Chapter 3. Prioritization of Fisheries

Due to the large number of California's marine fisheries, and the time and effort needed to prepare fishery management plans (FMPs), it becomes imperative to set priorities. Although the goal is to eventually develop FMPs for all California's marine fisheries, the Marine Life Management Act (MLMA) clearly states that the Master Plan will provide a prioritized list for preparation of FMPs. Fishery management plans are to be prioritized based on a fishery's need for changes in conservation and management measures in order to comply with state policies and requirements established by the MLMA [§7073 (b)2 FGC].

A species' absence from a prioritized list does not signify it is not a candidate for conservation measures; it just precludes it from being the subject of a Department of Fish and Game (DFG) FMP at present. A fishery that is not listed for prioritization or ranks low may be identified as a high priority in the future (see Chapter 7). An emerging fishery, for example, may be elevated to top priority and supercede existing prioritized FMPs.

3.1 Shortened List of Fisheries

A draft list of California's marine fisheries was submitted for review to marine fishery experts outside the DFG including representatives from the sport and commercial fishing industry, scientific community, and conservation groups. It was noted that due to the comprehensive and somewhat disparate nature of the data sources (Appendix C), some individual species and species groupings were included on the list that were not relevant. Species that reside primarily outside state waters or occur in fresh water habitats were eliminated. Additional species were suggested by breaking down a few of the species groupings into more specific components. This resulted in a final list of more than 375 marine fishes, invertebrates, plants and algae managed by the state (Appendix D). Appendices E and F list fisheries for which the Commission or Legislature has specific management authority.

Before prioritization, we shortened this list by selecting those species that are: 1) the subject of a significant directed marine fishery at present, were in the past, or may be in the foreseeable future; 2) not already included in an existing management plan (federal or state), or in one currently being developed; and 3) open to harvest or take.

This reduced the list to109 fisheries including 59 finfishes, 48 invertebrates, and 2 algae (Appendix G). Many of the species were eliminated because they are included in Pacific Fishery Management Council (PFMC) management plans (Appendix D); are currently the subjects of FMPs in development (nearshore finfishes, white seabass, and abalone); or due to an absence of a directed fishery, coupled with a lack of commercial or sport interest in the taking of these species.

The Master Plan recognizes the importance of the market squid fishery, but did not include it in the prioritization process due to concurrent legislative activities. The California legislature emphasized the importance of market squid and required the DFG to focus on this fishery and submit a report on its status along with recommendations for management and conservation measures. This report was submitted in May 2001. The Master Plan also recognizes that pending legislation would give authority for

management of squid permanently to the Commission and require the development of an FMP by the end of 2002. This would cause squid to be considered as one of the top priorities for an FMP.

3.2 Development of Criteria

Prioritizing California's marine fisheries for FMPs is a complex task. There are numerous intertwined issues, as well as much information (or lack of information) to consider. The DFG decided that a standardized approach was necessary. The guidelines for this process were that it should be objective, quantitative, equitable, reproducible, justified – and above all – credible.

As a first step, we evaluated current approaches to fisheries prioritization being used or developed by consulting groups, government agencies, the American Fisheries Society, and within the DFG. Although the fisheries being addressed often differed, the approaches generally involved evaluating lists of similar criteria that fall into the following categories:

Biological: Some species have characteristics that make them more vulnerable to or less able to rebound from exploitation.

Environmental: Some species have distributions and abundances that are greatly affected by changes in oceanographic conditions.

Fishery: Many species undergo varying degrees and methods of exploitation.

Socioeconomic: Some species have a higher value to sport or commercial fisheries.

Management: Some species have effective management regulations already in place.

We took components from several of these categories, modified them to better fit California marine fisheries, and developed a preliminary approach to prioritizing.

The draft prioritization approach was sent to marine fisheries experts in academia and the federal government for review. We also solicited input from the Marine Life Management Act Evaluation Advisory Committee (MLMAEAC), which is a group of constituents representing sport and commercial fishing, environmental and conservation groups, and the scientific community.

3.3 Prioritization Approaches

The comments and suggestions we received from the outside review resulted in three separate prioritization approaches. These approaches were intended to provide a rough cut of the highest priority fisheries. Approaches A and B were developed for finfishes, and differ slightly. Approach A emphasizes two main factors: a species' exploitation history and specific life history parameters. It identifies species of greatest concern without ranking them. Approach B, on the other hand, ranks species based on scores assigned to them from a wide variety of questions addressing aspects of their biology, habitat and environmental requirements, landings, management, and

economics. The main difference between the two approaches is the relatively greater emphasis on landings and landing trends in approach A. Approach C was developed for the prioritization of invertebrates, and uses life span as a primary factor.

These fisheries prioritization approaches are not static. Instead, they are evolving processes that incorporate changes as more information is gathered and input is received. Future versions of the Master Plan will refine these approaches, or develop new methods, to aid in the prioritization of fisheries for FMPs.

3.3.1 Approach A (Finfish)

This approach examined the exploitation history of each finfish species along with several life history parameters (Appendix H). Analysis of exploitation histories involved an evaluation of the amount and trends of sport and commercial landings over the past 20 years, taking into consideration effort, market conditions, regulations, oceanographic conditions, and other factors. We reviewed internal and external documentation, and consulted experts with unique knowledge of certain fisheries. The productivity of a species was inferred by considering several life history parameters: growth rate, fecundity, age at maturation, and life expectancy. The intent was to identify species with lower productivity, which would have greater difficulty rebounding from exploitation. The combination of exploitation histories and a low inherent productivity would identify those species of greatest concern and most in need of management attention.

3.3.2 Approach B (Finfish)

This approach was intended to identify species most vulnerable to overexploitation based on a wide variety of factors. This approach scored and totaled 18 questions addressing biological, habitat, environmental, fishery, management, and economic issues for each finfish species (Appendix I). Species were then ranked according to their total score.

3.3.3 Approach C (Invertebrate)

It was apparent that the prioritization approaches used for finfishes would not be directly applicable to invertebrates. Life history characteristics are very different or poorly understood for many invertebrates. In addition, there is little information on their sport take, and some species exploited in the past are now uncommon along the California coast.

Since a species' life span is an indicator of its response to environmental variation, it was selected as the single measure of how a species might respond to exploitation. In general, long life span indicates the relative difficulty for a species to "leave" successful offspring from each reproductive episode. Thus, more reproductive episodes (i.e. years) are needed in order for an individual to replace itself. Many invertebrates, for example, release tens of thousands of eggs and sperm into the water column during each spawning. However, distances between individuals and vagaries of currents can hinder fertilization. Furthermore, even if fertilization is successful, larvae and post settlement recruits experience a very high mortality rate and thus few survive

to become adults. The additional burden of exploitation would be expected to cause problems for long-term success of the species. All else being equal, long-lived species need more regulation.

The first part of this prioritization approach grouped invertebrates into either short (≤ 5 years), moderate (6-20 years), or long (> 20 years) life span categories. The invertebrates in the long life span group were then further prioritized based on current exploitation.

3.3.4 Approach D (Algae)

Because few algae remained after the list of fisheries was shortened (Appendix G), they were not prioritized further.

3.4 Results of Prioritization Approaches

3.4.1 Finfishes

Approach A identified 10 species of greatest concern, in no order of priority (Table 3-1). These finfish species generally have either high landings with significant decreasing trends over the years, very low productivity, or both.

Table 3-1. Species of greatest concern based on approach A (finfish).

Common Name	Scientific Name
Pile perch	*Rhacochilus vacca*
Redtail surfperch	*Amphistichus rhodoterus*
Shiner perch	*Cymatogaster aggregata*
Walleye surfperch	*Hyperprosopon argenteum*
White seaperch	*Phanerodon furcatus*
Barred sand bass	*Paralabrax nebulifer*
Kelp bass	*Paralabrax clathratus*
Brown smoothhound	*Mustelus henlei*
Gray smoothhound	*Mustelus californicus*
Shovelnose guitarfish	*Rhinobatos productus*

Approach B identified, in order of priority, California halibut, brown smoothhound, and white seaperch as top species for future FMPs (Table 3-2). Other species of surfperches (black perch, barred surfperch, pile perch, rainbow seaperch, and redtail surfperch) and sharks and rays (gray smoothhound and bat ray) also ranked high in this approach.

Table 3-2. Top ranked species based on approach B (finfish).	
Common Name	Scientific Name
Callifornia halibut	*Paralichthys californicus*
Brown smoothhound	*Mustelus henlei*
White seaperch	*Phanerodon furcatus*
White sturgeon	*Acipenser transmontanus*
Black perch	*Embiotoca jacksoni*
Barred surfperch	*Amphistichus argenteus*
Jacksmelt	*Atherinopsis californiensis*
Night smelt	*Spirinchus starksi*
Pile perch	*Rhacochilus vacca*
Bat ray	*Myliobatis californica*
Gray smoothhound	*Mustelus californicus*
Rainbow seaperch	*Hypsurus caryi*
Redtail surfperch	*Amphistichus rhodoterus*

It is not surprising that both approaches identified several surfperches and nearshore sharks as high priorities for FMPs. Surfperches and nearshore sharks possess certain life history characteristics such as low fecundity (long gestation periods and bearing live young) and slow growth, that make it difficult to rebound from exploitation. In addition, several surfperches and sharks utilize bays and estuaries as nurseries which make them particularly vulnerable to overfishing and habitat degradation. Several surfperches have undergone significant declines in catch, catch-per-unit effort, size, and abundance in fishery-dependent and fishery-independent surveys. In addition, there are relatively few regulations in place for surfperches and nearshore sharks. Both groups are a high priority for FMPs.

Barred sand bass and kelp bass were also identified as species in need of an FMP. Both of these finfishes are major components of the sport fishery in southern California. There is some concern for these resources since landings of these species, kelp bass in particular, have steadily declined. In addition, barred sand bass are often targeted in spawning aggregations, and kelp bass are non-migratory residents of rocky reefs subject to heavy fishing pressure. Barred sand bass and kelp bass are also relatively slow growing and long-lived which may hinder their ability to rebound from exploitation.

California halibut was identified as a top priority for an FMP by Approach B. This was primarily due to certain life history characteristics and the substantial, yet relatively stable, landings that occur for both sport and commercial fishing. California halibut are

long-lived and are dependent upon bay and estuarine habitats as nursery areas. These habitats are particularly susceptible to damage, and most of them have been lost or considerably altered from their original state.

3.4.2 Invertebrates

Thirteen invertebrates were identified as species of greatest concern, based on their long life spans (Table 3-3). Red sea urchins are by far the longest lived; large individuals may exceed an age of 100 years. Although the life span of California spiny lobsters is not known, adults are believed to be long-lived as well. Of the long-lived species, both red sea urchin and spiny lobster are the most exploited fisheries, and high priorities for an FMP.

Table 3-3. Species of greatest concern based on approach C (invertebrate).

Common Name	Scientific Name
Red sea urchin	*Strongylocentrotus franciscanus*
Purple sea urchin	*Strongylocentrotus purpuratus*
California spiny lobster	*Panulirus interruptus*
Sea cucumber	*Parastichopus* spp. *(P. californicus*, *P. parvimensis***)**
Wavy top shell	*Astraea undosa*
Kellet's whelk	*Kelletia kelletii*
Top shell	*Tegula* spp.(*T. funebralis,T. eiseni, T. gallina, T. aureotincta*)
Giant (owl) limpet	*Lottia gigantea*
Rock scallop	*Hinnites giganteus*
Gaper or horse clam	*Tresus nuttallii*
Geoduck	*Panopea generosa*
Pismo clam	*Tivela stultorum*
California mussel	*Mytilus californianus*

There are species in the early stages of exploitation that need special consideration because their life history attributes are less well known. Purple sea urchins probably live for at least 50 years. Size structure of sea cucumber, wavy top shell, and Kellet's whelk populations all show very few small individuals, which suggests low recruitment rates and long life. All of these species are high priorities for FMPs.

There remain, however, a number of species that are not part of an established fishery or a developing commercial fishery, but are collected for food. Of these species, top shells (*Tegula* spp.) and giant (owl) limpets are also long-lived. Although prohibited

from commercial take, giant (owl) limpets appear to be particularly affected by exploitation. These intertidal invertebrates are also a high priority for an FMP.

3.4.3 Algae

The major algal species harvested are giant kelp and to a lesser extent, bull kelp. These species are a high priority for an FMP even though an environmental document addressing them has recently been adopted. An FMP for giant kelp and bull kelp will contain information not in the environmental document such as data needs and research protocols, costs of implementation and research, harvest control rules with guidelines indicating when overharvesting has occurred, recovery plans, and a review process.

Although not on the shortened list of fisheries to be considered for FMPs, there are a number of algal species that currently represent a small harvest but have potential for further development. These are *Postelsia palmaeformis*, *Laminaria* spp., *Porphyra* spp., *Gracilaria* spp. and *Fucus* spp.

3.5 Assignment of Fisheries to Fishery Management Plans

Identifying species of greatest need for changes in conservation and management measures is only part of the goal. The MLMA requires that these individual species be assigned to FMPs. Fishery management plans may contain one or many species. If a fishery targets a single species and impacts no others, then a single species FMP may be best. Conversely, if a particular fishery commonly takes many species, even though it is targeting a single species, then a multiple species FMP may be more appropriate.

The three prioritization approaches identified several species that are taken in the same fishery or have similar life histories. Several of these species can be grouped into the same FMP. Therefore, we propose ten groups of species as the top priorities for future FMPs (Table 3-4).

3.6 Top Three Fishery Management Plans

Since the MLMA requires that research protocols be developed for the top three fisheries identified in the Master Plan, we needed to further refine the list of the highest priority fisheries. This was difficult since there was no single approach to prioritize finfishes, invertebrates, and algae together due to differences in their life histories, fishery characteristics, and our knowledge regarding these areas. The three prioritization approaches were used to identify the groups of species most in need of an FMP, but were not intended to produce a strict ordination of top fisheries. It was felt that some degree of subjectivity would ultimately be involved in determining the order of the top fisheries. For example, several important criteria such as the ecosystem role of the target species, amount of bycatch in a fishery, and habitat impacts were difficult to quantify and incorporate into the prioritization approaches. These issues need to be considered in the final selection of top FMPs.

Table 3-4. Top fishery management plans and species groups identified from prioritization approaches.	
Fishery Management Plan	Species
Surfperches	White seaperch, redtail surfperch, pile perch, shiner perch, walleye surfperch, black perch, barred surfperch, rainbow surfperch, striped seaperch, and rubberlip seaperch
Nearshore Sharks and Rays	Brown smoothhound, gray smoothhound, Pacific angel shark, shovelnose guitarfish, and bat ray
Sea Basses	Barred sand bass and kelp bass
Halibut	California halibut
Sea Urchins	Red sea urchin and purple sea urchin
Lobster	California spiny lobster
Sea Cucumbers	Giant red sea cucumber and warty sea cucumber
Subtidal Snails	Kellet's whelk and wavy top shell
Intertidal Invertebrates	*Tegula* spp. and giant (owl) limpet
Kelp	Giant kelp and bull kelp

Based on our analysis, it was clear that at least ten species or species groups are in need of management plans. After reviewing public input, we decided upon sea urchins, California halibut, and nearshore sharks and rays as the top three fisheries for the following reasons:

Sea urchins

Sea urchins are locally abundant, subtidal invertebrates that play an important ecological role in kelp forest communities. Sea urchins graze on kelp, provide habitat and shelter for other species, are important prey, and compete with other species, such as abalone, for food and space. In addition, red sea urchins support one of the most economically valuable commercial fisheries in California. The fishery began in 1971 with statewide landings peaking in 1988. However, fishery-dependent and fishery-independent data have indicated dramatic declines in catches and reductions of harvestable stocks since then. Current management policies have been ineffective in curbing these declines.

Evidence from both DFG and academic researchers indicates that red sea urchin stocks in northern California are overexploited in at least three of the four major port areas. Age and growth data indicate that our present management, based on minimum size limits, is not protecting the portion of the spawning stock most important for long-term population growth in the northern fishery.

Southern California's red sea urchin stocks also show evidence of depletion. The catch at the northern Channel Islands has steadily fallen from about 16 million pounds in 1991 to just over 3 million pounds in 2000. The northern Channel Islands have provided

the majority of the statewide sea urchin catch since the fishery began in 1971. Although catch declines are more difficult to interpret In southern California for a variety of reasons, potential sea urchin fishery effort appears to be far in excess of the available harvestable stock. In order to address this problem and the overexploitation of the northern California resource, a sea urchin FMP is needed. A draft sea urchin FMP was developed in 1994 but was not implemented, due partly to the lack of a guiding mandate such as the MLMA.

California halibut

California halibut are found statewide, are highly prized by sport fishermen, and support a viable commercial fishery. The halibut population appears healthy based on stable sport and commercial catches. However, the DFG faces several issues related to management of the halibut fishery that could be addressed by an FMP.

One of the main issues concerning the halibut fishery is a user-group conflict between sport and commercial fisheries. Currently both are open year round and are often in direct competition. In addition, there are gear and area conflicts as halibut are taken by hook and line, gillnets, and trawls.

Another issue is bycatch. Federal observers have documented bycatch of marine mammals and seabirds in the halibut gillnet fishery that is cause for concern. Halibut are also taken by trawling, and bycatch consists of groundfish and other bottom dwelling species. Research into gillnet modifications, seasonal closures, and area closures may develop fishing methods that reduce the bycatch to lower levels. Research could also be applied to develop alternative fishing gear that is effective in taking halibut, but without the bycatch problem.

Juvenile halibut are known to utilize bays, estuaries, and other nearshore areas as nursery areas. Further research is needed to identify nursery habitat and quantify juvenile production throughout the state. Habitat protection is one of the most important issues facing management of many marine species. The above issues are well-suited for an FMP.

Nearshore sharks and rays

Nearshore sharks and rays share life history parameters that make them very susceptible to overfishing, including: slow growth, long life, low reproductive rates, and low natural mortality rates. They also utilize bays and estuaries as nursery areas, where they are susceptible to habitat loss and degradation. In addition, they are taken by a variety of gear and often not kept, resulting in poor catch data.

In general, the record of management for shark fisheries world-wide, has been a poor one. The rapid development of fisheries, combined with their low reproductive capacity, and a general reliance on fishery-dependent data as a source of information on life history parameters, has led to declines in nearly every developed shark fishery prior to the adoption of management regulations. In California, such declines prior to effective management have occurred in fisheries for the Pacific angel shark, thresher shark, spiny dogfish and soupfin shark.

Nearshore sharks and rays are taken by sport and commercial fishermen throughout California, except for the shovelnose guitarfish, which is rare north of

Monterey Bay. Commercial landings of Pacific angel shark peaked in the mid-1980s at over 1 million pounds, then began to decline. Minimum size limits were adopted in 1990, and gillnets, the primary commercial gear utilized in the Pacific angel shark fishery, were banned in state waters in 1994. In 1999, only 53,000 pounds of Pacific angel shark were landed.

Brown and grey smoothhound landings were only 10,000 pounds in 1999, but these sharks are possibly taken and discarded in trawl and other fisheries because of their low value. Bat rays are not widely regarded as a desirable food fish, but they are also taken by sport and commercial fishermen, then discarded.

There has been concern for the health of leopard shark and spiny dogfish populations. Leopard sharks are primarily found in bays, estuaries, and shallow nearshore waters where they are easily taken by sport fishermen. Although not targeted by sport or commercial fishermen, the spiny dogfish is probably significant bycatch in some fisheries. Both of these species are listed in the PFMC Pacific Coast Groundfish Plan but are not actively managed. The DFG is considering the addition of leopard shark and spiny dogfish to the nearshore sharks and rays FMP, which would require that PFMC transfer authority for management of these species to the state.