Chapter 3. Management Measures for Sustainable Nearshore Fisheries

The Marine Life Management Act (MLMA) sets sustainability as an overall goal for the fishery management system [Fish and Game Code (FGC) §7056]. Within the definition of sustainability, the MLMA includes not only the maintenance of fishery populations, but also the fullest possible range of present and long-term benefits, ecological benefits, and biological diversity [FGC §99.5]. The MLMA calls for achieving its primary goal of sustainability by meeting several objectives:

- preventing overfishing
- rebuilding depressed stocks
- ensuring conservation
- promoting habitat protection and restoration

To this end, fishery management plans (FMPs) must contain measures that will be used for the conservation and management of the fishery (FGC §7082). Among others measures, the MLMA mentions area and time closures, size limits, gear restrictions, and restricted access.

The NFMP Project will meet these requirements and the goals and objectives of the Nearshore Fishery Management Plan (NFMP) by employing five management measures. Each of these measures addresses an aspect of fishery management; together they form an integral approach to meeting the MLMA guidelines for sustainability.

1. **Fishery Control Rule**: The NFMP describes a Fishery Control Rule that includes three stages, recognizing the practical level of knowledge and understanding of the fishery. As knowledge increases, management can become less precautionary. The fishery control rule provides a protocol for determining sustainable levels of fishing that then are implemented through the adoption of specific management tools such as size limits or time closures.

2. Regional Management: The NFMP recognizes the significant geographical differences in the nearshore fishery and proposes developing management tailored to conditions specific to each of four regions.

3. Marine Protected Areas: The NFMP uses marine protected areas (MPAs) to ensure that the MLMA's objectives for protection of habitat and ecosystem integrity, recognition of non-consumptive uses and sustainable fisheries are met. The NFMP recognizes

fishery control rule - control rules are the primary mechanism for achieving sustainable use, preventing overfishing, preserving habitat, rebuilding depressed stocks, and recognizing the importance of non-consumptive uses. In addition, control rules must be based on objective, measurable criteria such as population size, productivity, or density, or other inputs. Formulas are often used to calculate an allowable catch (fishing mortality); however, control rules do not have to be cast in terms of fishing mortality rates or biomass levels. In general, they help identify key management measures appropriate to the fishery.

the authority of the Marine Life Protection Act (MLPA) to design a Master Plan for MPAs in California. The Master Plan will make recommendations on specific sites for MPAs, implementation and phasing, funding, monitoring, enforcement, and management. The NFMP includes an approach to MPAs, citing the biological criteria.

4. Restricted Access: The NFMP bases its approach to restricted access upon the Fish and Game Commission's restricted access policy, and presents four initial options for regional restricted access programs in the commercial fishery.

5. Allocation: The NFMP builds upon the allocation policy adopted by the Commission in December 2000. **Total allowable catch (TAC)** will be calculated regionally. Allocation between commercial and recreational fisheries will be determined by region based upon historical catches.

total allowable catch (TAC) - means a specified numerical objective for catch (including discard mortality), the attainment (or expected attainment) of which may cause closure of the fishery. In Stage I, TAC is equivalent to a proxy for OY. In Stages II and III, TAC is equivalent to OY.

biomass - the total weight of a stock or population of organisms at a given point in time.

Finally, effective implementation of the NFMP's measures will benefit from transfer of management authority to the State for some or all of the nearshore species currently managed under the federal groundfish fishery management plan.

Taken together, these measures will meet the goals and objectives of the MLMA and the NFMP. While implementation of the measures will be phased over several years and will evolve, the ultimate success of the NFMP and compliance with the MLMA depends upon their full implementation.

Understanding Fishery Control Rules

Fishery Control Rules are the primary mechanism for achieving the MLMA'a primary standards for management: sustainable use, preventing overfishing, preserve habitat, rebuilding depressed stocks, and recognizing the importance of non-consumptive uses. In federal fisheries management, formulas in FMPs often provide for the direct calculation of an allowable catch (fishing mortality).

Fishery Control Rules do not have to be cast in terms of fishing mortality rates or **biomass** levels. Simply put, a Control Rule seeks to identify measures of "good" and "bad" stock condition (by comparing perceived stock status with biological reference points), as well as the actions that will make the stock condition change from "bad" to "good." In general, Control Rules help identify key management measures appropriate to the fishery. In addition, Control Rules must be based on objective, measurable criteria. Examples of such criteria include population size, productivity, or density, or other input.

There are many possible approaches to developing Fishery Control Rules. Choosing the appropriate one for a fishery depends on the management objectives for that fishery; the kind, amount, and quality of Essential Fishery Information (EFI) that is available; and the pros and cons of different Control Rule approaches, none of which is ruled out under the MLMA. Different Control Rule approaches that are available to the Commission for management of the nearshore fishery are described in this section and the adopted approach presented.

Maximum Sustainable Yield

Maximum sustainable yield (MSY) is defined in the FGC §96.5 as the highest average yield over time that does not result in a continuing reduction in stock abundance, taking into account fluctuations in abundance and environmental variability. The MSY model determines upper limits on catch, which may be expressed as:

- a fixed fishing rate, such that a constant fraction of the population may be caught each year
- a fixed yield, such that fishermen may expect consistency in allowable catches over several years
- a constant escapement rate, such that a particular spawning **population** size is maintained

population - organisms of the same species that occur in a particular place at a given time. A population may contain several discrete breeding groups or stocks.

recruitment - either the rate of entry of recruits into the fishery or the process by which such recruits are generated. It is usually associated with attainment of a particular age or size, but can also be dependent on such factors as the fishes' appearance on a particular fishing ground, or how they grow to a size large enough to be captured by a certain fishing gear.

The reliability of estimates for MSY varies with the degree of understanding about the status and dynamics of a fishery. The vehicle for determining the status of a population and estimates of MSY is a stock assessment. MSY is specific for each species or population of fish. Biological information for completing a stock assessment ideally includes: population dynamics, abundance, life history, and environmental factors, with specifics that include age structure of the population, the age at first spawning, fecundity, ratio of males to females in the population, natural mortality, fishing mortality, growth rate, spawning behavior, habitats at different life stages, migratory habits, food habits, and estimate of the total number or weight of fish in a population. Little of this information exists for the species in the nearshore fishery. Where key factors such as natural mortality rate and **recruitment** are unknown, assumptions must be made, resulting in uncertainty about the validity of estimates.

In a data-poor situation, fishery-dependent data are sometimes the only information available. Because of biases inherent in fishery-dependent information, reliance on this approach is appropriate only when fishery-independent information is inadequate. These assessments use such information as: types of fishing gear, pounds of fish caught by each type over many years, fishing effort by each type over many years, discard rates for different gears, age structure of the fish caught by each group, ratio of males to females in the catch, marketing considerations, value of fish to different groups, time and geographic area of best catches.

The Department believes that there is sufficient available information to conduct stock assessments for cabezon, California scorpionfish, and possibly California sheephead in the next several years. Conducting stock assessments of most of the other 16 nearshore species is unlikely in the next decade since most of the required biological information is not available.

When information needed to calculate MSY is lacking, an alternative approach is to select a proxy, or functional equivalent, of MSY, as the Commission did in December 2000 when it adopted interim regulations for management of the nearshore fishery.

MSY by itself is inadequate as a Fishery Control Rule approach under the MLMA. MSY emphasizes fishery yield of target species, on a species-by-species basis, to the exclusion of economic, social, or ecological factors. Other shortcomings of the MSY approach include the difficulties of applying it to sedentary species, mixed-population fisheries, species with complex life histories, species whose populations fluctuate widely from short-term **equilibrium**, and populations with long-term changes in recruitment, all of which are relevant to the nearshore fishery.

The California coast is subject to strong variability in ocean climate over time scales of several decades. Species populations vary in their sensitivity to this variability, but MSY can change substantially from decade to decade, and the use of a single long-term MSY can be dangerous during periods of unfavorable climate. This problem is only slowly being resolved, as most historical data series are still too short to support analysis of climate effects.

equilibrium - a steady-state situation which may exist after specified conditions (such as fishing pressure, environmental conditions, and population parameters such as growth, mortality and recruitment rates) have been consistent for long enough to affect all age classes in a population. A true equilibrium state is often never attained in natural systems.

proxy - an equivalent piece of information that can serve as a substitute for that which is specified.

variant of Restrepo approach - The Restrepo approach addresses precautionary conditions in setting allowable fishing mortality. Under the specific conditions for interim management for cabezon, greenlings, and California sheephead, a 50% reduction in allowable catch from the recent average was deemed an appropriate variant of the Restrepo approach.

Optimum Yield

Optimum yield (OY) is defined in FGC §97 as the amount of fish taken in a fishery that does all of the following: (a) provides the greatest overall benefit to the people of California, particularly with respect to food production and recreational opportunities, and takes into account the protection of marine ecosystems, and (b) is the MSY of the fishery, reduced by relevant economic, social, or ecological factors, and (c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing MSY in the fishery. Uncertainty must also be taken into account when setting an OY. As defined, OY can never exceed MSY.

Optimum yield levels may be set as a fraction of MSY, if MSY has been calculated. When information needed to calculate MSY is lacking, an alternative approach is to select a **proxy**, or functional equivalent for both, as the Commission did in December 2000 when it adopted interim regulations for management of the nearshore fishery.

Proxy for Maximum Sustainable Yield and Precautionary Optimum Yield

There often is insufficient knowledge to calculate MSY. Restrepo et al. (1998) provide an alternative approach for federal fisheries management, and the State has used a **variant of the Restrepo approach** in the interim regulations for the nearshore fishery. In that approach, a proxy for MSY is calculated when MSY-related parameters cannot be estimated from available data or when their estimated values are deemed to be unreliable for various reasons (for instance, extremely low precision, insufficient contrast in the data, or inadequate models).

The proxy for MSY in data-poor and data-moderate situations in this approach is based on the historical average catch, selecting a period when there is no indication that abundance is declining. A proxy for OY is then determined by reducing the proxy MSY by a percentage that can vary depending on the amount of information available. As uncertainty decreases about the status of stocks and their response to fishing pressure, less precautionary management can be adopted. This approach to risk management reduces the chance of inadvertent overfishing when little is known about the status of a stock.

There are no definitions or standards for measuring the level of data richness for a fishery other than the general guidance provided in Restrepo et al. (1998):

- Data-rich cases: Reliable estimates of MSY-related quantities and current stock size are available. Stock assessments may be sophisticated, and provide a reasonably complete accounting of uncertainty.

- Data-moderate cases: Reliable estimates of MSY-related quantities are either unavailable or of limited use due to peculiar life history, poor data contrast, or high recruitment variability, but reliable estimates of current stock size and all critical life history (such as growth) and fishery (such as selectivity) parameters are available. Stock assessments may range from simple to sophisticated, and uncertainty can be reasonably characterized and quantified.

- Data-poor cases: Reliable estimates of MSY-related quantities are unavailable, as are reliable estimates of either current stock size or certain critical life history or fishery parameters. Stock assessments are minimal, and measurements of uncertainty may be qualitative rather than quantitative. Restrepo et al. (1998) add the additional caveat that fisheries involving several populations, as is the case with the nearshore fishery, are likely to be of mixed data richness.

Since Restrepo et al. (1998) does not consider ecosystem concerns, the fishery control rule approach in the NFMP redefines these three categories of data richness. There are large gaps in knowledge for most individual NFMP species, with EFI limited to catch history and partial life history information, therefore the Commission adopted the following approach in the nearshore fishery interim regulations for cabezon, greenlings, and sheephead: commercial and recreational catch history for 1993 through 1998 was averaged to select a proxy for MSY. Because of the data-poor state of EFI for this fishery, a proxy OY was set at 50% of the proxy MSY. The Pacific Fishery Management Council (PFMC) has adopted a similar approach to setting allowable catches for the rockfish that comprise the balance of the species covered by the NFMP.

Other Fishery Control Rule Approaches

The MLMA requires a shift in fisheries management from a focus on individual populations that are assumed to be coastwide, to a focus on the sustainability and resiliency of the entire nearshore ecosystem, differentiating among regions that differ biologically and incorporating information on the effects of environmental change over periods of years or decades.

MSY/OY limits, as they have traditionally been applied, are based on assumptions that populations are at equilibrium, that populations vary in tandem throughout state waters, that species interactions are minor determinants of population viability, and that species other than the target species are not of direct concern.

Implementation of the NFMP proposes nearshore monitoring and assessment approaches designed to create a data-rich environment for ecosystem-based management (see Section 1 Chapter 4). Each of these approaches can contribute to calculation of Total Allowable Catch for the fishery. They include:

> **density** - number of organisms per unit of area or volume. *Absolute density* is the number of individuals of any given group (such as taxon) that occurs within a designated area of bottom or volume of water column. *Relative density* is the density of a single group in one place compared to another, or the density of one group compared to another in the same place.
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> **food web** - the feeding relationships in communities that determine the flow of energy and materials from plants to herbivores, carnivores, and scavengers.
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> **productivity** - describes the birth, growth and death rates of a stock. A highly productive stock is characterized by high birth, growth and mortality rates, and as a consequence has a high turnover. Such stocks can usually sustain higher exploitation rates and, if depleted, could recover more rapidly than comparatively less productive stocks.
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> **community structure** - a tightly structured group of organisms for which there are known or assumed relations at

- using regional **density** estimates: This approach is important for sedentary species like those of the NFMP. It also makes it possible to capture biological information about regional differences in **food webs** and **productivity** that affect allowable fishing mortality.
- using within-habitat density estimates instead of assuming that regional waters contain a single, evenly distributed population. Habitat-specific data MAY be expanded to obtain an independent estimate of the population size and how the population is changing over time. This minimizes the risk of exceeding catch limits.

- detecting changes in density, **community structure**, and community function from year to year by comparing areas of similar habitat that are subject to different levels of fishing pressure and comparing fished and closed areas. The ability to measure rates of change over relatively short time periods makes it possible to employ rates of decline as a Control Rule criterion.

- concurrent, or at least correlated, data gathering for the physical environment, target species for the NFMP, other commercial species (vertebrate and invertebrate), as well as non-target species of importance. These can include any ecologically significant species, such as those that provide habitat structure (kelp, soft corals), constitute a food base (forage species), are **functional keystones** (sea urchins, otter, abalone), are of conservation interest (sea birds, marine mammals), or that interact with nearshore ecosystem in ways that bear on allowable catch (prey and predators that move through the nearshore system).

> **functional keystones** - individual organisms or groups of species whose removal may engender dramatic changes in the structure and functioning of a biological community.
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> **adaptive management** - in regard to a marine fishery, means a scientific 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. Monitoring and evaluation shall be emphasized so that the interaction of different elements within the system can be better understood.

As with the other Fishery Control Rule approaches, there are drawbacks to these alternative approaches. As with the traditional MSY/OY approach, much EFI is lacking and may take several to many years to acquire. Although by incorporating an ecosystem perspective these approaches represent the conceptual direction in which fishery management is moving, they are innovative. There are no applied models in the marine environment to use as guidance. Applying these approaches will both require and benefit **adaptive management**.

Fishery Control Rule Approach

Much of the NFMP's approach to sustainability rests on its Fishery Control Rule which explicitly recognizes the need to reflect the state of knowledge about a fishery in its management. As knowledge improves through the research and monitoring proposed in Chapter 4, management can be based more on information and less on precaution.

The Control Rule for the NFMP incorporates and blends different approaches to meet its three objectives:

1. Maintain healthy populations of target species.

2. Avoid extreme fishery effects on the ecosystem.

3. Anticipate the effects of environmental change on the fishery.

To accomplish those objectives, the control rule integrates:

- EFI about the demographics of target species, ecosystem effects of the fishery, and the effects of environmental change on the fishery
- different levels of availability of EFI (data-poor, data-moderate, or data-rich circumstances)
- management strategies that include more or less precaution, depending on the levels of EFI

The framework for the Control Rule includes three general categories:

Stage I - data-poor EFI, with precaution as the primary basis for setting TAC

Stage II - data-moderate EFI that supports improved single species management

Stage III - data-rich EFI that supports ecosystem-based management

The current state of ecosystem knowledge for the nearshore habitat is data-poor. In Stage I and Stage II, only crude precautionary adjustments are available to address uncertainty about ecosystem effects of a fishery. Details of Stage III management will need to be developed and refined as it becomes clearer what types of relevant information can be most successfully collected, as more of that information becomes available, and as models and other analyses are developed to apply that information using the full range of management measures.

The NFMP Fishery Control Rule is based upon a few underlying considerations. First, there are uncertainties about marine ecosystems that will never be resolved. Consequently, the need for precaution in fishery management can be reduced with improved information, but never eliminated. Secondly, historic single-species management has commonly resulted in inadvertent over-exploitation. The Fishery Control Rule has been designed to address this risk. Finally, in Stage II and Stage III, better information can result in higher TACs.

Although the description of the three stages implies a stepwise progression, the boundary between stages is well defined only between Stage I and the other two. Application of elements of Stage II and Stage III management may vary in degree and time among species and regions: as usable information of different types becomes available, it can be incorporated into management models. This control rule approach provides for changing the trigger points for regulatory action as information improves.

Role of Marine Protected Areas in Nearshore Management

The MLMA management goals of conserving entire systems, recognizing non-consumptive values, ensuring sustainable fisheries, conserving habitat, and rebuilding depressed fisheries cannot be effectively achieved solely through limits on total fishing mortality. Consequently, a combination of a network of MPAs and limits on total fishing mortality will achieve the principal management goals. Size, placement, and the number of MPAs for nearshore fishery management is dependent upon the goals and objectives that they are intended to address.

The NFMP recommends the creation of a network of MPAs to provide several benefits that complement other management measures in areas open to fishing. Non-fishery management benefits include basic levels of ecosystem conservation and consideration for non-consumptive uses (both of which are MLMA mandates). Fishery management benefits of the MPAs, as well as of temporary closed areas, include buffering against management mistakes, full protection for some fraction of target and bycatch populations, and possible increased reproductive potential due to the restoration of more natural age structure. MPAs should provide a degree of protection against overfishing, and if a population level is found to be depressed, MPAs should speed the rebuilding process. MPAs may also enhance fishery yields outside their borders over time. Because MPAs allow fish to live their natural lifespans, they allow populations to benefit from the naturally evolved life history strategies against prolonged recruitment failures, such as were seen in the 1990s for some species.

An MPA network that functions as intended for management of the nearshore fishery and ecosystem will accomplish the following:

1. Ecosystem biodiversity-Protect representative and unique marine habitats, ecological processes, and population of interest, which include, but are not limited to, habitats such as rocky reefs and kelp forests used by multiple species, and populations that are valued for their consumptive and non-consumptive uses.

2. Risk Management-Provide a buffer against environmental fluctuations which affect recruitment success and uncertainties associated with fisheries management. Reduce the risk of management mistakes and uncertainties associated with fisheries management.

3. Research-Acquire baseline data to assess natural and human impacts in both protected and non-protected areas. Evaluate the short- and long-term effectiveness of MPAs as a management tool.

4. Sustainable fisheries-Achieve sustainable fisheries by integrating MPAs into fisheries management. Help ensure depressed fisheries are rebuilt to the highest sustainable yields and maintained at productive levels. Ensure current stock levels are maintained.

5. Intrinsic value-Improve recreational and educational opportunities provided by marine ecosystems that are subject to minimal human disturbance. Protect marine natural heritage which includes the aesthetic and non-consumptive values of California's living marine resources.

Stage I: Precautionary Management in a Data-Poor Environment

Conditions for Stage I Management

In data-poor circumstances, precaution will be the primary basis for setting TACs since there is little or no information on demographics, ecological effects of the fishery, or the effects of environmental change on the fishery.

Setting TACs

In Stage I management, information on stock size, life history, ecosystem relationships of the target species, and the effects of environmental change are all minimal or lacking. Catch history is the only, or primary, information available. The response is a precautionary approach in which a limit is placed on catches of all target species that is equal to a fraction of the average catch of some series of years when there was evidence that abundance was not declining. The imposed reduction is an application of risk management that provides a reasonable expectation that overfishing will be avoided at the reduced level of catch. In the absence of information to the contrary, the fraction will be 50%, which assumes that the stock is below the target biomass but above the overfished threshold. This approach is consistent with that described in Restrepo et al. (1998) for dealing in a precautionary manner with fishery management in a data-poor environment. (The Commission adopted this approach in the interim regulations for cabezon, California sheephead, and greenling in December 2000. The PFMC adopted this approach to set TACs for its minor rockfish category, which includes the rockfish and California scorpionfish included in the NFMP.) As the information improves, TACs can be revised upwards or downwards accordingly.

For the NFMP, Stage I management means the establishment of a TAC for each of the 19 target species whenever this is possible and practical. In some cases, the characteristics of the fishery and/or catch reporting limitations make it necessary to pool the TAC for a group or complex of related species. For example, it is not possible to target individual rockfish species to the exclusion of others, and identification of catch to species level is sometimes unreliable. For these taxa, a pooled TAC should be defined.

In the case of pooled TACs, it is important to identify the weakest species in the complex and include measures to protect them from overexploitation. One approach can be to examine the catch history for each species in the complex separately, derive a species TAC for it, and then sum the results across species to get an aggregate TAC. This could identify weak stocks that may have experienced declines in landings that were masked by the aggregated landing for the entire complex. A more aggressive approach is to rank species in the catch complex using the American Fisheries Society vulnerability criteria if sufficient life history information is available, and then base the aggregate TAC on the most vulnerable species in the complex by limiting the TAC contribution of each species in the complex to that of the weakest member. This approach could greatly constrain TAC for an abundant species that is targeted by non-selective gear, but would protect the weakest stocks and provide strong incentive for the development of more selective fishing methods. In order to manage based on total catch, it is also essential to be able to estimate both sport and commercial discards and the extent to which discarded fish survive, so that TACs can be adjusted up or down. Discards should be allocated according to fishing sector, so that allocations to each sector can be adjusted depending on their discard rates, thereby providing an incentive to reduce discards.

Exceeding or Failing to Attain TACs

Regulatory action to bring the annual catch in line with the TAC, such as a restriction in catch, time, area, or gear, is triggered when the TAC for any given species or species complex is exceeded or is expected to be exceeded within one or more of the four nearshore regional management areas. Such regulations could be adopted either in-season or for the following season. The intent of the fishery regulations is to provide fishery participants an opportunity to catch the TAC, but not exceed it, and to allow as close to a year-round fishery as possible. No rollover of “unused” portions of the TAC to the next season should be allowed for Stage I fisheries, due to uncertainty about population stability and catch sustainability.

Additional Steps During Stage I Management

In Stage I, it is difficult to evaluate quantitatively the effectiveness of management measures in meeting the three control rule objectives other than to ensure that TACs are not exceeded. Quantitative evaluation becomes feasible as additional steps are implemented in anticipation of Stage II. During Stage I management, it is important to increase the quality and quantity of data necessary for more informed and less precautionary management, primarily in seven areas:

1. improvements to the fishery-dependent data base, including improvement of accuracy and completeness; subsequent analysis of the catch and age/size composition of sport and commercial catches; and implementation of more accurate methods of recording catch location, such as 1-mile square reporting blocks (explained in Stage II)

2. implementation of fishery-independent surveys (such as using trawls, longlines, ichthyoplankton samples, scuba or submersible observations)

3. augmentation of life history and population data in order to track changes with time and environmental conditions

4. selection of study areas in each region subject to varied fishing effort, including reference reserves, and initiation of comparative studies of those areas in preparation for Stage II and Stage III management

5. high-resolution mapping of nearshore habitats

6. studies of discard survival for the 19 NFMP species

7. development of new and improvement of existing ecosystem information (such as food web studies and physical oceanographic information) for eventual incorporation into fishery models

Stage II: Improved Single Species Management in a Data-Moderate Environment

Conditions for Stage II Management

Stage II, data-moderate, improved single-species management can be implemented once data streams from any or all of the first six new or improved information sources listed in Stage I are established and the data are incorporated into models and other methods of analysis used to set TACs. Stage II management is possible with adequate abundance, density, recruitment, mortality, stock productivity, life history, landings, and habitat information to allow regional TACs to be set for any of the 19 NFMP species or species complexes. Some species will be eligible for Stage II management before others, with cabezon and sheephead anticipated to be the first candidates.

Setting TACs

In Stage II, uncertainty because of inadequate demographic information is reduced, resulting in less need for strictly precautionary management. However, precautionary adjustments to TACs are still necessary because of minimal information about ecosystem effects of the fishery and the effects of environmental change on the fishery.

Setting TACs under Stage II management differs fundamentally from the process in Stage I in terms of reality, robustness, precision, and biological soundness. A great deal more fishery-dependent and fishery-independent information can be employed in a series of models with complementary strengths, and whose validity is constantly tested by additional data.

Stage II management incorporates population modeling and other analyses that replace the strictly precautionary approach to TACs in Stage I. Where data are still weak, techniques such as sensitivity analysis and Bayesian probability estimation should be applied to clarify decision making. This process will be greatly facilitated by explicit knowledge about the distribution of the preferred habitat of each species and variation in density, age structure, recruits per spawner, and estimated biomass within-habitat. Existing time series of catch and biomass indices also offer great potential.

These existing data, once expanded in a model or series of models, will make it possible to establish discrete triggers for regulatory action with measured or projected changes in the density, age structure, biomass, or other indicators for each target species. Any set of parameter values, or variables derived from these values, can serve as appropriate triggers for raising or lowering TACs for individual species. Also, partial or provisional stock assessments using traditional integrated stock assessment techniques can be used in setting Stage II TACs.

Based on data and modeling, including risk analysis, the regional TAC can be revised upwards or downwards as often as annually. NFMP species that are relatively long-lived and that include numerous year classes are less likely to be subject to rapid changes in abundance. However, surplus production tends to be low, making them susceptible to overfishing, and slow to recover from it.

The Stage II approach differs from the adoption of a stock-specific MSY and OY derived from it in only one respect. The calculation of MSY assumes equilibrium population dynamics while the NFMP approach does not. The calculation of MSY also deals with quantities like “virgin biomass” and “carrying capacity” that are very difficult to measure as real numbers. In practice, a more useful yardstick is an estimate of what a fish stock would look like at any given time if fishing were not a factor. For this reason, the NFMP employs the term “unfished biomass” or “$B_{Unfished}$”, and the term “Total Allowable Catch” instead of OY. A decline or increase in $B_{Unfished}$ may be reflected as a decrease or increase in fecundity, stock density, and/or recruit per spawning individual, with the result that stock biomass is reduced or augmented for some time. Regardless of the terms that one uses, accurate population estimates require monitoring of year-to-year variation in recruitment success, growth rates, and environmental conditions. Under Stage II (and Stage III), the objective is to recalculate $B_{Unfished}$ as frequently as the varied types of data allow, with annual recalculations eventually possible and perhaps desirable for some species.

For the purposes of this FMP, $B_{Unfished}$ is defined as an estimate of the biomass or stock size that would exist if there had been no fishing in recent history (within several generations of the relevant species). Based on the estimated $B_{Unfished}$, a TAC will be calculated for each stock, including downward adjustments made for social, economic, or ecological factors or if abundance is determined to be lower than the level that would achieve $0.6B_{Unfished}$. In cases where the status of the stock is known but $B_{Unfished}$ may not be directly calculated because of difficulty in determining a spawner recruit relation or other parameters, the default rate $F_{50\%}$ for NFMP finfish would be the fishing rate that reduces the average recruits per spawner to 50% of the unfished level ($0.5B_{Unfished}$).

When an assessed stock is believed to be below its $0.6B_{Unfished}$ size, TAC would be reduced below the $F_{50\%}$ fishing rate. In the default approach, TAC is reduced below $F_{50\%}$ along a straight line between $0.6B_{Unfished}$ catch (i.e., applying $F_{50\%}$ at 0.6BUnfished) and zero catch at 20% of the unfished biomass (i.e., $0.2B_{Unfished}$). This same line would be used as the interim Stage II rebuilding plan if a stock falls below its overfished/rebuilding threshold (i.e., $0.30B_{Unfished}$). The point at which the line intersects the horizontal axis implies that zero catch would be allowed, and is also used for determining the slope of the TAC line between $0.6B_{Unfished}$ and $0.2B_{Unfished}$. In some circumstances (e.g., multiple-year recruitment failures), more aggressive reductions in fishing mortality may be necessary.

The method for assessing whether a population is overfished is based on an estimate of unfished biomass and its relation to current biomass. Under Stage II management, an overfished stock is defined as a stock that falls below the threshold of 30% $B_{Unfished}$. Eventually, the reference reserves in the ecosystem will be able to serve as a direct indication of unfished biomass, once populations in the reference reserves are found to have approached the unfished density and other population characteristics, which can then be used to calculate $B_{Unfished}$. The comparison of reference reserves in each management region with areas open to fishing can provide data used to establish TACs based on direct fishing impacts on target fish density, age structure, and population viability. When this situation is reached, overfishing may also be defined as a condition in which spawning biomass per recruit is less than 30% of that inside reference reserves. Ultimately, management approaches such as rolling closures could also be considered as a possible means of maximizing TACs outside of MPAs and reference reserves.

For stocks below their overfished/rebuilding threshold, an interim rebuilding adjustment would be made to TAC until a rebuilding plan is developed. Rebuilding times may be influenced by many factors, including the degree to which a stock has declined, the inherent productivity of the stock, generation time for the stock, and the chance of seeing a successful year class in any given period of time. In general, rebuilding plans provide for recovery to $0.6B_{Unfished}$ or its proxy in 10 years or less. In cases where that is not possible due to the biological characteristics of the stock, the allowable time is one generation plus the length of time to recover in the absence of fishing.

<u>Exceeding or failing to attain TACs</u>

The management responses to exceeding or failing to attain a TAC in Stage II management are the same as for Stage I. As Stage II management progresses, one of the most important advances in data will be that it becomes spatially explicit at an increasingly high resolution. In many cases it may be advantageous to manage the nearshore species on the finest spatial scale for which supporting data are available. For some invertebrate species, nearshore management has already progressed to the use of one-mile square fishery management blocks nested within the 10-minute latitute by 10-minute longitude (94 square miles) blocks that are the current standard. In some circumstances it may make biological sense to manage areas as small as individual reefs, but this is not practical to enforce, and is extremely labor-intensive from a regulatory standpoint. Thus the ultimate limit on spatial resolution for management will be set in response to explicit conservation needs, as modified by the spatial resolution of research, the precision with which fishermen and enforcement agents can position themselves at sea, and the ability of regulatory processes to respond.

Basic Stage II management corresponds to the current expectation for federally managed species. Reaching this level of management for the California nearshore is playing catch-up to today's standards. With recent advances in natural resource modeling plus the innovative approaches to monitoring and data acquisition outlined in the NFMP, Stage II management should substantially reduce uncertainty about the sustainability of the nearshore finfish fishery.

Stage III: Ecosystem-Based Management in a Data-Rich Environment

The MLMA requires that fishery impacts be managed to “conserve the health and diversity of marine ecosystems and marine living resources.” Stage III management is intended to meet that standard. At present, however, it must be recognized that even first-order ecological relationships are poorly understood, and populations in reference reserves are not yet assessed nor have they fully responded to the elimination of fishing pressure. Since Stage III management will be data driven, it is reasonable to expect that its full implementation is several years in the future for nearshore finfish (though the time frame may be shorter for some nearshore invertebrate or kelp fisheries). This does not preclude putting in place elements of Stage III management as soon as possible. Stage III concepts have not been extensively researched or applied in practical management, and consequently it is difficult to anticipate a timetable for implementation.

Conditions for Stage III Management

Stage III, data-rich, ecosystem-based management will build on the information from the first six information sources listed under Stage I and also incorporate information modeling information from the seventh to models for managing the fishery. The threshold for shifting to Stage III management under the NFMP includes two conditions:

1. The comparison of study areas subject to varied fishing effort, including reference reserves in each region, will provide data on alteration to food web and other aspects of ecosystem function that are attributable to fishing, and may provide additional useful information for establishing TACs that take basic ecosystem conservation into consideration.

2. Together with physical oceanographic information, the comparison of protected reference areas with areas open to fishing provides data on the impact of fluctuating climate regime on fishery productivity. This may permit reducing TACs to protect populations when they are under stress, or raising TACs during periods of high productivity.

Achieving Stage III management is a complex and challenging process. Stage III focuses initially on the 19 target species, using ecosystem-related parameters in addition to the species-specific life history and population parameters that form the backbone of Stage II. In Stage III the data for management would be expanded to encompass non-target species and physical oceanography. The MLMA recognizes the importance of non-fishery species due to their ecological function and non-consumptive values. For reference reserves to function as intended in Stage III it will be necessary to determine that populations within the reserves have reached a level that serve as a reasonable indication of an unfished state under the prevailing environmental conditions.

Setting TACs

While uncertainty because of inadequate demographic information is reduced in Stage II management, Stage III management further reduces uncertainty related to possible ecosystem effects of the fishery, and effects of environmental change on the fishery. This, in turn, can reduce the need for strictly precautionary reductions in calculating TACs.

One step in Stage III is to extend the set of parameters that triggers raising or lowering TACs to include indicators of fishery-caused alteration to bioenergetics and community structure. Examples would include a switch in prey base, change in productivity at one or more trophic levels, and changes in the connectance (a measure of complexity) or resilience of the food web. In all cases, the parameters should be robustly quantifiable, and clearly of significance for the health of target species and the ecological community that supports them.

To address severe existing or developing effects of the fishery on the ecosystem or non-target species (such as insufficient forage for predator species, shift in species composition due to change in predator-prey relative abundance, etc.), a determination can be made as to what sort of management measure would be appropriate. Adjustments to TACs, creation of closed areas, size limits, or gear restrictions could be appropriate, depending on the nature of the impact. Remedies should be applied even before definitive information about the specific cause is available. The other step in Stage III is to use data comparing reference areas and fished areas to isolate the influence of climate (or other forces extrinsic to the fishery), and adjust TACs down or up accordingly. For example, the Pacific Decadal Oscillation may produce long cycles of relatively high or low abundance of NFMP species that can be factored into raising or lowering $B_{Unfished}$ and TACs derived from it.

The Stage II control rules for setting TACs would also be the defaults for Stage III management. However, Stage III TACs and other management measures can be more or less restrictive, depending on levels of information or uncertainty about trophic relationships, ecosystem effects of the fishery, effects of environmental change on the fishery, and existence of closed areas that can allow for higher TACs.

Exceeding or failing to attain TACs

The management responses to exceeding or failing to attain a TAC in Stage III management are the same as for Stage II.

Potential Measures of Ecosystem Structure and Function for Stage III

This stage of implementation for Stage III management incorporates measures of changes to ecosystem properties attibutable to fishing effects. Protocols for measuring such changes, and their corresponding set of catch control rules and other management measures, must still be developed; this is one of the most important areas for research and development under the NFMP. Existing theory puts forward several key parameters for initial consideration. One class of parameters, life history changes, are already incorporated into the control rules described above. Additional examples of ecosystem information that may be possible to incorporate in Stage III management are:

A. Trophic Parameters. Trophic parameters can be measured and interpreted accurately by means of stable isotope and stomach content analysis; stable isotope analysis is now a routine and economical procedure that is available at several California universities and other institutions.

1. Effective Trophic Level: a number that describes how high in a food web, on average, a particular species or life phase is feeding, integrated over a period of several weeks.

2. Maximum Food Chain Length: an estimate of the maximum number of trophic links in a community.

3. Connectance: one of several biologically meaningful measures of food web complexity that can be related to community stability. Connectance is the proportion of all of the theoretically possible connections in a food web that are actually present.

B. Functional Diversity: ecologists have found several measures of community diversity to have useful relationships to community properties such as productivity, ecosystem size, and various kinds of stability.

1. Species Richness: the number of species that occurs within a given area, and how this number scales with increasing areas of examination.

2. Evenness: a measure of the shape of the relative abundance curve over all the species in a community. Shifts in evenness can provide an early warning of major changes in relative abundance to come.

3. Redundancy: within any ecological community, there may be more than one species funtioning in more or less the same ecological role. Such species are considered members of the same functional group, or guild. Though superficially similar and functionally substitutable, guild members tend to vary in other aspects of their biology, such as tolerance to changes in climate, food base, and water quality. Thus, having more species per guild may increase the stability, and hence the productivity over time, of a marine community. Inversely, a loss of species richness, manifested as a reduction in redundancy, or number of species per guild, could render a marine community more vulnerable to wild swings in stock sizes and productivity.

Potential Measures of the Effects of Environmental Change to the Fishery For Stage III

This stage of implementation for Stage III management incorporates existing measures or anticipated effects on the fishery attributable to environmental change. Protocols for measuring such changes, and their corresponding set of catch control rules and other management measures, must still be developed. Existing theory and practice provide key parameters for initial consideration such as:

1. Presence or absence of short-term environmental change (for instance, a severe El Niño or La Niña, or a shift in the Pacific Decadal Oscillation) that may result in sharply depressing or enhancing productivity or result in other changes in the fishery.

2. Sea surface temperature as a proxy for the effects of environmental change (such as in management of the Pacific sardine fishery.)

3. Shifts in abundance of populations that co-vary with NFMP species or relevant non-target species.

Understanding Regional Management

The California fishery for the 19 NFMP species occurs in nearly all coastal waters, including offshore rocks and islands, between the Oregon border and the U.S.-Mexico international boundary. Along the state's 1,100 mi (1,770 km) of shoreline, nearshore habitat and associated finfish communities change dramatically with latitude, and less dramatically around prominent features such as islands and capes. Regional management of the nearshore finfish fishery recognizes these geographic differences, and makes it possible to more closely match regulations to prevailing conditions. Regional management will enhance the ability to tailor management to local conditions and to reduce the risk of regional overfishing or depletion.

The foundation of the regional approach is formed by regional management areas for which separate management harvest guidelines and uniform regulations may be set. The selection of regional management areas should be based on a number factors, including jurisdictional boundaries, oceanographic characteristics, genetics, species distributions, species assemblages, historical landings, and social and economic patterns (Table 1.3-1).

Choosing the optimum number of regional management areas involves trade-offs in matching boundaries with these factors as well as with staffing and other requirements. For example, while managing fisheries based on the State's ten port complexes may make sense for some purposes, administratively it would be disproportionately expensive.

The NFMP Project will manage the nearshore fishery in four regions and additional regions be created only through an amendment to the NFMP. An example of how other jurisdictions have addressed regional management can be found in Appendix G.

Table 1.3-1. Factors considered in reviewing regional management approaches

FACTORS	One statewide region	Three regions (break at Point Conception, Cape Mendocino)	Four regions (additional break at Año Nuevo)
Oceanographic areas	Includes more than one oceanographic area	Central Coast/South Coast region boundary associated with major oceanographic boundary; North Coast and Central Coast regions within one oceanographic area	Central Coast/South Coast region boundary associated with major oceanographic boundary; North Coast and two central coast regions within one oceanographic area
Distributions of 19 nearshore species	Distributions of some species do not span the entire State	Better match of species distributions, although some species span more than one region	More species span one or more regions than for other approaches
Genetics	May include more than one genetically discrete population (substock) for some species	North Coast/Central Coast boundary may divide a substock of grass rockfish. Regions to the north and south of Point Conception may contain populations of grass rockfish (and probably other nearshore species) that have enough genetic divergence	Similar to 3-region approach; the break between the two possible central-coast substocks of grass rockfish lies somewhere between Fort Bragg and Big Creek, and so may be close to the boundary between the North-Central Coast and South-Central Coast regions
Historical landings	Large differences throughout the State in the species composition of the landings	Some differences within regions in the species composition of landings, particularly in the central region	Smaller differences within regions in the species composition of landings compared to other approaches
Restricted access	Assumes that the fishery is conducted in the same manner statewide	Addresses expansion of the fishery and differing fishing practices, except in the central region	Allows current permittees to compete for restricted access permits on an equal basis, based on time in the fishery and gears used
Socio-economic considerations	Treats all coastal communities as the same; assumes same economic infrastructure, employment characteristics, and productivity	Some unique socioeconomic characteristics of southernmost and northernmost areas are captured and preserved through 3-region approach	4-region approach recognizes and preserves more of the unique characteristics of the local areas in terms of employment, output, cultural/historical values, etc.
Available data sources	Commercial data (CalCOM) by port complex combined for state; recreational data (MRFSS) from No. CA and So. CA combined for state	Commercial data by port complex easily divided into three regions; methodology for separating the north coast region data from the rest of No. CA MRFSS data is being developed	Commercial data by port complex easily divided into four regions; may be able to modify methodology used in 3-region approach for breaking out the recreational (MRFSS) landings for two central coast regions
Regulatory mandates	Spans two PFMC management areas and contains part of a third	Best alignment with PFMC management areas	Central PFMC management area spans two central coast regions

Staffing needs	Status quo (35 PYs)	87.75 Pys	113 PYs
Costs	$3.78 million	$5.97 million	$7.07 million
Table 1.3-1. (cont.) Factors considered in reviewing regional management approaches			
Advantages	Management boundaries are known. It is easier to enforce one statewide area. The management structure is already in place, and no new regulations are needed.	Management could be structured for distinct fisheries. Regulations could be applied to stocks of species. Staff could more easily and accurately track and monitor landings of nearshore fish.	Management could be structured for distinct fisheries. Regulations could be applied to stocks of species. Staff could more easily and accurately track and monitor landings of nearshore fish.
Disadvantages	Distinct fisheries are present in different parts of the State and the same regulations would be applied to different stocks. Markets and composition of catch are dissimilar between different sections of the State, so it would be difficult to track	The management structure is not in place, and new regulations would be required. There would be increased staffing costs. Regions still might be too large for such issues as restricted access, conservation areas (reserves), or socio-economic factors.	The management structure is not in place, and new regulations would be required. There would be increased staffing costs. Also, recreational landings for the two regional management areas along the central coast may be difficult to obtain.

Current Status of Regional Management by the State and Federal Governments

Currently, species under state management are managed statewide. For commercial fisheries regulated by the Legislature, the state's waters are divided into districts defined in FGC §11000-11039 (Figure 1.3-1). For these fisheries, regulations such as restrictions on capture of particular species or use of particular fishing gear, are usually defined in terms of these districts. For ocean fisheries regulated by the Commission, one statewide ocean district has been defined (California Code of Regulations Title 14, §27). The Commission usually designates area regulations with geographic land reference points or with latitude and longitude.

The commercial and recreational fisheries for nearshore rockfishes in California are currently managed by the Council using three adjacent management areas with the boundaries at Cape Mendocino and Point Conception.

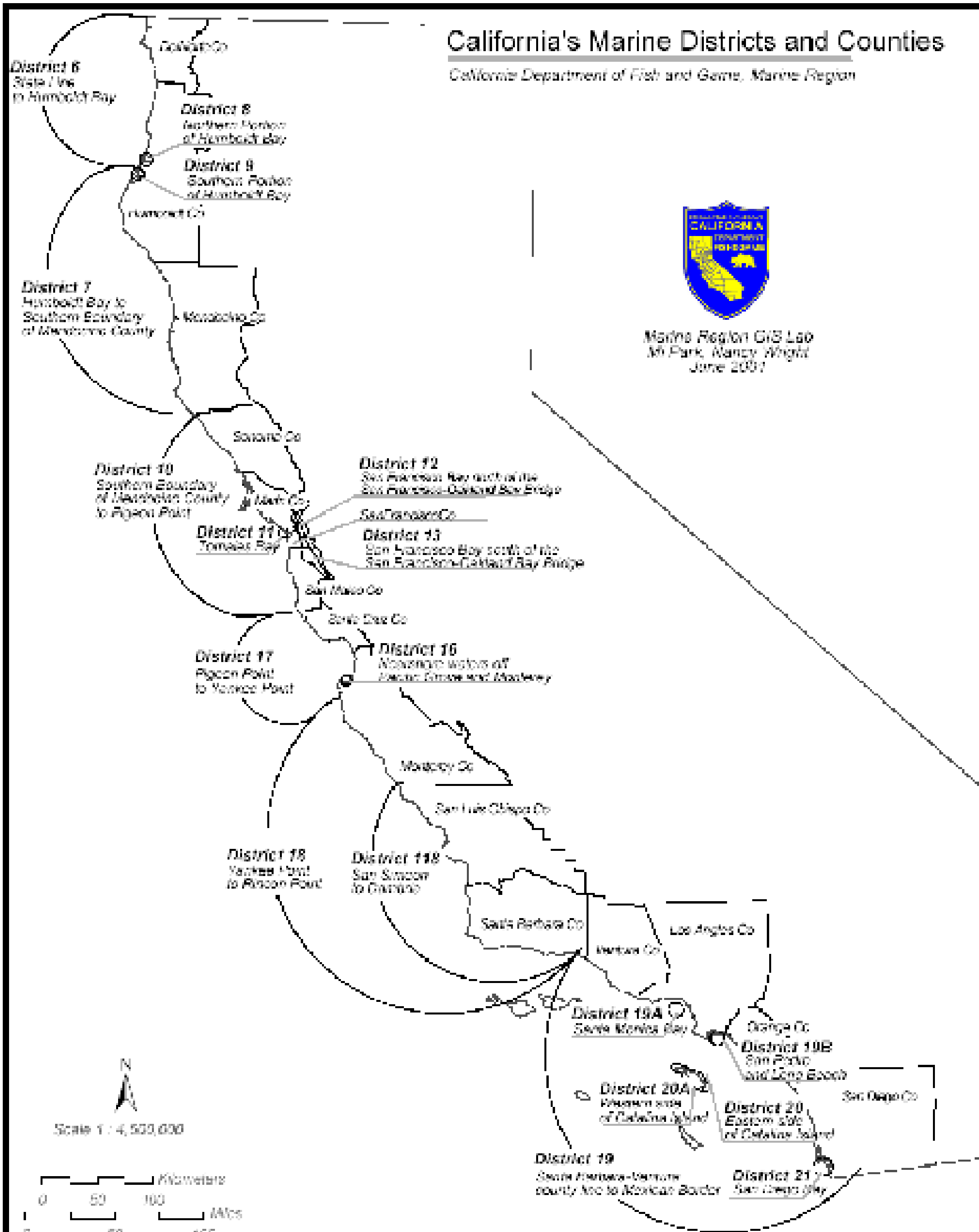

Figure 1.3-1. California’s marine districts and counties.

Factors Considered in the Evaluation of Regional Management Approaches

Besides jurisdictional boundaries, a number of other factors were used in evaluating regional management approaches for the nearshore fishery (Table 1.3-1).

Oceanographic Characteristics

According to Global Ocean Ecosystems Dynamics' Report Number 11(1994), two coastal regions occur along the California coast:

1. Cape Blanco, Oregon to Point Conception. Generally, the dominant ocean current flows southward. A number of features such as jets and eddies are associated with this flow, especially in summer. Below the surface, the California Undercurrent streams northward through the area. This sub-surface northward flow extends to the surface next to the coast in winter (and is then called the Davidson Current). Winter storm activity generally is moderate. Wind patterns foster upwelling, with the strongest upwelling in spring and summer. Primary productivity is strongly seasonal.

2. Point Conception south into Mexico. The California Current flows southeastward along the western side of the Southern California Bight, which dominates the geography of the region. Between the California Current and the coast, surface waters generally flow northward (the Southern California Countercurrent). Sub-surface northward flow also extends to the surface next to the coast in winter. In this area, waters generally mix strongly but remain in the area and do not jet or eddy as they do north of Point Conception, Santa Barbara County. Winds are not favorable to upwelling, which is usually weak. Similarly, primary productivity is not strongly seasonal as in the north.

Species Distributions

Common ranges of nearshore finfish species vary throughout the State. Certain nearshore species are found predominantly within readily defined regional areas. Information about the distribution of the 19 NFMP finfish species is presented in Chapter 2 and Appendix D.

Genetics

A number of factors may generate genetic differences among substocks of a species. Genetic differences may be fostered by historical geographical barriers such as those created by changes in sea level or by present-day geographical barriers such as Point Conception, Santa Barbara County. If these geographical barriers cause populations of the same species to become isolated, then these populations may eventually become genetically distinct. Life history characteristics, such as mating behaviors and internal versus external fertilization, may also promote genetic differences among different substocks. In addition, patterns in the dispersal of larvae may foster genetic differences. If larvae disperse evenly but not far from the adults, they are more likely to be isolated and therefore more likely to become genetically distinct from other groups of the same species.

Within the nearshore finfish species, copper rockfish, brown rockfish, and grass rockfish, for example, show significant differences along the California coast (Vetter personal communication). On the other hand, gopher rockfish and black-and-yellow rockfish are similar in many ways but are considered separate species. These findings suggest that nearshore rockfish do not disperse widely and should be managed regionally.

Historical Landings

Commercial landings of nearshore finfish species also exhibit geographic patterns. Over the past 11 years, nearshore rockfish dominated the landings north of Point Año Nuevo (source: CalCOM tables, Appendix E). Between Point Año Nuevo and Point Conception, nearshore rockfish also contributed greatly to the nearshore landings; however, starting in 1994 cabezon became an increasingly important component of the landings in this area. In the area south of Point Conception, California sheephead generally dominated the nearshore landings.

Geographic patterns also were noted within the commercial landings of specific nearshore rockfish (including California scorpionfish). Between 1995 and 1999, black rockfish dominated landings of nearshore rockfish north of Cape Mendocino, while the California scorpionfish had the highest landings among these species south of Point Conception (particularly in the Los Angeles and San Diego port complexes). During this same time period, brown, copper, gopher, and grass rockfish were important contributors to the nearshore landings between Cape Mendocino and Point Conception. However, landings of copper and brown rockfish tended to be higher in the northern central coast area (Fort Bragg, Bodega Bay, and San Francisco port complexes), while landings of gopher and grass rockfish were higher in the southern central coast area (Monterey/Santa Cruz and Morro Bay/Port San Luis port complexes).

Available Data Sources

Commercial data can be easily summarized for the different regional approaches. However, the Marine Recreational Fisheries Statistics Survey data is only summarized at this time for the area north and south of Point Conception.

Other Factors

Other factors such as restricted access, socioeconomic considerations, and staffing needs/costs also were used in evaluating the different regional management approaches. For specifics on how these factors relate to the different management approaches, refer to Table 1.3-1.

Regional Management Approach

The nearshore fishery is geographically diverse. The 19 species of finfish are not uniformly distributed along the coast. Likewise, commercial and recreational fisheries, as well as non-consumptive activities, are pursued with varying intensity in different areas. Effective management must take this diversity into account.

With this in mind, the NFMP Project creates four management areas:

- North Coast Region - from the Oregon border to Cape Mendocino (Humboldt County)
- North-Central Coast Region - from Cape Mendocino to Point Año Nuevo (San Mateo County)
- South-Central Coast Region - from Point Año Nuevo to Point (Santa Barbara County)
- South Coast Region - from Point Conception to the border of Mexico.

This approach aligns the South Coast regional management area with a specific major geographic feature at Point Conception. It also addresses the differences in the nearshore fishery that are observed along the central California coast (such as dominance of cabezon in the landings from the southern part of the central California coast) by dividing the central coast into two management areas. Point Año Nuevo is the preferred boundary between these two regional management areas because the kelp beds south of Point Año Nuevo tend to be composed predominately of the giant kelp, while the kelp beds north are more likely to contain bull kelp, and few fishermen from the Monterey port complex fish north of Point Año Nuevo.

<u>Implementation of Regional Management</u>

Further division of the four adopted regional management areas or changes to the boundaries will require an amendment to the NFMP.

For each regional management area, routine management measures will be managed by framework provisions of the NFMP. Additional management measures aimed at addressing socio-economic or other issues, may be adopted under the framework provisions of the NFMP for sub-areas of a regional management area. For example, if the qualifying characteristics for a restricted access program show sufficient differences, the Commission may apply different criteria and management measures to the fishery within these different sub-areas.

If current regulations are inconsistent with the adopted regional management area approach, and if the Commission determines that this inconsistency will undermine the ecological or socio-economic objectives of the NFMP, implementation will be phased-in over a period of up to 24 months. During this time, regulations will be altered appropriately. For example, for the regional management areas defined as extending from Point Conception to the border of Mexico, use of the current finfish trap permit (required for the take of certain nearshore finfish species in the area south of Point Arguello) would occur in two management areas, because Point Arguello is approximately 15 mi (24 km) further north and west along the coast than Point Conception. Therefore, a phase-in period would need to be incorporated into the implementation process to minimize the disruption of commercial fishing activities in the Point Conception to Point Arguello fishing zone.

Besides bringing current regulations into alignment with the adopted regional management approach, implementation of the regional management approach will require the phasing in of other activities such as restricted access (Table 1.3-2) and regional advisory committees (RACs). The NFMP provides for the establishment of RACs. These committees will be composed of representatives from interested constituent groups from within each region. Membership of RACs should reflect the diverse interests, including various sectors of the commercial fishing industry, recreational anglers and divers, Commercial Passenger Fishing Vessel (CPFV) operators, non-consumptive users, conservationists, the scientific community, and any other group or persons identified by the Commission or Department. The Department will solicit nominations for the different stakeholder representatives. These individuals will be appointed by the Director of the Department to the RACs and will serve for a term to be determined by the Fish and Game Commission.

Table 1.3-2. Possible scenario of implementation of management measures and tools on a regional basis[1]

	Current	Short-term	Long-term
Management measures			
Fishery control rules	Statewide	Statewide	Statewide or by region
Marine reserve areas	Current MLPA process	By region - phased in	By region
Allocation	Statewide	Statewide	Statewide or by region
Restricted access	Under development	Statewide - phased in	By region
Management tools			
For example, size limits, bag/trip limits, seasonal closures	Statewide for state managed species; by region for Council managed species	By region - some phase in may be required	By region

1. This scenario applies to the approaches, not to the specific management regulations. For example, each region might have a different harvest level for a specific species, but these harvest levels would be calculated using the same statewide fishery control rule. In the long-term, however, as some species move from being data-poor to data-moderate, the fishery control rules might shift to different stages which might then be applied regionally.

The RACs will receive reports from the Department on the status of the fishery (Figure 1.3-2). If these reports indicate the need for quick action, then Department staff will convene a conference call with RAC members. Each committee will meet once each year, most likely in the spring. The Department will provide the RACs with an annual status report of the fishery and Department management recommendations. Based on these materials, public discussions, and the RAC meeting, the RACs may decide to provide recommendations to the Department regarding management of the fishery. The Department will forward the RAC's recommendations and views along with its regulatory package to the Commission. An example timeline showing RAC involvement management/regulation process is shown in Appendix H.

Initial planning indicates that supporting the regional management approach will involve the following activities in each region:

- acquiring sampling and landings data
- acquiring fishery-independent data
- acquiring socio-economic information
- editing and maintaining databases
- tracking landings during the season
- analyzing data
- developing and reviewing regulations
- developing and implementing major management programs such as restricted access
- enforcing regulations
- supporting regional advisory committees and other constituent involvement activities
- coordinating with other regions, agencies, and the Commission
- providing administrative support

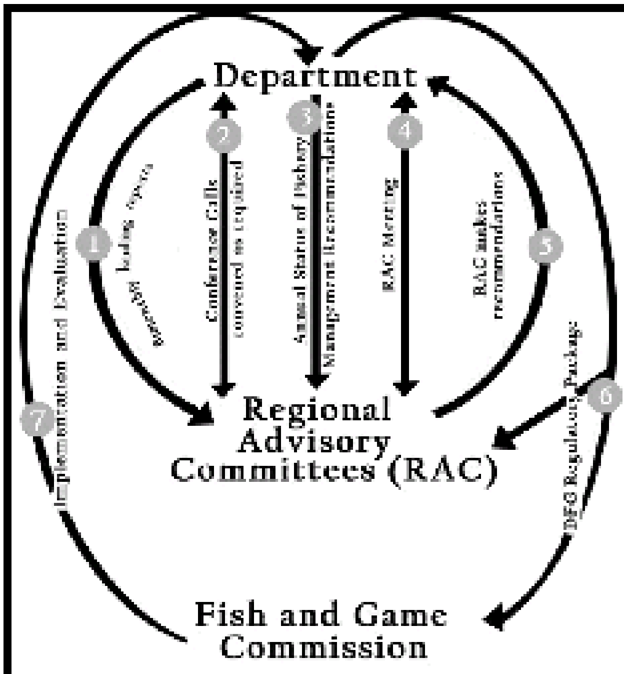

Figure 1.3-2. Flow of information and recommendations between the regional advisory committees, the Department of Fish and Game, and the Fish and Game Commission. The numbers track the flow of recommendations and information over time.

Understanding Marine Protected Areas

While the fisheries management strategy described in Fishery Control Rules will contribute significantly to meeting the goals and objectives of the MLMA for sustainable fisheries, it will not eliminate uncertainty and risk, particularly the risk of geographical depletion. Nor will it contribute to equally important MLMA goals of conserving ecosystems and habitat, improving understanding of marine systems, and providing for non-consumptive activities such as diving in areas in which portions of ecosystems are preserved.

Marine Protected Areas, especially marine reserves where no commercial or recreational take is allowed, are uniquely capable of eliminating several remaining risks to the sustainability of fishing and to conserving ecosystems and habitat. While conventional management measures such as time and area closures have been used to protect certain species in certain areas at certain times, they generally do not protect whole communities of organisms. For these reasons, the NFMP proposes a substantial role for MPAs. However, rather than establishing these MPAs itself, the NFMP relies on the process now underway under the authority of the MLPA. Current MPAs are shown in Figure 1.3-3, 1.3-4 and 1.3-5. The MLPA calls for a more simplified system and will only use three designations for protection from extractive uses. These are State Marine Reserves (SMR), State Marine Conservation Areas (SMCA), and State Marine Parks (SMP).

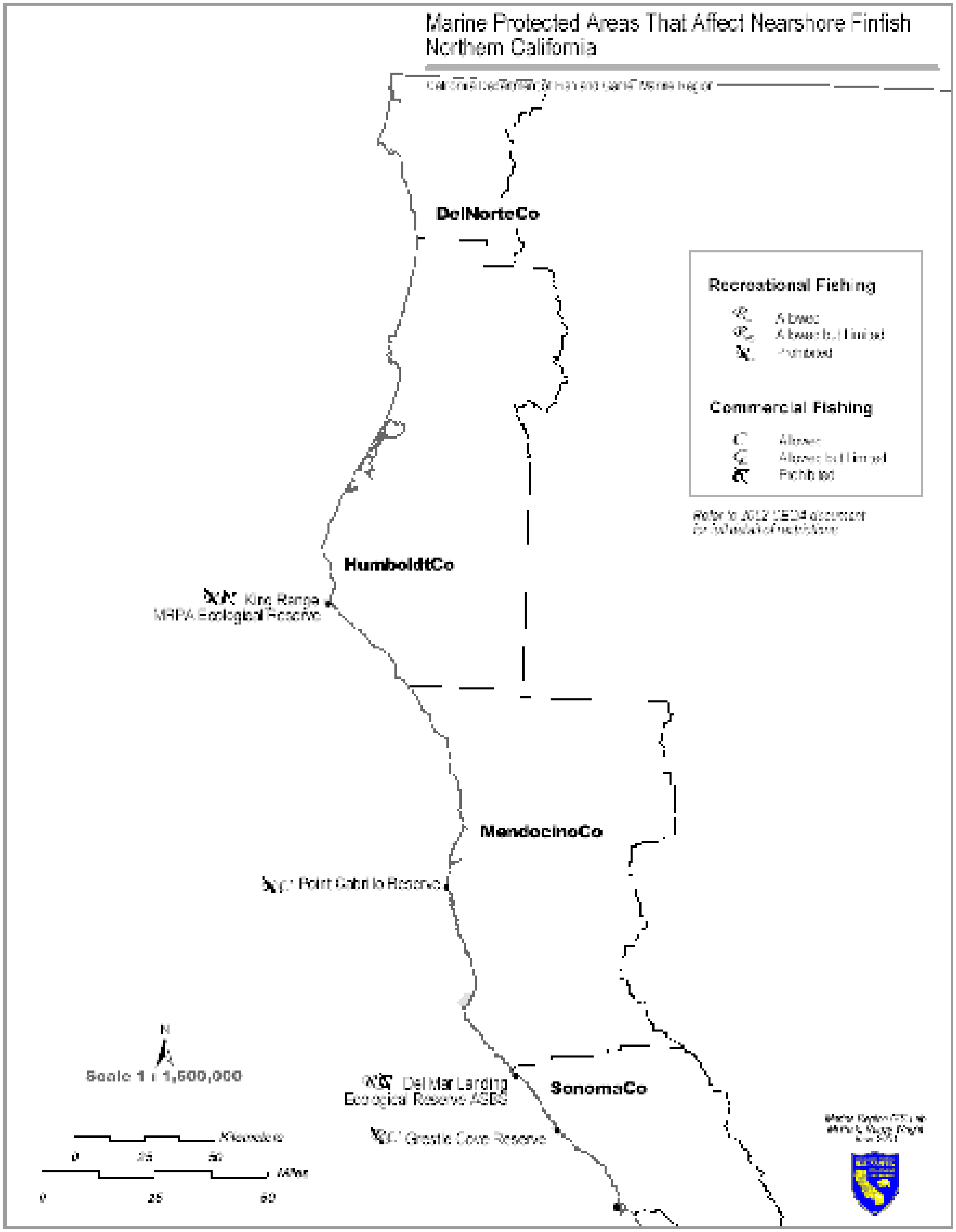

Figure 1.3-3. Northern California marine protected areas

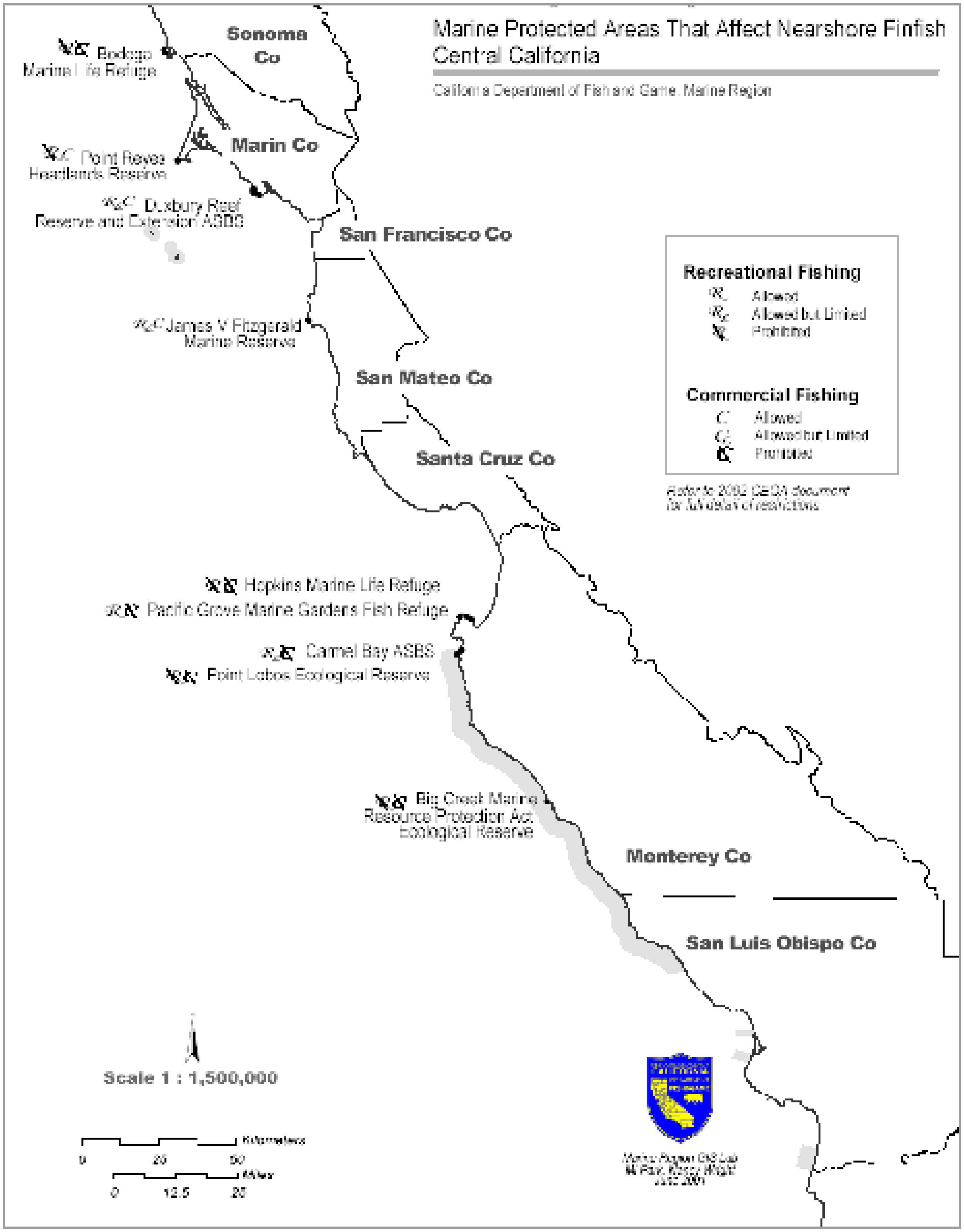

Figure 1.3-4. Central California marine protected areas

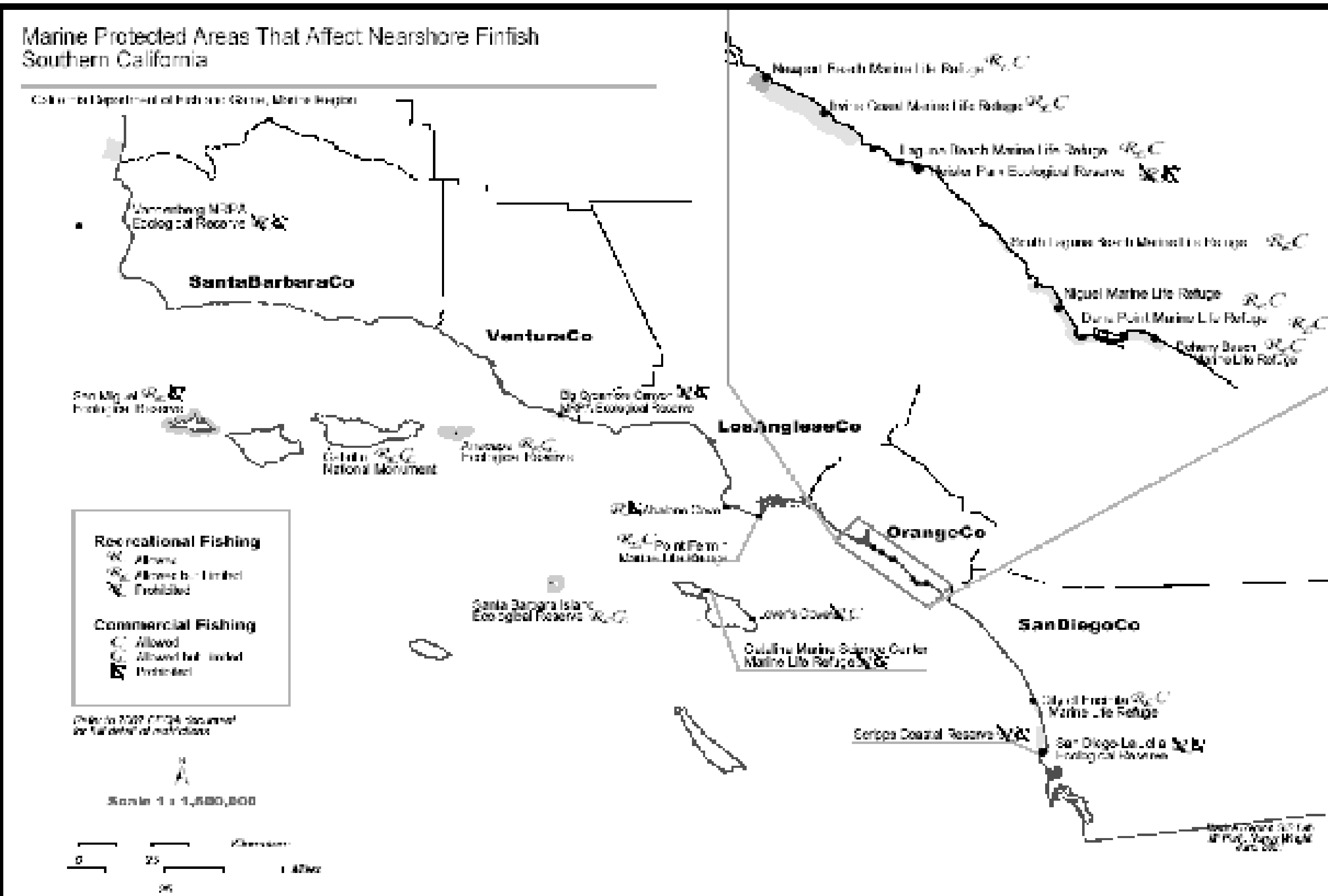

Figure 1.3-5. Southern California marine protected areas

State Marine Reserves, the MPA area designation that eliminates all take from the reserve area, are among the most effective means of protecting ecosystems and habitat and of recognizing non-consumptive uses of marine resources—all elements of responsible management under the MLMA. Unlike other management measures that focus on protecting particular species or groups of species, SMRs seek to protect entire communities. Within SMRs, fish populations generally have been found to be denser and more diverse than in fished areas. Besides possible benefits to fishermen from fish that emigrate from SMRs, these areas provide unusually rich experiences for divers. Without the disturbance caused by fishing, fish communities in SMRs can return to a more natural state that is valuable in and of itself. As a result, trends in their abundance can elucidate marine processes that are otherwise beyond study, making it possible to distinguish the impacts of human activities such as fishing from the impacts of natural phenomena such as climate change.

State Marine Conservation Areas regulate the catch allowed in protected areas by identifying certain species, or guilds of species, that can not be taken. In addition, certain types of recreational and commercial fishing gear may be endorsed or prohibited.

A third form of MPA regulation is the State Marine Park, where all commercial fishing is prohibited and recreational fishing may be prohibited for certain species or groups of species, such as the 19 NFMP species.

In recent years, the role of MPAs and marine reserves has received increasing attention and study. In 2001, the National Research Council (NRC) of the National Academy of Sciences published an exhaustive review of MPAs generally and marine reserves specifically (NRC 2001). The NRC found that marine reserves can address one or more of the following fisheries management objectives:

- allow depleted fisheries to recover from overfishing, with the most dramatic recovery occurring within the boundaries of a reserve
- prevent the collapse of fish stocks, especially if key fishery habitat is included within the boundaries
- improve sustainable yield of fisheries, through spill-over of juveniles and adults from reserves into fishing grounds and perhaps through dispersal of larvae into fished areas if networks of reserves are properly designed
- provide the only effective means to ensure against overfishing of some species if exploitation is high and there is substantial uncertainty in stock assessments—both conditions that exist in the nearshore finfish fishery
- particularly in the case of relatively sedentary fish such as nearshore finfish, protect a portion of populations from errors in assessing risk and from environmental fluctuations

The NRC report also confirmed that marine reserves protect representative and unique marine habitats, ecological processes, and biological diversity.

Marine Protected Area Approach

The goals of the MLPA are complementary to those of the MLMA and the NFMP. They include protection of ecosystems, representative habitats, and marine wildlife populations. The MLPA recognizes that current MPAs are ineffective in meeting the goals of the Act, and requires the Department to develop a Master Plan for MPAs in California, including recommendations on specific sites for MPAs, implementation and phasing, funding, monitoring, enforcement, and management.

Marine Reserves (and to a lesser degree Marine Conservation Areas and Marine Parks) are especially capable of meeting the MLMA's goals regarding conservation of ecological communities and allowing non-extractive uses of marine living resources. To meet these goals, according to the NRC report, a minimum of 10% of appropriate habitat should be included in marine reserves, if management outside the reserves is excellent. If management outside the reserves is less effective, 20% or more area may be required. A network of MPAs should place reserves and conservation areas close enough together to benefit from larval transport between MPAs. In addition, the size of individual MPAs must be large enough to protect adequate spawning biomass and to retain larval recruitment from outside of the MPA.

The total benefits that a network of MPAs can provide are still not completely clear. It is well established in the scientific literature that there are positive localized effects from MPAs (Dugan and Davis 1993; Roberts 1998; NRC et al. 2001; Palumbi 2001; Halpern forthcoming). However, there currently is a limited understanding of the regional effects of a network of MPAs on fisheries populations (Palumbi 2001). In addition, there is little known about larval dispersal distances and connectivity between remote geographic locations. For that reason, California MPAs will provide opportunities for long-term research.

The MLPA requires that MPAs in each region encompass a representative variety of marine habitat types and communities, across a range of depths and environmental conditions. Similar types of marine habitats and communities should be replicated in more than one marine reserve in each region designated by the MLPA. These requirements are consistent with establishing a network of reserves that will contribute to the MLMA's goals of sustainable fisheries, ecosystem and habitat protection, and the recognition of non-consumptive uses.

Under the MLPA as amended in 2001, the Department must submit to the Commission a draft Master Plan for MPAs, together with regulatory language and environmental analysis, by January 2003. The Commission must adopt a final Master Plan and preferred alternative for the siting of MPAs by December 2003.

If the individual, networked sites in the MLPA Master Plan are to fulfill the goals of the MLMA and the NFMP, they should have the following natural features and restrictions:

- restriction of the allowed take in any MPA so that the directed fishing or significant bycatch of the 19 NFMP species is prohibited (Dugan and Davis 1993; Fujita et al. 1997; Lauk et al. 1998; Murray et al. 1999; Roberts et al. forthcoming; NRC 2001)

- include some areas that have been productive fishing grounds for the 19 NFMP species in the past but are no longer heavily used by the fishery (Davis1989; Dugan and Davis 1993; Murray et al. 1999; NRC 2001; Palumbi 2001;Roberts et al. 2001; Roberts et al. forthcoming)

- include some areas known to enhance distribution or retain larvae of NFMP species (Leaman 1991; Dugan and Davis 1993; Ballantine 1997; Fujita et.al1997; Lauk et. al 1998; Roberts 1998; Murray et. al 1999; Parrish 1999; NRC 2001; Palumbi 2001; Parrish et. al 2001; Roberts et. al forthcoming)

- consist of an area large enough to address biological characteristics such as movement patterns and home range. There is an expectation that some portion of NFMP stocks will spend the majority of their life cycle within the boundaries of the MPA (Dugan and Davis 1993; Ballantine 1997; Fujita et. al 1997; Roberts 1998; Murray et. al 1999; Paddack and Estes 2000; NRC 2001; Palumbi 2001; Parrish et. al 2001; Roberts et. al forthcoming)

- consist of areas that replicate various habitat types within each region including areas that exhibit representative productivity (Dugan and Davis 1993; Ballantine 1997; Fujita et. al 1997; Lauk et. al 1998; Roberts 1998; Murray et. al 1999; NRC 2001; Palumbi 2001; Parrish et. al 2001; Roberts et. al forthcoming)

The Department and Commission will continue to closely coordinate the NFMP with the MLPA process. The Department and Commission will annually review progress of the MLPA process in contributing to the goals and objectives of the NFMP and in reflecting the considerations described above. Once the Master Plan has been adopted by the Commission, the Department and Commission will thoroughly review the plan and adjust the NFMP accordingly.

Understanding Restricted Access

Matching fishing capacity of fleets with available resources is key to fisheries that are economically and ecologically sustainable. When fishing capacity is significantly greater than fish populations are likely to sustain, fishing activities must be restrained through time closures, gear restrictions, and other measures. Applying such restrictions often is ineffective in bringing fishing effort into balance with fish populations and encourages fishermen to race for the fish by fishing longer or by investing in more fishing gear. Although the number of participants in the commercial nearshore finfish fishery has been declining, the capacity of fishing fleets remains far above levels necessary to fill **quotas**.

> **quota** - means a specified numerical objective for landings (excluding discard mortality), the attainment (or expected attainment) of which may cause closure of the fishery.

Restricted access programs attempt to balance the fishing capacity of the commercial fleet with the size of the resource in a way that results in an economically viable and sustainable fishery. It also promotes conservation among participants by giving them a sense of ownership in the fishery. The MLMA specifically recognizes the value of restricted access in promoting sustainable fisheries. Restricted access is one of the management measures specifically mentioned by the MLMA (FGC §7082). The MLMA also includes the establishment of a restricted access program (FGC §8587.1) as one of the regulatory measures that the Commission may apply to the nearshore finfish fishery. Finally, the MLMA calls for allowing fishery participants to suggest ways of reducing or avoiding excess fishing effort in fisheries [FGC §7056(e)].

In 1999, the Commission adopted a policy statement to guide the development of restricted access programs (Appendix I). The policy identified four principal purposes for restricted access programs, consistent with the MLMA. These are:

- to promote sustainable fisheries
- to provide for an orderly fishery
- to promote conservation among participants
- to maintain the long-term economic viability of fisheries

Among other things, the policy requires the following:

- programs must be developed with the substantial involvement of participants, as described in FGC §7059
- programs must be reviewed every 4 years
- programs not based on harvest rights must include a capacity goal that matches the fishing capacity of a fleet with available catch limits
- programs must include a means of adjusting fleet capacity to meet the capacity goal
- where a fleet is above the fishery's capacity goal, transfers of permits can be allowed only if consistent with meeting the capacity goal
- a restricted access permit may include a fee above administrative costs to pay for other management and conservation costs
- transfer of a permit may allow a vessel upgrade, but only if the program includes a permit consolidation or vessel retirement process
- any program based on harvest rights must consider the following, among other things:

  a) past participation in making a fair and equitable initial allocation of shares
  b) assessments for establishing TACs
  c) limits on concentration of shares
  d) cost recovery from quota owners
  e) transferability of shares
  f) recreational fisheries

The NFMP Project uses the Commission's policy as a framework for developing restricted access programs for the nearshore finfish fishery.

The Nearshore Commercial Fishery

California's nearshore commercial fishing fleet primarily uses line or trap gear to catch nearshore species. The NFMP Project will manage 19 of these species. Of these 19 species, the NFMP Project will develop a restricted access program initially for the 10 species identified in the MLMA (FGC §8588). Of these 10 species, the five rockfish species and California scorpionfish are actively managed by the Council, which has placed caps on catches in the last several years. The 10 species also include cabezon and kelp greenling, which are included in the federal fishery management plan for Pacific coast groundfish but are not actively managed by the Council, as well as California sheephead and rock greenling. Therefore, these four species are subject to regulation by the Commission, which set limits on recreational and commercial catches for 2001.

In 1996, the southern California finfish trap fishery became a limited entry fishery by the adoption of the requirement for a finfish trap permit to take finfish between Point Arguello in Santa Barbara County and the California-Mexican border. The number of permits issued for the fishery has fallen from more than 300 in 1997-1998 to 125 permits in 2000-2001.

Beginning in 1999, the MLMA required that commercial fishermen landing any of the 10 species possess a nearshore fishery permit. For the 1999-2000 fishing year, more than 1,100 permits were sold. In 2000, the Commission imposed a moratorium on the issuance of new permits. For the 2001-2002 fishing year, 750 nearshore fishery permits were issued. Of these permittees, 119 also held finfish trap permits. In 2001, the Commission required that fishermen have landed at least 100 lb of nearshore fish in the period 1994-2000 in order to qualify for a permit in 2002-2003. It is expected that this measure will reduce the number of permittees to about 525. The Commission also has set a control date of 31 December 1999; only those who participated in the fishery before this date will be eligible for any restricted access program.

A key element of any restricted access program that is not based on harvest rights is to set a capacity goal for a fleet. In a basic sense, a capacity goal is set based on how much fishing power can take allowable catches. In the case of the nearshore finfish fishery, the Council and the Commission have set limits on catches of various species. The Commission, for instance, adopted the Department’s recommendation to base catch limits on recent average catches reduced by 50% as a precautionary measure. The OYs set by the Commission and Council represent the allowable catches with which the fleet capacity must be matched in setting a capacity goal.

In some fisheries, fishing power or capacity can be measured by the size of nets used or length of the hull and the number of participants. The diverse and small-scale character of the nearshore commercial fishery prevents the use of such measures. Instead, the most practical measure is past performance. Using this approach, a reasonable range for current capacity in the commercial fishing fleet can be developed using catches during a period such as 1994-1999. Maximum catches in this period can serve as an upper bound on a realistic estimate of capacity, while average catches can serve as a lower bound on fishing capacity.

If the nearshore fleet’s capacity is based on maximum catches by the number of fishermen with nearshore permits in 1999, the current fleet has a capacity of more than 1.9 million lb (86,000 kg). This is almost seven times the current commercial allocation, and twice the highest annual landings on record.

This imbalance has resulted in heavy pressure on nearshore finfish populations, leading to restrictions on the commercial fishery such as the reduction of the fishing week to three days in 2001. By beginning to bring the fishing capacity of the fleet back into balance with available resources, a restricted access program will promote the ecological and economic sustainability of the fishery, consistent with the MLMA and Commission policy. Also, as the fleet comes into balance, there will likely be less need for the restrictions that have characterized the last several years.

Although there are many types of restricted access programs, several types are likely worth evaluating for the nearshore finfish fishery. These are described in Table 1.3-3. The NFMP does not specify a single type of restricted access program. Instead, it uses the Commission's policy on restricted access as the framework within which to develop restricted access programs in the coming years.

Because of the regional character of the fishery, initial efforts will focus upon developing restricted access programs appropriate for individual regions. An effective program for the nearshore fleet north of Cape Mendocino (Humboldt County), where the fishery is relatively small and new, is likely to be quite different than an effective program in southern California, where a larger fishery has operated for more than a decade.

Restricted access programs will evolve with time and changes in the fishery itself. Furthermore, the periodic review required by the Commission's policy will encourage adjustments. The NFMP anticipates that restricted access programs will evolve toward greater transferability and toward harvest rights.

Table 1.3-3. Comparison of the different restricted access programs

Type of program	Description	What happens when the TAC* is reached?	How can they increase their share of the TAC?	Benefits/drawbacks

Basic restricted access	One TAC for each region, which is available to all. May need a set-aside for bycatch.	All fishing in the region ceases.	Use more gear and/or fish more days.	Does not slow the race to fish or promote resource stewardship. Additional management measures likely (i.e., time/area closures). Monitoring costs minimal.
Tiered	The region's TAC is split between the tiers. The tier's allotment is available to all. One tier could be made up of people landing nearshore species incidentally.	Fishing ceases for all members of the tier that has caught its allotment. Other tiers may remain open.	Use more gear and/or fish more days.	Does not slow the race to fish or promote resource stewardship. Additional management measures likely (i.e., time/area closures). Monitoring costs increased over basic program.
Tiered, stackable	The region's TAC is split between the tiers with equal division of the tier's allotment to each participant in that tier. One tier could be made of people landing nearshore species incidentally.	When an individual catches their quota, they must cease fishing. Other participants that have not caught their quota may continue fishing.	Buy or lease permits, within prescribed limits	Stops the race to fish and promotes stewardship of the resource. Enforcement and licensing costs increase due to tracking individual's fishing activity. Requires real-time management.
Individual fishing shares (IFS)	Individual shares of the TAC based upon fishing history (usually expressed as a percentage of the TAC). May need a set-aside for incidental take in other fisheries.	When an individual catches their share, they must cease fishing. Other participants that have not caught their share may continue fishing.	Buy or lease additional shares, within prescribed limits.	Stops the race to fish and promotes stewardship of the resource. Enforcement and licensing costs increase due to tracking individual's fishing activity. Requires real-time management. May have to wait until management authority is transferred to the State.

*TAC = total allowable catch

The Recreational Fishery and Commercial Passenger Fishing Vessel Fleet

Unlike the commercial fishery, participation in the recreational fishery for nearshore species is not limited by permits. Recreational fishing effort is limited by seasons and bag limits, and recently by restriction of gear to one line with two hooks. The NFMP Project does not restrict access to the recreational fishery.

Some recreational fishermen do rely on CPFVs to get to fishing areas. Currently, CPFVs are required to have a commercial boat registration and a CPFV license. If it should become necessary to restrict the number of vessels participating in this fishery, the first step is a control date, after which new vessels entering the fishery would not be guaranteed participation in a CPFV restricted access program. A control date could be set statewide or regionally, depending upon trends in the fishery.

<u>Approach to Restricting Access to the Nearshore Fishery</u>

The adopted approach is to develop a restricted access program for the nearshore fishery. However, the NFMP does not specify which type of program should be developed. Different types of restricted access programs may be appropriate for different regions or sectors of the nearshore fishery. There are four types of restricted access programs under consideration. These include basic restricted access (limiting the number of participants); a tiered system which places participants in different tiers based on fishing history and sets a quota for the tiers as a whole; a tiered, stackable system which places participants in different tiers, gives everyone in the tier an equal part of the tier's quota, and allows participants to stack permits, within limits; and finally, an Individual Fishing Share (IFS) system which gives shares of the quota (usually expressed as a percentage of the overall quota) to individuals who can use, buy, sell, or lease shares, within limits. These four programs are discussed in detail below.

A moratorium currently exists on issuing permits required to take 10 of the 19 nearshore species. Under this approach, a formal restricted access program would be adopted for the take of these 10 species. The Commission's policy on restricted access would be used in developing this program (California Fish and Game Commission 2001). As part of that policy, a capacity goal would be established based on Department and industry input and using the best available biological and economic data. With the implementation of regional management, a capacity goal will be established for each region. Should the number of participants be very different from the capacity goal a mechanism to reach that goal would also be necessary. This can be achieved by attrition, 2-for-1 or other similar means of transferring permits, annual performance requirements or vessel buybacks.

Initial qualifying criteria would likely be based on historic landings in the fishery; possibly combined with a requirement of participation in the fishery in recent years. The number of years that a fisherman participated in the fishery may also be considered. A control date of 31 December 1999 has been set for this fishery, which means that participation prior to that date will be necessary to be included in the restricted access program. When regional management is implemented, qualifying criteria will be set for each region. Once someone qualifies for a region, they could no longer fish in another region unless they also qualify for a permit in that region. Four approaches, below, describe different types of restricted access programs and the advantages and disadvantages of each.

The recreational fishery has no permit or limitation on the number of people that can fish in the nearshore area. However, they do have season and bag limits in place to ensure that the recreational allocation is not exceeded. There is little support within the recreational community for restricting the number of fishermen in the nearshore area as that is the most accessible area for small boats. Commercial Passenger

Fishing Vessels take anglers to the fishing grounds for a fee. With the possibility of extensive closures for shelf rockfish and other species, effort by CPFVs for nearshore fishes may increase.

Basic Restricted Access Program

A basic restricted access program limits participation in a fishery to a number which matches or is close to the capacity goal. In addition, a mechanism to reach the capacity goal (transferability issues) and initial qualifying criteria would be set. This program would also set fees to offset the costs of administering the program.

The advantage of a basic restricted access program is that it is the easiest program to monitor because there is just one quota, unless there is more than one region. However, the differences in fishing practices and historical participation make it difficult to develop an equitable program statewide. The advent of regional management could make this easier by splitting participants into smaller groups, hopefully with similar backgrounds. The disadvantages are that it does little to slow the race for fish or reduce overcapitalization and effort in the fleet. In addition, gear endorsements restrict fishermen to one type of gear which may not be as effective in catching the target species as another gear.

Tiered Restricted Access Program

A tiered restricted access program separates permittees into different tiers based on fishing history (such as gears used, level of participation). Each tier would receive a portion of the overall quota. Regional Management would provide for be a tiered program in one or more regions. If one tier reaches its quota all participants in the tier would have to cease fishing, while the other tier(s) remain open. A capacity goal for each tier would need to be developed along with mechanisms to reach that goal (transferability). To address bycatch issues, one tier could be for participants that catch nearshore fish incidentally. It is possible that not all tiers would be transferable. Initial qualifying criteria would have to be developed for each tier.

The advantages to this program are that it would help preserve the diversity of the fleet because there would be more than one way to qualify for a permit, and that it deals with bycatch directly. One disadvantage is that administrative and monitoring costs would increase as the number of tiers and regions . Additionally, effort may increase as participants attempt to attain a “fair” share of the tier’s quota.

Tiered, Stackable Restricted Access Program

A tiered, stackable restricted access program is similar to a tiered program in that permittees would be separated into tiers based on fishing history. Each tier would receive a portion of the overall quota. However, in a stackable tier program, the tier’s quota is divided evenly among participants. If one participant reaches his allotment, he would have to cease fishing, while others could continue fishing. Permittees would be able to buy or lease permits from other participants and stack them on their permit, within prescribed limits. Since the allotments add up to the available quota, there is no need to develop a capacity goal.

The advantages to this type of program are that it allows for many different levels of participation, and there is no incentive to increase effort. Management and administrative costs would increase in order to track each individual's landings as well as the number of permits.

Individual Fishing Shares Program

By dividing the total commercial harvest allocation into individual fishing shares (IFS), total fishing effort can be controlled while providing for an orderly fishery. Fishing shares represent an individual's portion of the total commercial allocation, and often are expressed in potential harvestable pounds, or as a percentage-share of the total commercial allocation.

Among other benefits, fishermen can time their harvest activities around favorable market conditions, and would have no incentives to overcapitalize fishing operations by investing in extra fishing equipment beyond what is necessary to catching their share (as this would reduce their profits). Lastly, this system fosters a sense of resource stewardship in the fishing shareholder, treating the resource as an investment with dividends accruing from conservation practices.

This approach could be applied by the Commission in the harvest of California sheephead. A transfer of jurisdiction from the Council to the State would be necessary to apply this approach to most of the other nearshore species, because they are part of the federal groundfish plan.

An IFS represents an exclusive right to catch a portion of the allowable commercial harvest, but does not convey title or ownership of unharvested fish resources. Permittees could buy, sell, or transfer their individual fishing shares subject to a cap on the percentage of the regional allocation that one person or entity may control in a season. Transfers or sales of fishing shares between permittees must be documented by the Department. Like a stackable tiers program, an IFS program requires greater administrative support, including timely monitoring of quota transfers and of landings.

<u>Understanding Allocation of Total Allowable Catch</u>

Allocation means to assign a pre-determined amount of resource to different sectors. For nearshore fishery management, this means setting aside a certain amount of nearshore fish for recreational and commercial extractive uses.

One of the most difficult and controversial aspects of management in many fisheries is the allocation of allowable catches between commercial and recreational fishermen. From area to area along the coast, and by species, there is a wide range of impacts on the nearshore ecosystem from recreational and commercial fishing. There is also a wide range of interaction or competition for species or access to areas between users. The NFMP, which the MLMA mandates, must address the allocation of nearshore finfish after ensuring that fisheries and resources are sustainable economically and ecologically.

The MLMA provides limited guidance on allocation. Specifically, the MLMA calls for:

- coordinating recreational and commercial fishery management [FGC § 7056(f)]
- maintaining a sufficient resource to support a reasonable recreational fishery [FGC §7055 (c)]
- encouraging the growth of commercial fisheries [FGC §7055 (d)],
- observing the long-term interests of people dependent on fishing for food livelihood, or recreation, and minimizing the adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies [FGC §7056 (i)(j)]
- allocating increases or restrictions of the overall harvest in a fishery fairly among recreational and commercial sectors participating in the fishery [FGC §7072(c)]

The Master Plan adopted by the Commission in December 2001 recognizes the difficulty of setting an overall, consistent policy on allocation, and calls for developing guidance on allocation decisions through a framework process developed in advance.

Discussions regarding allocation often center on different concepts of fairness. The Master Plan lists factors such as present versus historical participation, economics of the fishery, local community impacts, product quality and flow to the consumer, gear conflicts, non-consumptive values, fishing efficiency, and recreational versus commercial sectors as being factors to consider. Several of these factors can be illuminated by analyzing various sets of data. Unfortunately, all relevant data sets suffer from important shortcomings.

Other features of the nearshore finfish fishery must be taken into account in setting a policy on allocation. The nearshore area and species may present the only opportunity for some users (shoreline and skiff fishermen and divers) to enjoy California's marine living resources. Others, who do not actively fish or dive, may hold a strong desire to purchase and consume the nearshore fish taken by the commercial fishery. Dependence on and historical use of nearshore finfish varies tremendously along the coast.

Information Considered in the Selection of Allocation Approaches

The MLMA requires managers to consider extractive uses (such as recreational and commercial fishing that removes resources), non-extractive uses (such as underwater photography), and ecosystem aspects of marine living resources. Specifically it states "California's marine recreational 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 order to assure the long-term economic, recreational, ecological, cultural, and social benefits of those fisheries and the marine habitats on which they depend" (FGC §7055).

In developing options for allocating nearshore fisheries, the Department reviewed allocation policy and practices by a number of states, the federal government, and the governments of other countries (Appendix G).

Management tools such as catch quotas, seasons, area closures, bag limits, and other regulations can be used to allocate fishery resources, directly or indirectly, with the intent to increase or restrict a group's access or harvest of a resource. Decisions on allocation and the tools needed to implement those decisions must take into consideration complex biological, social, and economic factors.

Current Status of Allocation

Cabezon, California Sheephead, Greenlings, and Monkeyface Prickleback

In 2000, the Department proposed to the Commission that harvest levels of nearshore species under state management be based on an average of recent catches reduced by 50% as a precautionary measure in response to uncertainty about the status of the stocks and the data-poor situation of these nearshore fisheries. Initially six approaches for allocating nearshore catch were proposed.

Allocation shares ultimately were based on the historical catch ratios of California sheephead, cabezon, and greenlings by the recreational and commercial fisheries in the 1980s and 1990s. This period best reflects the changing character of the fishery by including years when each sector dominated the landings. In the 1980s, the recreational fishery landed most of these nearshore finfish. In the late 1980s, commercial landings rose with the expansion of a commercial live-fish fishery. In the 1990s, the commercial fishery dominated the take of these fish, and, overall, increased its landings substantially from what was recorded in the 1980s.

In December 2000, the Commission decided to allocate cabezon, California sheephead, and greenlings based on the ratio of commercial and recreational catches during the combined period: 1983-1989, and 1993-1999. The Department recommended and the Commission adopted management restrictions, including size limits, seasonal and area closures for commercial and recreational fishermen, and weekday closures for the commercial sector, in order to restrain catches within the adopted limits.

Nearshore Rockfish

Currently, the State adopts management measures and restrictions that are consistent with the PFMC's distribution of the OY it sets for nearshore rockfish south of Cape Mendocino, Humboldt County. In setting its allowable take the Council estimates anticipated recreational catches in the coming year based on current regulations. Upon recommendation of the Department, the Commission adopts regulations for the recreational fishery that are consistent with the Council's decisions. The Council then subtracts this recreational set aside from the Acceptable Biological Catch in order to determine the commercial set aside which is adjusted upward or downward based on the state of the stocks. The Council adopts commercial regulatory measures, such as trip-limits, as needed.

Allocation Approach

In developing the project, the Department considered several approaches to allocation that reflect recent experience and the comments of constituents, members of the Nearshore Advisory Committee, and the peer review panel (Appendix A). Through this process, four general approaches emerged. The adopted NFMP Project approach is the use of historical fishery information, applied regionally, with provisions for local decision-making processes to determine possible separation of areas and species.

This approach builds upon that used by the Commission in its allocations under the interim regulations adopted in December 2000 for cabezon, California sheephead, and the greenlings. This approach will apply the same general principle of using historical landings as a guide but will make two major changes. First, calculation of historical landings will be conducted after a careful review of commercial and recreational landings information to ensure use of the most accurate information possible. Second, allocation shares will be calculated by region rather than statewide.

The principal advantage of this approach is that it recognizes the significant regional differences in the fishery and improves the ability to track and monitor catch information. A short-term disadvantage is the need to phase-in regional management. Setting allocation decisions at a regional level helps provide for MLMA mandates of constituent involvement in decisionmaking. Additionally, it furthers efforts to assure that increases or restrictions of the overall harvest in a fishery shall be allocated fairly among recreational and commercial sectors participating in the fishery.

General List of Management Measures

Each of the alternative management strategies considered in the development of the NFMP relies upon the use of management measures for its implementation. Once the Commission sets an allowable catch level under the NFMP Project management strategy, the Commission must adopt one or more management measures to restrain catches within quotas. Similarly, in achieving other objectives of the NFMP and the MLMA, the Commission may adopt yet other measures. For instance, the Commission may impose restrictions on the use of certain fishing gear or fishing in certain areas at certain times in order to reduce the catch of vulnerable species. The types of management measures include:

- quotas
- harvest guidelines
- allocation
- landing limits including trip frequency limits, bag limits and punch cards
- control of bycatch
- time and/or area closures
- marine protected areas
- prohibition on take of certain species
- size limits
- permits, licenses, gear endorsements, fishing stamps, and fees
- controls on fishing gear

- other forms of effort control
- measures to monitor catch and effort or to enforce regulations

Although the Commission will normally establish, adjust, or remove management measures during annual or biannual review, the Commission may take such action at any time if it deems it necessary to meeting the goals and objectives of the NFMP and the MLMA. The Commission may adopt, adjust, or remove management measures for resource conservation or for social or economic reasons, as long as they are consistent with the procedures, goals, and objectives of the NFMP.

Quotas

Quotas are the maximum number or amount of fish that can be legally landed in a specified time period. A quota may apply to an entire fishery, a sector of a fishery, or to an individual fisherman. After a quota has been reached, that part of the fishery or that participant must cease fishing. Quotas may apply to catches of target species or bycatch species, or to catches in particular areas or during particular times. Quotas may be used to limit overall catches to sustainable levels, to allocate available catch among sectors, or to protect vulnerable species, among other purposes.

Harvest Guidelines

A harvest guideline is a numerical harvest objective that, unlike a quota, does not require a closure of a fishery when it is reached. A harvest guideline may be a single estimate of sustainable catch levels or a range of such estimates. A harvest guideline may also be expressed as an absolute weight of fish or a percentage of the entire stock size.

Allocation

Allocation is the distribution of opportunity to fish among user groups. When the harvest of a stock is restricted by management, the different groups of fishermen that use that stock often find themselves in conflict. The conflict occurs because each user group realizes it could harvest more fish if the other group did not exist or if the other group were restricted even further. From a biological standpoint, there is no fair or unfair allocation. Allocation is a political, social, and economic decision usually made by elected or appointed officials. In an attempt to be fair, allocation decisions are often made on the basis of historical catches. Disputes often arise over the accuracy of historical records, particularly when poorly documented fisheries are involved.

Allocation of fishery resources may result from any type of management measure, but is most commonly the result of a numerical quota or harvest guideline for a specific gear, fishery sector, geographic area, use, or vessel category. Most fishery management measures allocate fishery resources to some degree because they differentially affect access of each fishery sector to the resource. Fishery resources may be allocated to accomplish one or more biological, social, or economic objectives. The MLMA states in the FGC §7072 (c) "To the extent that conservation and management measures in a fishery management plan either increase or restrict the overall harvest in a fishery, fishery management plans shall allocate those increases or restrictions fairly among recreational and commercial sectors participating in the fishery.

Landing Limits, Trip Frequency Limits, Bag Limits, and Punch Cards

A landing limit is the amount of fish that may be taken and retained, possessed, or landed from a single fishing trip or during a specified period of time. The limit can be for a particular species, species group, or other grouping of fish, and the limit can be by weight or number of fish. A trip frequency limit is a limit on the number of trips during a specified period of time. Trips may be defined in various ways. Trip landing limits and trip frequency limits are used to limit the overall catch and/or delay achievement of a quota or harvest guideline. Trip landing limits can be used to minimize targeting on a species or species group while allowing landings of some level of incidental catch. Trip landing limits are most effective when fishermen can control what is caught. Trip landing and frequency limits may also be used to discourage waste by limiting landings to amounts that can be utilized by available markets and/or processing capabilities.

Bag limits are a type of trip or landing limit that has long been used in recreational fisheries. The intended effect of bag limits is to restrict the overall catch, to spread the available catch over a large number of anglers, and to avoid waste. Punch cards can be used as a reporting system to monitor catch and as a means of restricting catch in the recreational fishery.

Bycatch Restrictions

To one degree or another, nearly all types of sport and commercial fishing gear capture marine life other than the fish that are being sought. While recreational and commercial fishermen may retain some bycatch, they discard fish that are of an undesirable species, size, or quality, or that regulations require that they release. The MLMA calls for limiting bycatch to an acceptable types and amounts [FGC 7056(d)]. If the amount or type of bycatch is unacceptable, the MLMA calls for adopting management measures that minimize the bycatch and the mortality of discards that cannot be avoided. Management measures used to regulate bycatch include, a bycatch allowance that limits bycatch, gear restrictions, and time or area closures.

Time/Area Closures

Fisheries management sometimes prohibits fishing during certain times and/or in certain areas through closures in order to achieve conservation objectives or to reduce conflicts between user groups. Conservation objectives include the protection of spawning populations and of vulnerable species or life-stages, such as juveniles. Closures may also be used to reduce the amount of fishing effort and catches in observing a quota, to avoid localized depletion, or to rebuild populations in specific areas. Area closures can be effective for residential nearshore species because they are susceptible to localized depletion.

Marine Protected Areas

Marine protected areas are primarily intended to protect or conserve marine life and habitat. They include:

- marine life reserves, where no taking of marine life is allowed
- State Marine Parks, which allow recreational fishing and prohibit commercial extraction
- State Marine Conservation Areas, which 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 area's objectives, goals, and guidelines.

Marine protected areas are defined in the NFMP to include areas closed to all forms of take, as well as areas with specific limitations on gear allowed, species taken, and/or user groups allowed. The Marine Life Protection Act established a process for establishing MPAs.

Prohibited Species

Fisheries managers may prohibit the retention of species whose population status is poor. When caught, individuals of prohibited species must be released.

Size Limits

Size limits are used to prevent the harvest of either small or large fish. Minimum size limits reduce the harvest of small fish that have not reached their full reproductive capacity. Maximum size limits protect larger fish that produce more eggs. Slot limits include both maximum and minimum size limits. Size limits can be applied to all fisheries, but are generally used where fish are handled individually or in small groups such as in hook-and-line fisheries. Size limits lose their effectiveness when the survival of the fish returned to the sea is low.

Permits, Licenses, Gear Endorsements, Fishing Stamps, and Fees

The Commission may determine that effective management requires an accurate count of the number of participants in the fishery. To this end, the Commission may establish requirements for permits, licenses, gear endorsements, and fishing stamps. To protect the resource or to achieve other goals and objectives of the NFMP, the Commission may limit participation in the fishery, limit the number of people allowed to use specific types of fishing gear, or limit the number of people allowed to fish in a region or specific area. In addition, the Commission may establish fees as long as the fee is consistent with applicable law, management measures, and the goals and objectives of the NFMP.

Controls on Fishing Gear

Restrictions on the amounts, types, and use of gear are common management measures used to limit effort, protect habitat, protect specific species or life stages, avoid wasteful practices, or reduce the risk of depleting populations in specific areas.

The NFMP authorizes the Commission to establish, modify, or remove specific gear measures including definitions of legal gear, the amount of gear that can be used by an individual or a vessel, the size of vessels, gear marking, escape panels and ports, the length of time gear may be left unattended, and the time of day or the days of the week or time of year that a gear can be used.

Other Forms of Effort Control

The Commission may determine that successful management of fisheries requires limiting recreational or commercial effort in order to achieve the objectives of the NFMP. Effort limitation includes almost all methods of restricting or reducing fishing activities, such as gear restrictions and time or area restrictions. Limited entry programs restrict the total number of permitted fishing licenses or vessels; individual fishing shares limit the catch allowed per license, permit, or individual and may limit the number of individuals who participate. The total effort in the nearshore recreational fishery has recently been limited by regulations intended to protect not only nearshore species, but also overfished lingcod and rockfishes that spend their adult lives on the continental shelf.

Management Measures to Monitor Catch and Effort or to Enforce Regulations

Fisheries themselves can provide important information for management, including information on species, volume, and location of catches, type of fishing gear, bycatch, and measures of fishing effort. This information can be collected through logbooks, punch cards, designated landing stations, and observers on individual fishing vessels. The NFMP authorizes development of data reporting and observer programs as determined by the Commission. Any special reporting requirement will be imposed only if it is expected to enhance the ability to monitor the catch or bycatch accurately.

Under the NFMP, the Commission may require that, as may be appropriate and feasible, nearshore fishing vessels allow onboard observers for the purpose of collecting scientific information. Specifications for any observer program will be developed in cooperation and consultation with the operators of the fishing vessels under consideration.

The Commission may also require that vessel operators maintain and submit logbooks, that accurately record such information as: daily and cumulative catch by species; effort, processing, and transfer information; crew size; time; position; duration of fishing; sea depth; gear type; identification of vessels. Any special reporting requirement may be imposed only if it is expected to enhance the ability to monitor the catch or bycatch accurately.