's Point to a line drawn 270° from Gualala Point. 1.33 square miles.

Bed 304. From a line drawn 270° from Gualala Point to a line drawn 240° from Iverson Point 0.89 square miles.

Bed 305. From a line drawn 240° from Iverson Point to a line drawn 330° from Point Arena. 1.11 square miles.

Bed 306. From a line drawn 330° from Point Arena to a line drawn 270° from Stillwell Point. 1.03 square miles.

Bed 307. From a line drawn 270° from Stillwell Point to a line drawn 270° from the middle of Ten-mile River. 0.93 square miles.

Bed 308. From a line drawn 270° from the middle of Ten -mile River to a line drawn 180° from Point Delgada. 0.20 square miles.

Bed 309. From a line drawn 180° from Point Delgada to a line drawn 260° from Cape Mendocino. 0.14 square miles.

Bed 310. From a line drawn 260° from Cape Mendocino to a line drawn 300° from the South jetty of Humboldt Bay. 0.0 square miles.

Bed 311. From a line drawn 300° from the South jetty of Humboldt Bay to a line drawn 270° from the middle of the Klamath River. 0.00 square miles.

Bed 312. From a line drawn 270° from the middle of the Klamath River to a line drawn 250° from the California-Oregon Boundry. 0.20 square miles.

Total of mainland beds
Point Montera to
Oregon Boundary . . . . 5.83 square miles

Grand Total 74.13 square miles

(k) Those beds open to harvest and not subject to lease are as follows:

Mainland Beds (Pt. Arguello to Mexico)		*Mainland Beds (Pt. Arguello to Pt. Montara)*	
Bed No.	Square Miles	Bed No.	Square Miles
1	0.20	205	0.64

2	0.10	~~206~~	~~0.04~~
7	0.66	213	2.14
8	1.53	215	0.80
9	0.39	217	2.38
~~10~~	~~0.00~~	218	0.49
13	0.54	219	1.28
14	0.74	220	1.88
~~15~~	~~0.04~~	221	0.90
18	0.15	222	0.81
~~22~~	~~0.05~~	~~224~~	~~0.06~~
23	0.10	~~225~~	~~0.00~~
~~24~~	~~0.05~~	Total	~~11.42~~ 11.32
25	0.18		
28	0.60		
33	0.97		
Total	~~6.30~~ 6.16		

Mainland Beds (Pt. Montara to California-Oregon Border)		*Island Beds*	
Bed No.	Square Miles	Bed No.	Square Miles
~~303~~	~~1.33~~	101	0.66
~~304~~	~~0.89~~	104	0.22

Mainland Beds (Pt. Montara to California-Oregon Border)		*Island Beds*	
Bed No.	Square Miles	Bed No.	Square Miles
~~305~~	~~1.11~~	105	0.75
~~306~~	~~1.03~~	109	0.32
~~307~~	~~0.93~~	110	0.64
Total	~~5.29~~	112	0.11

113	0.59
114	2.18
115	1.59
116	0.62
117	1.35
118	1.51
Total	10.54

NOTE

Authority cited: Sections 6653 and 6700, Fish and Game Code. Reference: Sections 6653 and 6700-6707, Fish and Game Code.

Appendix 3
California Kelp Harvest (*Macrocystis pyrifera*) 1916 - 1999

Year	Open Beds	Leased Beds	Total Tons
1916	134,537	-	134,537
1917	394,974	-	394,974
1918	395,098	-	395,098
1919	16,673	-	16,673
1920	25,464	-	25,464
1921	-	-	no data
1922	-	-	no data
1923	-	-	no data
1924	-	-	no data
1925	-	-	no data
1926	-	-	no data
1927	-	-	no data
1928	-	-	no data
1929	-	-	no data
1930	-	-	no data
1931	260	-	260
1932	302	10,013	10,315
1933	53	21,569	21,622
1934	1,827	14,053	15,880
1935	-	30,602	30,602
1936	14,337	34,980	49,317
1937	9,613	34,341	43,954
1938	18,284	29,413	47,697
1939	25,546	31,190	56,736
1940	33,322	25,682	59,004
1941	36,103	19,614	55,717
1942	44,880	17,018	61,898

1943	19,547	28,411	47,958
Year	Open Beds	Leased Beds	Total Tons
1944	22,710	30,319	53,030
1945	37,541	21,640	59,181
1946	60,385	30,684	91,069
1947	46,029	28,208	74,237
1948	50,966	27,675	78,641
1949	56,076	27,270	83,346
1950	49,955	50,647	100,602
1951	30,318	84,422	114,760
1952	37,906	72,252	110,158
1953	37,172	89,476	126,649
1954	40,269	65,946	106,215
1955	38,992	85,071	124,063
1956	35,476	82,339	117,815
1957	32,811	61,396	94,207
1958	41,106	72,956	114,062
1959	42,290	47,309	89,599
1960	61,915	58,385	120,300
1961	71,953	57,303	129,256
1962	86,228	54,005	140,233
1963	57,517	63,515	121,032
1964	35,593	91,661	127,254
1965	33,464	101,665	135,129
1966	11,101	108,363	119,464
1967	9,331	122,164	131,495
1968	20,388	114,465	134,853
1969	10,029	121,210	131,239
1970	8,543	118,496	127,039
1971	33,959	121,600	155,559

1972	13,270	149,241	162,511
1973	24,539	128,541	153,080
Year	Open Beds	Leased Beds	Total Tons
1974	37,994	132,187	170,181
1975	30,213	141,384	171,597
1976	27,279	131,092	158,371
1977	21,899	108,698	130,597
1978	34,911	134,117	169,029
1979	22,513	148,507	171,020
1980	26,840	120,796	147,636
1981	27,894	45,170	73,064
1982	17,276	69,227	86,503
1983	3,159	2,112	5,271
1984	24,469	21,990	46,479
1985	43,962	43,338	87,300
1986	33,767	23,065	56,832
1987	11,011	82,253	93,264
1988	46,670	43,945	90,615
1989	34,595	98,165	132,761
1990	32,515	118,924	151,439
1991	37,123	90,381	127,505
1992	42,595	48,652	91,247
1993	39,748	53,192	92,940
1994	26,325	54,682	81,006
1995	4,217	73,536	77,753
1996	13,537	64,924	78,461
1997	12,366	32,977	73,165
1998	2,090	23,224	25,313
1999	8,076	34,135	42,211

Appendix 4

Public Responses to 2001 Kelp CEQA Document

(1)

Fred Wendell

From: Linda VanHook <abaloneint@earthlink.net>
To: Fred Wendell <fwendell@dfg2.ca.gov>
Sent: Friday, January 05, 2001 6:58 AM
Subject: Re: F&G Game kelp Regs. revisions

1a Thanks for sending along the info. I don't see anything right off the bat that would be offensive. Please keep me in the info loop as this progresses. Thanks again,
C.

Fred Wendell

From: <Pacificabalone@cs.com>
To: <racollin@dfg.ca.gov>
Sent: Wednesday, January 17, 2001 10:46 PM
Subject: Feedback on Kelp CEQA document

Dear Rob,
The following is my feedback on the CEQA listed by paragraph and sub-section.

2a 165.b.1 - The harvester may determine weight..."that has been approved by the department". COMMENT: what is the criteria for approval, this needs to be clarified.

2b 165.c.5.C - Prior commission approval of a kelp harvest plan...mechanical harvester...
COMMENT: what is the criteria for approval, as this stands it depends only on whoever is at the helm of the commission at the time.

2c 165.c.5.E - The commission may designate...for a specified period of time. COMMENT: what is the criteria for closure, this too is positioned to be a very subjective.

2d Finally, although I object to the closure of the area between the breakwater and Drake for the purpose of throwing the environmentalists a bone, I understand it.

Thanks for allowing us a chance to give comment.
Gary Russell
Pacific Abalone Farms

3

Jan. 14, 01

Dear Mr. Collins,

3a I am writing to you to comment on what I think are some fundamental management strategies to use in managing our kelp beds. First of all kelp should be managed to maintain its health and viability for all of the natural ocean systems that depend upon it. Once that criteria is met, then we can manage it for harvesting. I believe that before we can manage it to be 3b a healthy eco-system, we need to have the most current scientific knowledge and research to assess what comprises a viable ecosystem. Mr. North's study which was comprised in 1968 is absolutely not adequate to use as an assessment for today.

3c I believe that the kelp harvesters themselves should not be able to regulate themselves, the state Fish and Game should do this and if the state is unable to because of lack of funds then the federal government should be inlisted to protect and regulate the natural resources of the 3d National Marine Sanctuary. I also believe that he entire coast of California should be regulated not just our local area.

3e As you can see I do not support a no action approach to manage this profoundly important resource. Please do keep me posted on this process. I thank you for your time and attention.

Sincerely,

Jenny Pursell

Mike Tobin & Jenny Pursell
18 Paseo Cuarto
Salinas, CA 93908

4

THE ABALONE FARM, INC.

P.O. BOX 136 CAYUCOS, CA 93430 **805/995-2495** FAX # 805/995-0236 LIC # 0014 DEALER # 6862

January 24, 2001

Robson Collins
Department of Fish and Game
20 Lower Ragsdale Dr.
Monterey, CA 93940

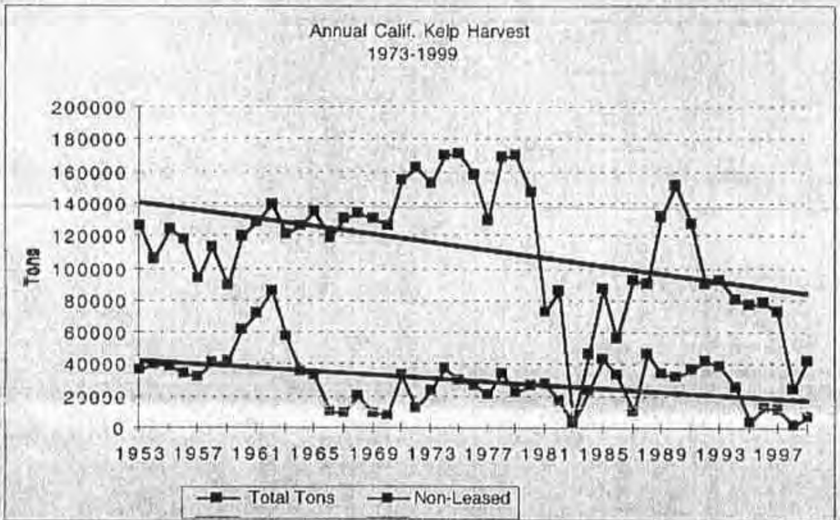
Dear Mr. Collins,

I would like to take this opportunity to comment on the Department's Draft Final Environmental Document Giant and Bull Kelp Commercial and Sport Fishing Regulations. I commend you and the other members of the Kelp Management Team for putting together a very thorough document.

4A However, I do have a few concerns with the report. It appears to me that the proposed changes in the regulations are directed at the kelp harvesting activities of the abalone growers, who by the Department's numbers account for less than 1.7% (page 3-76) of the
4B annual kelp harvest. The current regulations have served the state well for many years. In fact, I believe the Department could point to kelp harvesting as an example of one of their best managed fisheries, with sustained harvests for many, many years with no negative impacts on the resource.

4C In the report itself the Departments states that maintaining the current regulations will have no negative impacts. You also state that adopting your proposed changes will have no impacts on the resource. However, these proposed changes could have noticeable negative impacts on the abalone aquaculturists who have built their business and invested tremendous amounts of money based on the current regulations and the assumption that kelp harvesting would remain a legal activity for many years to come. Please remember that one of the mandates of the Department is to promote aquaculture. While it is true that
4D another mandate of the Department is to protect our natural resources, I don't believe the Department should be proposing actions detrimental to aquaculture when there is no danger to the natural resources.

4E The Department's data show a definite downward trend in kelp harvesting (see chart). This is not a brief anomoly due to El Nino or other events.



4E
ISP Alginates (Kelco) has moved a lot of their production offshore, and there are fewer abalone farms than there were in the past. Given this downward trend in harvesting, I don't understand the need for more restrictive regulations.

Section (c)(4) states "The commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested".
4F What does this mean (properly harvested), and what is the intended purpose? It seems to me that if you are harvesting kelp in compliance with the state's regulations, you are by definition 'properly harvesting'. If you are not in compliance, you are not 'properly
4G harvesting'. What criteria would be evaluated in the decision to close a bed? Who is responsible for bringing this data to the commission? I am afraid that certain parties or individuals will use this regulation to petition the commission for closure of beds or areas
4H of beds on a regular basis, thereby necessitating a response by the harvesters in order to allow harvest to continue. This type of activity can consume a tremendous amount of
4i time and effort on our part. This section also appears to be redundant with Section (c)(4)(E).

Section (c)(4)(B) states that Nereocystis harvesting be closed from April 1-July 31 within
4j the boundaries of the Monterey National Marine Sanctuary (MNMS). The text on page 2-3 of the report states the closure is from March 1-July 31. The dates need to be clarified, but either way this regulation is counter-productive, as it limits an abalone grower's ability to use drift bull kelp. I would think that the state and the MNMS would rather have the growers using drift kelp that is already technically dead as opposed to harvesting growing Macrocystis. I would propose that at the least the wording be changed to "*no harvesting of attached Nereocystis plants from the period....*". However, I question the need for this regulation in the first place. How much attached Nereocystis is being harvest within the MNMS borders? Within the state waters? I would guess that it is very little. ISP Alginates (Kelco) doesn't harvest Nereocystis, we (AFI) don't harvest Nereocystis, and none of the growers in the Monterey/Santa Cruz area harvest any kelp more than a mile or two from the harbor. Is this level of harvesting having any affect on
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4K the Nereocystis beds within the Sanctuary? Throughout Section 4 of the report, the Department states that there is a '...lack of apparent impacts under the existing regulatory strategy...', so what is being accomplished with this additional regulation?

4L Section (c)(4)(c) states that "Prior commission approval of a kelp harvesting plan is necessary before a kelp harvester may use a mechanical harvester to harvest giant kelp in a non-leased kelp bed in the area north of Santa Rosa Creek". What is this regulation trying to accomplish? The report does not even address this regulation in its summary on pages 2-1 to 2-3, so it is impossible to determine your intent. The Department is potentially restricting mechanical harvesting of giant kelp from almost half of the California coastline. 4M What constitutes a valid plan that would be approved by the commission? How long will it take to get approval? How long will commission approval remain in effect, as the commission only meets monthly? I can tell you our plan right now- Drive boat to kelp bed, harvest kelp, return to port. I think every kelp harvester has the exact same plan. Is this an approvable plan? The ambiguity of this regulation is frightening, as it puts the future needs of our business at the whims of some unknown person with an unknown process.

4N Section (c)(4)(E) states "The commission may designate, through emergency regulation, a non-leased kelp bed or portion of a bed as a harvest control area for a specified period of time. The commission shall set a cumulative harvest tonnage limit that may not be exceeded by a kelp harvester while harvesting within the control area during any consecutive 7-day period. The department shall maintain a list of active control areas, their effective time period, and their cumulative harvest tonnage on its web page." While I appreciate the Department's stated goal of find an alternative to closing an entire bed to all harvesting if they feel it is warranted, I have serious concerns about how this regulation would be implemented. First of all, who presents the information to the commission that a harvest control area is warranted- the Department, concerned citizens, Friends of the Sea Otter, all of the above? How does the commission decide if a control area is needed? How do they set the weekly limits? Since the commission only meets monthly, at the most, will this then become a monthly issue, with the abalone growers having to traipse across the state each month to argue for increased limits if the kelp is outgrowing the current limits? We all know that the amount of kelp in a bed can change 4O radically in a very short amount of time. Also, no offense intended, but the Department is not noted for keeping up to date information on their web page- in mid 1999 I was reading all about the S. California sport abalone regulations, despite the fact that all abalone harvest was curtailed in mid 1997. Now they are proposing to gather information from all kelp harvesters and post it on the web on a daily basis? I'm sorry, but I am skeptical. If the information on the web page is not current when a harvester leaves the dock at 5 am, and he is busted several hours later because the Department has finally calculated that the weekly limit has been achieved, will he still be cited? Will he be allowed to keep the kelp, as it is a violation to throw it back? If two or three harvesters are in a harvest control area on the same day, report their harvest, and their harvest pushes the cumulative total for the week over the allotment, who is in trouble? The last one to report, the last one to the dock, all three?

4P There needs to be a lot more detail on how the Department plans to implement this regulation. If this is the Department's solution to the user conflicts occurring in Bed 220, then I believe it is not a solution at all, but will merely exacerbate the problem and

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prolong the conflict. I can see the anti-harvesting groups, some of which have made it pointedly clear that they want to see all kelp harvesting stopped, arguing before the commission on a regular basis to establish a harvest control area in a particular area they are concerned with. I think that all of the abalone growers have begrudgingly accepted the reality of a large closed area in the Cannery Row area set aside for "non-consumptive users". However, I do not think that all of the "non-consumptive users" are going to view this as an adequate measure, and I can easily see them using this new regulation to attempt to limit or eliminate kelp harvesting in other portions of Bed 220 and beyond.

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Again, I feel these proposed changes to the regulations are strongly biased against the abalone growers, and could have potentially devastating impacts. The algin producers use large ships that are capable of reaching kelp beds anywhere in the state. If the Department were to make a bed they wanted to harvest off limits, they can easily move elsewhere. While they might suffer some financial loss, their business would survive. The abalone growers, on the other hand, are dependent upon a few kelp beds close to harbors. Some of them harvest kelp in boats as small as 12'-15'. If the commission were to use some of these ambiguous new regulations to suddenly close the only areas the abalone growers can access, their entire inventory could perish before the next scheduled commission meeting. While the current managers within the Department, such as yourself, have given verbal reassurance that they would not use these proposed regulations to arbitrarily close kelp harvesting, these reassurances are not adequate for the long term. The regulations, if adopted as written, could be around longer than the current management or commissioners. We must make sure that any proposed regulations actually accomplish the Department's goals (which are not very clearly stated) and protect the rights of the abalone growers to continue to harvest kelp in a legal and responsible manner.

Thank you for your consideration of these comments. I look forward to seeing you at the commission meeting in February to discuss these issues further.

Sincerely,

Ray Fields

CC: Justin Malan, California Aquaculture Assoc.
CA Dept. of Fish and Game Commisioners
Fred Wendell, CA Dept. of Fish and Game
Bob Hulbrock, CA Dept. of Fish and Game

⑤

US ABALONE

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Fish and Game Commission
1416 Ninth Street
Sacramento, CA 95814

2 February 2001

Dear Commissioners,

I have reviewed the Department's Draft Final Environmental Document for Giant and Bull Kelp Commercial and Sport Regulations. While the Report appears to be thorough and well thought out, there are several areas of concern that may negatively impact my business if the proposed project were to pass in its present form. Specifically, amendments 3 and 6 (P. 2.1), and Proposed Regulatory Changes (c) 4, (c) 4B, (c) 4C, and (c) 4E (P. Appendix 2-3). I have discussed in detail many of these concerns in written comments that I made regarding the Monterey Bay National Marine Sanctuary's (MBNMS) recommendations. Specially, in my letters dated 23 February 2000 and 7 August 2000 that were addressed to William Douros, Superintendent MBNMS, with copies sent to Mr. Robert Treanor, Executive Director, Fish and Game Commission, and Robert Hight, Director, Department of Fish and Game, and in a letter to Mr. Hight dated 16 October 2000. I would encourage the Commissioners to review these correspondence if you have not already done so.

US Abalone is a publically held Company having completed an Initial Public Offering in June 1997. The Company's shareholder base of over 500 households can be characterized as educated, middle to upper income, environmentally conscientious, and mostly residing in Monterey and Santa Cruz Counties. The business plan, capital outlay, and the future success of our Company was based in part on its ability to harvest kelp locally. Investment decisions by shareholders were based in part on a stable regulatory environment which included the ability to harvest kelp. In addition to the investment by local residents in US Abalone the local aquaculture industry annually contributes over $1 million into the local economy by patronizing local vendors, marketing and sales to local customers, charitable events, and through payroll and property taxes. US Abalone has been in operation for over 11 years and primarily harvests in kelp Beds #220, #221, and #222.

Below I have provided an explanation for each proposed changes that I am concerned about:

Amendment 3 - "Regulations controlling the commercial harvest of bull kelp should be amended to restrict acceptable harvest methods and seasons to protect that species near the southern limits of its geographic distribution."

This amendment proposes to increase regulations on the take of bull kelp near the southern limits of its geographic range. This proposal was put forth by the Staff of the Monterey Bay National Marine Sanctuary (MBNMS). The MBNMS held numerous meetings on their proposed recommendations to the Department. These meetings were attended by 5 people at the Monterey meeting held on 24 July 2000, 3 people at its Santa Cruz hearings held on 19 July 2000, and 4 people at its 20 July 2000 meeting in Half Moon Bay. Furthermore, at the Sanctuary Advisory

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Council meeting on 4 August of 2000 this recommendation was resoundingly rejected by a 10 to 2 vote of citizen's representing a cross-section of the community. This included representatives of the Agriculture, Business, Conservation, Education, Recreation, Research, and Tourism Industries to name but a few of the community interests that voted to reject this recommendation.

As I stated in my letter to the Department's Director, Mr. Robert Hight, dated 16 October 2000, the bull kelp beds only start in Bed #224 which is approximately 15 miles north of Santa Cruz.
5B There are no bull kelp beds in the areas where kelp is harvested. The bull kelp that is taken is either drift or beach wrack, neither of which is reproductively viable. This recommendation does not appear to have any resource or scientific basis, nor does it appear to have any bearing on the user conflict along Cannery Row.

The importance of bull kelp to my operation is vital as during the fall through spring months, during periods of inclement weather we use the drift kelp to sustain our abalone. If we are unable to collect bull kelp as beach wrack or drift in the months of September through April it would
5C mean that we would have to go to Monterey to collect kelp. The Sanctuary Advisory Council strongly urged the MBNMS Staff to reject this proposal. I would like to urge the Commission to strongly consider rejecting this proposed recommendation as well.

In addition to my own needs, the Cities of Monterey and Santa Cruz annually bury thousands of tons of bull and giant kelp on their beaches. Some of this we collect off their beaches or as drift before it reaches the shore. If this recommendation were to pass as proposed, the burying of bull
5D kelp by these Cities would in effect be a violation of the law during the closed months.

I strongly urge the Commission to consider rejecting this proposed amendment.

Amendment 6 - "The regulations should also be amended to provide a method for placing temporary harvest controls in beds or portions of beds where necessary for resource protection."

This regulation is vague and does not indicate or specify how a closure would be determined. As
5E kelp beds are highly variable, changing quite rapidly in a very short time frame, this proposed amendment as stated could severely impact businesses, such as abalone farmers, who depend on kelp for their survival.

I strongly urge the Commission to consider rejecting this proposed amendment.

Proposed Regulatory Changes (P. Appendix 2-3)

(e) 4 - "The commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested."

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This proposed regulatory change is unclear as to why it was even proposed. It seems as though kelp harvesting as managed by the Department is being properly harvested, either by hand or by use of a mechanical harvester. I strongly urge the Commission to consider rejecting this proposed amendment.

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(c) 4B - "Between April 1 and July 31, a kelp harvester may not harvest bull kelp from a non-leased kelp bed that lies partially or totally within the boundary of the MBNMS extending from Santa Rosa Creek, San Luis Obispo County, northward to Rocky Point, Marin County."

See above comments under Amendment #3.

(c) 4C - "Prior commission approval of a kelp harvest plan is necessary before a kelp harvester may use a mechanical harvester to harvest giant kelp in a non-leased kelp bed in the area north of Santa Rosa Creek."

This proposed change stemmed from a recommendation put forth by the MBNMS. At its 4 August 2000 Sanctuary Advisory Council meeting, this recommendation was resoundingly rejected by an 11 to 3 margin. The Sanctuary Advisory Council members including representatives of the Agriculture, Business, Conservation, Education, Recreation, Research, and Tourism communities voted to reject this recommendation. Yet the MBNMS Superintendent ignored the Council's rejection of this recommendation. Its seems that when members of the agriculture, business, conservation, education, research, recreation, and tourism industries come together to oppose such a recommendation that our public officials should take notice and not ignore their will as I believe was done in this instance.

The rationale for rejecting this proposed regulatory change is that it would in effect undermine the sustainable management of kelp within the MBNMS. As I have outlined in previous letters to the Staff of the MBNMS and to Director Hight, the same amount of kelp will be harvested whether it is by hand in a very narrow area or throughout a much broader area. Currently kelp is harvested within 1-2 miles of the Santa Cruz and Monterey Harbors. A mechanical harvester would allow for kelp to be harvested in a much larger area, thus reducing the impact in any one area. A mechanical harvester operated out of Santa Cruz for over 10 years with no public complaints or comments being made during the DFG Kelp Plan Review in 1995. Also, for a Company such as mine to consider such a large capital investment ($100-150K) with no assurance that we would be able to operate our boat may preclude us from making such a capital outlay. Furthermore, the proposal to limit mechanical harvesting does not address the real issue at hand. The whole issue had always revolved around hand harvesting along Cannery Row.

I strongly urge the Commission to consider rejecting this proposed amendment.

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5i (c) 4E - "The commission may designate, through emergency regulation, a non-leased kelp bed or portion of a bed as a harvest control area for a specified period of time. The commission shall set a cumulative harvest tonnage limit that may not be exceeded by a kelp harvester while harvesting within the control area during any consecutive 7-day period."

The language is vague and unclear as to what the Department is trying to achieve through this recommendation. Please see attachment regarding estimates of kelp biomass in Beds #220, #221, and #222.

I strongly urge the Commission to consider rejecting this proposed amendment.

Finally, I have attached a table with figures and numbers that have been provided by the DFG and the MBNMS in its kelp reports. As you can see the amount of kelp currently being harvested in beds #220, #221, and #222 is insignificant relative to the amount of kelp habitat available within these beds. The amount of kelp harvested even if doubled in the next five years would still be far below 1% of the available kelp. In addition, our efforts to maintain a broad harvest area using a mechanical harvester will further minimize any perceived impact to the kelp beds.

5j In summary, the main flaw in the Report is that it never clarifies why any regulatory changes are needed or what these changes will accomplish. To the contrary the Report states that the proposed changes will have no significant effect on the kelp resources, but will impact the abalone growers who account for 1.7% of the kelp harvested statewide.

In conclusion the DFG has always supported and promoted aquaculture, yet the main regulatory changes proposed will severely impact this industry. I sincerely hope that the Commissioners put into perspective the proposed changes and consider how they will effect small aquaculture businesses.

Thank you very much for your time and consideration.

Sincerely,

David A. Ebert, Ph.D.
Vice President

cc: Mr. Bruce McPherson, State Senator, 15th District
Mr. Fred Keeley, State Assemblyman, 27th District
Mr. Robert Hight, Director, Department Fish and Game
Mr. David Bunn, Legislative Director, Department Fish and Game
Mr. Dirk Brazil, Deputy Director, Department Fish and Game

KELP HARVESTED BETWEEN 1989-99 FROM KELP BEDS:

	TOTAL	AVG./YR. HARVESTED
#220	4,185 TONS	380 TONS
#221	3,496 TONS	318 TONS
#222	651 TONS	59 TONS

AVERAGE BIOMASS OF KELP PRODUCED ANNUALLY IN THE FOLLOWING BEDS:

#220	96.3 MILLION TONS
#221	46.1 MILLION TONS
#222	41.5 MILLION TONS

SANCTUARY AMOUNT OF KELP BIOMASS: 11.8 BILLION TONS

ANNUAL PERCENT BIOMASS OF KELP HARVESTED FROM BEDS:

#220	0.00039 %
#221	0.00068 %
#222	0.00016 %

DATA SOURCE: DEPARTMENT OF FISH AND GAME AND THE MONTEREY BAY NATIONAL MARINE SANCTUARY KELP REPORT.

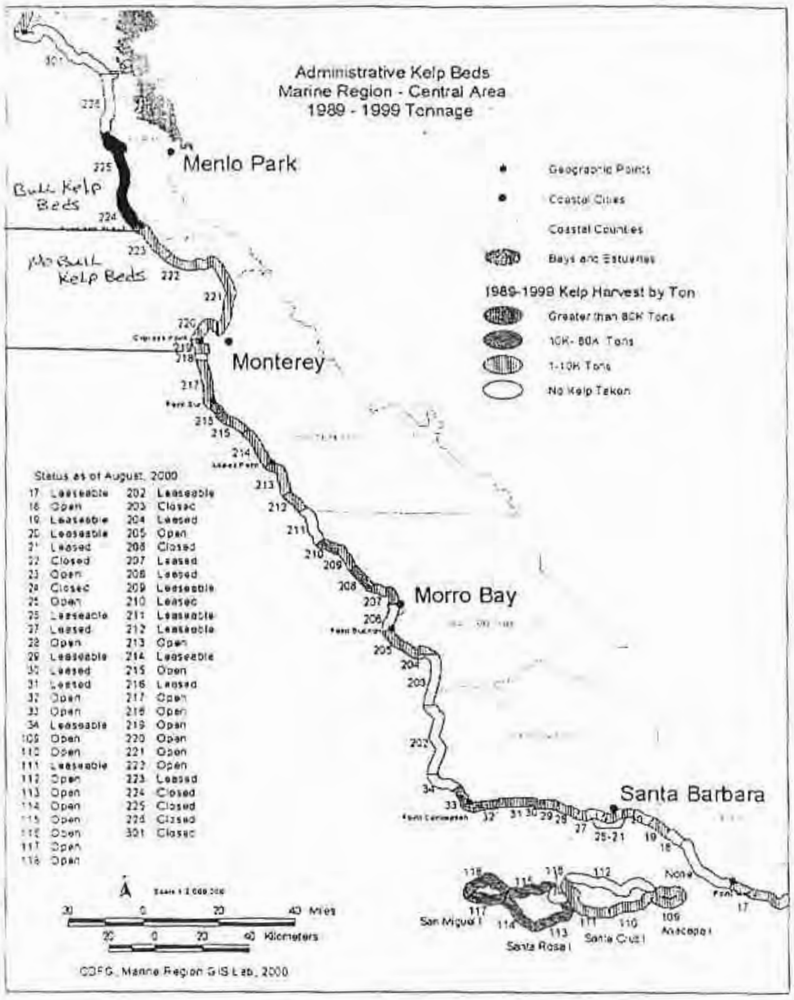

Figure 2-1b. Administrative Kelp Beds, Santa Barbara to Bodega Bay

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200 11 55

Mr. Robert Hight, Director
California Department Fish and Game
1416 Ninth Street
Sacramento, CA 95814

16 October 2000

RE: Monterey Bay National Marine Sanctuary Final Kelp Management Report.

Dear Mr. Hight,

I am writing in regards to the Monterey Bay National Marine Sanctuary's (MBNMS) final kelp management report. While the Sanctuary's staff has spent considerable effort, time and resources to develop their report on this issue I have some concerns regarding the final report recommendations . Specifically three of the recommendations that were made to the Department by the MBNMS.

I would like to preface my comments with a bit of background information. The MBNMS held several public hearings regarding the kelp harvesting issue. The attendance at three of these widely publicized meetings was 5 at the Monterey meeting held on 24 July 2000, the Santa Cruz meeting held on 19 July 2000 was attended by 3 people, and the Half Moon Bay meeting held on 20 July 2000 was attended by 4 people. A total of 12 people attended these public hearings for this supposedly important issue. Monterey as you are aware has been the center of controversy on this issue yet only 5 people took time to attend the Sanctuary's public meeting.

At the Sanctuary Advisory Council (SAC) meeting, an open public meeting that was also widely publicized, on 4 August 2000 **ALL** of the abalone growers effected by this issue plus a representative from ISP Alginates (formerly Kelco) attended and gave public testimony. In addition, the Executive Director for a local conservation organization spoke positively about the benefits abalone farming and kelp harvesting have to the community. **NO** one from the public spoke in opposition to kelp harvesting at this <u>very important public meeting</u> regarding this activity within the MBNMS.

As you are aware, the SAC is a citizen's volunteer committee comprised of representatives from various interest groups within the local community. This includes representatives from the Agriculture, Business, Conservation, Education, Recreation, Research, and Tourism communities, in addition representatives from the Harbor Districts, Coastal Commission, State Resources Agency, State EPA, Coast Guard, and other governmental agencies sit on the SAC. The SAC is intended to give a broad representation of the various community interests within the area of the MBNMS.

The MBNMS in their second draft report on kelp harvesting made 9 recommendations. These recommendations were discussed and voted on by the SAC at their 4 August 2000 meeting. Of the 9 recommendations 3 were overwhelmingly rejected by the SAC; these were recommendations #3, #5, and #9. I wish to address each of these recommendations as they may impact my business.

Recommendation #3 which is of considerable importance to my Company restricts our ability to harvest kelp using a mechanical cutter. This recommendation was rejected by the SAC by an 11 to 3 margin. Draft recommendation # 3 prohibits the use of mechanical harvesting in beds #220 and #221. The SAC in casting their votes I believe sent a strong message that there should be no limitations on the method by which abalone growers harvest kelp.

The SAC, I believe, realized that whether I harvest by hand or use a mechanical harvester it will not effect the amount of kelp I need to feed my abalone. The difference will be in the area I have available to harvest. For example, bed #221 stretches approximately 40 miles from the Monterey Breakwater to the Lighthouse in Santa Cruz. Currently in my small boat I can only range between 1-2 miles from the harbor. I eventually would like to step up to a larger boat so that I could range further within this bed. To step up to a larger boat would in all practicality involve getting a small mechanical harvester. I would then be able to harvest kelp from a much broader area within this kelp bed than I am currently able to at this time. I might add that a small mechanical harvester operated in bed #221 for over 10 years without any issues having been raised by the public. This same boat also operated in bed #220 between Point Pinos and Cypress Point, occasionally, during this same time period.

This entire issue has, as I have previously stated, always revolved around the Cannery Row area of bed #220. It involved one business using small boats to hand-harvest kelp along Cannery Row. This particular business (Pacific Mariculture) operated a mechanical harvester for 10 years on the Santa Cruz side of Monterey Bay (bed #221), between Point Pinos and Cypress Point (bed#220), and in Carmel Bay (bed #219) with very little notice. It was only when the independent owner of the mechanical harvester ceased operations that Pacific Mariculture was forced to hand-harvest on Cannery Row (combined with the proposed Ed Ricketts Underwater Park) that this became an issue. That's why this whole issue regarding mechanical harvesting seems so ludicrous ! I might add that the former president of Pacific Mariculture is now the Chairman of the Board of Directors for a prominent local conservation organization based in Santa Cruz. Even within bed #220 which includes the Cannery Row area, that portion extending from Point Pinos to Cypress Point has never been an issue of controversy as it has been harvested for many years by ISP Alginates (Kelco) using mechanical harvesters much larger than I would envision for my Company.

While I applaud the MBNMS staff for leaving beds #219, #222, and #223 open to mechanical harvesting, these beds are located north of Santa Cruz along the open exposed coastline. At times of the year it is virtually impossible to operate in these areas, while the more protected waters of bed #221 may offer a safe haven in which to harvest kelp.

My main disagreement with the MBNMS over this recommendation is that they are attempting to restrict the area where kelp can be harvested, thus potentially creating a problem by concentrating all of the harvesting into small areas. I believe that is why the SAC overwhelmingly rejected this recommendation. The same amount of kelp will be harvested whether it comes from one small area or over the entire 40 mile stretch of bed #221. Everyone seems to agree, including MBNMS staff, that spreading out the harvest will lessen any perceived impact to an area. The ability of my Company to use a mechanical harvester in bed #221 may make the difference between staying on the Santa Cruz side of Monterey Bay or going to bed #220 on the Monterey side of the Bay to hand-harvest as we have done historically. I sincerely hope that the DFG, like the SAC, **will reject** this recommendation as being overbearing and unnecessary.

Recommendation #5 regarding the harvest of bull kelp was rejected by the SAC by a 10 to 2 vote. As I have stated in previous correspondence to the MBNMS and DFG, bull kelp beds only start north of Santa Cruz in bed #224 which the MBNMS has recommended to close to kelp harvesting. There are no bull kelp beds within the areas that are currently harvested. The bull kelp that is harvested is either drift kelp or beach wrack, neither of which is reproductively viable. This entire recommendation has no resource or scientific basis. I hope that the DFG considers **rejecting** this recommendation by the MBNMS.

Finally, recommendation #9 regarding the closure of beds #224 and north to kelp harvesting. The SAC **rejected** this recommendation by a 10-3 vote. At this time there is an insufficient amount of kelp in these beds to consider harvesting. However, with the return of sea otters to the Half Moon Bay area and points north, the possibility exists that giant kelp beds may return to this area. It would be short-sighted to close these beds in the event that giant kelp does re-establish itself in this area within the next couple of years. I hope that the DFG considers either **rejecting** this recommendation or adding a provision to open it if a sufficient kelp canopy were to re-establish itself in the future.

I appreciate your time and sincere consideration on this most important issue for my Company. Thank you very much.

Sincerely,

David A. Ebert
Vice President

cc: Robert Treanor, Executive Director, Fish and Game Commission
Dirk Brazil, Deputy Director, Department of Fish and Game
David Bunn, Legislative Director, Department of Fish and Game
Fred Wendell, Department of Fish and Game
Rob Collins, Department of Fish and Game
Aaron King, Monterey Bay National Marine Sanctuary
Justin Malan, Executive Director, California Aquaculture Association

6

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
299 Foam Street, Suite D
Monterey, California 93940

February 2, 2001

Mr. Mike Chrisman, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, California 95814

RE: Draft Kelp CEQA document and proposed management regime for 2001-2005

Dear Mr. Chrisman:

The Monterey Bay National Marine Sanctuary (MBNMS) appreciates this opportunity to comment on the State of California's Draft Kelp CEQA document and proposed kelp management regime for the period of 2001 to 2005. The MBNMS is also appreciative that the Commission has scheduled its April 5-6 meeting in Monterey. This will allow residents that live along the Sanctuary's coast to have an opportunity to make verbal comments to your commission on this issue.

On October 3, 2000, the MBNMS sent the California Department of Fish and Game (DFG) and the California Fish and Game Commission (FGC) copies of our "Kelp Management Report: Background, Environmental Setting and Recommendations" (see attached summary of final recommendations). My office began drafting this document through an open, public process in the fall of 1999, well in advance of DFG's initiation of a review of California's kelp management regime. In crafting our recommendations, we relied heavily on input from our Sanctuary Advisory Council, a 24-member group representing stakeholders, agencies and the public, and input we received at eight public hearings in central California.

The Sanctuary's approach overall has been to not exercise our regulatory authority on kelp harvesting, and instead rely on the State's regulatory structure to address concerns we and the public believe exist in the current kelp harvesting program. As the Superintendent of a Federal agency that shares DFG's and FGC's resource management responsibility for kelp harvesting in central California, I am writing this letter to ensure that all of the concerns raised in our extensive public process and document are addressed in the State's new kelp management regime.

In general, the MBNMS believes the draft kelp CEQA document and proposed kelp management regime offer substantial improvements to existing regulations. After comparing the draft State CEQA document and proposed management strategy to the original set of MBNMS recommendations (attached), the MBNMS would like to make the following comments:

6A 1. We could not find any analysis of revenues generated from kelp harvesting activities and the costs of kelp resource management in the State's draft document. The MBNMS continues to believe that such a discussion is important for the people of California to fully understand the pros and cons of the harvest of their kelp resource (see MBNMS Recommendation #1). Additionally, such an analysis is necessary for the State to properly establish fees for kelp harvesting. While the MBNMS does not believe the State needs to realize a surplus from such fees, it does believe that those fees should minimally cover the costs of the management regime established as being necessary and appropriate by the State. The MBNMS requests that the FGC direct the DFG to add this analysis to the final CEQA document.

6B 2. The DFG is recommending a no-kelp harvest area similar, but smaller, to that recommended by the MBNMS for the area along Cannery Row in Monterey (see attached figure). The difference is that the State no-harvest area will only extend from the Coast Guard Wharf to Drake Street, instead of to the Charthouse restaurant. We believe the point of land on which the Charthouse restaurant sits is far more visible from offshore than Drake Street, especially in foggy conditions. Furthermore, the State's no harvest zone reduces protection along about 100 yards of coastline, an area hardly noticeable to kelp harvesters but important to local scuba diving interests. Our proposal reflected a compromise reached by our Advisory Council from competing alternatives. The MBNMS strongly urges the State to adopt the Charthouse restaurant as the northern end point to this no-harvest reserve.

6C 3. The DFG draft regulations suggest that any mechanical harvesting within the MBNMS be required to obtain prior FGC approval. While we had sought a ban on mechanical harvest in DFG Beds #220 and #221 offshore of the Monterey peninsula and Santa Cruz (see MBNMS Recommendation #3), we believe that the less restrictive strategy proposed by DFG would be acceptable. This is also more consistent with the recommendation of our Advisory Council that there be no restriction on mechanical harvesting.

6D 4. The MBNMS is pleased to see its recommendation for seasonal restrictions of *Nereocystis* harvesting included in the draft management regime, and endorses this concept.

6E 5. While MBNMS recommendations #7, #9 and #10 did not call for regulatory changes, they did call for changes in the way DFG conducts monitoring, enforcement and educational activities surrounding kelp harvesting. DFG staff have informed the MBNMS that they generally agree with these recommendations, and will work to implement them through future administrative actions. The MBNMS would also like to see an endorsement of these concepts by the FGC, and have related wording incorporated into the CEQA document.

6F 6. The MBNMS endorses the criteria method established by DFG in the draft regulations to define DFG Kelp Beds that contain too little kelp to sustain kelp harvesting activities, and, therefore, should be closed until those kelp beds may increase in size. This will, in effect, produce the result we had sought in our MBNMS Recommendation #8. The MBNMS is concerned however, that the proposed definition leaves open the possibility of a small kelp bed having just barely enough kelp to be open for harvesting. The MBNMS would, therefore, recommend that the regulations automatically define any DFG Kelp Bed as being a "harvest control area" if the size of the kelp bed is only between 1/2 and 1 square mile in size.

66 7. We understand that our recommendation #11, asking that the definition of take include plants, is beyond the scope of these kelp harvesting regulations, and could affect other aspects of State resource management. Therefore, DFG staff have informed the MBNMS that they have passed this recommendation over to their enforcement staff to determine if a need exists to alter the definition of "take" in the general Fish and Game Regulations. As this matter will affect how DFG may enforce its own regulations, the MBNMS asks that the FGC endorse the notion that "take" include plants such as kelp.

To reiterate, the MBNMS has received numerous comments and heard concerns from the public about kelp harvesting since the Sanctuary was designated in 1992, and we believe our recommendations in the MBNMS Kelp Report address those concerns in a fair and balanced manner. From January to August, 2000, the MBNMS held ten public meetings between Half Moon Bay and Cambria, including several with our Sanctuary Advisory Council, and we remain confident that on the balance our report has captured public input and has fully involved user groups. In addition, we continue to be focused on ensuring that kelp harvesting remain a viable and sustainable use of kelp within the MBNMS.

Over the course of the past year and a half, my staff worked closely with the DFG Marine Region staff to ensure that both agencies were aware of, and had an appreciation for, the other agency's work on kelp management. In particular, my staff has experienced an excellent working relationship with Mr. Robson Collins (Offshore Ecosystem Coordinator) and Mr. Fred Wendell (Chair, DFG Kelp Management Committee). All DFG staff we interacted with in this process deserve commendation for their professionalism and their expertise.

The issues we dealt with on this matter were difficult and contentious, yet we believe the educational value to the public of the MBNMS Kelp Report has been instrumental in creating a healthy dialogue on the best use of kelp.

Thank you for your attention to these matters.

Sincerely,

William J. Douros

William J. Douros
Superintendent

Attachments

cc: MBNMS Advisory Council Members
Robert Hight, Director, DFG
Robson Collins, Offshore Ecosystem Coordinator
Fred Wendell, Chair, DFG Kelp Management Committee

Recommendations to the State of California

from the

MBNMS Kelp Management Report: Background, Environmental Setting and Recommendations

Release Date: October 3, 2001

Recommendation #1: The MBNMS recommends that the State's kelp management process fully document and analyze the State's costs in managing kelp harvesting, including research, monitoring and enforcement, and evaluate the extent to which the revenues generated from various fees collected from the kelp harvesting industry (e.g., license fees, violation fines, business and personal taxes, tonnage fees) cover these costs.

Recommendation #2: The MBNMS recommends the designation of a single no-kelp-harvest area from the City of Monterey's Coast Guard Breakwater to the north wall at the current location of the Charthouse Restaurant extending from the mean high-tide mark to a depth of 100 feet. This no-harvest area must be monitored for its effectiveness in reducing multiple-use conflicts and increasing kelp canopy to allow for proper re-evaluation in five years.

Recommendation #3: The MBNMS recommends that there be no mechanical harvesting within DFG Kelp Beds #220 and #221.

Recommendation #4: The MBNMS recommends the implementation of a system of limited entry for kelp harvesting in DFG Kelp Bed #220.

Recommendation #5: The MBNMS recommends that no hand-harvesting (including possession) of Nereocystis be allowed in the MBNMS between April 1 and August 31 (inclusive) of each year.

Recommendation #6: The MBNMS recommends that the State restrict annual harvest of any kelp bed available for harvest in the MBNMS to 50% of that bed's total maximum canopy cover.

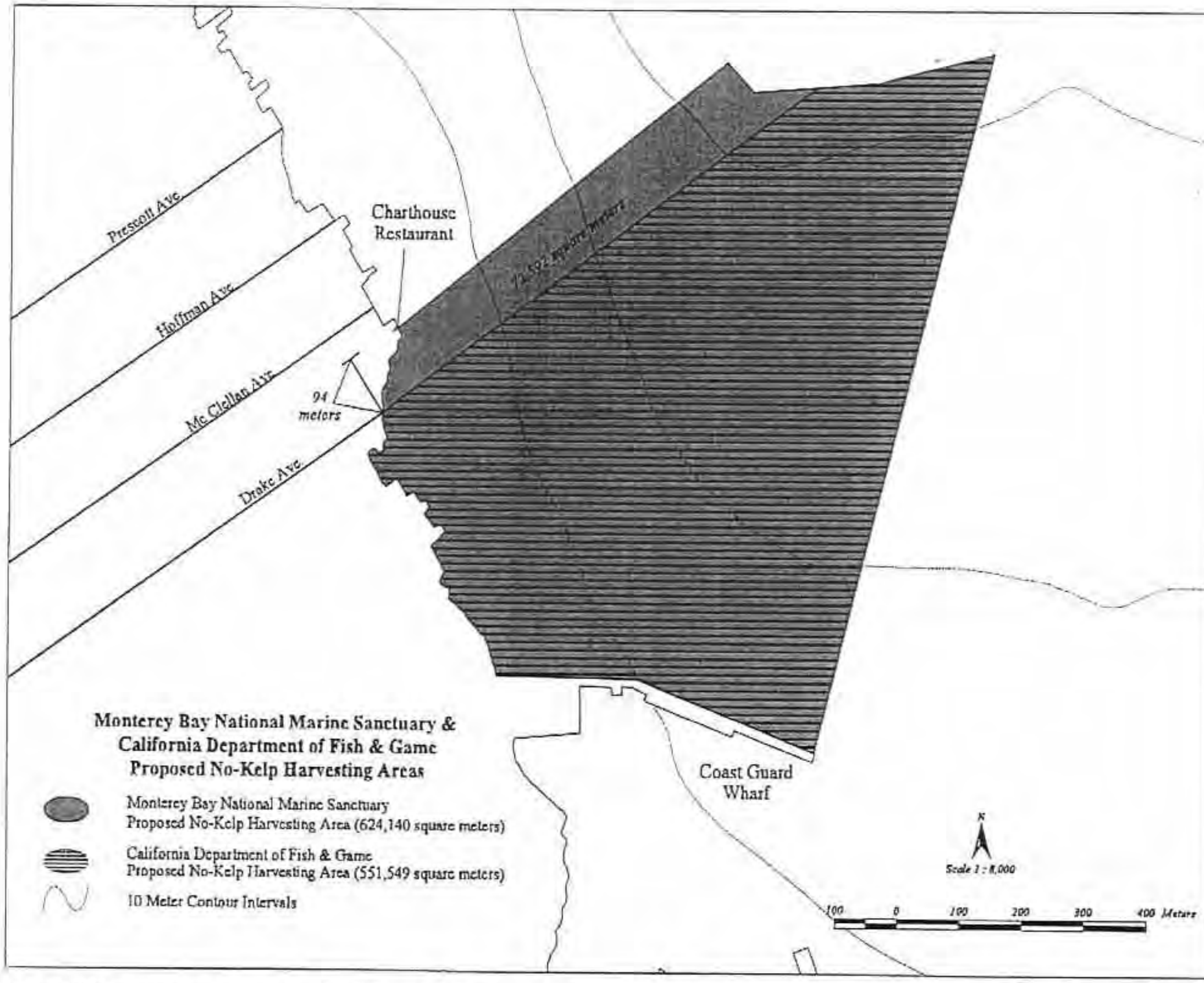
Recommendation #7: The MBNMS recommends that the State implement a more systematic method to collect, analyze and publish useful data on kelp harvesting. The MBNMS further recommends that the State resist any efforts to limit public access to kelp harvesting data.

Recommendation #8: The MBNMS recommends that DFG Beds #224, 225, 226 and 301 be closed to harvesting.

Recommendation #9: The MBNMS recommends that the State ensure its kelp management process evaluates the adequacy of current monitoring and enforcement of kelp harvesting activities, and strengthens them where necessary.

Recommendation #10: The MBNMS recommends that the State implement an education program on kelp forest ecology and sustainable kelp harvesting for a variety of audiences, including kelp harvesters and the general public.

Recommendation #11: The MBNMS recommends that the definition of "take" in the California Code of Regulations (Title 14, CCR, Chapt 1., Section 1.80) be amended to include plants.



The MBNMS proposed no-harvest area along Cannery Row is 94 meters longer than the DFG area. With a boundary out to the 100 foot depth contour, this calculates to a DFG surface area that is 88% of the MBNMS surface area.

(13)

MONTEREY ABALONE COMPANY

160 WHARF NUMBER 2
MONTEREY, CA 93940

California Fish and Game Commission
1416 9th St. Room 1320
Sacramento, CA 95814

Dear Commissioners:

As the owners of Monterey Abalone Company, and as citizens concerned about the marine environment, we would like to offer the following comments on the Department of Fish and Game's proposed changes to the kelp harvesting regulations as described in the Department's December, 2000 Draft Final Environmental Document.

13A

We feel that the wording of the following proposed changes is vague, and therefore, these changes should be stricken unless there can be more precise language provided. We would be happy to provide input to help make the language more precise.

- Section 165c4: "The commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to ensure that kelp is properly harvested." We would like to understand what is meant by "properly harvested" so that we can avoid improper harvesting, and the closure of the beds where we harvest.
- Section 165c4E: This change has to do with the establishment of harvest control areas. Again, no criteria for the establishment of the control areas are established in the proposed regulation. Such criteria would be helpful as guidelines for us in our harvesting, and would reduce spurious arguments for the designation of harvest control areas.

13B

The regulation proposed in 165c4D creates a no-kelp-harvest area in bed 220. We have lots of experience in this area since our farm is located nearby. Please consider the following points:

- this area was established as a no-kelp-harvest area a couple of years ago. The stated purpose was to use it as a control area in a study on the effects of kelp harvesting. Since then, there have been no studies conducted using this area as a control area, and there are none proposed. The no-harvest area is proposed as a way to separate user groups, although there is little to no interaction between user groups in that, or other areas. The need for a no-kelp-harvest area should be reviewed in five years when Fish and Game conducts its review of kelp harvesting regulations.

13C

- The seaward boundary of the no-harvest area needs to be established. We recommend that the boundary be a straight line between the end of the Monterey breakwater, and the point where the 60 foot depth contour intersects the line created by a seaward extension running 40 degrees magnetic north from the terminus of the west side of Drake Ave., not the 100 foot depth contour as has been proposed by the Sanctuary.

13c Kelp does not grow outside the 60' contour in this area, and the 100' contour projects the area into commonly used boating lanes. If the area is marked by buoys, as it should be, then there will be buoys in boating lanes, causing a hazard for no good reason. Not one additional kelp plant will be protected by extending the no-harvest area to the 100' contour, but it will cause more regulatory burden, confusion, and hazard by creating a boundary that is difficult to mark and enforce.

13a In addition to these comments, it should be noted that an educational effort by the Dept of Fish and Game to inform the public about the positive impacts of regulated kelp harvesting would go a long way towards avoiding user conflicts. Such conflicts are most frequently based upon a perception by the public that kelp harvesting is detrimental to the health and well being of kelp beds and injurious to wildlife. This perception is based upon ignorance of the science that underlies the resource and results in problems that could be avoided up front if the general public were better informed. Signage in multiple use areas explaining how and what harvested kelp is used for would be an inexpensive and highly effective way to educate the public about the benefits derived from kelp harvesting.

Sincerely,

Arthur Seavey
President

Joseph Cavanaugh
Chairman

(14)

CC - Dept 2/14/01

John -
FYI + Kelp file.
Thanks,
Bob

HOPE - Helping Our F... ent

Box 1495, Carmel, ...

Robert Traynor
Calif. Dept. of Fish and Game

Friday, February 9, 2001

Kelp Regulations DEIR Comments

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KELP D-EIR
The 22 pages of citations summarized in this Kelp DEIR is generally very good. Although the DEIR missed mentioning the officially Endangered and protected Stellar Sea Lion and Abalone and the legal requirement to make two specific findings of significant impact, this is the first environmental document I've reviewed in a long time where I learned of new environmental impacts (such as fish using the kelp forest as a reference point). All too often, the burden of providing relevant research data and citations is improperly placed on the public. Thank you for your efforts.

14A **But, the alarming, precipitous collapse of animals interdependent upon kelp forests including marine mammals, abalone, rockfish and perhaps other families which is well documented and officially recognized, should be a big red flag. The huge cumulative damage of overfishing, sewage and natural climate variation added to the wholly preventable kelp extraction impacts should make it obvious that it is time to pause and say "Enough" to even more man-made damage until we genuinely begin to permanently reverse the impacts we are causing here.**

INFORMATION AND EXPERTISE MISSING
14B In spite of extensive citations some expert rationale is missing and needed. Vital consultations with federal experts on the ESA & MMPA listed species involved will greatly improve the scientific information needed and would provide meaning to the data to allow making the best decision here. Without those Biological Opinions this document is missing significant relevant information and reasoning which prevent making a reasonable decision.

QUANTIFICATION MISSING

14c Except for the few paragraphs on noise (which we do appreciate) there is little relevant quantification of potentially significant environmental impacts.

Please disclose all quantitative criteria the DEIR uses to determine the threshold for a potentially significant environmental impact (i.e. baseline, thresholds of significance, percent of resource remaining).

SIGNIFICANT ENVIRONMENTAL IMPACTS IN ADDITION TO USER-CONFLICTS

This controversy is not simply a user-conflict (p 6-1).

14D **Our Kelp Forest Ecotone harbors the greatest density of biomass, the most productive communities and the greatest biodiversity in the North Pacific.** There is widespread public concern about any removal of large areas of vital and critical habitat – habitat for a host of threatened, endangered legally protected and keystone species (e.g. the beloved Southern Sea Otter, Stellar Sea Lion and gray whale calves) and other sea life. It is our opinion almost all Californians prefer to have the kelp forest wholly protected rather than harmed and lost by selling it to industrial extractors.

II. Processes:

INADEQUATE PURPOSE

The DEIR purpose (p 2-4) related to protecting natural phenomena is only stated in the negative – it does not state positively or clearly what the goal is. Without a clear purpose no one can determine whether the purpose is ever met.

14E By doing so it implies that kelp cutting is a natural event when is clearly is not. This may be because the theme is backwards as described below.

* Please rewrite the project purpose to state positively what is proposed related to protecting natural phenomena.

INTERNALLY INCONSISTENT PURPOSE

14F "One-fourth ... shall remain unleased..." yet that fourth is available for new commercial use. If that fourth is used – it no longer remains open.

One can't have both – a fourth either remains open or is used.

Please recraft this so that it is internally consistent.

THEME UPSIDE DOWN

The DEIR often analyzes only what is restricted – not on what is allowed. The far bigger picture is what kelp extraction is allowed under these proposed regulations.

The "No action" alternative uses this novel view and implies it is the same as a no-project Alternative. This is not correct.

BASELINE

14G

14G

The baseline also improperly attempts to sell this concept. Since the Agency has the authority to prevent all kelp extraction. the baseline is not continued kelp extraction, it is zero kelp extraction.

All potentially significant environmental impacts of regulations must be compared to zero kelp extraction. The impacts SHOULD NOT, as the DEIR attempts, be compared to continued kelp extraction.

III. Facts

STELLAR SEA LION (EUMETOPIAS JUBATA) OVERLOOKED

14u This species is known to inhabit Monterey Bay, to use Kelp forests and to frequent Monterey Coast Guard pier. It is an indicator species. The DEIR did not mention this Endangered Species. This species was listed as Threatened under FESA in 1990, and given heightened protection as "Endangered" FESA status in 1996. Its population has dropped from 140,000 in 1960 to some 16,000 in 1998. They eat bottom dwelling fish such as pollock.

SEA OTTERS

Sea Otters use Kelp beds (Giant Kelp - Macrocystis pyrifera & Bull kelp - Nereocystis leutkeana) as refuge from predators including white sharks and winter storms, to define territory and as nursery areas for females with pups. Sea otters feed on various invertebrates that exist in kelp forests (Foster and Schiel, 1985).

The Southern Sea Otter (enhydra lutris nereis) was federally protected under the Endangered Species Act as a Federally listed Threatened species in 1977. It is also protected under the Marine Mammal Protection Act. The Marine Mammal Protection Act 1972, USC 16 establishes a moratorium on the taking ("harass, hunt, capture or kill") and importation of marine mammals and marine mammal products, with exceptions for scientific research, allowable incidental taking, exemptions for subsistence activities by Alaskan natives and hardship exemptions (16 U.S.C. 1371). The MMPA requires all private or public actions that intentionally take marine mammals to get a permit.

MMPA is administered by US-FWS to protect sea otters.

Monterey County coastal waters contain the largest concentration of the Southern Sea Otter. It lives in nearshore kelp beds out to the 100 meter depth contour and occurs from Ano Nuevo in Santa Cruz County to the north to approximately Pt. Conception in the south. A small number (17 - 25 individuals) were relocated to San Nicholas Island. It is a keystone species (Miller 9 8) that keeps sea urchins from depleting kelp beds.

"As one of the few marine representatives of the order Carnivora, the sea otter evolved to inhabit a narrow ecological zone adapting to the near shore community and preferring a rocky shoreline with kelp beds." FWS, Draft Southern Sea Otter Recovery Plan June 1996

"Otters feed in both rocky and soft sediment nearshore areas, as well as in the kelp understory and canopy." US-Fish & Wildlife Service, "The Southern Sea Otter. Its Biology, Life Habits and History"

"Otters live in waters with temperatures between 35 and 60 degrees F." Ibid. Removal of kelp canopy can change the water temperature by changing sunlight reaching the mid and bottom seawater column, decreased insulation that kelp provides, and allowing increased surface disturbance by wind.

14x

14I

WHALE HABITAT

Migrating gray whales, especially the young, stick close to kelp forests for protection. Gray Whales have been observed entering kelp forests to escape predation from killer whales (Orcinus orca, Baldridge, 1972) and also to feed on invertebrates such as midwater crustacean swarms (Nerini, 1984)."

ROCKFISH DECLINES

Young fish, such as rockfish and surf perch, graze on plankton found in the top several feet of a kelp canopy. The Monterey Bay rockfish populations experienced a significant decline in the 1990's.

ABALONE IMPACTS OVERLOOKED

Abalone, Sea Urchins, Sea Otters and Kelp forests are all closely interdependent. Their complex relationships are poorly understood. White, Black, Pink and Green Abalone have all experienced catastrophic declines in recent years resulting in a complete ban on commercial take. The decline of abalone correlates with kelp harvesting. These parallel declines may be a coincidence, but it is possible the extraction of kelp forests plays a significant role in the cause of Abalone declines.

WHITE ABALONE HIGHLY ENDANGERED

DF&G Banned harvest of White Abalone in 1995. Calif. Fish & Game Code 5521. "A moratorium is imposed on the taking, possessing, or landing of abalone (genus Haliotis) for commercial or recreational purposes in ocean waters of the state south of a line drawn due west magnetic from the center of the mouth of the San Francisco Bay, including all islands offshore the
14J mainland of California, including, but not limited to, the Farallon Islands and the Southern California Channel Islands. It is unlawful to take, possess, or land abalone for commercial or recreational purposes in those ocean waters while the moratorium is in effect."

The White abalone (Haliotis soreni) is an endangered species. This abalone has declined by 99.9% in the last thirty years. The White abalone occurs from near Point Conception (near Santa Barbara) to Punta Eugenia, Baja California, Mexico. It lives at a depth of 80-300 feet, feeds on marine algae and can live up to 40 years. Within the lifetime of single abalone, the entire species has declined from between two to four million individuals, to between 600 and 1,600 individuals. In the last 33 three years, it has not successfully reproduced on a broad scale. Though other factors may be preventing reproduction, over fishing is rapidly driving it to extinction. The Southwest Center for Biological Diversity filed a petition on 4-28-99 to list the White abalone (Haliotis soreni) as an endangered species.

Selling for $20 to $22 per pound in 1999 White Abalone has attracted poachers who have been caught at Point Pinos at night. (Herald July 25 1999 p A7)

KELP IMPACTS

We do appreciate the DEIR's recognition of impact shifting (p 1-2). But the claim "Cut canopy will be restored from young fronds beneath the surface" (p 4-12) is misleading at best, false at worst. Kelp grows up from the ocean bottom, it does not grow from the top. When cut at or near the surface that frond stops growing. Cut kelp might as well have been cut from the bottom as it essentially kills that 30 to 60 to 100 foot frond.

Do you deny or agree with this?

14K

14K

Page 4-18 2nd paragraph: "mainly from growth of new fronds from below." Does this mean fronds from the same stipe or from others?

Cutting Kelp at the surface can result in kelp tips no closer than four to eight feet below the surface. Kelp is typically commercially cut at low tide and stretched to the surface. When not stretched it leans over due to currents. When adding the currents and high tide the top of the cut kelp can easily be 4 to 8 feet below the surface.

Do you deny or agree with this?

KELP DESTRUCTION IS UNSTABLE

"One common phenomena occurring in areas where surface canopies have been removed is the recruitment of the brown alga Desmarestia ligulata (Foster, 1982a; Reed and Foster, 1984). This species forms a dense subsurface canopy which can inhibit recruitment of other algal species including giant kelp (Dayton et all, 1992)." - Monterey Bay National Marine Sanctuary Kelp Management Plan Jan 14 2000

14L

When kelp forests are removed, sea otters must move to other kelp canopies. When Sea otters move north the area where they eat sea urchins move north. When sea urchins reach a certain population they can turn the ocean bottom into "barren grounds." P 3-29 Barren grounds do not allow kelp to regenerate. Sewage can worsen the impacts on kelp forests by increasing the number of sea urchins. p 3-49

Because of the extremely threatened state of Abalone it seems highly wise and reasonable to restrict extraction of all species which are closely interdependent until threatened and endangered species (e.g. Abalone, Sea Otters, Stellar Sea Lions) are clearly recovering.

KELP ECOSYSTEM

Kelp (Giant Kelp - Macrocystis pyrifera & Bull kelp - Nereocystis leutkeana) forests provide habitat for a large variety of invertebrates, fishes, birds, and mammals which are distributed among the three different regions of the forests; the surface canopies, the midwater and the substrate (Foster and Schiel, 1985).

"Fish diversity and abundance decrease in areas where the kelp canopies have been removed (Bodkin, J. of Exp. Mar. Bio. Ecology 1988). Variations in fish abundance may have significant impacts on other communities. For example juvenile rockfishes associated with kelp forests in Monterey bay can reduce the amount of barnacle larvae reaching the intertidal to 2% of the level found in the absence of fish (Gaines and Roughgarden, 1998)." - Monterey Bay National Marine Sanctuary Kelp Management Plan Jan 14 2000

"The floating canopy is thick enough to provide footing for birds as large as the great blue heron. The forests provide a nursery, feeding grounds, and shelter, so it is not surprising that large numbers and a great diversity of invertebrates and fish are found in association with the forests." A number of mammals (California Sea Lion, gray whale, harbor seal, and sea otter frequent the forests. At least 13 birds species use the Giant Kelp as feeding ground (pigeon, guillemot, brown pelican, pelagic cormorant, snowy egret, great blue heron, western grebe, western gull, eared grebe, Brandt's cormorant, surf scooter, common loon, common murre, elegant tern). - California an Environmental Atlas and Guide, Bern Kreissman. 1991 p 68

Page 4-19 says "...plants had been lost during the winter in the experimentally harvested are but not in the unharvested control."

Didn't this kelp cutting impair a Giant kelp bed?

Page 4-18 says "...cut fronds grew very little after harvesting..."

14M

14m

Didn't this kelp cutting impair a Giant kelp bed? If not please explain what criteria you use to determine a Giant kelp bed is impaired?

14N Page 4-21 says "...any activity that removes the pnuematocyst and blades results in the death of that [Bull Kelp] plant as well as loss of regenerative and reproductive material."

Doesn't this mean kelp cutting impairs a Bull kelp bed? If not please explain what criteria you use to determine a Bull kelp bed is impaired?

BIOMASS LOSS

A Kelp forest, like every other ecosystem, exists in a dynamic equilibrium. It is not a wholly closed system, but its biomass is wholly recycled and used by biota living in and near it.

This action would allow a huge permanent and irrevocable statewide loss of Kelp Biomass. It is a colossal loss of biomass in a fragile ecotone. There is abundantly officially-recognized evidence of the ecological collapse of the kelp-ecosystem. That includes alarming, precipitous declines of keystone and indicator animals dependent upon kelp forests including sea otters, abalone, and

14o rockfish.

Adding the wholly preventable kelp extraction impacts to the huge cumulative damage of overfishing, sewage and natural climate variation is an insult. It should be overwhelming obvious that it is time to say "Enough" to additional, preventable man-made damage until we genuinely begin to permanently reverse the impacts we are causing here.

Please quantify the yearly biomass loss expected with these new regulations.

Please prepare real mitigation for the loss of biomass.

Please prepare a regulation trigger at that level of biomass loss to stop all further harvesting that year.

14p

There is clear evidence that multiple kelp cutting extractions per year can "cause the loss of 'plants' and reduced production of biomass."

Please create a regulation to prohibit multiple kelp cutting extractions per year. A model would be

14Q the British Columbia regulation which only allows extraction of 20 percent of the standing stock per year (with other conditions). (p 4-22)

KELP FOREST FRAGMENTATION AND EDGE EFFECTS

Kelp Extraction is admittedly designed to cause kelp forest fragmentation and increase edge effect impacts.

"Conservation Biology's central tenets are not hard to grasp. For a natural habitat to be viable (and for a conservation strategy to succeed) there is a handful of general rules: bigger is better; a single large habitat is usually better than several small, isolated ones; large native carnivores are better than none; intact habitat is preferable to artificially disturbed habitat; and connected habitats are usually better than fragmented ones." Sierra Magazine Sept./Oct 1995 p 97

14R

"Edge habitats have been well-demonstrated to differ from core habitats in several ecological systems." US-FWS Marbled Murrelet 1997

14s

EDGE EFFECTS & WEATHER

"Edge effect" describes how kelp at a newly cut edge of a forest are exposed to much higher wave surges - which can stress them prematurely, increase the number pulled out by storms, and cause the loss of marine wildlife and biodiversity necessary to sustain a healthy kelp forest.

Kelp forests near induced edges, for example, may have a higher density but lower diversity of fish than the interior. "A number of studies in land forests have shown increased predation of songbird and quail eggs near forest edges." - Mitch Lansky "Beyond the Beauty Strip"

NEW LINEAR EDGES

14t

Please identify and map the lengths of each existing and potential edge of kelp forest and analyze the impacts of kelp forest fragmentation and edge effects.

Please identify and map the length of the new edges created for each numbered kelp bed after the proposed extraction that were previously unaffected by edge.

Please describe the health of the forest when it is reduced to "Islands" (where there may no longer be any true forest interior).

If Kelp Extraction is allowed, a regulation needs to minimise fragmentation and edge effect impacts.

NOISE IMPACTS ON LISTED SPECIES UNRECOGNIZED

Thank you for providing atmospheric noise levels for kelp extraction equipment and the noise significance threshold of 65 dBA.

We recognize that acoustics, both atmospheric and underwater, are complex and require careful recognition of references. In light of this the following noise impacts need to be further analyzed because -

1. Noise above the ocean surface can be confined in a reflective layer (like a light tube) and consequently travel many miles without appreciable reduction. The DEIR recognizes noise variance with atmospheric conditions (4-14) - but only when it enhances noise reduction. It fails to recognize "certain atmospheric" conditions which increase noise impacts.

2. Noise levels underwater are louder than air noise levels at the same distance from a source. Underwater spreading loss and attenuation losses are much lower than in air. Compared to noise above the surface, underwater noise travels about six times faster (1,470 m/s vs. 340 m/s at typical California temperatures) and travel much farther before reducing to insignificant levels (noise is substantially louder at greater distances underwater).

As an example Oil Tankers often generate in excess of 200 dBA underwater (ATOC FEIS 1996), yet your table only recognizes a tiny fraction of their noise impact by limiting its analysis to the atmospheric noise of a "Tanker" at 80 dBA.

Please measure actual underwater noise of the kelp extraction vessels at 15 meters, 100 meters and at 1000 meters to determine empirical sound pressure diminishment, if detectable.

14u

14u

3. Above and below surface noise impacts on listed species.

Noise Impacts on Wildlife
Kelp cutting boats admittedly disturb Sea Otters (p 4-9).

Please describe, and measure in meters how far sea otters move from their locations in kelp before the kelp extraction vessels arrive.

The noise from boat engines and mechanical kelp extraction equipment can disturb Sea Otters -

> "Effects [of noise] on animals have not been studied extensively. **These [effects] are analogous to those in humans. There is auditory loss which deprives the animal of signals of danger or the presence of prey. Animals depend on hearing in territorial stakeouts, courtship, mating. Noise which masks natural sounds can be detrimental to survival. Impulse noises produce startle, violent escape efforts, and panic. Noise around construction work, factories, and airports disrupt habitats.** Such responses have caused injuries to domestic cattle and horses in stalls. Animals migrate from such conditions when an alternate area can be found." (Environmental Protection, Emil Chanlett 1979), citing "Effect of Noise on Wildlife and other Animals," EPA-NTID 300.5, J.Fletcher, 1971

a. The underwater noise will exceed table 4.1 baseline values (i.e. 78, 76 dBA at 50 feet).
b. The underwater noise at distances farther than 50 feet will remain higher than in air.
c. The underwater noise will remain significantly higher than the 65 dBA threshold at "sensitive locations".

Please analyze the impacts of noise on listed species.

We expect that any objective analysis will find a potentially significant impact of noise on the listed species.

Page 4-14 "impacts of the proposed project 'on' noise levels,..." The word "On" is incorrect and we hope it is a typographical error only. The impacts are "Of" or "from" the proposed project's noise levels "ON" recreation...

DISTANCE OFFSHORE REGULATION NEEDED
The noise analysis does not recognize any kelp extraction closer to shore than 2,600 feet. However, there is no condition or regulation to enforce this. Thus it would be perfectly legal to extract kelp up to the shoreline.

Please create a regulation to prohibit use of kelp extraction vessels closer to shore than 2640 feet. Otherwise the DEIR noise analysis need to be revised to include noise impacts closer than 2640 feet from shore.

DEPTH RESTRICTION NEEDED
The DEIR claims Kelp extractors do not operate in waters shallower than 30 feet. p 4-11 However, there is no condition or regulation to enforce this. Thus it would be perfectly legal to extract kelp up to the shoreline.

14v

14v

Please describe how close to shore 31 foot deep kelp beds can be. For example at Lover's Point in Pacific Grove kelp beds deeper than 30 feet grow within a stone's throw of the rocky point.

Please create a regulation prohibiting use of kelp extraction in water depths of less than 30 feet.

AIR POLLUTION
We appreciate the Diesel and Gasoline emission tables. No significance thresholds for air pollution are given. Please do so for each air pollutant.

Table 4-2, 3 and 4 are not meaningful because of the bizarre use of units of measure. Thousandths of a ton is clearly not a common unit of measure and is difficult to convert without paper. Pounds of Carbon Monoxide is far more meaningful to the average reader as they are
14w familiar with the concept of suicide by a few ounces of CO in an enclosed garage.
Please change Table 4-2,3 & 4 so they are more meaningful. We request you change "Emission rate" to pounds per hour from tons/day.

MISC.
p 4-14 "appreciable" does not make sense. Please use another word.
p 4-18 2nd paragraph: Please replace "affect" with effect"
p 4-18 states "removal of the canopy eliminates it as a source of food,..."
To which species does a "source of food" refer? Fish?
14x p 4-19 Please define "Haptera" and "hapteral growth" since there is no index or glossary.
While you're at it - please include an index and a glossary.

IV. Law

CEQA REQUIRES FINDING OF SIGNIFICANT IMPACT
CEQA Guideline 15065 "Mandatory Findings of Significance" states -

"A lead agency shall find that a project may have a significant effect on the environment and thereby require an EIR to be prepared for the project where any of the following conditions occur:"
"(a) The project has the potential to ... reduce the number or *restrict the range* of a an endangered, rare or endangered plant or animal threatened species, ..."

This means that if the range of species is reduced in any amount (one-quarter acre was enough in the controlling case) a finding of significant environmental impact must be made.

The DEIR admits ESA listed Sea Otters, MMPA listed Gray Whales, California Sea Lions, Elephant Seals, and Harbor seals use the kelp forest as habitat. pg 3-43

All whales, sea lions, harbor seals and sea otters are protected under the Marine Mammal Protection Act.

Migrating gray whales, especially the young, stick close to kelp forests for protection. Gray Whales have been observed entering kelp forests to escape predation from killer whales (Orcinus

14y

14Y

orca, Baldridge, 1972) and also to feed on invertebrates such as midwater crustacean swarms (Nerini, 1984)."

Sea Otters use Kelp beds (Giant Kelp - Macrocystis pyrifera & Bull kelp - Nereocystis leutkeana) as refuge from predators including white sharks and winter storms, to define territory and as nursery areas for females with pups. Sea otters feed on various invertebrates that exist in kelp forests (Foster and Schiel, 1985).

We conclude that the widespread removal of tens of square miles of kelp habitat for these listed species is a legally mandated significant impact.

Because of these mandatory significant impacts, the DEIR must analyze mitigations and alternatives.

* Please make a finding of significant impact for the listed species habitat and range loss, re-write the DEIR, prepare alternatives and mitigations and recirculate it as a revised DEIR.

ESA & MMPA TAKE ARE SIGNIFICANT IMPACTS

The presence of Kelp cutting boats admittedly disturbs Sea Otters (p 4-9 and 6-2 "less disruption of sea otters in occupied beds"). Harassment, ESA "take" of a listed species, includes influencing its behavior by human presence. Both the ESA and MMPA forbid harassment of listed species. This is take of ESA & MMPA listed species. The noise from boat engines and mechanical equipment also disturbs Sea Otters, as does the removal of kelp which serves as their protection from predators including sharks. Any harassment of an ESA listed species is "take", a violation of Section 9 of the U.S. Endangered Species Act.

14Z Activities authorized by this project which violate a federal environmental law are significant environmental impacts.

Since the Dept is also charged with enforcing Federal ESA, it seems perfectly appropriate to have all California Department of Fish and Game regulations prohibit any activity which could result in take of a listed species.

Please re-write the DEIR to recognize this significant environmental impact.

Please re-write the regulations to avoid this significant environmental impact.

Because of these significant impacts, the DEIR must analyze mitigations and alternatives.

BIOLOGICAL OPINIONS NEEDED

Federal experts are available and required to comment on this document which has federal involvement. We do not understand why there is no Consultation or Biological Opinion.

Is California Department of Fish and Game legally prohibited from having US-Fish & Wildlife Service or US-National Marine Fisheries Service consult on this?

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* Please obtain a Biological Opinion on this project's impacts on the potential take under the ESA and MMPA of Southern Sea Otter (enhydra lutris nereis).

* Please obtain a Biological Opinion on this project's impacts on the potential take under the ESA and MMPA of the Stellar Sea Lion (Eumetopias jubata).

The DEIR laments not having a way to measure a precautionary approach (p 6-2). The Dept., also charged with enforcing Federal ESA, can create regulations which use all measures necessary to avoid potential take as one threshold to a precautionary approach and which is minimally consistent with federal ESA law.

CONSULTATION REQUIRED

14BB National Marine Sanctuaries Act requires Federal Lead agency to consult with Dept. of Commerce on any activities "that are likely to destroy, cause the loss of or injure any sanctuary resource." (16 USC Sec 1434 (d)) We believe that NOAA is this project's federal lead agency. But whether it is or not it is CDF&G should initiate consultation.

V. Reasoning

CUMULATIVE IMPACTS ADMITTED BUT UNADDRESSED

The document oddly claims it "fully discloses potential cumulative impacts". This is admittedly false. There is substantial evidence that the Kelp forest ecosystem is potentially near collapse. **But alarming, precipitous declines in marine mammals, abalone, rockfish and perhaps other families should be a big red flag. The huge cumulative damage of overfishing, sewage and natural climate variation added to kelp extraction impacts should make it obvious that it is time to say - Enough.**

The DEIR admits "The numerical relationship of species in some kelp beds has changed due to [human] removal of dominant kelp inhabitants by various sources." p 2-4

This admits there are cumulative significant environmental impacts on kelp inhabiting species. But instead of analyzing this impact as a cumulative impact it is dismissed because, it claims, kelp destruction plays a "minor" role.

Even if kelp destruction plays a minor role in impacts on kelp dependent or inhabiting species kelp extraction contributes to this serious cumulative impact and must legally be analyzed in that context.

ECOSYSTEM SERVICES

Seagrass/algae beds provide approx. $19,000 in Ecosystem services per hectare per year. - "The value of the worlds ecosystem services and natural capital" by Costanza et all, Nature 15 May 1997 pg 256. Those services include: Species protection (think of what it costs to keep an endangered animal alive in a zoo, compared to a native habitat), storm protection, and other aspects of habitat response to environmental variability mainly controlled by vegetation structure, prevention of loss by wind, or other removal processes, nutrient cycling, waste treatment, pollution control, detoxification, atmospheric gas regulation, climate regulation, pollination, dynamic regulation of populations, reduction of herbivory by top predators, habitat for resident and transient populations, food, fuel and fodder production, medicine products, genes for disease

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resistance, ornamental species, eco-tourism, sport fishing, and other outdoor activities, aesthetic, artistic, educational, spiritual and scientific values.

How many total square miles of kelp are there in California?

How many square miles of kelp could be cut by this project?
(Please count the square miles of each cut separately.)

*** Please list and quantify the loss of ecosystem services due to this project.**

Please explain and quantify how kelp cutting is in the public interest.

14dd

Please obtain, review and incorporate facts from "The Ecology of Giant Kelp Forests in California: A Community Profile. Slidell, Louisiana: US-Fish & Wildlife Service, 1985, Fisher, Michael S. and Scheil, David R.

SEWAGE CUMULATIVE IMPACT

"A variety of influences can adversely affect the great kelp, but sewage pollution is a specific peril, as was demonstrated by the loss of a large forest off the Palos Verdes Peninsula in Los Angeles County and disappearances off several other sites in southern California in the 1950s." California an Environmental Atlas and Guide, Bern Kreissman, 1991 p 68

CALIFORNIA SEWAGE

"In 1998, beaches statewide were closed for a combined total of 3,273 days, compared to 745 days in 1991, according to the most recent data available from the Natural Resources Defense Council. Sewage spills and urban runoff caused the majority of the closures." AP May 28, 2000

PACIFIC GROVE

The Pacific Grove sewer system spilled some 70,000 gallons of sewage directly into the Monterey Bay National Marine Sanctuary in January 2000. This violated the Clean Water Act, California Water Code and possibly the Endangered Species Act. As a result the Regional Water Quality Control Board fined Pacific Grove a mere $75,000 (out of a possible $700,000) with the warning from staff counsel and board members that "next time there would be a much sterner fine." The four criteria for assessing penalties - History of violations, Ability to Pay, Culpability, Economic Benefit - all were found NOT to justify assessing less than maximum civil liability.

Monterey County Environmental Health Dept. closed Pacific Grove's Lover's Point Beach seven (7) times between January 2000 and May 2000 - four times because of sewage spills and thrice for high bacteria levels. The increased detection of health problems is directly related to increased testing. In Summer 1999 testing began on a weekly basis.

Monterey County Environmental Health Dept. closed Lover's Point Beach in Oct 99 due to an observed 1000 gallon sewage spill. That week, fecal coliform levels exceeded state health standards at San Carlos Beach, Del Monte Beach, Asilomar Beach, Spanish Bay and Stillwater Cove.

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PEBBLE BEACH

Monterey County Health Dept. closed the Spanish Bay beach "for a few days to a week" beginning on March 22 2000 because of a sewage spill from a broken sewer main. Herald Mar 23 2000

"Contamination shuts Stillwater Cove" headline Herald Apr 6 2000 "High levels of fecal coliform have been found...coming from a storm sewer that drains the famous Pebble Beach Golf Links, said Walter Wong, the county's director of Environmental Health."

CARMEL

"About 1,000 gallons of sewage spilled into Mission Trail Park in Carmel early Thursday evening." From the park it flowed into nearby Mission Trail creek, than about half a mile down to the Carmel River and into the Carmel River Lagoon and the Carmel Bay. "Emergency crews flushed the spill area with bleach and about 1000 gallons of water." Herald, Mar 24, 2000

HUNTINGTON BEACH

Huntington Beach was closed for more than 60 peak summer days due to elevated bacteria levels. AP May 28, 2000

CHLORINE

Chlorine bleach is the standard application after a spill. Chlorine is extremely toxic and reactive itself. Chlorine can harm and kill kelp and its reproductive cells.

* Please analyze the widespread cumulative impacts of sewage and chlorine on kelp forests.

* Please analyze the cumulative environmental impacts of all related activities on kelp as habitat.

* Please analyze the cumulative environmental impacts of all related activities on kelp related species.

MITIGATION

Reading Chapter 5 on Mitigation, felt like it had turned my thought processes into a Klein bottle (a 3 dimensional Mobius strip). It confuses Mitigations and Alternatives. That is certainly excusable because not many people clearly understand the difference. Let me try to explain.

MITIGATIONS VS ALTERNATIVES

Mitigation means doing the same project, but changing how you implement that project. Alternatives means doing a different project with the same goal.

Example: Three experts tell a woman she should walk across an icy river. Toxicologist says she should wade because the water isn't toxic - just cold. Cardiologist says she can mitigate the cold by wearing a wetsuit. Hydrologist says its OK because other rivers aren't more than 4 feet deep. To their shock - the woman refuses. "Why?" they ask. "Because there's a bridge just upstream." (adapted from Mary O'Brien's Making Better Environmental Decisions)

The difference between Mitigations and Alternatives is generally that Alternatives involve the entire goal of the project (to get to the other side by walking across a bridge versus wading across

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a river) while Mitigations deal with subsets of the proposed project (how to minimize freezing if wading the river).

For this project real alternatives would include finding alternative sources for algin and abalone food.

ALTERNATIVES TOO LIMITED
The DEIR is not correct in saying "The only alternatives to regulating the take of kelp would be to allow harvest without restriction or to prohibit consumptive use of these resources." P 5-1

To analyze alternatives properly one must understand the goal.

"Sustainable harvest" and insuring "a supply of kelp" are not necessarily in the public interest or valid goals. Without a valid goal no one can determine whether the goal is ever met.

There seem to be only two different products for which kelp is extracted - algin and abalone food. If alternative sources for products to use in place of algin and abalone food are found there is no need to allow any kelp extraction.

*** Please prepare a list and analysis of alternative sources for algin.**

*** Please prepare a list and analysis of alternative sources for abalone food.**

There is no analysis of an alternative which protects the kelp bed habitat used by the ESA listed Southern Sea Otter (enhydra lutris nereis).

There is no analysis of an alternative which avoids take of ESA listed species.

* Please analyze an alternative which avoids take and protects all kelp bed habitat potentially used by the ESA listed species Southern Sea Otter, Gray Whale and the Stellar Sea Lion.

INCLUDE A GENUINE NO-PROJECT ALTERNATIVE
As explained above the DEIR claims that the "No action" alternative is the same as a no-project Alternative. This is not correct.

What is the text of the findings that were made to limit the take of Bull kelp north of Point Arguello?

14GG * Please analyze an alternative which prohibits all extraction of all kelp beds in California. Clearly, this would be the environmentally preferred alternative.

Please put us on your list of "Interested Parties" so we get all notices of the proposed project (if for no other reason than we ask under authority of CEQA Sections: 21092.(b)(3) and 21092.2)

Incidental Take Permits
Please put us on your list of "Interested Parties" so we get all notices of any Incidental Take Application and copies of all related Biological Reports related in any way to this project or this property.

Please send us a copy of the staff report and the FEIR for this item.

If you do not adopt the issues raised in this letter, please send us a copy of the approval as soon as it is signed.

Please also send us the Notice of Determination or Exemption as soon as it is filed. If it is not filed within 5 days of the signed decision, please notify us of that.

Please let us know immediately if you feel we have not yet exhausted our Administrative remedies or that we do not have standing.

If this is the case please let us know what actions you feel are necessary for us to have standing and to have exhausted our Administrative remedies prior to your final decision.

Please acknowledge receipt of this letter within 5 days.

We look forward to your substantive, written response to the issues raised here within 10 days. If any of this is in the slightest way unclear please contact us ASAP by phone, email or mail.

With all due Respect,

David Dilworth, Acting Secretary and Trustee 831/624-6500

HOPE - Helping Our Peninsula's Environment

Box 1495, Carmel, CA 93921 - 831/624-6500

Robert Traynor
Calif. Dept. of Fish and Game

Thursday, February 15, 2001

15 FEB 01 11 30

Kelp Regulations DEIR Errata

On page 6 of our comments please note the word **"are" should be "area"** in the comment -

> Page 4-19 says "...plants had been lost during the winter in the experimentally harvested are but not in the unharvested control."

We inadvertently wrote "We look forward to your substantive, written response to the issues raised here within 10 days." We realize you will not be able to substantively respond within 10 days. We do look forward to your substantive, reasoned responses to each of our comments as required by CEQA law and Guidelines.

With all due Respect,

David Dilworth, Acting Secretary and Trustee 831/624-6500

(15)

RCMP - Responsible Consumers of the Monterey Peninsula
Box 1495, Carmel, CA 93921 - 831/624-6500

15 Feb 01 11 30

"To the extent that commerce is ungoverned, commerce governs."
-Lance Olsen

Robert Traynor
Calif. Dept. of Fish and Game

Thursday, February 15, 2001

Kelp Regulations DEIR Comments
LEASE TIMES IMPROPER

15A **We urge redrafting the DEIR and regulations to fit the significant environmental impacts of removing significant critical biomass from habitat supporting several officially listed species in danger of extinction.**

15B **LEASE DURATION EXCESSIVE**
The Lease Duration of 20 years is far too long.

Lessees tend to think they have a property right when leases are too long as evidenced by the fiercee and even **violent reactions** (Catron County in New Mexico and in Nevada) to federal agencies trying to reduce grazing leases because of newly realized grazing caused impacts.

Please prepare a regulation that reduces the lease duration to 2 years maximum.

15C SUSPENSION FOR LAW VIOLATIONS IS TOO SHORT
When a for profit business breaks the law a mere suspension for a maximum of one year does not even add up to a slap on the wrist.

Please prepare a regulation that increases makes it a criminal act to violate kelp cutting guidelines lease suspension with no maximum.

Please prepare a regulation that suspends lease time with no maximum number of years.

15D ECOSYSTEM COLLAPSE CRITERIA NEEDED
We're dealing with an ecosystem where we have substantial evidence of an impending ecosystem collapse.

Please explain all measurable criteria you are using to determine when the trigger point of ecosystem collapse could occur?

Please put us on your list of "Interested Parties" so we get all notices of the proposed project (if for no other reason than we ask under authority of CEQA Sections: 21092.(b)(3) and 21092.2)

With all due Respect,
David Dilworth, Co-Chair

(16)

*American Oceans Campaign * Center for Marine Conservation*

February 15, 2001

Rob Collins
Department of Fish and Game
20 Lower Ragsdale Drive
Monterey, CA 93940

Via Facsimile and U.S. Mail (Fax: (831) 649-2917)

RE: Comments on the Department of Fish and Game's December 2000 Draft Final Environmental Document for Giant and Bull Kelp Commercial and Sport Fishing Regulations

Dear Mr. Collins,

The Center for Marine Conservation and American Oceans Campaign, on behalf of our combined membership of more than 20,000 California citizens, welcomes the opportunity to provide comments on the December 2000 Draft Final Environmental Document for Giant and Bull Kelp Commercial and Sport Fishing Regulations (hereafter, "the Document"). We have several questions with regard to the Document and some specific concerns with it as written. We recommend that the Department of Fish and Game take the following actions:

1) Extend the comment period on the Document by 15 days to allow for other interested parties to comment;
2) Amend the proposed project to incorporate the Department's recommendation to, "develop a biologically tenable threshold value beyond which the impacts [of kelp harvesting] could be anticipated before imposing harvest limitations on a broad scale."[1]
3) Review the legal and scientific adequacy of the Document with respect to our comments below, and if inadequate, revise the Document to meet these legal requirements.

We respectfully request a written response to these comments and recommendations, and we look forward to discussing this Document and the management of kelp harvesting further, as time permits.

16A While the Department of Fish and Game may have the authority under CEQA to produce an environmental document in lieu of the EIR/ND requirement, we can find no discussion in the Document of the reasons for the decision to pursue this approach. We strongly encourage the Department to explicitly state why it chose to develop this alternative approach, particularly in light of the potential for impacts to the Southern sea otter *(Enhydra lutris nereis)*, a protected species listed as "threatened" pursuant to the Endangered Species Act (16 U.S.C. §1531 et seq) and protected under the Marine Mammal Protection Act (16 U.S.C. §1361 et seq), and to several groundfish species listed as "overfished" by the National Marine Fisheries Service (NMFS).[2]

[1] Draft Final Environmental Document, at 1-2

[2] National Marine Fisheries Service, Report to Congress, Status of Fisheries of the United States, January 2001.

16b

While we support the Department's primary objective for the project (to "insure that kelp harvesting does not impair the health and diversity of marine ecosystems and marine living resources")[3] we are concerned that the analysis provided in the Document may not adequately meet the legal requirement of utilizing the "best available science"[4], and we are unsure that the preferred alternative will effectively meet this objective. Much of the scientific information referenced in the Document is one or more decades old, dating to a period of significantly different ecology, prior to the major El Nino events of the past twenty-plus years, the "200 year storm" event of 1988, and the increased fishing pressure and other human impacts on the nearshore environment. We are concerned by the lack of recent scientific information regarding the impacts of kelp harvesting on the ecosystem and on individual species (particularly fish and marine mammals), and we strongly urge the Department to amend the preferred alternative to require further investigation of the impact(s) of kelp harvesting on the ecosystem.

16c

At a minimum, the preferred alternative should also incorporate the Department's own recommendation to "develop a biologically tenable threshold value beyond which the impacts [of kelp harvesting] could be anticipated before imposing harvest limitations on a broad scale."[5]

Specifically, the Document details several potential impacts to fish, marine mammals, birds, and invertebrates. We commend the Department for recognizing in the Document that kelp provides habitat for a large number of fish species, that kelp provides food and hiding places for juvenile fish species, and that studies have shown a positive relationship between kelp density and fish density.[6] Reports on Essential Fish Habitat (EFH) and other documents prepared by NMFS and the National Oceanic and Atmospheric Administration (NOAA) reinforce the importance of kelp as habitat for many fish species, including "overfished" species such as Lingcod (Ophiodon elongatus) and Bocaccio (Sebastes paucispinis).[7] Moreover, the Document states that, "kelp harvesting affected the distribution of fishes associated with kelp forests, especially juvenile rockfishes… the removal of canopy cover may also contribute to greater predator success in harvested versus control areas."[8] Other research cited in the Document found "a significant reduction in fish populations in the harvested area following the harvest, as well as a significant reduction in the fish population in the unharvested area."[9] Recognition that recreational fishermen follow the kelp harvesters to improve fishing effort and to gain access to areas previously "closed due to the density of kelp" demonstrates that "kelp harvesting can indirectly increase fishing related mortality."[10] CEQA requires an analysis of such indirect impacts,[11] and we urge the Department to ensure such indirect impacts are not significant.

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[3] Draft Final Environmental Document, at 2-4
[4] Fish and Game Code Section 7056 (g)
[5] Draft Final Environmental Document, at 1-2
[6] Draft Final Environmental Document, at 3-38 to 3-41
[7] See, e.g., NMFS. 1998. Essential fish habitat: West Coast groundfish. Appendix. Seattle, WA., or NOAA. 1990. West Coast of North America coastal and ocean zones strategic assessment: Data atlas. U.S. Dep. Commerce NOAA. OMA/NOS, Ocean Assessments Division, Strategic Assessment Branch. Invertebrate and Fish Volume.
[8] Draft Final Environmental Document, at 4-1
[9] Id. at 4-3
[10] Id. at 4-2
[11] CCR Title 14 §15126.2(a)

16d

We recognize that there is much scientific uncertainty surrounding the analysis of impacts of the proposed project. However, the Department's conclusion with respect to Giant Kelp, that "harvesting of canopies may open some areas to predation by fishes that otherwise would not feed in the area, and potentially increases the fishing mortality for some fish species due to easier access to those species,"[12] appears to indicate a potentially significant impact. The Department acknowledges as much with respect to bull kelp harvesting, stating that "at this time, too little research has been done on the effect of bull kelp harvest on fish and until more information is gathered, it is impossible to tell whether the impacts are significant or not."[13]

Similarly, the Document acknowledges the scientific evidence that kelp is the preferred habitat of the Southern sea otter *(Enhydra lutris nereis)* and that kelp forests function as nursery areas for the species.[14] While there has not been a recorded, direct take of a Southern sea otter by kelp harvesters, there is a potential for harm to the species. Harassment and other forms of "take" of species protected under the Marine Mammal Protection Act and the Endangered Species Act are prohibited by law.[15] The Document notes that kelp harvesting may impact the population of the Southern sea otter by requiring them to shift rafting or foraging locations and/or reducing the amount of available invertebrate prey (food).[16] Even though critical habitat for the species has not been designated under the ESA,[17] consideration of habitat impacts on the species is
16e important. We also note that the status of the Southern sea otter population is listed as threatened under the Endangered Species Act,[18] rather than "uncertain" (as is stated in the Document).[19] Again, we strongly recommend that the Department undertake further studies to examine the impact of kelp harvesting on the Southern sea otter population, and we note that the Monterey Bay National Marine Sanctuary may be required to perform a Section 7 consultation under the Endangered Species Act which would result in the biological assessment by the U.S. Fish and Wildlife Service, which may provide additional scientific information on the impact of kelp harvesting on this species. We strongly urge the Department and Commission to ensure that they meet their mandate of adaptive management[20] by incorporating any new scientific information in future management decisions.

Furthermore, we are concerned that throughout the Document the analysis of the effects of kelp harvesting on habitat for other marine species may not be adequate under CEQA, and that the project may not conform with existing law protecting marine habitat ("the health of marine habitat is maintained and, to the extent feasible, habitat is restored, and where appropriate, habitat is enhanced"[21]). Although Section 7084 (b) of the Fish and Game Code specifically exempts kelp harvesting from the requirement to address and "minimize adverse effects on habitat caused by fishing",[22] CEQA guidelines require that a mandatory finding of significance

16f

[12] Draft Final Environmental Document, at 4-4
[13] Id. at 4-5
[14] Id. at 3-42 to 3-43
[15] 16 U.S.C. §1361 et seq and 16 U.S.C. §1531 et seq, respectively
[16] Draft Final Environmental Document, at 4-8 to 4-10
[17] 50 CFR 226
[18] 50 CFR 17.11
[19] Draft Final Environmental Document, at 4-10
[20] Fish and Game Code §7056 (g); see also Fish and Game Code §7055 (b)
[21] Fish and Game Code §7056 (b)
[22] Fish and Game Code §7084 (a)

16F

be triggered if the project has the potential to substantially reduce the habitat of a fish or wildlife species.[23] The Federal Endangered Species Act also may limit an agency's decision that causes loss of habitat for endangered or threatened species.[24] Similarly, we are unsure whether the discussion of cumulative impacts in the Document is appropriate and complete as well. We urge the Department to re-examine the Document in light of these requirements and ensure that the Document meets these legal requirements.

In addition, we are concerned that the discussion of management techniques in Section 2.5 does not include a discussion of per-bed harvest limits. This management technique is a key element of Alternative 1 and is the only alternative to the preferred alternative that is not a "no action" alternative. As such, a more substantial discussion of the technique, its expected costs and benefits to the environment, and the legal authority to apply it, should be provided as though this Document were an EIR.[25] The Document states that Alternative 1 would result in both less displacement of juvenile fish and less disruption of sea otters in occupied beds, but suggests that the ecological benefits to kelp and other species would not be significant in most geographical areas.[26] We believe that further research and analysis on this issue is warranted.

16G

Perhaps most importantly, we are concerned by the Document's analysis in support of the preferred alternative. In the Document Summary, the Document asserts that the "project is not expected to have any adverse impacts on the bull or giant kelp resources or on their associated communities" because the impacts from kelp harvesting, compared to other human activities affecting these ecological communities, is minor.[27] Yet in the discussion of the alternatives to the project, Alternative 1 is not the preferred alternative because of "1) potential impacts to the algin industry and local economies."[28] Neither of these arguments seems persuasive or appropriate for an Environmental document prepared pursuant to CEQA.[29] We strongly recommend that the Department revise these sections to comply with CEQA.

Finally, we note that the Department's notice and involvement of stakeholders could have been improved. While we recognize that the Department is making improvements, several stakeholders and other interested persons will not be able to meet the deadline for comments, as they were unaware of the availability of the Document. Several comments on the impacts of kelp harvesting on nearshore fish species were raised at the recent scoping meetings for the Nearshore Fishery Management Plan, yet the Department did not announce the availability of
16H this Document or the impending deadline for comments. Moreover, as the proposed project occurs in areas of Essential Fish Habitat (EFH) designated under the West Coast Groundfish Fishery Management Plan, we strongly urge the Department to ensure NMFS has an opportunity to comment on this Document. We strongly encourage the Department to continue to improve their involvement of the public with respect to actions by the Commission and Department with respect to kelp harvesting.

[23] CCR Title 14 §15056
[24] 16 U.S.C. §§1538 (a) (1) (B), 1539
[25] CCR Title 14 §15126.6 (d)
[26] Draft Final Environmental Document, at 6-2
[27] Id, at 1-6
[28] Id, at 6-3
[29] See, e.g., CCR Title 14 §15131

16I At this time, we are not prepared to offer substantial comments as to the relative merits of the preferred Alternative, particularly with respect to Alternative 1. As noted throughout the Document, kelp is an important habitat for a wide range of species occurring in the nearshore environment. The Document details a number of impacts which may cumulatively or indirectly be significant. We are concerned that although substantial scientific uncertainty exists, this uncertainly may mask the significance of the project's impact(s) on the marine environment, and in the absence of scientific certainty a precautionary approach must be utilized. We strongly encourage the Department to amend the preferred alternative to, at a minimum, develop a biologically tenable threshold value beyond which the impacts [of kelp harvesting] could be anticipated before imposing harvest limitations on a broad scale."[30]

Thank you for the opportunity to comment on the Draft Final Environmental Document. Please feel free to contact us at your convenience to discuss these comments and questions. We look forward to working with you to continue to conserve and sustain California's marine ecosystems for the benefit of all the state's citizens.

Sincerely,

Doug Obegi
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[30] Draft Final Environmental Document, at 1-2

CALIFORNIA AQUACULTURE ASSOCIATION

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February 13, 2001

FRED W
805 772 7567

Commissioners
Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

SUBJECT: Five Year Status Report and Environmental Document on Kelp Management and Harvesting: Item 5, February 2, 2001 Agenda

Dear Commissioners:

The California Aquaculture Association (CAA) and in particular the abalone growers in the State, would like to commend the Department for its considerable effort in preparing the Final Environmental Document on Giant and Bull Kelp Regulations. We are pleased to offer our general support for the document, and offer the following recommendations in an effort to make the regulations clearer and fairer. We hope that the action that your Commission takes on this matter now will establish a kelp management plan that will stay in place until at least the next five-year review.

As you are all well aware, the California Fish and Game Code (Section 1700.f) explicitly charges the Department with the ..."*development of commercial aquaculture*" in the State. Our comments are provided with this mandate in mind.

17A Firstly, our industry – in this case it is just the abalone growers – is responsible for a *small fraction* of the kelp harvest in the State, yet much of the focus of the document before you deals with the areas and harvesting practices of our growers. Abalone growers account for a mere 1.7% of the State's commercial take. By those numbers alone, we have a very small impact on the resource. Also, the report shows a definite downturn in kelp harvesting in general, providing us all with even greater confidence that our kelp resources are safe.

17B Second, this document proposes changes to the current regulations that may significantly impede part of our industry's ability to harvest kelp at certain times and it certain areas - despite no evidence that these changes will enhance overall kelp resources. . It is therefore imperative that the Commission recognizes that the restrictions on harvesting that are proposed in the document may in fact be addressing user conflict issues rather than kelp sustainability concerns. We urge the Commission to make the distinction between

Fish and Game Commissioners
Kelp EIR
Page 2

17B

these two considerations so that our industry is not needlessly jeopardized by overly restrictive regulations.

Thirdly, CAA urges the Commission to consider very carefully the specific recommendations of the abalone growers that seek greater regulatory clarification. Regulatory predictability is a cornerstone of effective and fair government. Businesses -- particularly those that have a slow rate of return on their investments like abalone growers – need the assurance that the rules under which they operate are not subject to rapid and unpredictable changes.

17C

There is no viable economic alternative to fresh kelp for most of the California abalone growers at this stage. They have built their businesses up with a reasonable expectation that their sustainable harvest will continue to be permitted. Because of this, these kelp harvest regulations *must* be deliberative, science-based and stable.

17D For example, under the Proposed Regulatory changes Section 165.c.4, provides that the "*Commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested*". The phrase "*properly harvested*" is not defined, and is subject to differing interpretation. These regulations should establish clear decision-making process and clear criteria, such as an historical record showing a decline in the kelp resource, to guide such a closure.

17E In addition, the proposed restriction on harvesting Nereocystis under Section 165.c.4.B does not appear to have been justified with the data provided. If however this justification can be provided, CAA would seek clarification on whether the restriction would apply to attached kelp, or drift kelp as well.

17F Further, the restrictions on mechanical harvesting under Section 165.c.4.C appear to be redundant if the other harvesting limitations are in place.

17G Finally, we urge the Commission to direct the Department to redraft Section 165.c.4.E under which nonleased kelp beds may be designated as harvest control areas. While we support this adaptive management approach, we need to establish in these regulations better-defined criteria that may trigger such a closure.

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Kelp EIR
Page 3

CAA and its abalone growers pride themselves in practicing sustainable aquaculture. We have already accommodated the interests of other users by agreeing to the closure of a significant section of bed 220 and to the restriction on mechanical harvesting in an even greater portion of this bed. We look to your Commission to bring an equitable closure to this matter and to help us secure our small niche in the complex California environment for our businesses.

As always, CAA stands ready to assist you and the Department in any way we can.

Sincerely,

Justin Malan

Justin Malan
Executive Director

Cc: Mr. Robert Hight, Director, Dept. of Fish and Game
Senator Bruce McPherson, 15th District
Assemblymember Fred Keeley, 27th District
CAA membership

Fred Wendell

From: Rob Collins <RACollin@dfg.ca.gov>
To: <fwendell@dfg2.ca.gov>
Sent: Friday, February 16, 2001 8:26 AM
Subject: Re: Fw: Comment: Draft Environmental Doc. on Kelp Mgmt.

Fred, you didn't get it all. Here it is again.

John O?Connor Feb. 15, 2001
PO Box 116
Bolinas CA. 94924

Mr. Rob Collins
California Department of Fish and Game
20 Lower Ragsdale Ave.
Monterey, CA. 93940

Re: Kelp harvesting effect on essential fish habitat.

Dear Mr. Collins:

18A In over four hundred references cited in the Draft Final Environmental Document of The Giant and Bull Kelp Commercial and Sport Fishing Regulations there are five citations that refer to the effects that kelp harvesting has on fish populations and only one of those studies is concerned with the effects that kelp harvesting has on young of the year rockfish. These studies are from before 1968 to 1993, and were all done years before the drastic downturn in rockfish populations was acknowledged by regulators. The Draft Kelp Regulations utilize the 33 year old study by W.J.North (1968) to suggest that changes in the 1968 general equilibrium attributable to kelp harvesting compared to the present conditions surrounding kelp harvesting are minor irrespective of changes that have actually occurred in the ocean since 1968.

Young of the year rockfish and other fish species sometimes swarm in the canopy cover and may be damaged or become vulnerable to predation during harvesting. Major rockfish species such as the troubled bocaccio rockfish that are down to less than 5% of unfished, the blue rockfish and olive rockfish, among others, use the canopy in early life stages. Kelp forests and kelp harvesting are an integral part of the nearshore fishery and should be part of the nearshore fishery management plan. New studies that will quantify present kelp harvesting?s disruption of kelp forest fish species must be part of the Giant and Bull Kelp Regulations and the 2002 Nearshore Fishery Management Plan.

18B Because the Draft Final Environmental Document, Giant and Bull Kelp Commercial and Sport Fishing Regulations, Dec. 2000 lacks timely studies I suggest that the document is incomplete and needs further revisions.

02/16/2001

Sent by:Don Schultze Feb-16-01 10:39am From 9167227658+885 772 7569 Page 2

(19)

Abalone International Inc.
P.O. Box 1640
Crescent City, California 95531
Phone (707) 464-6913 - Fax (707) 464-1802

Mr. Robert Hight, Director
California Department of Fish and Game

Dear Director Hight,

Thank you for this opportunity to comment on the Draft of the Proposed kelp Regulations. I think it is important to note that the kelp harvesting industries of California have worked with the Department for many years with the result being the maintenance of healthy dynamic kelp beds along the coast. It does seem however as if some of the proposed changes will have a negative impact on our industry, that of the abalone farmers, without increasing the protection of the beds in any real scientific way. To help improve the plan, I would like to suggest the following: 19A

Amendment 3 - "Regulations controlling the commercial harvest of bull kelp should be amended to restrict acceptable harvest methods and seasons to protect that species near the southern limits of its geographic distribution."

This amendment proposes to increase regulations on the take of bull kelp near the southern limits of its geographic range. As I am certain the Department is already aware, the bull kelp beds only start in Bed #224 which is approximately 15 miles north of Santa Cruz. There are no bull kelp beds in the areas where kelp is harvested. The bull kelp that is taken is either drift or already up on the beach. Therefore recommendation does not appear to have any resource or scientific basis with regards to maintaining a reproducing bed, but it would have the effect of being a great burden on at least one of the farms in particular. The farm uses both drift kelp, and beach kelp to help supplement their feeding of abalone. It would be unreasonably burdensome to expect them to sort through beach kelp removing any bull kelp to be left on the beach. In addition we are talking about a miniscule percentage of the drift/wrack kelp in that area's ecosystem that is used, yet a food supply which can at times be vital. The Sanctuary's Advisory Council strongly urged the MBNMS Staff to reject this proposal. The Cities of Monterey and Santa Cruz bury tons of bull and giant kelp along their public beaches. If this recommendation were to pass as proposed, the burying of bull kelp by these Cities would in effect be a violation of the law. 19B

I strongly urge the Commission to consider rejecting this proposed amendment.

Amendment 6 - "The regulations should also be amended to provide a

19C

01/31/2001

19c

method for placing temporary harvest controls in beds or portions of beds where necessary for resource protection."

This regulation is vague and does not indicate or specify how a closure would be determined. As the Department is aware, kelp beds are highly variable changing quite rapidly in a very short time frame. It is not feasible for the Department to assess, develop, and implement temporary harvest controls so quickly in this dynamic system without severely impacting abalone farmers who depend on steady kelp supplies for their survival.

I strongly urge the Commission to consider rejecting this proposed amendment.

Proposed Regulatory Changes (P. Appendix 2-3)
(c) 4 - "The commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested."

Kelp harvesting as managed by the Department is being properly harvested, either by hand or by use of a mechanical harvester. The wording here seems vague, and unclear as to it's purpose. Kelp harvesters, and methods are well known to the Department as it is a small group. Both the alginate, and abalone
industries have developed with the long term health of the kelp beds in mind.

19D

I strongly urge the Commission to reject this proposed amendment.

(c) 4B - "Between April 1 and July 31, a kelp harvester may not harvest bull kelp from a nonleased kelp bed that lies partially or totally within the boundary of the MBNMS extending from Santa Rosa Creek, San Luis Obispo County, northward to Rocky Point, Marin County."

Here again see my above comments under Amendment #3.

(c) 4C - "Prior commission approval of a kelp harvest plan is necessary before a kelp harvester may use a mechanical harvester to harvest giant kelp in a non-leased kelp bed in the area north of Santa Rosa Creek."

This proposal seems unduly burdensome on both the Commission, as well as the kelp harvester. This process could take months which would effectively stop harvesting of kelp in this area for the season. The Department
is already fully aware of the harvest methods used, and inclusion of this change
would do nothing more them add extra burdensome regulations without any added protection to the beds. The same tonnage of kelp will be harvested whether it is by hand in a very narrow area or throughout a much broader

01/31/2001

19E

19E

area mechanically.
Currently kelp is harvested within 1-2 miles of the Santa Cruz and Monterey Harbors. A mechanical harvester would allow for kelp to be harvested in a much larger area, thus reducing the impact in any one area. A mechanical harvester operated out of Santa Cruz for over 10 years with no public complaints or comments being made during the DFG Kelp Plan Review in 1995. The proposal to limit mechanical harvesting does not address the real issue at hand. The whole issue has historically always
revolved around hand harvesting along Cannery Row.

I strongly urge the Commission to consider rejecting this proposed amendment.

19F

(c) 4E - "The commission may designate, through emergency regulation, a non-leased kelp bed or portion of a bed as a harvest control area for a specified period of time. The commission shall set a cumulative harvest tonnage limit that may not be exceeded by a kelp harvester while harvesting within the control area during any consecutive 7-day period."

Again the language is vague and unclear as to what the Department is trying to
achieve through this recommendation.

I strongly urge the Commission to consider rejecting this proposed amendment.

In summary, one of the main challenges of the Department is to promote aquaculture.
It has "encouraged" status within California. These businesses are built over a
long period of years, and therefore sudden changes are particularly damaging to
aquaculture farms. This is, and has been one of the crucial differences between
aquaculture, and the traditional fisheries. One need only look to the recent Department
handling of the RLP issue to see the long term damage ill conceived, rash changes
in regulations can have on even "exemplary" models of aquaculture in California.
I hope the Department will resist the temptation to add more questionable regulations
onto the abalone farming, and kelp harvesting industries.

Sincerely,

Chris Van Hook

Chris Van Hook, Owner
Abalone International Inc.

01/31/2001

CC: Robert Treanor, Exec. Director of Fish & Game Commission
Robson Collins, Monterey CA Dept. of Fish & Game
Justin Malan, Exec. Director of California Aquaculture Assoc.

20

Comments on the State of CA Draft Final Environmental Document: **Giant and Bull Kelp Commercial and Sport Fishing Regulations**

From a concerned underwater photographer,
Richard Todd
17675 Riverbend Road
Salinas, CA 93908

FISH A... Received FEB 1 6 2001 ...RRO B...

INTRODUCTION

I am an underwater photographer and videographer intimately acquainted with the kelp forests and their health along the California coast and especially in the area off the city of Monterey known as Ed Ricketts Underwater Park. I have been a certified diver since 1970. I grew up diving the freshwater lakes and quarries of the Midwest. I purchased my first underwater camera in the 1970's in an attempt, like most underwater photographers, to show my non-diving friends and relatives what it is like beneath the surface. In the 70's and 80's I was drawn to areas of richer biodiversity and this included the magnificent kelp forests of California. Nowhere was healthy kelp easier to access for an out-of-state traveler than Monterey. I brought co-workers, I brought small groups, and I even brought foreign exchange students from Netherlands to the kelp forests, so that they too, could experience, photograph and relate the exhilarating experience to *their* friends. It was never difficult finding interest in a return visit. Kelp forests are rather unique to the underwater world, and there just are not that many areas in the world that have them accessible from shore.

It was only natural that I chose to move to Monterey area with my wife. Diving more often and getting to know the diving community, we all shared what we were seeing – with each other and especially our non-diving friends. We organized exhibits at churches, at Monterey Airport, at the Pacific Grove Museum all to show and share what we saw. We started the Monterey Peninsula Underwater Photographers (MPUP) so that we could surround ourselves with others of like interest and incredible talent. We all worked hard to preserve what we all saw as a steady decline in the health of this living ecosystem. We inevitably got involved in the move to act responsibly in preserving this marine heritage for our future generations.

Diving has been around for a relatively short time – since the 50's. In my lifetime, I have seen a devastating decline in the health of kelp ecosystems, in the maturity and numbers of fish, and my diving dates only from the 70's. I am truly concerned that future divers will not have any healthy kelp forests accessible to see *other than* our archived pictures! MPUP includes as members scientists, researchers, and retired Fish & Game marine biologists that can put numbers and percent decline to what we see over the years. I do not need numbers to confirm what my eyes and cameras record. I need only to travel to the Pt. Lobos, where kelp harvesting and commercial fishing are not allowed. The difference is obvious.

DIVERS REACTION TO THE ED RICKETTS UNDERWATER PARK

Divers welcomed the idea of an underwater park in Monterey off Cannery Row. Just like most urban apartment dwellers welcome a city park, a desire for accessibility to nature is inherent in us all. With analogous similarities to an above-water park, it should be an accessible way for people to escape commercial encroachment and enjoy nature. Scenery and intrinsic interrelationships of the entire food chain must be preserved, even protected, so they can be observed by this and future generations. Fish need a haven to reproduce. The kelp forest is such a haven. Living up to the true definition of the term "Sanctuary" this park should provide a safe breeding area and give offspring a tiny space in which to be free of Man's predation, deliberate or accidental.

A portion of divers spearfish for "sport". The overwhelming majority of spearfisherman support an Underwater Park with protections. They are only too willing to travel elsewhere for their "sport" if it means a true sanctuary for reproduction and natural ecosystem is established and if the Ed Ricketts Underwater Park will guarantee public access to this natural environment as proposed. [1,2]

20A Divers have witnessed first hand the depletion of the ecosystem that made Cannery Row such a thriving business. Sardines are no longer available in the numbers that enabled multiple processing factories to thrive in Monterey. Hundreds of tons of squid are still taken just outside the Park boundaries. Tons of anchovies go to reduction plants. The rockfish that once were allowed to reach maturity, have been depleted by commercial net fishing. So much, that Department of Fish & Game researchers have reported "...the majority of game fish populations in this area are severely depleted, and consist mainly of immature individuals".[3] Even these immature fish are reported to be threatened by live fish trappers operating within the Park.

Divers realize that the kelp forest canopy provides a haven for immature individuals. The canopy itself is the very base of the food web feeding various commercial interests. The canopy is a necessary support for mammals like the endangered Sea Otter. The Sea Otter itself symbolizes a true success story of Monterey embraced by millions of school children, tourists, and proclaimed loudly on T-shirts. Most photos, drawings, and cartoons justly picture a Monterey Sea Otter literally entwined in Giant Kelp. That is how closely dependent their health is related.

Most divers support the no-take concept of the Park and oppose allowing commercial harvesting in the Department of Fish & Game designated Bed 220. We feel that the kelp harvesters unjustly overturned the City of Monterey regulations to go against public trust. We urge the Department of Fish & Game, and the Resources Agency to manage this unique and fragile ecosystem in a manner which fulfills public trust. Please consider the following:

COMMERCIAL INTEREST AND VALUE OF KELP

20B Divers may own businesses, but to claim that the Underwater Park was "...developed by local business owners," (pg 3-77) is to misrepresent the true concern of over two thousand supporters of the park. It also ignores history of the 5 year campaign waged by citizens, scientists, and concerned individuals who expressed opinions during 7 public hearings. It also diminishes the support of the City Council of Monterey, Congressman Sam Farr, the Center for Marine Conservation, and the Monterey Bay National Marine Santuary's (MBNMS) own Sanctuary Advisory Council.

The Monterey County Hospitality Association, in 1996, called for a halt to kelp harvesting from Cannery Row to Lover's Pt. because it, "...impairs our visitors' experience, degrades the watershed, and is an incompatible use, in light of the value tourism brings to our economy."[4] The purpose was to try to impress upon regulators the *value of living kelp* as opposed to abalone feed as a dead plant.

Royalties calculated at $1.71/ton ignores kelp's value *alive* and assigns a (easy but inaccurate) value of the spot market price of Alginic Acid. At the time of the above-mentioned call for a halt to harvesting, Monterey County Tourism was a $1.14 billion business, employing over 16,000 persons.[4] Even using an extremely conservative estimate of 10% as the percentage of tourism due to marine related activities, this places a much higher value on live kelp. Using an estimated production[5] from Bed 220 of 33,000 tons/year, this places its value at $3,450 / ton of live kelp.

20c It is incredulous to accept MBNMS' widely disseminated allegation that "Divers may permanently alter the community structure of this kelp bed". The same paid consultants found "No significant impact" from the removal of up to 600 tons of kelp / year by commercial harvesters from the Underwater Park.[5] To claim that the kelp bed is damaged more by divers than harvesters is a blatant attempt to discredit diving conservationists.

The Draft Environmental Document loses credibility by including this unsubstantiated smoke screen as fact. It should be removed (pg. 3-77).

MECHANICAL HARVESTING AND RECOMMENDED CLOSURES

20D The MBNMS recommended (Recommendation #3) closing beds 220 and 221 to mechanical harvesting. DFG's proposed legislation would allow mechanical harvesting north of Santa Rosa Creek if prior Commission approval were given. It took hand harvesters less than a month in 1996 to clear-cut the entire Cannery Row kelp forest. Events such as these added impetus to the establishment of protection as a park. Productivity estimates for Monterey kelp forests are only one-eighth of Southern CA kelp beds.[6]

20E The MBNMS recommended (Recommendation #5) that harvesting in North Coast beds not be allowed during its breeding season from April 1 to August 31. DFG's proposed legislation would shorten this to July 31. There is no scientific evidence to support disallowing the MBNMS recommendation. Furthermore, the MBNMS (Recommendation #8) that the North Coast beds 224, 225, and 226 are too small to support a commercial aquaculture industry.

ENDANGERED CALIFORNIA SEA OTTER NEED KELP IN THE WINTER

20F The harvested top portions of kelp are the very parts utilized by California Sea Otters during their winter pupping season. Kelp harvest levels *increase* in the winter when kelp production is at its slowest and natural predation from abalone is at a maximum. In Winter, California Sea Otters retreat to the more protected areas of the Pacific Grove and Monterey shoreline for refuge. Bed 220 is already located in an *existing* refuge, the Pacific Grove Marine Gardens Fish Refuge.

The first draft of the MBNMS recommendations included a Winter closure on harvesting from Lover's Pt. To Hopkins Marine Station (Figure 6-1, area F) but was defeated by the Sanctuary Advisory Committee for inclusion in the final draft. It is already a protected area. Let it truly be so in the Winter when Otters need it most.

SPECIFIC RECOMMENDATIONS

20G **Proposed Section 165 (7)**
Royalties from kelp harvesting should be calculated, not on the market price for Alginic Acid, but the highest social use and economic value of each kelp forest *when living*.

20H **Proposed Section 165 (5D)**
The MBNMS recommendation to close the area from the Coast Guard Jetty to Drake Avenue alone is inadequate. A *complete* prohibition on all kelp harvesting in the *entire* Ed Ricketts Underwater Park should be included, reflecting its status as a park and refuge.

20I **Proposed Section 165 (5C)**
The MBNMS recommended closing beds 220 and 221 to mechanical harvesting. All mechanical harvesters should be prohibited north of Santa Rosa Creek (bed 219 and northward).

20J **Proposed Section 165 (5B)**
The MBNMS recommended closing all beds to harvesting during their reproductive season of April 1 to August 31. Seasonal closure of all beds to harvesting should be during the entire biological reproductive cycle.

20K **Proposed Section 165 (5)**
The MBNMS proposed closing beds 224, 225, and 226. These beds are too small and should be closed to harvesting.

20L **Proposed Closure in Areas Shown in Figure 6-1, Area F**
The Pacific Grove Marine Gardens Fish Refuge must be left undisturbed to provide refuge for the endangered California Sea Otters during their Winter pupping season. These beds (from Lovers Pt. to Hopkins Marine Station) should be closed to harvesting in Winter.

CONCLUSION

I realize there are Centuries of history of using the sea for commercial value, but kelp beds have a value alive, as much as any terrestrial forest or park. U.S. Forest Service Chief Mike Dombeck recently stated: "Social views are changing. People are looking at forests less as warehouses for products and more for their value as open space, watersheds and recreation." I represent a group of those people, divers, who are priviledged to see kelp as a true forest . Its value to us deserves to be protected and held to the same kind of values as any land refuge or forest.

Realizing that this same underwater forest has a value to kelp harvesters, we turn to you to protect *certain areas* of it from exploitation. We realize that harvesting will continue in California. We only ask that commercial kelp harvesting within one small area, the **Ed Ricketts Underwater Park**, be halted. Commercial harvesting is incompatible with any definition of the word "park". Kelp is the very thing that gives meaning to the word "sanctuary" to the food web. Fish, invertebrates, and even the cute-looking Sea Otter turn to the kelp beds for sanctuary. It is the expressed goal of the Ed Ricketts Underwater Park to provide such a sanctuary. The interests of the thousands of California citizens who expressed enough concern to form a park **ask that kelp harvesting be done outside the park boundaries.**

Respectfully submitted,

Richard Todd

CommentsEnvirDrft

[1] **Center for Marine Conservation, 1997.** Recommendations for the Establishment Edward F. Ricketts Marine Park. 18 pgs.

[2] **Cooper, Ed; McDonnell, et.al., 1997.** Proposal to Establish the Edward F. Ricketts Underwater Park. Unpublished.

[3] **Ventresca, D. to Russo, K. August 4, 1995.**

[4] **Lloyd, J. to Treanor, R., February 6, 1997.**

[5] **Donnellan, M. D., and Foster, M. S., 1999.** The effects of small-scale kelp harvesting on Giant Kelp – Surface canopy dynamics in the Ed Ricketts Underwater Park – Final Report to the Monterey Bay National Marine Santuary and the cities of Monterey and Pacific Grove.

[6] **Gerard, V.A., 1976.** Some aspects of material dynamics and energy flow in a kelp forest in Monterey Bay, CA. Doctoral dissertation in Biology, University of CA at Santa Cruz.

21

CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950
TELEPHONE (831) 648-3100
FAX (831) 657-9361

February 14, 2001

Mr. Fred Wendell
California Department of Fish & Game
213 Beach Street
Morro Bay, CA 93442

Dear Mr. Wendell:

At my request, our City staff has reviewed your Department's "Draft Final Environmental Document - Giant and Bull Kelp Commercial and Sport Fishing Regulations" (December 2000) and related documents. This letter conveys the City of Pacific Grove's comments on the draft document.

The City generally supports the recommended alternative in the Department's draft document: the proposed kelp management changes generally represent improvements from the status quo.

In addition, the City agrees with the comments and concerns expressed by the Monterey Bay National Marine Sanctuary in the letter dated February 2, 2001 from MBNMS Superintendent William J. Douros to Mike Chrisman, President, California Fish and Game Commission.

21A We reiterate and emphasize two particular points of concern. First is the need for more and better research on the effects of kelp harvesting on certain components of the ecosystem. This is the first recommendation for research topics listed by the MBNMS's October 3, 2000 document "Monterey Bay National Marine Sanctuary Final Kelp Management Report - Background, Environmental Setting and Recommendations." Of particular concern are the unstudied or little-studied effects of kelp harvesting on kelp canopy fishes, kelp canopy invertebrates, benthic invertebrates, birds, and Sea Otters. Important questions remain regarding both the effects on these animals of kelp habitat reduction and the direct mortality of many kelp canopy organisms through by-catch during kelp harvesting. Adequate quantification is particularly lacking. Researching these questions should be a high priority in managing kelp resources.

21B Second, we note that both drift kelp and beach kelp wrack are very important ecologically and that both need to be conserved. Drift kelp is almost unique in providing structural habitats in our

Recycled Paper

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21B

open water marine environment for many fishes and invertebrates, and it provides important nutrients. Many seabirds make heavy use of drift kelp, both for resting and for foraging. Kelp wrack decomposing on our beaches helps support both aquatic and terrestrial ecosystems along our shores. Kelp wrack is known to be important to migratory shorebird species that feed on the concentrated supply of invertebrates such as amphipods and flies that swarm in the wrack. These shorebirds require regular stops along their migration routes at which they can feed on such rich food sources, without which they cannot deposit enough fat to support their long migratory flights. As California estuaries and other habitats for migratory shorebirds have been developed and degraded by humans, the stresses and limitations on the migrating shorebirds have greatly increased, thus increasing the importance of the food provided by kelp wrack on beaches. For these reasons we must assure that both drift kelp and kelp wrack continue to function in our region's marine and maritime ecosystems, and in sufficient quantities. Kelp management should always have goals of maintaining as vital ecological resources these three forms of kelp: the intact kelp forest, drift kelp, and beach kelp wrack.

Thank you for considering our comments.

Sincerely,

Sandra L. Koffman

Sandra L. Koffman
Mayor

22

PATRICK J. LOVEJOY

California Department of Fish and Game
213 Beach Sr.
Morro Bay, Calif. 93442
attn. Fred Wendell

Feb 13,2001

Dear Mr. Wendell,

22A It has been brought to my attention that the DFG is forming new policy on kelp forest management. I am concerned, as a citizen of central California, that this policy is slanted too much in favor of the commercial harvesters and the abalone industry. I would like to remind you that there is a significant tourism revenue derived from the SCUBA diving industry that is also affected by the policies regarding kelp harvesting. This industry brings far more money into the local economy than the kelp harvesting industry.

22B Additionally, given that there are only 74 acres of kelp forest in the entire state, there is a strong environmental reason to preserve some portion of this resource unblemished.

22C While there are ample studies demonstrating that cutting the kelp judiciously does not affect the health of the plant itself, there are no studies that show that kelp cutting has no negative affect on the kelp forest environment, including, but not limited to, the rock fish and invertebrate community. In fact, in the report published by the Monterey Bay National Marine Sanctuary on their kelp management recommendations, it was pointed out that up to one third of the motile canopy invertebrates were removed during harvest of the kelp plant. One can assume that the incidental take of the sessile invertebrates is greater. How does this affect the fishery? How does it affect the food resource for sea birds? This has not been shown. The precautionary principle requires you to protect the resource until it can be demonstrated that such use is compatible with the goals of a sustainable resource management. Kelp is not the only resource affected by its harvest.

22D The environmental and tourism user groups' uses for the kelp forest are compatible. The demand for more MPA's along the Monterey and Pacific Grove coast line is demonstrable. The city of Pacific Grove is presently asking the DFG to enforce the already existing laws protecting its shoreline. The city of Monterey has designated the shoreline of Cannery Row as Ed Ricketts underwater park. The users of that park demand it be a fully protected MPA. The Carmel Ecological Preserve, while supposedly an invertebrate preserve, hypocritically allows kelp harvesting and its incidental invertebrate take. Additionally, former President Clinton issued a mandate that more underwater parks be established.

22E I am also concerned, as a taxpayer, that the public's resource is being sold at unreasonably low prices. I see no rational reason why a rare and valuable resource should be sold a per tonnage rate less than a gallon of gasoline. It is time our resource managers charged a rate for public properties commensurate with market rates for other commodities. The present price structure amounts to a subsidy for a small special interest group.

1052 HAPPY VALLEY ROAD • SANTA CRUZ, CALIFORNIA • 95065
PHONE: 831-426-5581 • FAX: 831-458-1836

22F Can you give me a good reason why one small user group (kelp harvesters) should be given preferential treatment to a much larger group of citizens, to a larger economic resource, to new government policies on ocean management, and to the health of the marine environment?

Thank You,

Patrick Lovejoy

LUMIGENIC℠ media (23)

Mr. Fred Wendell
Calif. Dept. of Fish & Game
213 Beach St
Morro Bay, CA 93442

(805-772-1714)

February 13, 2001

Dear Mr. Wendell,

23A This letter comprises my comments on the "MBNMS Final Kelp Management Report." My overall opinion is that the plan permits overly aggressive harvests from an ecosystem management viewpoint, and tilts the balance between destructive users and non-destructive "users" inappropriately in favor of the kelp cutters. It also fails to deal with a newly revived kelp clearing technique that threatens to destroy entire beds, not just their canopies.

Before I get into details, let me relate my background. I've learned to dive in Carmel bay and have been diving the Monterey Peninsula since 1978, twenty three years ago. I make a significant part of my living taking underwater photographs here and around the world. I've watched the slow decline in aspects of local ecosystems, and their shift to warmer-water species. I have degrees in Psychology and Biology from Stanford, the latter based in part on work at Hopkins Marine Station. I'm a former scuba instructor, and am currently active in two local underwater photography clubs, as well as some conservation groups.

Kelp "harvesting" as it's been practiced in recent decades entails the cutting off of kelp stipes near the surface, and the removal of the cut upper portion of the kelp (canopy) plus any life forms that still cling to it, most notably crabs and snails. The fundamental principle is that kelp, which grows quickly, can recover, and the habitat represented by the cut-away canopy would eventually restore itself. Used judiciously, this technique should yield a *sustainable* harvest, so long as habitat removal impacts are properly monitored. Recently an article in the newsletter of the San Jose Flipper Dippers related a State Parks employee's story of how kelp "harvesters" off the Limekiln Creek area of Big Sur are not cutting off the canopy, but have revived a method whereby stipes are grabbed, and yanked upward with enough force to break the stipes (at an uncontrolled depth) or to pull the entire plant, including the holdfast, right off the bottom. This is a horrifying development, as it marks a change from cutting of a plant that can, in time, recover, to the killing and removal of the whole plant and all (not just some) of the organisms attached to it. Whole kelp beds, and the entire underwater ecosystems they support, could by destroyed—no, "harvested"— literally overnight this way. Virbrantly living kelp forests could be turned into the man-made equivalent of impoverished urchin barrens. This practice was, I believe used in the early decades of the 20th century,

23B

The shortest distance between two minds

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23B

when kelp was used in the manufacture of gunpowder, and our understanding of ecosystem management was non-existent. **Harvest of kelp deeper than the surface, especially by this "tug and tear" method must be banned.** I fear the current plan was written without knowledge of the return of this unsound, unsustainable practice.

23C With regard to **Proposed Section 165 (7),** which sets royalties of $1.71 per ton for kelp, I can only conclude the recommendation's author has been brainwashed by the kelp cutting interests. Kelp forests are the key marine habitat in the region, drawing thousands of divers (who support many local businesses), kayakers, (supporting more businesses), whale watchers, birders, sight seers, (all of whom support businesses), and more. Selling off one of the regions primary attractions at $1.71 a ton is an outrageous government subsidy to one economically tiny industry. Kelp belongs to everyone, as do the animals living in it. Perhaps a few of us can pay $1.71 per ton to *keep it alive*. The bottom line—philosophically and economically—is that kelp is worth more living than dead.

23D With regard to **Proposed Section 165 (5D),** which proposes to save the tiny portion of Kelp bed 220 from the Breakwater to Drake Ave., I submit this tiny area of sanctuary is inadequate. From the standpoint of scientific study, the area spared cutting is inadequate as a control. The opportunity to study habitat impact of cutting is lost because just a single, tiny, area is unaffected. Likely habitat impacts could be extreme, rippling through mollusk and crustacean populations, rock fish reproduction, and on and on. From a human use standpoint, turning the overwhelming majority of a major offshore attraction and recreation area into an industrial resource available for the taking makes no sense. The majority of residents, of visitors, of businesses would prefer to have living kelp than dead. A complete ban on harvest from the Breakwater to Pt. Pinos or beyond is appropriate. A ban on cutting in the area from the Breakwater to Lovers' Point, corresponding to the existing Ed Ricketts Marine Park, would seem a minimum. Do we really think a Park and industrial resource exploitation are compatible? Moreover, in light of DFG's current study of remedies to the rockfish population crash, the proposed allowable amount and area of cutting is precipitous. DFG might accept this plan, and then very soon be forced to reverse course because kelp canopies provide key habitat for rockfish fry.

23E Finally, kelp is the primary habitat of the Southern Sea Otter, a federally listed endangered species. It probably also helps support Steller Sea Lions, another listed species. In light of the Endangered Species Act, this magnitude of assault on habitat is extraordinary and unacceptable, if not illegal. A network of areas closed to cutting, both by area (protected islands) and by season is called for. There is inadequate evidence of consideration for the effects on threatened species in this plan. There is inadequate scientific evidence in existence to show us that removal of this amount of habitat won't have grave impacts on endangered and threatened species. **Allowable limits on areal cutting should be far lower than 50%.**

Appendix 4 -87

Please, think about habitat, think about rockfish, think about the economic interests of more Californians than just a few kelp cutters.

Sincerely Yours,

Marc Shargel

Marc Shargel

(24)

DEFENDERS OF WILDLIFE

February 15, 2001

Robson Collins
Nearshore Ecosystem Coordinator
California Department of Fish and Game
20 Lower Ragsdale Drive, #100
Monterey, CA 93940

RE: DEFENDERS OF WILDLIFE'S COMMENTS ON THE DRAFT ENVIRONMENTAL DOCUMENT FOR GIANT AND BULL KELP COMMERCIAL AND SPORTFISH REGULATIONS

Dear Mr. Collins,

Defenders of Wildlife ("Defenders") submits the following comments on the California Department of Fish and Game ("CDFG") ***Draft Environmental Document for Giant and Bull Kelp Commercial and Sportfish Regulations*** ("Environmental Document"). Defenders will provide the following comments on the Environmental Document: an overview, legal comments and, finally, a section that presents feedback and comments on specific sections of the document.

OVERVIEW

Defenders appreciates the efforts of CDFG in undertaking this review of their 5 year management plan on kelp harvesting. While there were many opportunities for CDFG to get feedback from stakeholders and the public over the concerns on kelp harvesting and its relationship with this complex ecosystem, Defenders is concerned with the inadequate discussion on sea otter-kelp harvesting issues, potential impacts of harvesting on the entire ecosystem, and the failure to adequately address legal issues.

24A

The Environmental Document fails to acknowledge that there is a significant **lack of** **studies** documenting the impact of kelp harvesting on local sea otter populations and other marine animals. Additionally, the Environmental Document falls short in making any research recommendations on how to mitigate kelp harvesting's impacts on sea otters. In the final version (October 3, 2000) of the Monterey Bay National Marine Sanctuary's ("MBNMS") kelp report ("Report"), the Sanctuary recommended a research topic that would attempt to investigate the effects of kelp harvesting on a variety of kelp forest inhabitants, including sea otters. CDFG, despite suggested studies described in the Report, has not adopted any such recommended studies in this Environmental Document.

24B

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As for the protections afforded to sea otters under the Marine Mammal Protection Act ("MMPA") and the federal Endangered Species Act ("ESA"), the Environmental Document failed to address how removing portions of the kelp canopy, particularly during the winter months when kelp is already sparse, may affect the food supply, shelter and safety of sea otters. These actions, more than likely result in a "take" (defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal") under the MMPA and the ESA. CDFG has a responsibility to ensure that any activity that occurs within State waters does not result in a "take". The Review fails to adequately address this responsibility and how CDFG plans to monitor this activity against such a violation.

LEGAL COMMENTS ON THE CALIFORNIA DEPARTMENT OF FISH AND GAME KELP CEQA REVIEW

24c

1. CDFG has a legal obligation to prevent incidental take of sea otters under section 9 of the ESA (16 U.S.C. § 1538) and the MMPA. The courts have ruled that when a state affirmatively allows fishing activities to occur through licensing or other measures, and those activities are likely to result in entanglement of protected species, the responsible agency is in violation of the section 9 take prohibition. (*Strahan v. Coxe*, 127 F.3d 155, 163 (lst Cir. 1997), cert. denied, 119 S.#Ct.81, and cert. denied, 119 S.Ct. 437 (1998).) The same rationale that caused the court in *Strahan* to find that Massachusetts violated the Endangered Species Act by licensing gillnet and lobster pot fishing that will likely result in the entanglement of right whales applies to CDFG's, and the MBNMS's, regulation of kelp harvesting within the sea otters' habitat. In addition, recent case law confirms that the failure of government entities to prohibit or restrict activities that are likely to take listed species can be a violation of section 9 of the Endangered Species Act. (*Loggerhead Turtle v. Volusia County*, 148 F.3d 1231, 1249 (11th Cir. 1998), cert. denied, 119 S.Ct. 1488 (1999). The same reasoning would apply under the Marine Mammal Protection Act ("MMPA"), which imposes a strict prohibition against incidental take of sea otters. See 16 U.S.C §§ 1371(a)(1), 1372(a), 1387(a)(4).

Therefore, any Kelp Management Plan approved and implemented by CDFG must provide stringent protection for sea otters within state waters. The failure to do so may result in CDFG being in violation of the ESA and the MMPA.

24D

2. Social and economic ramifications (or impacts) are not appropriate in a CEQA analysis. Economic and social effects that are not related to physical impacts need not be evaluated in an environmental impact report. 14 Cal. Code Reg., § 15131(a); see *Goleta Union School Dist. v. Regents of the Univ. of Cal.*, 37 Cal.App.4[th] 1025 (1995). The social and economic effects may be taken into account to assist in determining the significance of physical changes to the environment. 14 Cal.Code Regs. § 15131(b). CDFG's CEQA process should address the environmental impacts associated with kelp harvesting, and economic and social impacts should only be considered or taken into account to assist in determining the significance of the environmental impacts. Environmental Document, Chapter 3 at p. 58, p. 70.

Appendix 4 -92

24E 3. Mitigation. Simply because the proposed project provides for a more conservative set of safeguards than provided for under the existing regulations, does not mean that the impacts to sea otters, and other marine life, are, in fact, mitigated. As the impacts to sea otters may be significant, the document must identify mitigation measures to reduce any such impacts to less than significant.

24F 4. Alternatives. The Environmental Document fails to provide a range of reasonable alternatives to the proposed action. The document should evaluate, identify, and discuss alternatives that reduce or close harvesting within sea otter habitat, and/or alternatives that reduce the amount of kelp harvested. Additionally, any alternative needs to address resource conflicts throughout the range of the sea otter, not just in bed 220.

SPECIFIC COMMENTS ON SECTIONS OF THE REVIEW

Chapter 3

24G ***p. 43, 1st sentence at top of page.*** "Until recently, the sea otter population............". This comment appears to suggest that the decline is now over after the spring 2000 count. This is an inaccurate interpretation of the southern sea otter census results or assessment of southern sea otter population trends. One count does not signify a reversal in a population trend. Some of the top sea otter biologists, including Dr. Jim Estes, have indicated that we would need to observe a minimum of 3 years of successive high spring counts before having any confidence that the trend had been reversed. Additionally, the fall 2000 count was down by 4.7% as compared to fall 1999.

24H ***p. 70, Socioeconomic Environment, sentence 6.*** "Kelp provides..........tourism.". Healthy kelp forests translate into the presence of sea otters. Sea otters are a huge focus of the 1.5 billion dollar tourism industry in Monterey County. When the kelp forests are gone or decimated by winter storms and/or kelp harvesting activities, tourists and the public complain about the lack of sea otters and healthy kelp forests to view.

24I ***p. 89, Management Concepts and Tools.*** "Reactive" and crisis management has gotten the state of California and wildlife agencies into a lot of trouble (i.e., California condor). There must be foresight and the preemptive strategy of addressing concerns and issues before they reach a crisis level and require "reactive" management techniques.

Chapter 4

24J ***p. 1, Section 4.1.*** Studies by Limbaugh (1955), Quast (1968) Miller and Geibel (1973) and others on impacts of kelp harvesting on fish populations are extremely outdated. Newer studies need to be developed, given that there are very different environmental conditions with California's marine ecosystem, and, specifically, kelp forests, from when those studies were conducted.

p. 6, Section 4.2. A conclusion that states that, "the overall effect on invertebrate populations does not appear to be significant" is not taking into account that there are a

24K

24K lack of studies in order to determine "significance" of kelp harvesting impacts on invertebrate and microinvertebrate populations.

24L *p. 8, Section 4.3.* A conclusion that states that, "any impacts from the proposed project on bird populations is considered to be short-term and less than significant" is not taking into account that there is a lack of studies in order to determine "significance" of kelp harvesting impacts on marine birds. There is also no reference to the association of marbled murrelets (*Brachyramphus marmoratus*) with kelp forests and that association does exist. This species of marine bird is a federally "threatened" and state "endangered" species.

24M *p. 8, Section 4.4.* Sea otters are protected by not just state and federal regulations, but also by state law as a "fully protected mammal" (Fish & Game Code, §4700), and federal law under the ESA and MMPA.

24N *p. 9, Section 4.4, paragraph 1, last sentence.* "They hear and see the ....passes". This might be applicable to the large harvesting boats used by ISP Alginatges, Inc., but a small skiff, used by many of the local hand harvesters, can potentially move within a sea otters threshold distance well before the otter was aware of the skiff's presence. If sea otters were displaced, disturbed, or harassed, this is a potential violation of the ESA and MMPA.

The reference to the two factors minimizing impact to sea otters to less than significant is not supported within the document. Harvesting that occurs in bad weather must not be allowed to impact any otter, not just within the closure area.

This section on sea otters is wholly inadequate in addressing biological and legal issues in reviewing potential kelp harvesting impacts on sea otters. And, again, a conclusion that states, "two factors tend to minimize the potential impacts to levels that are less than significant" is not based on any scientific studies to support such a conclusion. We know that sea otters use the kelp canopy for shelter and protection against predators and winter storms. They also use this ecosystem as a foraging area. If kelp harvesting has deleterious consequences in the sea otters' ability to use this habitat, the harvesting activity must have appropriate mitigation measures or be ceased, either temporarily or permanently.

Appendix 1

24O *p. 4-5, last sentence of p. 4 continuing to top of p. 5.* "Marine aquatic plants may not be cut or harvested in marine life refuges, marine reserves, ecological reserves, national parks or state underwater parks". This sentence should be carefully addressed considering that kelp harvesting occurs in a nationally designated marine sanctuary that has designated reserves and refuges. This is especially critical in areas where there may be a conflict between kelp harvesting practices and disturbance of marine life (sea otters, marine birds, invertebrate populations, etc.).

24P ***p. 19, Sections 2850 and 2851.*** The concept of designating "certain areas as sea life reserves ....where minimal disturbance occurs" is a critical point and one that seems to be absent throughout much of this document and is a key focus of the Marine Life Management Act (MLMA).

24Q ***p. 19-20, Section 2852, part (a).*** There is a great deal of "scientific uncertainty" when reviewing the association between kelp harvesting and the ecosystem that is affected. Necessary studies are missing from the scientific literature on the effects of kelp harvesting on marine invertebrates, marine birds, sea otters, and other marine animals. It is irresponsible to arrive at a conclusion of "no significant impacts" when the studies have not been conducted to determine this. A much more conservative approach needs to be undertaken when looking at alternatives, when "scientific uncertainty" is quite prevalent.

24R ***p. 20-21, Section 2853.*** A "master plan" team that is responsible to "advise and assist in the preparation of the master plan" on adoption and implementation of the Marine Life Protection Program" must include representatives from all stakeholders (including NGO's) and the public.

24S ***p. 25, Section 6421.*** Artificial reefs is a concept that is opposed by many in the conservation community. Any man-made intrusion upon an already fragile, affected ecosystem may have further detrimental impacts.

Appendix 2

24T ***p. 2, Section (c)(2).*** This still does not address the effect upon the first four feet of the kelp plant, a rich, diverse habitat with many marine animals associated with it.

24U ***p. 3, Section (4)(D).*** This designated "no harvesting zone" does not begin to take into account the heavily transited, frequently used sea otter areas along the waterfront between Drake Avenue and Hopkins Marine Station. There are rafts of sea otters and individual sea otters that utilize the nearshore waters adjacent to El Torito restaurant, Monterey Bay Aquarium and all along Cannery Row.

CONCLUSION

Defenders believes that kelp harvesting and its potential impacts on kelp forests and the associated marine life that inhabits these complex ecosystems suffers from a lack of studies to identify true impacts. Some of the existing regulations and planned changes, as identified by this CEQA Review, do not adequately address the mandates of the MLMA, the ESA and the MMPA. There are certain expectations and responsibilities with regard to the management of this unique resource and its inhabitants.

Defenders appreciates the opportunity to provide feedback on this Environmental Document and intends to continue our review of CDFG's development of a Kelp Management Plan.

Should you have any further questions please feel free to contact Kim Delfino, Defenders of Wildlife's California Programs Director, Nancy Weiss, Defenders of Wildlife's California Species Associate, or me.

Sincerely,

Jim Curland
Marine Program Associate

Cc: Mary Nichols (**California Resources Agency**)
Robert Hight (**California Department of Fish and Game**)
Robert Treanor (**California Fish and Game Commission**)
Carl Benz, Greg Sanders (**U. S. Fish and Wildlife Service**)
Aaron King (**Monterey Bay National Marine Sanctuary**)
Kaitlin Gaffney, Doug Obegi (**Center for Marine Conservation**)
Vicki Nichols (**Save Our Shores**)
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Don Mooney, Esq.

(25)

Rob Collins, Ecosystem Manager
California Dept. of Fish & Game
Ragsdale Drive
Monterey, CA 93940

Subject: Comments on Draft for California's Draft Final Environmental Document Giant and Bull Kelp Commercial and Sport Fishing Regulations

February 13, 2001

Dear Mr. Collins:

The foregoing are my comments and questions regarding California's Draft Kelp Environmental Quality Act (CEQA) Environmental Document and proposed kelp management for the period 2001 to 2005.

I have been a Dive Industry Representative on the Sanctuary Advisory Council since it's inception, a past representative and board member for the Northern California Scuba Retailer's Association (NCSRA) a Charter member of the Diving Equipment and Marketing Association (DEMA), a Charter boat operator and an SSI Pro 5000 diver with over 3,000 recreational dives in Central California waters. 95% of my dives have been in kelp forests. I am uniquely qualified to make comment on the behalf of those who I represent.

I appreciate the work you and your staff have done to make the process public, as well as the work the agency has done with respect to the document, however there are many questions that have come to light by my constituents and we appreciate the time and effort it takes to address the issues. Thank you in advance:

1. There are only 74.13 square miles of kelp beds along the entire 1,072 miles of California coastline. It has been said, if you took a globe 250 feet in diameter and laid an eyelash on it, that would represent the total area of our kelp forests. Do you agree with this?

25A With a habitat this small and important, no part of it should be taken without extensive study by unbiased scientists and ecologists. There is simply too much we don't know.

2. RE: Summary Conclusion (p1-6) The environment is NOT the same in 2000 as it was in 1968 (North) as your summary suggests. New species targeted by commercial fisheries are already depleted. New gear methods, including near-shore fisheries' traps and stick fishing methods, new technologies, pollution, sewage, declines in abalone, young-of-the-year rockfish and other species that are interdependent on kelp. Increased and more intense collection efforts have contributed to the decline of our kelp environment since 1968. More commercial take of sea life including The Monterey Bay Aquarium, Steinhart Aquarium, Pier 39, Marine World, Moss

25B

25B

Landing Marine Labs to name a few. More sea life supply companies are working since 1968. These new demands placed on our kelp forests should be cause for caution with respect to harvesting regulations. Question: How many collection permit holders are allowed to take marine life in California's 74.13 square miles of kelp beds? Please provide a list of names and companies in the final EIR and an analysis of their impact.

25C 3. (Effects on Environment 1-2) There is a "no-action alternative" (which is status quo.) and a "control alternative" listed, but no alternative for "no-harvest". Please address and evaluated both environmentally and socioeconomically.

25D 4. Would you please provide an analysis of the following costs?
A. The State's costs in management, research, monitoring and enforcement must be evaluated to determine if the Agency's licensing fees and royalties offsets the costs to the people of the State of California.
B. Environmental costs of harvesting. Please define.

25E 5. Socio-economics: The tourism business in Monterey County for example, is a 1.14 billion-dollar industry. The costs of the loss of the habitat in terms of the socio-economic aspects, view shed, impact to the diving and kayaking industries have not been considered or even recognized. For example the diving industry depends on healthy kelp forest canopies and its inherent sea life for it's sustainability. Millions of dollars have been spent by the industry advertising kelp forest diving. It is the major attraction for diving. With kelp canopies in jeopardy, the businesses suffer as would-be divers travel elsewhere to see marine life. The dive industry certainly brings in more revenue to the State of California than the licensing or the $1.71 per wet ton fee paid by harvesters. By contrast, when left alive and in place, the value of the kelp in the Ed Ricketts park area is over $32,000,000.00 (NCSRA: when demonstrating income generated from divers visiting Cannery Row.) In other revenue it has been estimated to be worth over $3,400.00 per ton if left alive. Would you please provide a substantive analysis of potential costs to the diving and kayaking industries.?

25F 6. Regarding the no-take zone: The Center for Marine Conservation, the City of Monterey, the Sanctuary Advisory Council, Congressman Sam Farr, and many other organizations and scientists favored the Ed Ricketts Park. Over 2,000 petitioners and 50 proponents verbally testified at the last joint city council hearings of Monterey and Pacific Grove specifically favoring a no-take zone from the Breakwater to Lover's Point.
Recommendation: <u>Kelp harvesting should not be allowed anywhere in the Ed Ricketts Park from the Breakwater to Hopkins Marine Refuge, out to the depth of 60 feet (the 10 fathom line). Please note that this is only 9.4% of kelp bed 220, which leaves over 90% of kelp bed 220 to harvesting! Question:</u>

25G 7. Request for Clarification: It appears there may be a word processing glitch on page 2-4. As you'll see the following words are exactly the same, but the placement of the first bullet makes it appear you are suggesting the opposite of what the policy of the agency suggests. Removing the first bullet clarifies: 2.2 Proposed Objectives (beginning bottom of page2-3) "The proposed project objectives are as follows: Insure that kelp harvesting does not impair the health and diversity of marine ecosystems and marine living resources. Where compatible with that objective:...." That first paragraph therefore should NOT be bulleted because that IS the stated objective, but immediately after "where compatible: the next two paragraphs SHOULD be bulleted as they were.

25H 8. Please correct: Mariculture Industry (Pg. 3-77) The Ed Ricketts Park was created by a grass roots movement of concerns for the environment, not "by local businesses owners for the use of diving" although many business owners as well as others supported the concept and divers were involved. It is well-documented that a retired California Fish & Game Biologist suggested the need for protection.

25I 9. Also a very significant player in the Kelp Co-op (p. 3-77) was Pacific Mariculture, the company who precipitated the public's concerns by clear-cutting the entire kelp canopy along Cannery Row in 1996 was not properly credited or even mentioned in the DEIR. Their action motivated the public's concern for the over harvesting of kelp and precipitated countless hours of meetings. Please include this event in the final document.

25J 10. Presentation of map bed #220 (page 2.9): If maps are shown for proposed closures in #220, a map of the entire bed should be shown with the delineated boundary to illustrate the percentage of the bed that is closed to harvest. A reader should be able to see how much of the bed is still open to harvest. Recommendation and request: include a chart that shows all of bed #220 with a shaded area representing closed or open area. What is the percentage of Bed # 220 that will be left open to harvest?

25K 11. What are the effects of erosion and in-shore and subtidal habitat changes by removal of surface canopy? Beach erosion and sand dispersal may also be effected particularly when a large percentage of the canopy is removed. With a canopy weakened by harvesting, seasonal swell affect surf-zone habitats. Miller & Giebel, 1973 note that repeated harvesting weakens the kelp holdfast, thereby making plants susceptible to being removed by storms.

25L 12. The two back-to-back studies by Coastal Solutions Group is extremely controversial and should not be used in an EIR unless clarified. The first study indicated there was no significant impact of hand kelp harvesting, the second stated that divers swimming through kelp forests may permanently alter the kelp bed. Please acknowledge this and the attached chart by Sanctuary Advisory Council Dive Representative David Clayton to include in the EIR appendix.

13. Another important point of kelp in the Cannery Row Ed Ricketts Park area is the use of its canopy as a safety barrier for kayakers, swimmers, divers and boaters. It is a very real safety concern by charter operators, divers, power and sailing enthusiasts and kayakers regarding the removal of kelp canopy in certain areas. Heavy hand-harvesting in the portion of bed #220 from the Breakwater to Point Pinos has cause many near-miss accidents

25M without the traditional canopy as a safety barrier. The kelp canopy also provides a means for kayakers to stop themselves from being pushed into boat traffic or dangerous ocean conditions when southerly winds come up, particularly from Ed Ricketts Park along Cannery Row to Lover's Point. What are the liability factors in removal of kelp canopy as a safety barrier for kayakers and divers?

14. There is no mention of lost habitat for mysid shrimp. This important species is required by state law for toxicology tests for municipalities throughout the State of California. The kelp canopy has been removed often

25N enough by harvesting that there is not enough mysid to conduct the required tests. Now state contracts cannot be fulfilled. (Kim Sievers, collector per. Comm.) Please address this concern.

15. Section 165 Harvesting of Kelp Weighing: Collection data should be monitored and substantiated by some one other than the harvesters

25O themselves. What is provided as a method of accountability? Please address these concerns.

16. Section 2.5.1.3.1 (page 2-12) Commercial Harvest: In many years, if 50% of the bed's maximum area is allowed to be taken, there will be no canopy left. There is also no mechanism for decisions of harvest amounts for seasonal variations such as during El Nino or other situations. What are the

25P potential biological impacts of harvesting? Harvesting should be determined on percentage of canopy cover left during the winter when it is most needed by its inhabitants. How will this be monitored and funded?
What evidence and methodology was used to determine that 50% should be the percentage of a bed that can be taken?

17. In the interest of smaller California companies: If we intend to continue using kelp, for abalone food, fertilizer, or alginate we should be helping

25Q companies grow it and enhance it, without endangering wild stocks or endangering its passive use. In New Zealand, harvesters are expected to grow their own after the first year in business.

There should be some limit to the amount of kelp that can be harvested by one company. Kelco is no longer a small California company and ISP Alginates is a multinational corporation with scores of offices throughout the world. Recommendation A: There should be limits placed on the amount of kelp that can be taken by one company as well as seasonal limits for each bed. Recommendation B. There should be a limited entry to this field with an

25R

25R established maximum number of permits available based on winter kelp cover and other ecological impacts How many permit holders are allowed to take kelp? How many permit holders are available? How many are pending approval? . Will the DFG recommend limited permits?

25S 18. Section 3.2.9.4 Mammals: No mention of the endangered Stellar Sea Lions which occasionally frequent our kelp forests and the Breakwater area of Bed #220. This may be critical habitat for them as well as threatened sea otters and abalone. Please address these concerns.

25T 19. Pacific Grove Marine Gardens Fish Refuge is identified as an area of special biological significance in other documents yet this area as a refuge is not mentioned or recognized in the document. Please include areas of special biological significance, reserves and refuges.

25U 20. There is no mention of kelp survivability due to frequency or amount of harvest. What evidence is cited and what mechanisms which have been created to determine the condition or state of the canopy? What percentage is currently dedicated for viewing, diving, otter, fish or other critical animal habitat?

Please respond within 30 days.
If you have any questions for clarification, please call. Thank you.

Sincerely,

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831-375-2200

diving@redshift.com

SEE ATTACHMENT – 2 pgs "POLITICS OF SCIENCE IN THE MBNMS"

Appendix 4 -106

(26)

Friends of the Edward F. Ricketts Marine Park
PO Box 8475 Monterey, CA 93943-8475 831-375-1670

Comments on the State of California Draft Final Environmental Document: Giant and Bull Kelp Commercial and Sport Fishing Regulations

Introduction

Less than one quarter of a square mile, the City of Monterey's Ed Ricketts Park represents only three tenths of one percent (.003%) of California's 74 square miles of kelp forests. This tiny area is appreciated and used by hundreds of thousands of residents and tourists annually. For many, it is their first sight of a kelp forest.

The Ed Ricketts Park was born out of a grass roots effort to protect all marine life and to guarantee public access to this natural kelp forest environment. (Center for Marine Conservation, 1997; Cooper and McDonnell, et.al.,1997) This Cannery Row area is under consideration as a State of California Underwater Park, for its recreational values. (Barry and Foster, 1997)

The two thousand members of the Friends of the Edward F Ricketts Marine Park organization have decades of experience both above and below the surface of the water. As trustees of our marine heritage, we believe that our children's children are entitled to enjoy some marine areas where all life is permanently protected.

The waters of the Ed Ricketts Park has been heavily fished for over a century. The large Rockfishes are long gone. "The majority of game fish populations in this area are severely depleted, and consist mainly of immature individuals. " (D. VanTresca, DFG to K. Russo: Aug. 5, 1995) These few remaining fishes are now threatened by live fish trappers. What little marine life that remains is a dwindling population of invertebrates and a questionable commercial supply of Giant Kelp. This kelp is the base of the food web, and the very habitat that thousands come to see.

Recommendations and Questions. Please respond:

Recommendation #1: **A complete prohibition on kelp harvesting in the entire Ed Ricketts Park, from the Coast Guard Jetty to Hopkins Marine Refuge, out to a depth of 60 feet.**

26A

Discussion: In light of the large citizen turnouts at hearings, the number of written comments in support of the park, with 2 to 1 testifying in support for no-take, over 2000 petition signers, overwhelming support from the Center for Marine Conservation, Congressman Sam Farr, The Sanctuary Advisory Council, and many others, the MBNMS recommendation to close the area from Drake Street to the Coast Guard Jetty is woefully inadequate. Even the Monterey County Hospitality Association called upon the CA Fish and Game Commission to halt harvesting along Cannery Row and out to Lovers Point, stating that "The Activity of kelp harvesting impairs our visitors' experience, degrades the viewshed, and is an incompatible use in light of the value tourism brings to our economy." (J. Lloyd to R. Treanor, Feb. 6, 1997). *Question: What is the biological and socioeconomic value of leaving the kelp in its natural state without harvest?*

26B

Recommendation #2 **The Ed Ricketts Park was developed by local concerned citizens, not "developed by local business owners" as stated in the DEIR (p. 3-77) Please correct this error or substantiate this claim.**

Discussion: This was a grass roots movement that involved many people as mentioned in the discussion above. In fact, the first idea of protection came from a retired Fish & Game Department Biologist.

26C

Recommendation #3: **Royalties from kelp harvesting should no longer reflect the the world spot market price for Alginic Acid, but should reflect the highest social use and economic value of each kelp forest..**

Discussion: **Proposed Section 165 (7)** (MBNMS Recommendation #1)
Monterey County tourism employs over 16,000 persons, and was a 1.14 billion dollar business in 1996, (J. Lloyd to R. Treanor, Feb. 6, 1997). An extremely conservative estimate is that 10% of tourism revenues are directly marine related (diving, kayaking, marine mammal watching, etc.) With the estimated Monterey production from Bed 220 of 33,000 tons of kelp per year (Donnellan and Foster, 1999) the fair market value of the Ed Ricketts Park kelp forest is approximately $3,450. per ton, if left alive. The royalties ($1.71/ ton) from sale of 600 tons of dead kelp generates just $1,000 per year for the people of California. Question: *What is DFG's estimate of economic value of kelp along Cannery Row to the tourist and dive industry if left unharvested?*

26D

Recommendation #4: **All Mechanical Harvesters should be prohibited from Bed 219 northward.**

Discussion: **Proposed Section 165 (5C)** (MBNMS Recommendation #3)
The MBNMS has recommended closing beds 220 and 221 to all mechanical harvesting. DFG's proposed legislation will allow mechanical harvest: "Prior Commission approval of a kelp harvest plan is necessary before a kelp harvester may use a mechanical harvester . . . north of Santa Rosa Creek". (165 (5C))
Productivity estimates for the Monterey kelp forest are one-eighth of those for southern CA beds (Gerard, 1976) Also, these Giant Kelp forests are near the limits of their range.
It took *hand* harvesters less than a month in 1996 to clear-cut the entire Cannery Row kelp canopy, .These kelp forests will not sustain mechanical harvest. *Question: What are the parameters that the Commission will use to evaluate a mechanical kelp harvest plan in these beds?*

Recommendation #5: **We support the seasonal closure of all Nereocystis beds within the MBNMS (221-302) during their entire biological reproductive season.**

26E *Discussion:* **Proposed Section 165 (5B)** (MBNMS Recommendation #5)
The MBNMS recommendation —that Nereocystis in north coast Beds not be harvested during its breeding season from April 1 to Aug. 31— has been shortened by DFG to July 31. *Question: Where is the scientific evidence that adequate recruitment will have taken place by either date?*

Recommendation #6: **We support the proposed closure of beds 224, 225 and 226**

Discussion: **Proposed Section 165 (5)** (MBNMS Recommendation #8)
As the MBNMS has noted, these north coast Nereocystis beds are too ephemeral, and too small to support a commercial aquaculture industry.

Recommendation #7: **Kelp canopies in sheltered areas must be left intact to provide habitat for the threatened California Sea Otter during its pupping season. We continue to support a winter ban on kelp harvest in The Pacific Grove Marine Gardens Fish Refuge, from Lover's Pt. to Hopkins Marine Station.**

Discussion: **Proposal shown in Figure 6-1 (F):** (MBNMS 1st Draft Recommendation)
Much of the problem in the Monterey area is that harvest levels increase in winter, when kelp
26F production is at a minimum. The bulk of the take in Bed 220 comes from an *existing* State of California Marine Refuge, "The Pacific Grove Marine Gardens Fish Refuge." In winter, Sea Otters retreat to the more sheltered areas of the Pacific Grove and Monterey shoreline. Concern about over harvest in this winter refuge led to the Sanctuary's 2nd draft recommendation for a winter closure from Lover's Pt. to Hopkins Marine Station (Figure 6-1, area F). This area of the Edward F. Ricketts Marine Park remains in the City of Pacific Grove's approval process. *Question: Please provide a substantive analysis that compares the value of the winter kelp canopy for sea otters, harbor seals and YOY rockfish vs. the value and need for commercial harvest during the winter from the Breakwater to Lover's Point.*

Other Remarks

CA DFG should enforce the already existing laws, such as Fish and Game Code Section 6654: *"If, at any time, the Commission finds that harvesting of kelp will tend to destroy or impair any kelp bed or beds, or parts thereof, or tend to impair or destroy the supply of food for any fish, the*
26G *Department shall serve on every person licensed to harvest such bed or beds, a written notice that the kelp bed or beds or parts therof, shall be closed to the harvesting of kelp for a period not to exceed one year."* Such closures should be done on a precautionary basis, as required by State Law, before, and not only after, "Irreparable ecological damage" has been done. (R. Collins pers. comm.)

US Forest Service Chief Mike Dombeck recently stated: "Social views are changing. People are looking at forests less as warehouses for products, and more for their value as open space, watersheds and recreation." The same could be said for our seas. It's time to bring California marine resource management into the twenty first century.

Conclusion

Kelp forests are the single most biodiverse temperate marine ecosystem and certainly among the most rare. We are not suggesting a stop to all kelp harvesting in California, but that commercial kelp harvesting within the Ed Ricketts Park be halted. Harvesting in the park is incompatible with its value as viewshed, a recreational area and the expressed concerns of literally thousands of California citizens.

Respectfully submitted by Friends of the Edward F Ricketts Marine Park,

Jim Thompson, M.S. Gayle Todd Charlene Mitchell

Jim Thompson, Gayle Todd Charlene Mitchell

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(27)

CHUCK DAVIS • TIDAL FLATS, LTD.
PHOTOGRAPHY & CINEMATOGRAPHY

14 February, 2001

Mr. Fred Wendell,
California Fish & Game
213 Beach Street
Morro Bay, CA 93442

Dear Mr. Wendell:

27A I am writing to you today because I have some dire concerns about the depletion of our inshore marine life in Monterey Bay and in particular, I am very concerned about the extent to which giant kelp is being harvested. I have reviewed your Kelp-CEQA document and am contacting you in hope that you might reconsider your current regulations and rather than take the "no action" stance outlined in your report, I would plead with you to instead implement tighter restrictions on the harvesting of this precious resource -- a resource which is the backbone of the world's most biodiverse (and rarest) temperate marine ecosystem.

Regarding my background, I am a resident of Pacific Grove and make my living as a freelance marine/underwater photographer; I also have an undergraduate degree in fisheries biology from the University of Massachusetts/Amherst. My work has been published in such periodicals as *National Geographic, Natural History, Outside, Smithsonian, Time* and I am the author/photographer of *California Reefs* (Chronicle Books). My cinematography credits include work on numerous IMAX feature documentaries and television projects; for some six years I was also a diver/cameraman for the Cousteau Society aboard vessels *Alcyone* and *Calypso*. I have been a very active diver for over thirty years; I began diving off the coast of New England in the late 60's and made my first dive in Monterey Bay in 1977. While my assignment work has taken me to worldwide locations, the vast majority of my photography and underwater observations in the last ten years or so have taken place in Monterey Bay.

From my first hand underwater observations, I have seen -- especially over the past six or eight years -- an alarming decrease of marine life in our local kelp forests. In particular the rockfish populations seemed to have crashed -- instead of the once vibrant schools which I can remember photographing even in the early '90's, I now see very few adult rockfish and a preponderance of small juveniles instead. Certainly climate fluctuations have not helped this situation, but regardless of global warming, I can still head over to Point Lobos Reserve and find lush schools of rockfish -- the only difference is that at Point Lobos the fish are protected from harvest. I think this tells us a lot about the problem with our local fish populations. In direct relation to this, I feel the constant harvesting of giant kelp on the south side of Monterey Bay has not helped the recovery of our fish populations either -- in my opinion, any activity which degrades the quality of our local kelp forests (which are a nursery grounds for rockfish) can only make matters worse.

After reviewing your Kelp-CEQA document, I have the following comments and questions:

27B 1) I believe that now in the year 2001 it is time to reevaluate how we perceive our kelp resource;

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27B

instead of looking at it solely as a type of seaweed (and regulating it only in terms of its physical structure and growth characteristics) I believe it is time to view it in a grander and more accurate scale as a vital part of a marine eco*system* which offers physical shelter and food to thousands of vertebrate and invertebrate animals. Kelpshed and kelpwrack are not simply useless dead byproducts of the giant kelp forest that should be harvested lest they go to waste: When kelpshed falls to the kelp forest floor it becomes a source of food for myriad other kelp forest creatures. The surface canopy of the giant kelp forest also harbors thousands of marine creatures some very visible like kelp crabs and turban snails, others are microscopic in size. My question for Fish & Game is -- have you ever conducted studies to examine the giant kelp plant's roll in the coastal ecosystem? By removing thousands of tons of the giant kelp canopy -- and along with it subsequent marine life which is then not available as food to marine creatures -- how does that really affect the richness of the whole system? Surely studies have been conducted to assess how fast a kelp plant can grow under various growing conditions, but what happens to the whole *system* when you remove so much biomass on a regular basis from the same place? Common horse sense tells me that we will see (and are seeing right now) a kelp forest habitat which is a lesser form of itself. I have been simply dumbfounded some days when I've been out working on the water and in one area Fish & Game personnel are working hard to study sea otters and help their recovery - - and I applaud this effort -- yet in the same waters in the dead of winter when the kelp forest and otters are under the most environmental stress, kelp harvesters are allowed to poke, prod and cut off the kelp not only removing the canopy which the otters use for their resting periods, but also the attached marine life such as turban snails, kelp crabs and other creatures which otters use for food. To allow this type of activity within a marine sanctuary which hosts a threatened species of sea otters seems unconscionable to me.

27C

2) I would like to see Fish & Game apportion some areas within the south side of Monterey Bay as no-take reserves which would be completely protected from all kelp harvesting. I would like to see the entire Ed Ricketts Park, from the Coast Guard Jetty to Hopkins Marine Refuge out to a depth of 60 feet included in this no-take area. When considering the wide recreational and aesthetic value of this area -- and the related economic value -- it seems only prudent and fair to set aside this area for the mast majority of tax-paying citizens and visitors who contribute to our local economy. When one adds up the overall value of the kelp forest for the above uses vs. the commercial harvest value (a mere $ 1.71/ton paid to the state for removing this resource), the latter pales by comparison.

27D

I also wanted to ask you if Fish & Game, has ever conducted a study to evaluate the recreational, educational and aesthetic value of our kelp forests vs. the commercial harvesting value of the same?

3) In relation to item #2 above, I would also like to ask Fish & Game to reevaluate the fee it charges harvesters per ton to remove our kelp resource. Where and by what method was the $1.71/ton figure arrived at? If one considers the real overall value of this resource, it seems to me the value would be thousands of dollars per ton. Monterey County tourism employs over 16,000 people and (by 1996 statistics) is a 1.14 billion dollar business. One conservative estimate of the value of our kelp bed 220 (which estimates that 10% of tourism revenues are directly tied to the local marine environment such as kayaking, diving, coastal hiking/biking, marine mammal watching, etc.) would indicate that the kelp forest within the Ed Ricketts Park would have a fair market value of $3,450/ton if left alive. Whether one agrees with the practice of harvesting giant

27E

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27E kelp in a marine sanctuary with a threatened population of otters and a dwindling supply of fish -- or not -- it seems that selling a valuable public resource to harvesters at $1.71 per ton is pretty much giving it away for free.

27F 4) After reviewing your Kelp-CEQA document (and looking over the reported tonnages of kelp harvested) I was wondering, how these figures were arrived at? How does the Fish & Game monitor exactly how much kelp is harvested? Is this procedure on the honor system, or do Fish & Game personnel monitor the offloading of vessels? I also wanted to know about the kelp harvesting bycatch -- I apologize if this was published in report and I missed it, but I would like to know if there are any figures on the amount, of kelp snails, crabs and other marine life that go off to market with each ton of kelp that is trucked away for processing? If it isn't already, I feel the above should be monitored.

27G 5) Regarding the closure of all *Nereocystis* beds on the north coast, I am in support of closure of this area within the Monterey Bay National Marine Sanctuary during the entire biological reproductive season. I feel it is a mistake to lessen these restrictions by shortening this season by one month (to July 31 from August 31). Has the Fish & Game done any scientific studies which show adequate recruitment will have taken place by either or these dates?

In closing, I would like to thank you for your careful consideration of my comments. I am not suggesting the Fish & Game completely shut down all kelp harvesting; far from it. But I am asking Fish & Game to please consider the long term effects of this practice when it is conducted to excess for long periods of time in sensitive areas, especially on the south side of Monterey Bay and especially during winter months. I would also like to ask Fish & Game to please carefully consider the fact that kelp is a public resource that is not just important to harvesters but is also highly valued and enjoyed each year by tens of thousands of non-extractive users in the State of California as well.

Sincerely,

Chuck Davis

Chuck Davis

28

Comments on:

Draft
Department of Fish and Game
Giant and Bull Kelp Commercial and Sport Fishing Regulations

Thank you for your efforts in the latest draft. As a participant of the Monterey scoping meeting, I am happy to see that some of the comments were addressed.

As an avid underwater photographer in these waters for the last eleven years, a diver for twenty years, and a local underwater photography business owner for seven years I have spent countless hours above and below the waters along the Monterey Peninsula.

General Comments:

28A We know very little about one of the worlds most unique environments - the giant kelp forest. We are only beginning to acquire knowledge of the long term environmental cycles that effect it. As a place of special social significance and heavy use, the kelp forests of Cannery Row require use of precautionary management.

Recommendations and Questions:

28B ***1) Do not allow kelp harvesting within the Edward F. Rickett's Underwater Park.*** The kelp bed along Monterey is of significant social value. Its proximity to civilization and accessibility make it a viewshed and recreation area for hundreds of thousands of visitors and local residents. As a commercial crop, this small area is of little value to the public interest and represents less than 9.5% of kelp bed 220. Please include a proposal option to close the entire Edward F. Rickett's Underwater Park area (Breakwater to Hopkins) to kelp harvesting or justify its exclusion.

28C ***2) The socio-economic value of kelp along Monterey must be quantified.*** The tourist industry has estimated the kelp within the Ed Rickett's Park to be worth $3,400 per ton in local and state revenue. This stands in dramatic contrast to the publics income of $1.71 per ton of harvested kelp. In the EIR, please provide a determination of the actual value of Cannery Row kelp canopy, left unharvested, as a viewshed and recreation area for local residents and the tourism industry vs. its value to the public as a commercially harvested crop.

28D ***3) Lack of baseline data and monitoring procedures.*** Currently, DFG has an infrequent aerial survey and relies mostly on data from harvesters. Closing beds once harvested to 50% of canopy requires constant monitoring of seasonal and large scale environmental changes. How will DFG monitor canopy coverage and overall health of the kelp ecosystem to prevent over harvesting? What data supports that a 50% trigger is adequate to close a bed to harvest?

28E ***4) The kelp canopy must be preserved for juvenile rockfish habitat.*** The rockfish populations have significantly declined. Eliminating harvesting in the Rickett's Park will establish a rookery for juveniles and decrease the potential of predation. Do you agree or disagree?

28F ***5) The kelp canopy must be preserved as habitat for the threatened southern sea otter.*** Although otters have been found to be very adaptive, the Rickett's Park kelp forest becomes essential habitat during the winter months when canopy levels and available shelter decrease. Please provide an analysis of the potential impacts from harvesting activities and natural phenomenon that could simultaneously impact the limited and frequented winter Sea Otter habitat along Cannery Row in the EIR.

28G *6) An increase in water quality incidents warrant precautionary management.*
While the direct result of bacterial pollution is unclear, southern California kelp forests have been significantly impacted. The solution for our frequent spills is not in sight.
Please provide data and impact analysis analysis of the number and level of historic local sewage spills and an estimate of future spill frequency and include it in the EIR.

28H *7) Hand harvesting has shown a visual effect in the Rickett's Park.*
Page 4-12 states that hand harvesting has had "no appreciable visual effect on the canopy." In 1996 it took hand harvesters less that one month to clear cut the entire kelp forest along Cannery Row. This incident caused enough reaction to initiate many public meetings of concerned citizens, the kayak and diving industry, and the kelp harvesters. Please correct the document to include this significant event or justify its exclusion.

28I *8) The Ed Rickett's Underwater Park was developed by the community not just by business owners.*
Page 3-77 states that the Rickett's Park was "developed by local business owners for the use of diving and kayaking." The process involved a grass roots movement of over 2000 people, seven public hearings, the support of the City of Monterey, the Center for Marine Conservation, Congressman Sam Far, and the Sanctuary Advisory Council. Please correct this error or substantiate the claim.

28J *9) Underwater photographers, divers and kayakers do not benefit from kelp harvesting as the document states.*
Page 4-13 states that harvesting benefits underwater photographers by "opening lanes in the canopy that allows passage through dense beds and more light to penetrate and lighten the subsurface areas." The majority of all diving occurs along the outer edge of canopy. The shadows of the dense canopy is home to the fish we have come to see. The light dancing through the fronds is what makes it a magical place for photography. Kayakers explore this area to view the mammals and birds that inhabit the canopy. The most frequently used water entry points along Cannery Row never require passage through thick canopies. Divers and kayakers have asked for the ban of harvesting, thus how can the report substantiate it as a benefit? Please correct these errors and include researched facts on the economic and recreational effects of kelp harvesting on the diving and kayaking industries and sport users.

28K *10) Local abalone farms need support for alternative food sources.*
To insure a sustainable supply, kelp should be planted and grown. Artificial reefs and commercial food are alternatives to winter harvests along Cannery Row. New Zealand requires farms to grow their own kelp after two years. Please include research on alternative methods to harvesting. Why is their no proposal that encourages farms to grow their own kelp?

28L *11) No new harvesting permits should be issued.*
Local abalone farms state that they can't harvest enough kelp in winter and all central California farms must come to the protected waters of Monterey. To decrease pressure, a moratorium should be issued on all new permits. Please address the growth potential of the harvesting industry and its subsequent impact on the Cannery Row kelp beds in much more detail on the EIR. How many new farms and growing farms can be sustained?

28M *12) No mechanical harvesting from bed 219 northward.*
The low productivity of these northern beds will not sustain mechanical harvest.

28N *13) Seasonal closure of all Nereocystis within the MBNMS (221-302) from April 1 through August 31.*
The MBNMS correctly recommends closure of the beds throughout their entire reproductive cycle, NOT until July 31. Please justify this change of date.

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28o **14) *Support the proposed closure of beds 224, 225 and 226.***
These *Nereocystis* are too small to support commercial harvesting. What data and monitoring system will be used if these beds are left open to harvest?

28p **15) *All collection activities should be included in the kelp EIR.***
The collection of invertebrates by aquariums and researchers has dramatically increased with the addition of new aquariums and the growth of the local research community. Please determine the levels of these activities, include a list of permitted collectors and an analysis of their impact on the Cannery Row kelp environment.

Conclusion:
The Cannery Row kelp forest is of significant social value and is most susceptible to industrial impacts. The last 20 years has seen the public's increased reverence with this area. However, it has also been subjected to dramatic increases in invertebrate collection, loss of rock fish and civic pollution. It is time that we redefine the value of our unharvested resource and use precautionary management to insure that this resource is available to future generations.

Please note that I have requested a response to the issues raised in each of the above paragraphs. If the above items are not adopted, please provide a details justification. If you have any questions, please contact me. I look forward to your response to my comments within the next 30 days.

Sincerely,

Berkley White
429 Belden St.
Monterey, CA 93940
831-375-1670

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29

To: Rob Collins
Department of Fish and Game
20 Lower Ragsdale Dr.
Monterey ,CA 93940
racollin@dfg.ca.gov

Jessica Wheeler
429 Belden St.
Monterey, CA, 93940
831-375-1670
jesswh@yahoo.com

As a citizen of Monterey and as a biologist, it is important to me that our local unique and diverse ecosystem is properly managed and protected. I have studied marine algae and have a degree in marine biology. As a marine educator, kayaker, diver, and underwater photographer, I have an unique understanding of this system. I have taken 100's of people from all over the world on natural history tours to learn about the kelp canopy. Exploring the invertebrate life in the kelp canopy is a favorite among children and adults alike. What a wonderful resource for education. Thank you for listening in consideration of this critical issue.

Comments on the Draft Environmental Document on Kelp Management

29A 1. Recommendation: That The DFG's recommended no-harvest area of kelp bed #220be expanded to include the area from Drake to Hopkins marine station out to a depth of 60 feet. This area is designated as the Ed Ricketts Underwater park by the city of Monterey, and supported by the Center for Marine Conservation, the Sanctuary Advisory Council and 1000's of citizens. This leaves 90% of kelp bed 220 open for harvest. Please include this recommendation as a proposal option.

29B 2. Recommendation for consideration of the Kelp beds as extremely important habitat for the California sea otter (enhydra lutra nereis). This animal is protected by both the Endangered Species Act and the Marine Mammal Protection Act. The ESA also defined critical habitat. Habitat modification, impairing essential behaviors like breeding, feeding, and sheltering are included as harm "take".

3. Please continue to consider the vital areas along Cannery Row that are ideal habitat, the most protected areas from wave action, especially north west swell, during winter storms and summer wind waves. Please define long term research goals in solving these problems.

29C 4. Recommendation:In the kelp bed map, number 220 (page 2-9), should illustrate the closure area within the entire 220 bed. The current map is great for locating the area, but it is important to have a visual scale and reference of how much of bed 220 is open to harvesting vs. closed to harvesting. Please make this correction.

29D 5. Recommendation: section 2.5.1.3.1(page 2-12) No more than 50% of a beds maximum <u>seasonal capacity</u> can be removed <u>at any time</u> by harvesting. Seasonal variation would require new serveys for base line and much lower quotas in the winter months. Do you agree with this recommendaion? If not please explain.

Setting a quota per bed, per year is a good idea. However if you are allowed to take 50% of a leased bed there must be a time frame stipulated. What are the Commissions rules on open beds? This would prevent harvesting of 50% of a bed that has only 10% of its original cover. Tidal times, seasonal fluctuation and frequency of kelp bed surveys would be critical.

Comments on the Draft Environmental Document on Kelp Management continued

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29e 6. Recommendation: Streamline the enforcement potential by requiring kelp to be weighed at specific landing sights. The ability of the Department of Fish and Game to enforce the kelp harvesting quotas is in question if the kelp harvesters are asked to report their own tonnage taken and to obtain their own "scientifically recognized" studies of kelp abundance in order to obtain their permits. There must be a recommendation for more organized enforcement. Spot checks? Is it possible to have joint enforcement by the MBNMS and the city of Monterey in order to make this a more affordable operation for both organizations? Lack of resources including money and staff to properly address this management problem need to be addressed.

29F 7. Recommendation: Retain the wording or "in specially designated aquatic parks" as per section 10500(f) ... appendix 2-2
In consideration of the fact that the renaming of all designated "marine protected areas" is in process it seems practical to be more general. This also may allow the park system a way to create necessary enforcement without waiting to revisit this 5 year document.

29G 8. Recommendation: Data of kelp harvesting should remain available to the public.

29H 9. Recommendation for Additional Research:
a. Affects of kelp harvesting on California Sea Otters(displacement short and longer term, habitat degradation, exposure, food availability)
invertebrate food resources for otters, birds, fish, and other invertebrates that are removed with the canopy layer is evidence in itself. The remaining kelp canopy is a sanctuary against winter storm waves.
b. Hold Fast Studies concerning stipe density and holdfast health in lieu of less photosynthetic potential should be of highest priority. Weakened holdfasts and vulnerability of part or all of the kelp forest in storm conditions must also be cThe management of this unique biodiverse ecological system is critical. The reduction onsidered. The fact that the kelp plant must grow a stipe from the holdfast back up to the surface is an incredible amount of energy spent not to mention the stress on the holdfast of bearing many more stipes, and the fact that the initial stipe may grow as long as one hundred feet on the surface. Drift kelp and kelp wracks are also important to consider. Please define long term research goals in solving these problems.

29I 10. Recommendation:
Balance the cost of management, research, and enforcement of the kelp harvesting with the income generated by the licensing and tonnage fees and determine the actual value of the kelp in this manner. Kelp harvesting fees should generate money for research of the impact of harvesting on Macrocystis.

11. Recommendation:The socio-economic value of the kelp must be considered. How many people come to Monterey to see sea otters wrapped in the kelp or dive beneath its canopy ? Whether above or below water tourism in Monterey is huge. In Monterey County tourism is a 1.14 billion dollar industry. If you consider the value of this resource alive, it is estimated that the kelp is worth $3400.00 per ton . What is being done to address this issue?

29J 12. Recommendation: Change the inaccurate statement page 3-77 that the Ed Ricketts Underwater Park was created by business owners. Business had nothing to do with its creation. The process of creating the park was a grass roots movement of over 2000 people, including scientists, students and registered voters from all walks of life. Scores of meetings were held in addition to seven city sponsored public hearings. After its creation, however, business organizations supported it.

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29k 13. Recommendation:
Remove inaccuracy page 4-12 hand harvesting has "no appreciable visual effect on the canopy". This may be true in small quantities; however, in 1996 the area along Cannery row was over harvested! This was visually obvious to all when no kelp was remaining. This was an indicator that there was a large problem.

29L 14. Recommendation:Please remove inaccuracy page 4-13 that "opening lanes in the canopy that allows passage through dense beds and more light to penetrate and lighten the subsurface areas" benefits photographers. The more canaopy and diversity the ecosystem has, the more photographs there are to take.

Conclusion:

It is all to often that our resources are managed in such a way that there is damage before any action is taken for protection. We must learn to manage for sustainability and not crisis. Often damage is irreversible or takes an exponentially long time for recovery. If we want our resources to be sustainable the precautionary approach to management is the only answer.

Again , Thank you for all of the hard work and taking these ideas into consideration. I look forward to your response to each of these concerns. If they are not adopted into the document please explain.

Sincerely,

Jessica Wheeler

(30)

CITY HALL
BOX CC
CARMEL-BY-THE-SEA, CALIFORNIA 93921

February 2, 2001

Mr. Robson Collins
California Department of Fish & Game
20 Lower Ragsdale Drive
Monterey, CA 93940

Dear Mr. Collins

Carmel Beach is one of the crown jewels of the California coastline. Its clear waters, smooth white sands, and wind-swept cypresses are known the world over.

Like most other California beaches, Carmel Beach is vulnerable to coastal erosion. For over fifty years, the City of Carmel has been actively involved in protecting our shoreline, its beach, dunes, and bluffs, as well as the road, houses, and utilities that line the bluff top, from these erosion forces.

Just offshore from Carmel Beach lies an extensive kelp forest, described as Kelp Bed #219 in CDF&G documents. This bed is currently classified as "Open" and is subject to mechanical harvesting.

The City of Carmel is concerned about the impacts that large-scale kelp harvesting might have on our shoreline. There is evidence indicating that kelp beds buffer the energy of incoming waves. This might play a critical role in determining how much sand is deposited on the shore between late spring and late fall. And the amount of sand on the beach at the start of the winter storm season is one of the most important factors controlling the extent of erosion incurred by Carmel's beach and bluffs. Another important factor might be the timing of kelp harvesting operations. Kelp cutting early in the season might have a different effect than late harvesting.

Unfortunately, these impacts have been poorly studied and are not well understood. Furthermore, the City is aware that coastal processes impacting Carmel's shoreline, especially those related to sand transport and deposition, may be different from those affecting neighboring shorelines (e.g. Monterey Bay), so the results of studies conducted elsewhere may not apply to Carmel Beach.

30A

30A In view of the potential threats and tremendous costs that coastal erosion represents to both public and private property along the our shoreline, the City of Carmel hopes the Department of Fish and Game will take steps to better understand how kelp harvesting affects erosion along Carmel Beach before allowing further harvesting in Kelp Bed #219.

30B Our kelp beds are a resource that belongs to all Californians. While the City does not oppose occasional commercial harvesting of kelp, we hope this resource will be managed intelligently, and in such a way as to reduce or prevent detrimental effects on our shoreline.

Sincerely,

Gregory D'Ambrosio
Assistant City Administrator

Cc: William J. Douros, Monterey Bay National Marine Sanctuary

31

SAVE OUR SHORES

January 30, 2001

Robson Collins
Department of Fish and Game
20 Lower Ragsdale Dr.
Monterey, CA 93940

Dear Mr. Collins,

Save Our Shores (SOS) is a marine conservation organization dedicated to *protecting the ecological integrity of the Monterey Bay National Marine Sanctuary through policy research, education, and citizen action.* SOS is grateful for the opportunity to comment on the Department of Fish and Game (DFG) Draft Environmental Document on Kelp Management. We appreciate the significant amount of work that went into the document and want to thank the Department of Fish and Game and your staff for incorporating public concerns into the recommendations.

Save Our Shores has been actively involved in this issue and played a key role in soliciting public opinion for the Final Monterey Bay National Marine Sanctuary (MBNMS) Kelp Management Report. SOS hosted three public forums in Half Moon Bay, Santa Cruz, and Monterey. These forums included a panel discussion with representation from user groups including; recreation, conservation, DFG, NOAA, and kelp harvesters. Many of the people who attended these forums went on to submit formal comments during the NOAA public hearing on the MBNMS Kelp Management Report.

31A Save Our Shores' concerns regarding Kelp Harvesting were incorporated into the MBNMS staff recommendations in the aforementioned Kelp Report submitted to DFG. Therefore we request that these recommendations be included in the DFG Final Environmental Document on Kelp Management.

Thank you for your consideration of these comments.

Sincerely,

Vicki Nichols
Director of Policy and Research

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(32)

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P.O. BOX 779, DALY CITY, CA 94017

DRAFT ENV. DOC. - KELP

February 13, 2001

Fish and Game Commission
State of California
1416 Ninth Street
Sacramento, CA 95814

Re: Draft Environmental Document
Giant and Bull Kelp Regulations

Dear Commissioners and Staff,

The Central California Council of Diving Clubs, Inc. (Cen Cal) represents the recreational diving community from San Luis Obispo County to the Oregon border. We are a not for profit, membership corporation dedicated to protecting marine resources, maintaining ocean access and the education of our members. We are a member of the Underwater Society of America and the Confédération Mondiale des Activités Subaquatiques (World Underwater Federation).

32A We have reviewed the Draft, 2000 Final Environmental Document, Giant and Bull Kelp Commercial and Sport Fishing Regulations. We request that the proposed closure area in Monterey in Administrative Bed 220 be increased in size. The proposed northwest limit line is near the extension of Drake Avenue. We ask that it be moved northwestward to the extension of Prescott Avenue.

This is a compromise recommendation because we would like to see the proposed closure area extended all the way to Lovers Point. This whole area is used extensively by recreational divers and we would like the kelp and its associated environment kept lush for recreational use.

Sincerely yours,

Stephen E. Campi

Stephen E. Campi
President

ISP ALGINATES, Inc.
2145 East Belt Street, San Diego, CA 92113 • Tel: 619-557-3100 • Fax: 619-557-3126

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January 25, 2001

California Fish and Game Commission
1416 Ninth Street
Sacramento, CA 95814

Dear Commissioners:

ISP Alginates Inc., a San Diego based company formerly known as Kelco, is vitally interested in kelp resource management and therefore appreciates this opportunity to comment on the Draft Environmental Document on Giant and Bull Kelp Commercial and Sport Fishing Regulations.

ISP Alginates has sustainably harvested giant kelp (*Macrocystis pyrifera*) in California's waters for 71 years. The kelp we harvest is brought back to our San Diego plant where it is processed into algin – a colloidal chemical that is used in food, medicines, and many other consumer and commercial products. ISP Alginates employs approximately 200 people in San Diego, and our annual payroll and benefits total $20 million. Annual purchases for our San Diego facilities average $10 million, a majority of which goes to California vendors. In 2000, we invested over $5 million in capital to improve our algin processing facilities, research laboratories, and administration offices. The existence of a kelp dependent industry has a substantial indirect effect: new demands for other products are made, new jobs in other industries are created, and taxes are generated.

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ISP Alginates is pleased to note that the Draft Environmental Document accurately describes the importance of California's kelp forests, and we strongly agree that there should be effective management of the commercial harvest of kelp. This protects not only the natural resource, but also the industry itself. In general, ISP Alginates supports the Proposed Project set forth in the document. We do, however, have concerns regarding some of the Proposed Project's amendments to the existing kelp harvesting regulations. These concerns are addressed in detail below. For the record, ISP Alginates strongly opposes Alternative 1, which would establish statewide harvest controls. We completely agree with the draft document's conclusion that Alternative 1 should not be implemented. Alternative 1 would severely impact California's algin industry and would provide no ecological benefits to populations of giant kelp or their associated marine biota.

The following are ISP Alginates' comments regarding the Proposed Project's amendments:

1. Proposed Amendment: Clarification of what weighting methods are acceptable to determine the weight of kelp being landed.

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Comment: ISP Alginates agrees that all commercial kelp harvests in California should be appropriately weighed. We are, however, concerned that the proposed language really doesn't clarify what methods are acceptable. We have used a vessel displacement method for determining the weight of our kelp harvests for decades, and this has proven to be accurate, efficient, and cost effective. Assuming that it is the department's intention to continue utilizing vessel displacement as one of the approved volume conversion methods, then ISP Alginates supports this proposed amendment.

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2. Proposed Amendment: Clarification of what harvest information is required in landing records and what processes are to be followed in submitting reports.

Comment: ISP Alginates supports this proposed amendment.

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3. Proposed Amendment: Further restrictions on harvest methods and seasons for bull kelp near the southern limit of that species geographic range.

Comment: The proposed amendment would restrict the harvest of bull kelp to hand held cutting devices in non-leased beds. It would also restrict any bull kelp harvesting between April 1 and July 31 in non-leased beds within the Monterey Bay National Marine Sanctuary. ISP Alginates harvests giant kelp in both leased and non-leased beds in central California from approximately June to November. We specifically avoid collecting bull kelp during our giant kelp harvesting operations because bull kelp's algin content is low and of poor quality. Any bull kelp that we collect results in increased algin production costs and reduced quality of our finished products. ISP Alginates' marine biologists conduct regular aerial surveys of the kelp resources throughout California, and we note areas of high bull kelp concentrations. Our harvesters are specifically directed away from areas with abundant bull kelp. We do, however, get a small incidental take of bull kelp since our harvesters cannot completely avoid every bull kelp plant. The Monterey Bay National Marine Sanctuary's Kelp Management Report concluded that the small incidental take of bull kelp during giant kelp harvesting operations was not a concern. If it is the intent of the department to allow a small incidental take of bull kelp during giant kelp harvesting operations, then we could support this amendment. Unfortunately, we must strongly oppose the amendment as it is currently written since it would preclude our harvesting in much of the central California kelp resource.

4. Proposed Amendment: Regulations that specify which kelp beds are closed to harvest should be amended to include those beds where there has been little resource to prevent focused or repeated harvest where the potential is highest for resource damage.

Comment: Of the eighteen beds being recommended for closure, ISP Alginates has only harvested in Beds 22 and 24. We have not harvested any kelp from Beds 22 and 24 since the early 1980s because these beds have not fully recovered from the severe 1982-84 El Niño that destroyed most of the kelp growing on sand along the Santa Barbara coast. The kelp in Beds 22 and 24 remains too scattered for us to harvest economically. Prior to the El Niño, however, these beds were quite productive and important to our industry. We believe that

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both of these beds have the potential to fully recover given an appropriate time frame and favorable ocean and weather conditions. We are therefore opposed to the permanent closure of Beds 22 and 24.

5. Proposed Amendment: Regulations that specify which kelp beds are closed to harvest should be amended to include a portion of Bed 220 near Monterey to reduce user conflicts.

33F Comment: ISP Alginates is very familiar with the user conflict that exists in the Cannery Row area of Monterey. We have never harvested kelp off Cannery Row and we have no plans of ever harvesting there in the future. If the proposed closure in Bed 220 helps reduce the Cannery Row user conflict without posing undue hardship on the harvesters who have historically harvested that area, then ISP Alginates would fully support this amendment.

6. Proposed Amendment: The regulations should be amended to provide a method for placing temporary harvest controls in beds or portions of beds where necessary for the resource protection.

33G Comment: The proposed amendment indicates that the Commission may limit or prohibit the harvest of kelp within a bed or portion of a bed for any length of time to insure that kelp is properly harvested. It further proposes that the Commission may designate, through emergency regulation, a non-leased kelp bed or portion of a bed as a harvest control area with specific harvest tonnage limits for a specified period of time. We appreciate the department's stated goal of finding an alternative to closing an entire bed to all harvesting, but we have concerns about how this proposed amendment would be implemented. Our concern rests primarily with the amendment's subjective language. For instance, there is no clear definition for the term "properly harvested". We would assume that a kelp harvester complying with all state regulations would be harvesting properly, but the amendment leaves that undetermined. We therefore would like to see what procedures and criteria would be used to designate a particular kelp bed for temporary closure or harvest control. ISP Alginates cannot support this proposed amendment without further detail on how it would be implemented.

7. Proposed Amendment: Regulations guiding the leasing of kelp beds for the exclusive harvest of kelp should be amended to provide a method where interested parties can easily determine

33H which beds are currently available for harvest.

Comment: ISP Alginates supports this proposed amendment.

8. Proposed Amendment: Prior Commission approval of a kelp harvest plan is necessary before a kelp harvester may use a mechanical harvester to harvest giant kelp in a non-leased kelp bed in the area north of Santa Rosa Creek.

Comment: ISP Alginates has used mechanical harvesters in kelp beds throughout Central California since the early 1970s. It is our policy to notify the department and the Monterey Bay National Marine Sanctuary of our planned harvesting schedules to all central California

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kelp beds. We could support this amendment if its intention is to make this type of communication part of the regulations. Unfortunately, the proposed amendment is quite vague. It does not specify what qualifies as a harvesting plan and what is required for plan approval and implementation. Kelp canopies can develop at different rates and times of year so it is nearly impossible to predict how much kelp would be harvested from any given bed at any given time. Kelp canopies can also be quickly eliminated by storms or sloughing. In addition, weather plays a significant role in determining where we harvest. For example, we might schedule a trip to one of our leased beds only to be forced into a more weather protected non-leased bed because of strong winds or large swells. It would be impractical to get prior Commission approval for any of these unpredictable situations. This amendment as written could potentially restrict us from harvesting many if not all non-leased beds in Central California. We doubt that this is the intention of the proposed amendment, so we suggest appropriate language be added to the amendment to clearly define what a harvesting plan entails and how it is approved. This language should also incorporate the need for flexibility given the ephemeral nature of kelp canopies and changing weather patterns.

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In summary, ISP Alginates generally supports the Proposed Project and agrees with the conclusion of the department in rejecting Alternative 1. Unfortunately, we cannot give full support to the Proposed Project at this time due to the vague and speculative nature of several of the proposed amendments. We urge the department and the Commission to clarify the language in the proposed amendments dealing with mechanical harvesting of bull kelp as it relates to incidental take, temporary bed closures, harvest control areas, and harvesting plans.

ISP Alginates thanks you for the chance to review and comment on the Draft Environmental Document on Giant and Bull Kelp Commercial and Sport Fishing Regulations. If you or your staff has any questions regarding our comments, please feel free to contact me at 619-557-3194.

Sincerely,

Dale A. Glantz
Manager Harvesting and Marine Resources

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