3.6 FISH AND SEA TURTLES

3.6.1 Introduction

3.6.1.1 Definition of Resource

This section addresses marine fish and sea turtles that inhabit or are known to occur within the Point Mugu Sea Range. Species of fish and sea turtles that are currently listed as either endangered or threatened under the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531) are specifically addressed. Section 7 of the ESA requires federal agencies to consult with the USFWS or the National Marine Fisheries Service (NMFS) to ensure that their actions do not jeopardize the continued existence of a listed species or its critical habitat.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA; 16 U.S.C. §§ 1801 - 1882) were implemented "to identify and protect important marine and anadromous fish habitat." In accordance with these amendments, NMFS has developed Fishery Conservation Management Plans (FCMPs) that identify Essential Fish Habitat (EFH). EFH is defined in the MSFCMA as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The MSFCMA requires federal agencies to consult with NMFS to ensure that their actions do not adversely affect EFH.

Three EFH zones have been identified off the west coast of the U.S.: 1) Coastal Pelagic, 2) Groundfish, and 3) Pacific Salmon. Two of the three EFH zones (Coastal Pelagic and Groundfish) occur within the Point Mugu Sea Range, both extending from the coastline out to 200 miles (320 km) offshore along the entire length of the west coast of the U.S. (i.e., from the Mexican to the Canadian border). The Coastal Pelagic EFH includes surface waters or, more specifically, waters above the thermocline where sea surface temperatures range between 50° F to 79° F (10° C to 26° C). The Groundfish EFH includes surface waters and benthos, encompassing all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths seaward to the 200 mile (320 km) boundary.

3.6.1.2 Regional Setting

A - Fish

About 481 species of fish inhabit the SCB (Cross and Allen 1993). The great diversity of species in the area occurs for several reasons: 1) the ranges of many temperate and tropical species extend into and terminate in the SCB; 2) the area has complex bottom topography and a complex physical oceanographic regime that includes several water masses and a changeable marine climate (Horn and Allen 1978; Cross and Allen 1993); and 3) the islands and nearshore areas provide a diversity of habitats that include soft bottom, rock reefs, extensive kelp beds, and estuaries, bays, and lagoons.

Point Conception is recognized as a boundary for the distribution of certain fish species, especially for southern species (Cross and Allen 1993). South of Point Conception, northern species tend to move into deep, colder water or upwelling areas. A few southern species occupy warm nearshore habitats such as bays and estuaries north of Point Conception. There are also seasonal migrations of temperate and subtropical species into the SCB and invasions of tropical species during warm-water years and northern species during cold-water years (Cross and Allen 1993).

During their life cycles and over the period of a day, fish may occupy more than one habitat. Some bays and estuaries serve as nursery areas for juveniles of some species. At night, some benthic and midwater species rise to the surface and other species that dwell in kelp forests may become pelagic (i.e., mid-water) or move out over soft or rock substrates (i.e., ocean bottom habitats).

For the period 1994 to 1995, the most commonly harvested commercial species in the Sea Range were Pacific sardine, Pacific mackerel, yellowfin and skipjack tuna, rockfish, northern anchovy, swordfish, Dover sole, and thresher shark (Table 3.6-1). During 1995, reported landings from the entire Sea Range (excluding tunas, bonito, sharks, and rays and other species for which California landings are not shown in Table 3.6-1) accounted for 4.1 percent of the entire California catch (Table 3.6-1). U.S. landings of tunas in the Pacific averaged 240,000 tons (220,000 metric tons) per year in 1990-92 (NMFS 1995). Total landings of all tuna on the entire Sea Range were 1,626 tons (1,475 metric tons) or about 0.7 percent of the U.S. Pacific catch of 240,000 tons (220,000 metric tons).

Table 3.6-1. Sea Range and California Commercial Fish Catch Totals (in metric tons)

	Entire Sea Range[1]	California Landings	Entire Sea Range as Percent of California Total
All tuna	1,626		
Pacific bonito	14		
Pacific mackerel	620	8,667	7.2%
Jack mackerel	38	2,640	1.4%
Swordfish	73	788	9.3%
Pacific sardine	1,952	43,450	4.5%
Northern anchovy	224	1,881	11.9%
Thresher shark	39	155	25.2%
Sharks and rays	27		
Sablefish	20	2,716	0.7%
Lingcod	12	538	2.2%
Other demersal fish	52	4,618	1.1%
Dover sole	32	6,043	0.5%
California halibut	11	347	3.2%
Other flatfish	8	3,036	0.3%
All rockfish	458	11,620	3.9%
Other fish	6		
Total	**5,212**		
Total[2]	**3,539**	**86,499**	**4.1%**

[1] Total landings of various fish species from the Sea Range, as compared with total California landings in 1995. Right column shows landings from the entire Sea Range as a percent of total California landings.
[2] Excluding tuna, bonito, sharks, rays, and other fish not listed above.
Source: CDFG 1996a,b.

B - Sea Turtles

Four species of sea turtles found in U.S. waters are known to occur at sea within the Point Mugu Sea Range. All are currently listed as either endangered or threatened under the ESA (NMFS/USFWS 1995). These include loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), eastern Pacific green (*Chelonia agassizi*), and olive ridley (*Lepidochelys olivacea*) (NMFS/USFWS 1992; NMFS/USFWS 1996a). The eastern Pacific green, also known as the black sea turtle, is considered by some to be a subspecies of the green sea turtle (*C. mydas*). None of these four species is known to nest on beaches in southern California.

3.6.1.3 Region of Influence

The region of influence (ROI) for fish and sea turtles consists of the Point Mugu Sea Range and the offshore areas surrounding Point Mugu, San Nicolas Island, and the other Channel Islands. Descriptions are based on literature surveys, previously conducted field surveys, and commercial fisheries data obtained from CDFG. Marine biology (e.g., marine flora and benthic organisms) is discussed in Section 3.5, and marine mammals are discussed separately in Section 3.7.

3.6.2 Point Mugu Sea Range

This section describes fish and sea turtles that are known to inhabit or occur within the Point Mugu Sea Range. This includes fish that inhabit coastal waters of Point Mugu, San Nicolas Island, and the northern Channel Islands. Fish known to inhabit the Mugu Lagoon are also addressed within this section. Since one of the issues addressed within this EIS/OEIS is the potential for Sea Range operations to affect fish catchability, specific focus is given to commercially harvested fish species.

3.6.2.1 Fish

<u>A - Fish Species by Depth</u>

This section describes fish that inhabit waters of the Point Mugu Sea Range. The fish that inhabit nearshore waters of the islands and the mainland are described later in this chapter (Section 3.6.3.1-B).

Figure 3.6-1 shows the general biological zones of a vertical water column in an ocean environment. Fish on the Sea Range can be pelagic (living in the water column), benthic (living on the bottom), or demersal (associated with the bottom, but often found feeding in the water column). The pelagic habitat can be subdivided into the epipelagic, mesopelagic, and bathypelagic zones (see Figure 3.6-1). Epipelagic habitats in the SCB extend down to depths of 328 feet (100 m) and are inhabited by nearly 200 species of fish. The mesopelagic zone and the deep (greater than 1,640 feet [500 m]) bathypelagic zone, taken together, are inhabited by 124 species; coastal areas are inhabited by 79 species (Cross and Allen 1993).

The epipelagic zone is illuminated and subject to fluctuations in temperature. It is inhabited by large, active, fast-growing, and long-lived epipelagic fishes; by mesopelagic species that rise in the water column to feed at night; and by those demersal and benthic species that feed in the water column (Cross and Allen 1993). Epipelagic fish include small schooling herbivores such as northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax caeruleus*), and Pacific mackerel (*Scomber japonicus*); schooling predators such as Pacific bonito (*Sarda chiliensis*) and yellowtail (*Seriola lalandi*); and large solitary predators such as sharks and swordfish (*Xiphias gladius*) (Cross and Allen 1993). Most of this section addresses commercially harvested species that are either wholly or partially epipelagic. Mesopelagic fish are discussed near the end of this section.

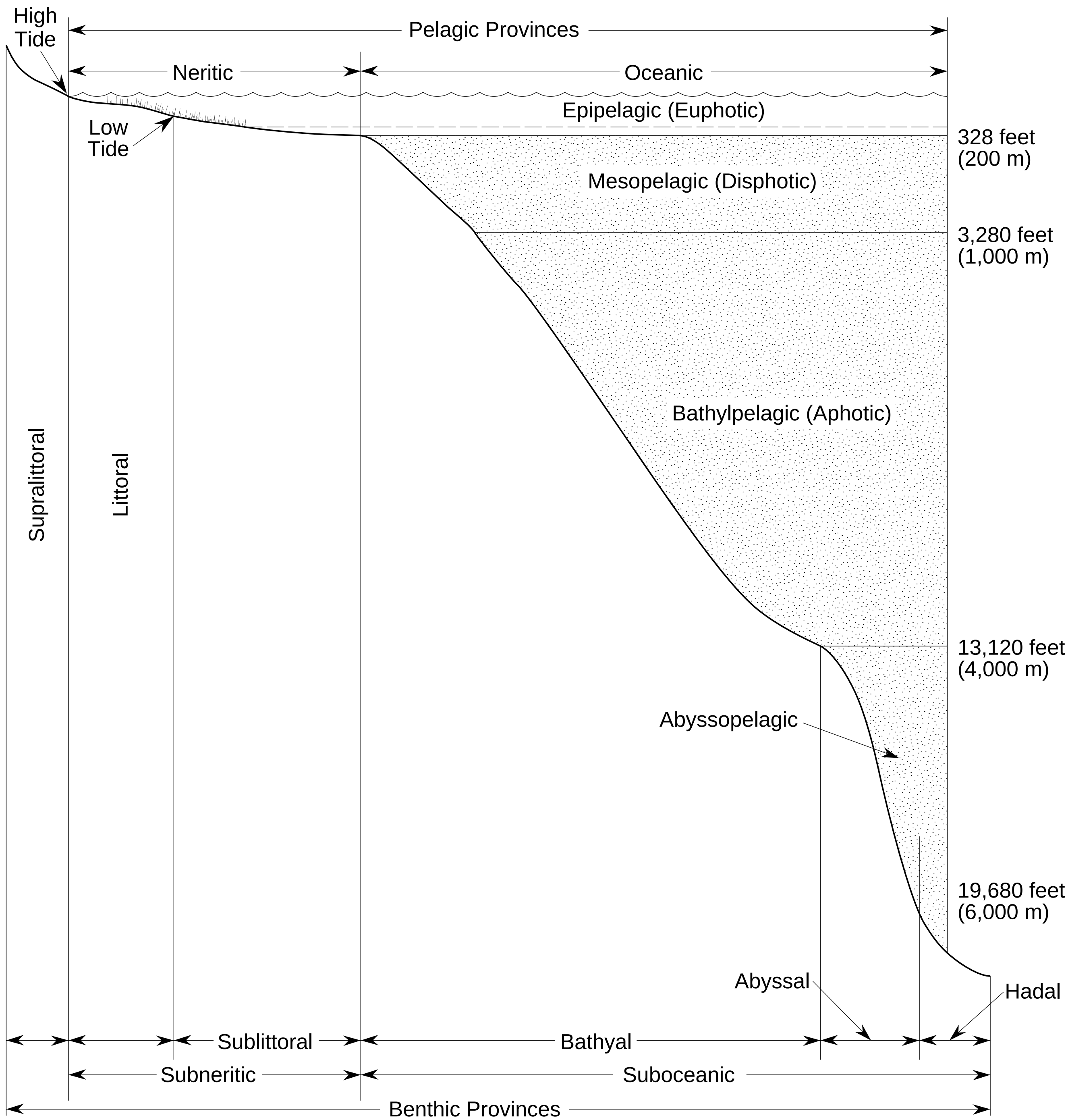


Figure 3.6-1
General Biologic Zones of the Ocean Environment

B - Commercially Harvested Species

The waters of the Sea Range support valuable commercial and recreational fisheries based on small pelagic species like sardines and anchovies, large pelagic species such as tuna and shark, and bottom or near-bottom dwelling halibut, sole, and rockfish. The recreational fishery includes fishing from commercial party vessels (chartered fishing boats), privately owned fishing boats, and shore-based fishing. Because it yields information on the distribution and relative abundance of fish, only the commercial fishery is considered in this and following sections. Recreational fishery landings are addressed in Chapter 3.10, Land Use.

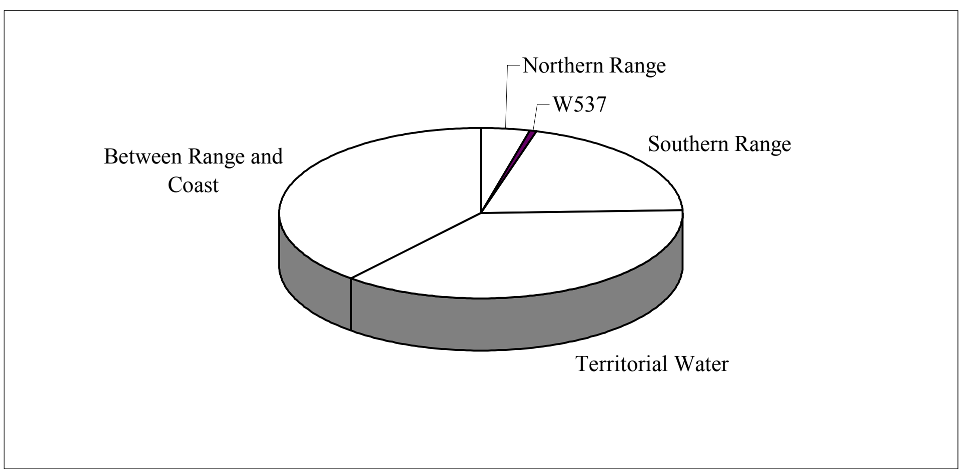
In 1994-1995, an average of 8 million pounds (3.6 million kg) of fish per year were reported as being landed from the entire Sea Range by the commercial fisheries (Table 3.6-2). An additional 5 million pounds (2.3 million kg) were reported as landed from areas between the Sea Range and the adjacent coast.

Table 3.6-2. Average Annual Landings, 1994-1995[1]

Area	pounds	kg
Sea Range		
Non-Territorial Waters	3,184,832	1,444,630
Territorial Waters	4,785,792	2,170,821
Total	**7,970,624**	**3,615,451**
Adjacent Coastal Areas	5,066,704	2,298,242

[1] Reported landings for the years 1991 to 1993 represent only 50 percent of the catch, while those for the years 1994 and 1995 represent about 80 percent of the catch. Thus, much of this discussion refers to landings in 1994 and 1995.
Source: CDFG 1996a,b.

Figure 3.6-2 shows a general distribution of commercial fish catch totals in various portions of the Sea Range. Total reported landings were much higher in the southern part of the Sea Range than in the northern part of the range (Table 3.6-3). A breakdown of total catch in the Sea Range is presented in Figure 3.6-3. Catch totals in nearshore areas adjacent to the Sea Range approached those of the entire Sea Range (Table 3.6-4).



Source: CDFG 1996c.

Figure 3.6-2
General Sea Range Commercial Fish Catch Totals

Table 3.6-3. Annual and Seasonal Commercial Fish Totals (in pounds) by Species in Non-Territorial Waters of the Sea Range

Species	Average Annual Landings on the Sea Range[1]				Seasonal Landings (pounds)[1]			
	Northern	W-537	Southern	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Yellowfin tuna	118	-	133,351	133,469	15,409	-	51	118,009
Skipjack tuna	1,653	54	1,574,672	1,576,378	14	-	213,904	1,362,459
Bluefin tuna	2,863	432	1,555	4,849	351	-	-	4,238
Other tuna	11,067	2,490	67,136	80,693	61,997	-	5,072	13,624
All tuna	**15,701**	**2,976**	**1,776,714**	**1,795,389**	**77,771**	**-**	**219,027**	**1,498,330**
Dover sole	61,324	-	11	61,335	34,188	24,732	1,708	707
California halibut	978	9	1,072	2,059	332	367	879	232
Other flatfish	29,763	92	505	30,361	19,958	1,157	633	8,565
All flatfish	**92,065**	**101**	**1,588**	**93,755**	**54,478**	**26,256**	**3,220**	**9,504**
Thornyheads	36,477	35	682	37,194	36,431	-	622	105
Red rockfish group	24,700	9,453	40,524	74,677	15,278	7,480	30,043	8,710
Other rockfish	81,486	16,423	76,589	174,497	45,094	19,867	51,617	37,274
All rockfish	**142,663**	**25,911**	**117,795**	**286,368**	**96,803**	**27,347**	**82,282**	**46,089**
Pacific bonito	2	17	12,265	12,285	12,275	-	10	-
Pacific mackerel	75,700	292	123,153	199,144	53,519	-	46,855	79,790
Jack mackerel	8	47	5,572	5,627	5,207	-	58	362
Swordfish	76,464	6,795	53,801	137,061	34,859	-	10,182	91,137
Pacific sardine	88,311	-	435,427	523,738	303,350	-	11,724	13,044
Northern anchovy	2,494	2,488	4,015	8,997	1,019	2,494	24	2,902
Other pelagic fish	232	525	5,783	6,540	653	159	1,202	731
Thresher shark	26,766	8,290	14,791	49,848	13,986	12	1,730	33,157
Sharks and rays	18,854	1,856	10,815	31,525	4,390	73	5,213	21,217
Other fish	20,666	808	15,062	36,536	12,911	5,321	11,665	3,771
Total	**559,926**	**50,106**	**2,576,781**	**3,186,813**	**671,221**	**61,662**	**393,192**	**1,800,034**

[1] Average annual landings from the Sea Range and areas between the Sea Range and coast (1994-95).
Source: CDFG 1996a.

C - Abundance of Fish

Relative Abundance of Fish on the Sea Range

Figure 3.6-4 shows average annual commercial fish landings for the years 1994 and 1995 standardized by surface area. Figures 3.6-5 through 3.6-8 show the same information broken down by season. Overall reported landings from non-Territorial Waters of the Sea Range averaged 11,273 pounds/50 NM^2 (5,113 kg/171 km^2). The reported landings in the southern portion of non-Territorial Waters of the Sea Range averaged 18,386 pounds/50 NM^2 (8,340 kg/171 km^2) and were about three times higher than landings in the northern part of the range (4,905 pounds/50 NM^2 [2,225 kg/171 km^2]). When standardized per unit area, landings from Territorial Waters of the Sea Range near San Nicolas Island, the Channel Islands, and from areas near the coast were about six times higher than landings from non-Territorial Waters of the Sea Range (Figure 3.6-4).

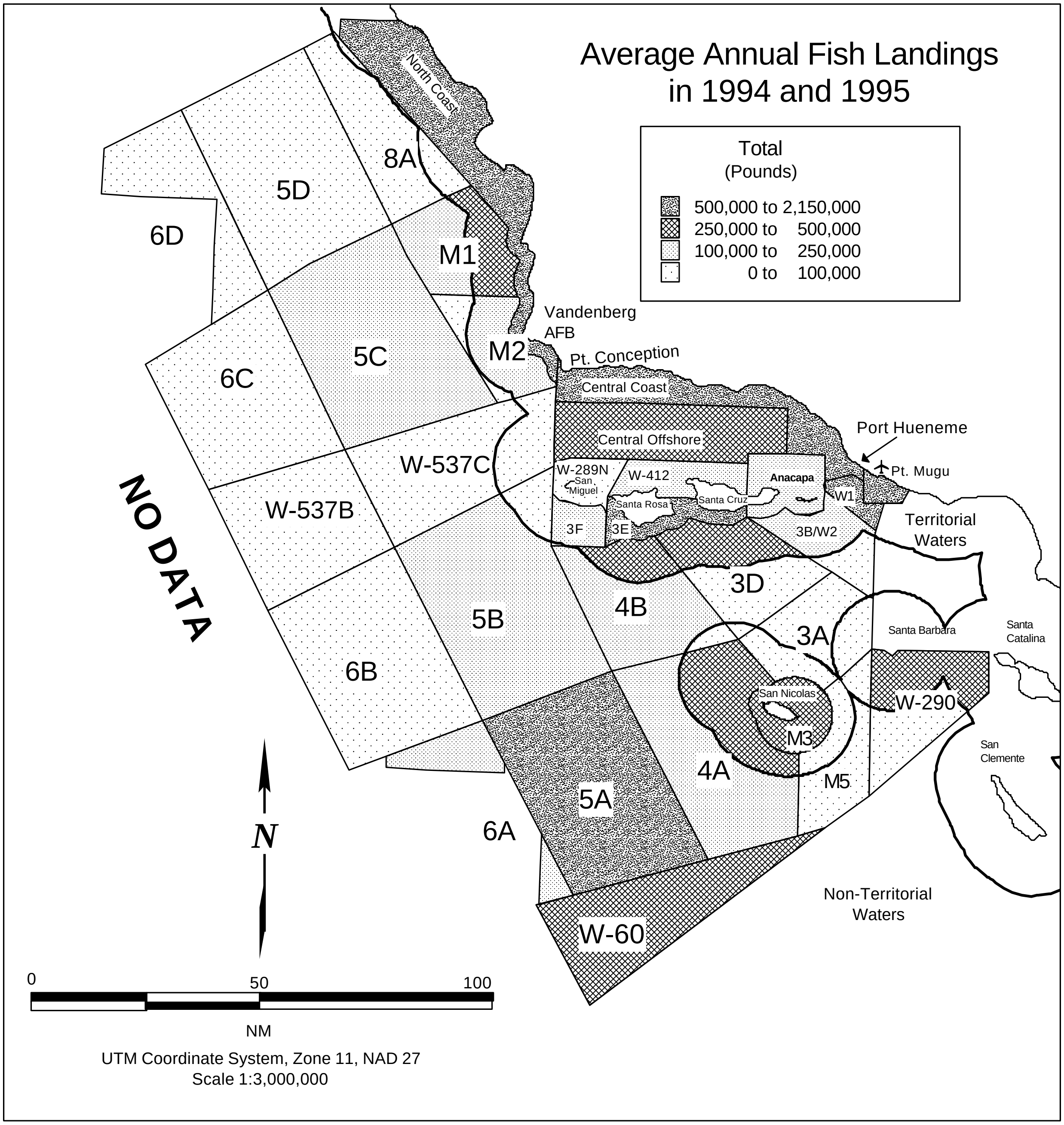
Overall, standardized landings of all fish species combined varied only by a factor of two from season to season. However, within individual areas, seasonal landings varied considerably (see Figures 3.6-5 through 3.6-8), mainly because, as shown above, some species were only caught in specific areas and the catch of these species varied considerably from season to season.

Table 3.6-4. Commercial Fish Totals by Range Area in the Sea Range

Non-Territorial Waters Range Area	Average Total Landing (pounds)	
Northern Range		
5C	134,985	
5D	55,473	
6C	27,127	
6D	84,051	
M1	199,916	
M2	12,609	
8A	45,763	
Northern Range Subtotal		559,924
W-537		
W-537B	14,966	
W-537C	35,141	
W-537 Subtotal		50,107
Southern Range		
3A	52,661	
3B/W2	13,672	
3D	42,360	
3F	1,071	
4A	237,175	
4B	246,792	
5A	1,008,289	
5B	167,181	
6A	121,330	
6B	81,924	
M5	82,803	
W-290	59,618	
W-60	461,528	
W-61	378	
Southern Range Subtotal		2,576,782
Non-Territorial Waters Subtotal		3,186,813

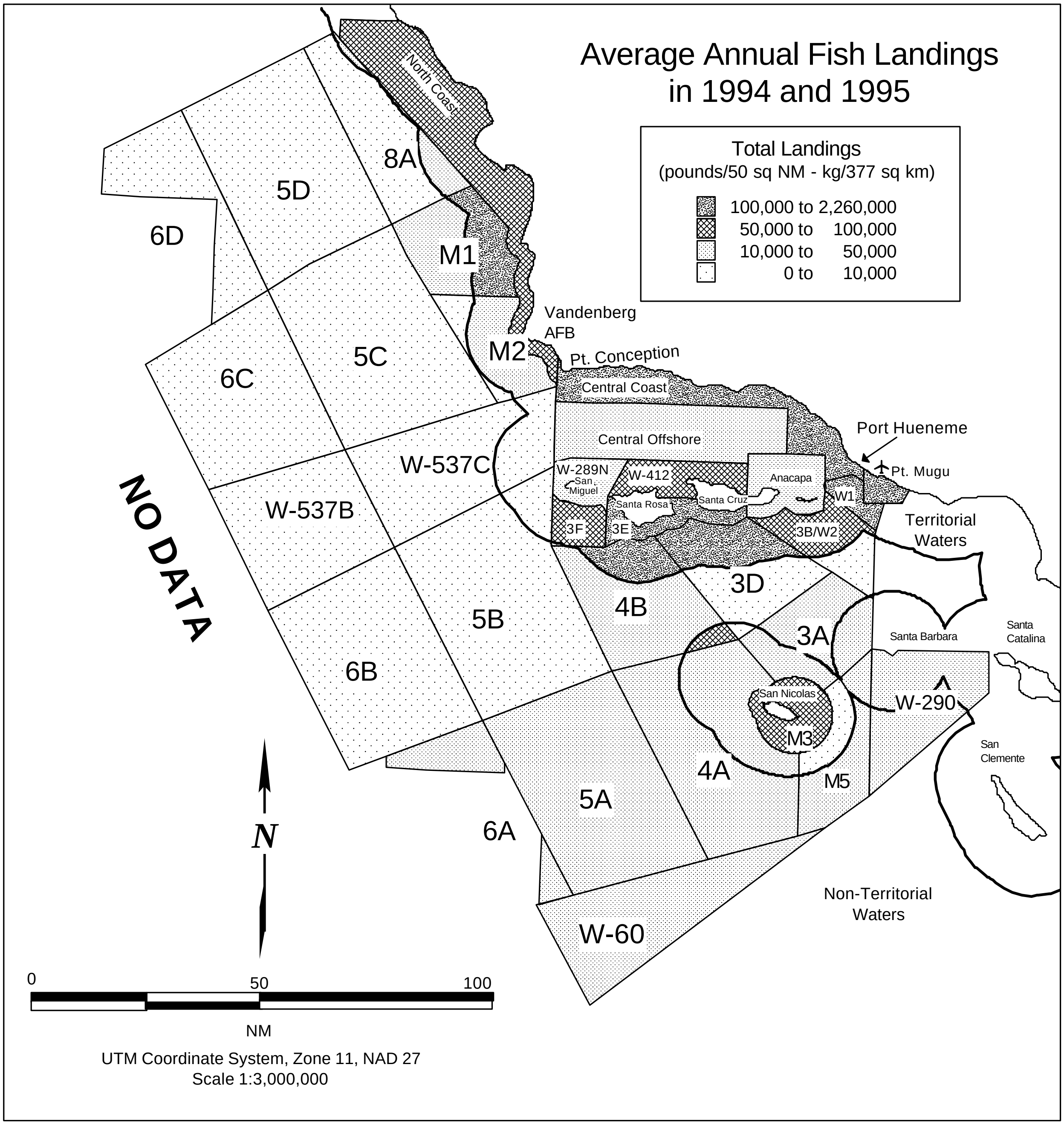
Territorial Waters Range Area	Average Total Landing (pounds)	
Northern Range		
8A	24,823	
M1	460,115	
M2	187,918	
Northern Range Subtotal		672,856
Santa Barbara Island		
M5	32,946	
3A	47,628	
W-290	266,629	
Santa Barbara Island Subtotal		347,203
San Nicolas Island		
3D	1,375	
4B	48,450	
M5	16,376	
4A	285,775	
3A	69,147	
M3	312,173	
San Nicolas Island Subtotal		733,296
Channel Islands		
3E	980,276	
3F	111,264	
W-289N	87,429	
W-412	224,762	
5B	9,178	
3D	498,134	
4B	294,170	
W-537C	20,565	
3B/W2	183,076	
Channel Islands Subtotal		2,408,854
Off Point Mugu		
W1		623,585
Territorial Waters Subtotal		4,785,794
Sea Range Total		7,972,607
Between Range and Coast		
East Islands	115,482	
North Coast	1,459,824	
Central Coast	1,096,304	
Central Offshore	250,341	
Off Point Mugu	2,144,753	
Range/Coast Subtotal		5,066,704
All Areas Total		13,039,311

Source: CDFG 1996a.



Note: Average annual commercial landings of all fish species from each range area and from areas between the Sea Range and coast for the years 1994 and 1995.
Source: CDFG 1996a.

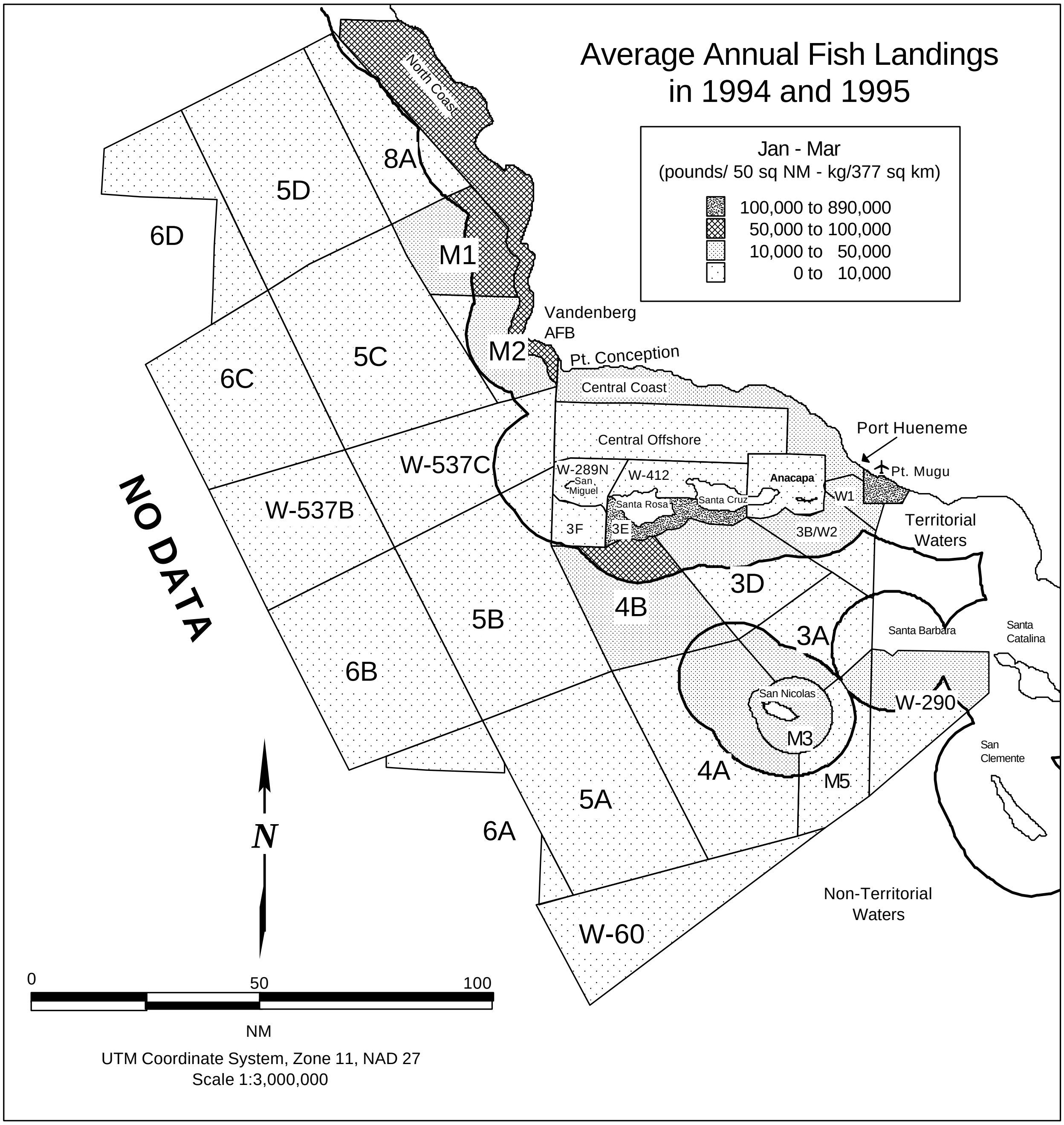
Figure 3.6-3
Average Annual Fish Landings in 1994 and 1995



Note: Average annual landings of all species from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.

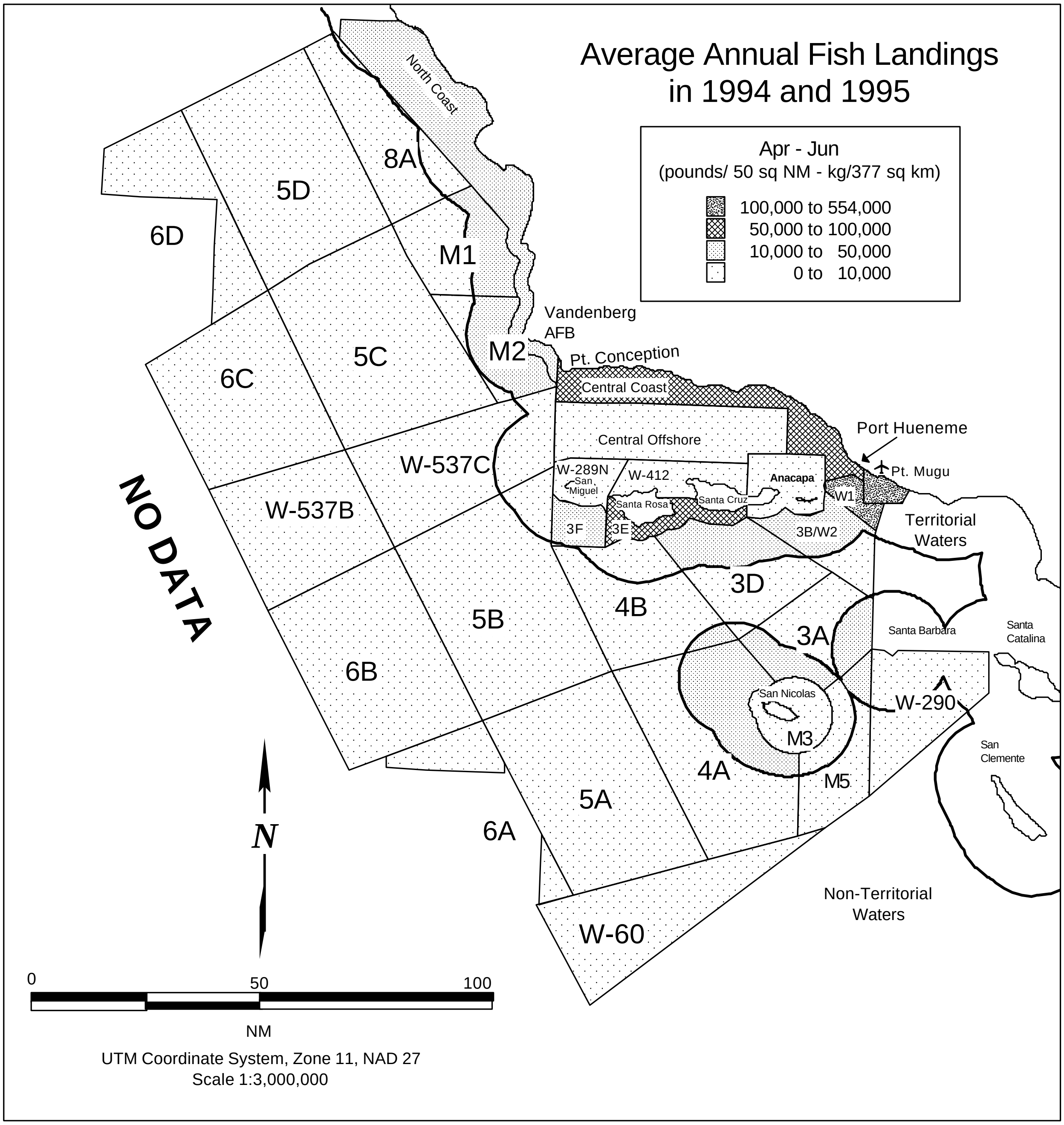
Source: CDFG 1996a.

Figure 3.6-4
Average Annual Fish Landings by Unit Area in 1994 and 1995



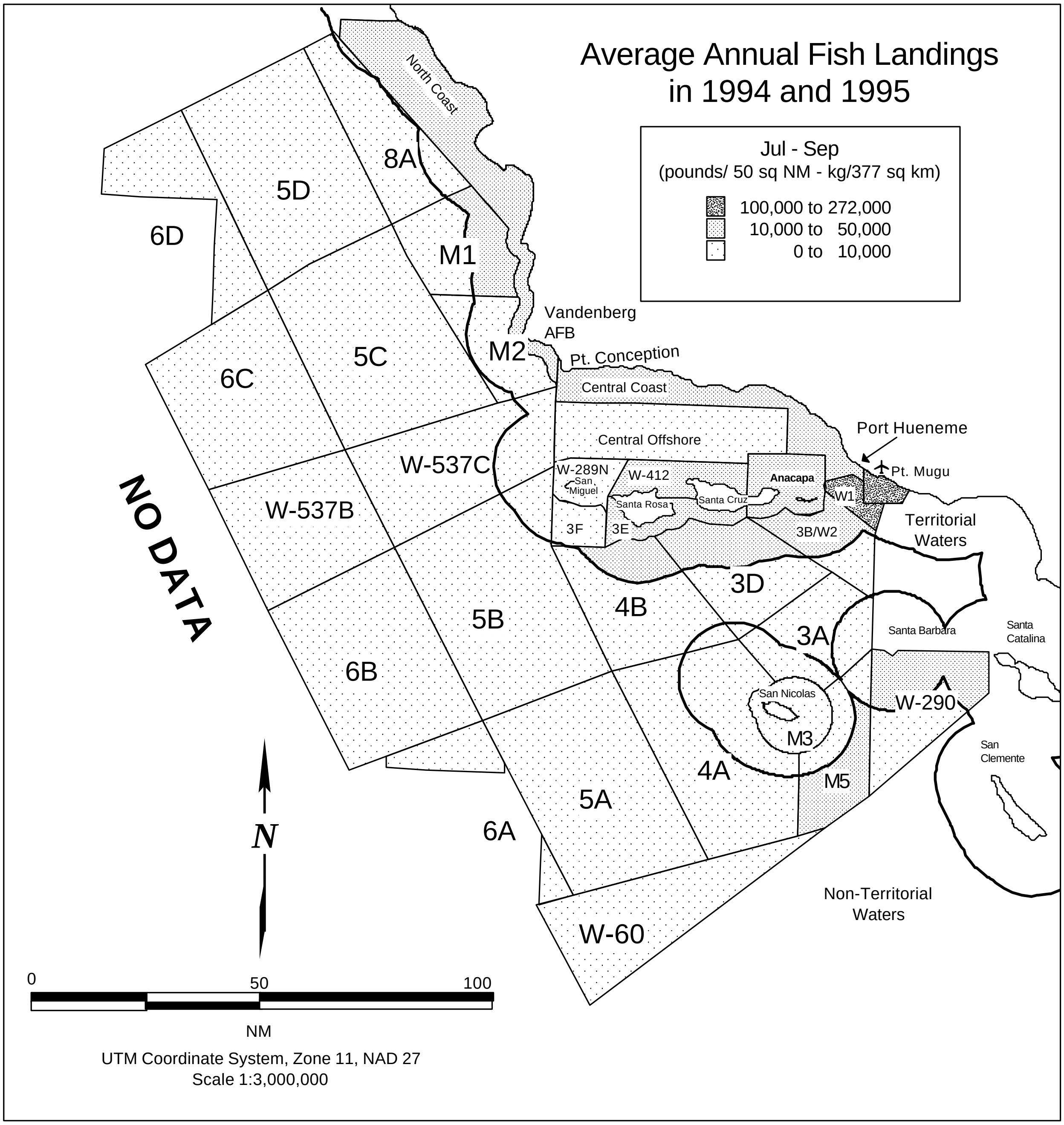
Note: Average total landings for the January to March period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-5
Average Annual Fish Landings in 1994 and 1995: January - March



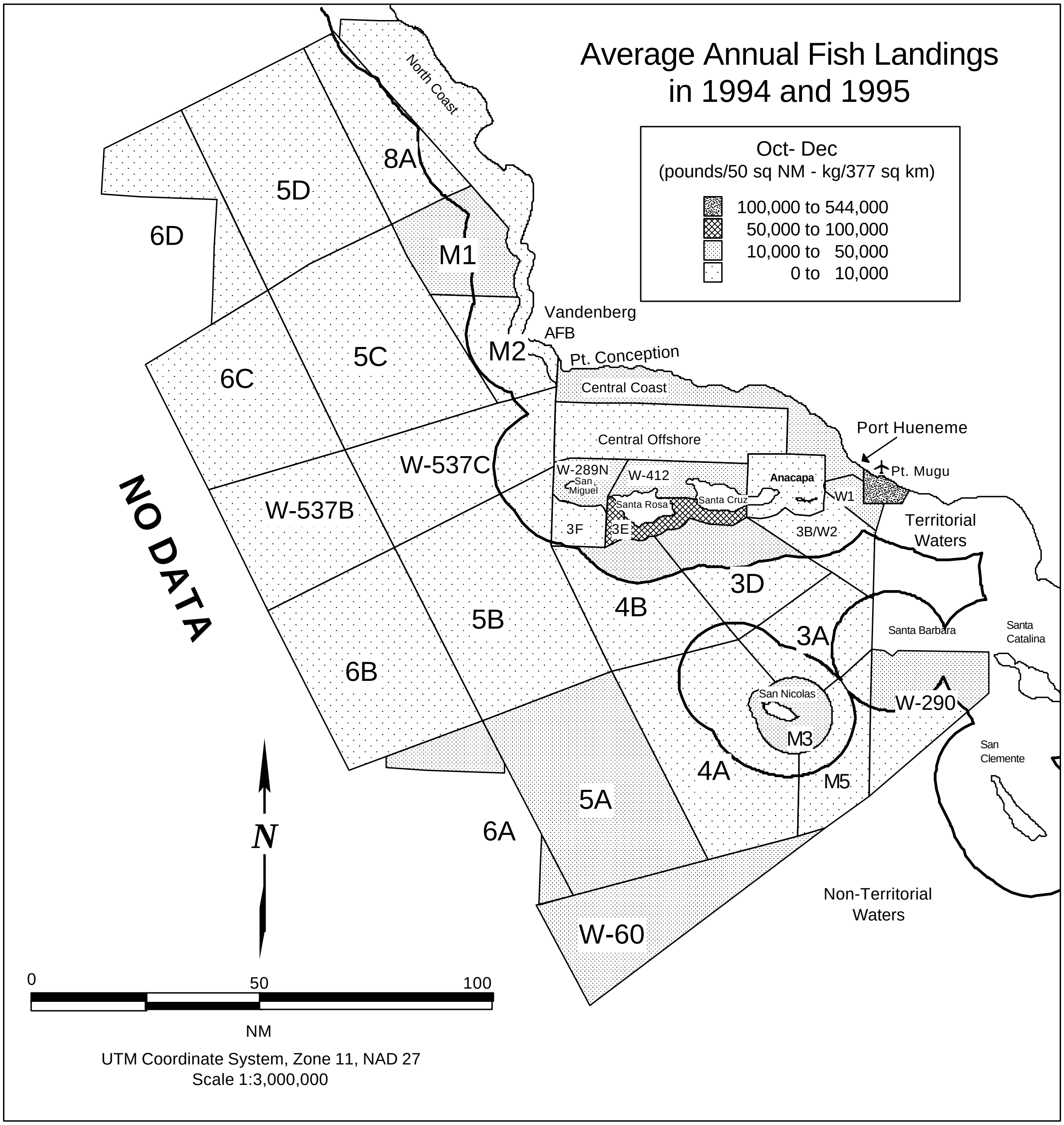
Note: Average total landings for the April to June period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-6
Average Annual Fish Landings in 1994 and 1995: April - June



Note: Average total landings for the July to September period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.
Source: CDFG 1996a.

Figure 3.6-7
Average Annual Fish Landings in 1994 and 1995: July - September



Note: Average total landings for the October to December period from each range area and adjacent coastal areas for the years 1994 to 1995 standardized as pounds landed/50 NM^2.

Source: CDFG 1996a.

Figure 3.6-8
Average Annual Fish Landings in 1994 and 1995: October - December

Attributes of Fish Schools

Squire (1972) computed the average weight of individual schools of common schooling species found off central and southern California (Table 3.6-5). He also noted whether schools were most abundant at or near the surface by day or by night.

Table 3.6-5. Average Weight of Individual Fish Schools

Species	Tons/School	At/Near Surface
Northern anchovy	36.5	night
Pacific sardine	26.5	night
Jack mackerel	24.1	night
Skipjack tuna	18.6	-
Albacore	18.2	-
Bluefin tuna	17.9	-
Pacific bonito	17.1	day
Pacific mackerel	16.9	night
Yellowtail	14.2	-
White seabass	4.9	-
Pacific barracuda	4.5	-

Source: Squire 1972.

Holliday and Larson (1979) studied the attributes of unidentified schools of fish in southern California with hydroacoustic methods and found that, since schools preferred depths near the seasonal thermocline, mean depth of schools varied with season. Fish schools apparently prefer the thermal gradient and not the temperature of the water, and the study speculated that fish schools aggregate at the thermocline because their food is most abundant there. The mean depth of schools was 148, 154, and 72 feet (45, 47, and 22 m) in December, May, and September, respectively.

D - Fish Abundance and Oceanographic Conditions

The physical oceanographic regime in the study area is dynamic and affects the abundance and distribution of fishes (Lenarz et al. 1995; MacCall 1996). Short-term fluctuations associated with an El Niño event are superimposed on long-term changes in oceanographic conditions. Many of the data presented here represent only a "snapshot" view of 5 years from a warm period during which there was an El Niño event.

During El Niño events, upwelling ceases or is much reduced and water temperatures rise, causing southern species to expand their distribution northward and northerly species to retreat farther north. During the El Niño of 1992-93, the abundance of tuna, which are tropical/subtropical species, increased dramatically in the Sea Range, while catches of the temperate northern anchovy were very low. El Niño conditions are also associated with reproductive failure of some rockfish species (Lenarz et al. 1995).

There is also a longer-term cycle in the thermal regime off California. The present warm regime began 20 years ago, and biological indicators suggest a transition to a cooler regime in the next decade (MacCall 1996). The present warm regime is associated with a decline in albacore tuna, northern anchovy, and Pacific mackerel stocks, and an increase in subtropical Pacific sardine stocks (MacCall 1996). During this time, the spawning biomass of northern anchovy decreased by a factor of four while the spawning biomass of Pacific sardine increased by a factor greater than 10.

E - Midwater Fishes

Midwater or mesopelagic fish are pelagic and inhabit depths of 164 to 1,969 feet (50 to 600 m). Many of these fish are strong swimmers; they migrate to surface waters each night and return to deep water during the day; have well developed eyes, swim bladders, and photophores; and are countershaded. In contrast, bathypelagic fish that inhabit the deepest waters are generally weak swimmers; have no or reduced eyes, swim bladders, and photophores; and are black or brown in color (Brown 1974).

There are about 120 species of midwater fishes in the SCB. Only a small percentage of them are important species commercially. Northern species are associated with the lower mesopelagic zone where Pacific subarctic water is the dominant water mass and are most common in winter and spring when intrusions of this northern water mass are greatest. Southern species are most common during summer and fall when water of southern origin intrudes. Central Pacific species are represented by only a few species (Cross and Allen 1993).

Within the study area, sampling within three deep water areas showed that three to nine species accounted for 90 percent of the individuals taken in each of the Santa Barbara Basin, the Santa Cruz Basin, and the Rodriguez Dome area (Brown 1974). The depth ranges of some epipelagic and demersal species or their juvenile or larval stages extend into the mesopelagic zone. These include Pacific hake (*Merluccius productus*), Pacific mackerel, swordfish, and sablefish.

F - Rare, Threatened and Endangered Species

On 18 August 1997 the NMFS listed the southern California Evolutionary Significant Unit (ESU) of westcoast steelhead (*Oncorhynchus mykiss*) as endangered (NMFS 1997a). The final listing took effect 17 October 1997 and ESA Section 9 (a) prohibitions (takings) became effective 60 days from the publication of the final listing (i.e., prohibitions went into effect on 16 December 1997).

Steelhead typically migrate to marine waters after spending 2 years in freshwater. They then reside in marine waters for 2 to 3 years prior to returning to their natal stream to spawn as 4- or 5-year olds. The southern California steelhead ESU occupies rivers from the Santa Maria River in San Luis Obispo County to Malibu Creek in Los Angeles County. The Sea Range encompasses the marine waters of this ESU.

3.6.2.2 Sea Turtles

Four species of sea turtles occur at sea within the Point Mugu Sea Range. Few specific data are available on use of the Sea Range by sea turtles, and no data are available on actual numbers of turtles occurring there. This section takes account of the best available information from the northeastern Pacific generally.

The distribution of sea turtles is strongly affected by seasonal changes in ocean temperature (Hubbs 1960; Radovich 1961). In general, sightings increase during summer as warm water moves northward along the coast (Stinson 1984). Sightings may also be more numerous in warm years compared to cold years.

Sea turtles typically remain submerged for several minutes to several hours depending upon their activity state (Standora et al. 1984; 1994; Renaud and Carpenter 1994). Long periods of submergence hamper detection and confound census estimates.

Young loggerhead, green/black, and olive ridley turtles are believed to move offshore into open ocean convergence zones where abundant food attracts sea turtles and other predators (Carr 1987; NRC 1990; NMFS/USFWS 1996c; d; Hunter and Mitchel 1966; Gooding and Magnuson 1967; Carr 1987). An eastern tropical Pacific survey reported that sea turtles were present during 15 percent of observations in flotsam habitats (Pitman 1990; Arenas and Hall 1992).

Stinson (1984) reported that over 60 percent of green/black and olive ridley sea turtles observed in California waters were in waters less than 164 feet (50 m) in depth. Green/black turtles were often observed along shore in areas of eelgrass. Loggerheads and leatherbacks were observed over a broader range of depths out to 3,280 feet (1,000 m). When sea turtles reach subadult size, they move to the shallow, nearshore benthic feeding grounds of adults (Carr 1987; NRC 1990; NMFS/USFWS 1996c, d). Aerial surveys off California, Oregon, and Washington have shown that most leatherbacks occur in slope waters and that few occur over the continental shelf (Eckert 1993). Tracking studies have shown that migrating leatherback turtles often travel parallel to deepwater contours ranging in depth from 660 to 11,500 feet (200 to 3,500 m) (Morreale et al. 1994).

In general, green/black and olive ridley turtles occupy shallow nearshore zones and pelagic leatherbacks and juvenile loggerheads may be found over all water depths.

<u>A - Sea Turtle Species in the Sea Range</u>

Loggerhead Sea Turtle

There are no known nesting sites in the central and eastern Pacific (Dodd 1988; Eckert 1993); however, juvenile loggerheads are abundant in waters of Baja California, Mexico (Bartlett 1989; Pitman 1990). Juveniles and adults are rare in western U.S. waters, and the few sightings are mostly from southern California (Guess 1981a; b; Stinson 1984). However, there have also been isolated sightings from Washington (Hodge 1982) and Alaska (Bane 1992).

Juvenile loggerhead sea turtles are common year-round in the coastal waters of southern California (Guess 1981a; b; Stinson 1984) but sightings are most common during July to September (Stinson 1984). Adult loggerheads are rare in this area. The juvenile loggerheads off southern California may represent the fringe of large aggregations that occur off the west coast of Baja California (Bartlett 1989; Pitman 1990).

Overall, loggerhead abundance in southern California waters is higher during warm years than during cold years, although during July through September the frequency of sightings is similar in warm and cold years (Stinson 1984). Decreased encounters during winter may represent decreased activity due to colder temperatures (Fritts et al. 1983). Loggerhead and green turtles have also been observed burying into soft substrate and entering a state of torpor as an adaptation to surviving seasonably cold temperatures (Carr et al. 1980).

In the Sea Range, juvenile loggerhead turtles may be encountered year-round with the greatest numbers seen during July through September. In winter, they may be more common during warm years. Adult loggerheads are rare at any time of the year.

Adult loggerhead turtles eat a wide variety of benthic invertebrates associated with hard bottom habitats including anemones, squid, snails, clams, crab, shrimp, sea urchins, and fish (Dodd 1988). Plants are occasionally taken. Large groups of juvenile loggerheads have been observed feeding on dense concentrations of pelagic red crab off the southwest tip of Baja California (Bartlett 1989; Pitman 1990).

Jellyfish have been reported in the diets of loggerhead turtles taken in north Pacific drift nets (NMFS/USFWS 1996b).

Leatherback Sea Turtle

There are no known nesting populations of Pacific leatherback turtles in U.S. waters. The coast of Mexico is generally regarded as the most important leatherback breeding ground in the world (NMFS/USFWS 1996c). Turtles from these southerly populations migrate north into U.S. waters. Sightings and incidental captures have been reported from California (van Denburgh 1905; Lowe and Norris 1955; Stinson 1984; Dutton and McDonald 1990b; 1992; Starbird et al. 1993) and from as far north as Alaska (Hodge 1979; Stinson 1984). There were 96 reported sightings of leatherbacks within 27 NM (50 km) of Monterey Bay, California, from 1986 to 1991 (Starbird et al. 1993). Fishermen "regularly" catch leatherbacks in drift/gill nets off Monterey Bay (Starbird 1991 [as cited in NMFS/USFWS 1996c]). Stinson (1984) concluded that the leatherback was the most common sea turtle in U.S. Pacific waters north of Mexico.

Off the U.S. west coast, leatherback sea turtles are most abundant from July to September and are rarely reported during winter and spring. Their appearance in southern California coincides with the arrival of the 64 to 68° F (18 to 20° C) isotherms (Stinson 1984). Stinson (1984) noted that the July appearance of leatherbacks along the U.S. west coast was "two-pronged," with turtles suddenly appearing in southern California and also in northern California, Oregon, and Washington with few sightings along the intermediate coastline. She speculated that turtles may be moving onshore from offshore areas where the water temperature is 55 to 59° F (13 to 15° C). Some of these turtles likely come from Mexico but it is possible that some have migrated from western Pacific nesting grounds via the Pacific Drift Current.

Turtle sightings tend to be more frequent in abnormally warm years or months and less so during cold years (Stinson 1984). This is particularly true in more northern areas during non-summer months. It has been suggested that unusually warm ocean temperatures are responsible for sightings of sea turtles in the northern Pacific (Radovich 1961).

In the Sea Range, leatherback sea turtles are common during the months of July, August, and September and in years when water temperatures are above normal. Their abundance is far lower during October through May.

Information concerning the diet of leatherback turtles is based mostly upon studies conducted in the western Atlantic. The pelagic leatherback turtle appears to feed primarily on jellyfish and obtains additional nutrition from the parasitic crustaceans and symbiotic fish that are associated with jellyfish (Bleakney 1965; Brongersma 1969 [as cited in NMFS/USFWS 1996c]; den Hartog and van Nierop 1984; Eckert 1993).

Green/Black Sea Turtle

The green sea turtle is a circumglobal species found in tropical waters at temperatures above 68° F (20° C). The genus *Chelonia* is often divided into two species: 1) the eastern Pacific green turtle (*C. agassizi*; Bocourt 1868), also known as the black sea turtle, is found in the eastern Pacific Basin from Baja California south to Peru and west to the Galapagos Islands, and 2) the green turtle (*C. mydas*; Linnaeus 1758) is the form found in the remainder of the global range. This taxonomic status remains controversial. The *Chelonia* spp. complex is sometimes be referred to as "green/black" sea turtles.

There are no known nesting sites along the west coast of the U.S. Along the Pacific coast, green/black turtles have been reported from Oregon (Forbes and Mckey-Fender 1968), British Columbia (Carl 1955), and southern Alaska (Hodge 1981), as well as California. Stinson (1984) reported that the green/black turtle was the most commonly observed “hard-shell” sea turtle on the U.S. west coast. Nearly 62 percent of green/black sightings are from Baja California and southern California. The northernmost reported resident population occurs in San Diego Bay (Stinson 1984; Dutton and McDonald 1990a,b, 1992; Dutton et al. 1994).

Green/black sea turtles are sighted year-round in the waters of southern California with the highest frequency of sightings being during the warm summer months of July through October (Stinson 1984). In waters south of Point Conception, Stinson (1984) found this seasonal pattern in sightings to be independent of inter-year temperature fluctuations. North of Point Conception, there were more sightings in warmer years.

The year-round presence of green/black turtles off southern California likely represents a stable north boundary of Mexican populations. As with juvenile loggerheads, the lower number of sightings during winter months may be indicative of a retreat to warmer southerly waters or perhaps dormancy and/or lower activity levels (Felger et al. 1976; Mendonca 1983).

In the Sea Range, green/black turtles may be encountered year-round with the highest concentrations being during July through September. Inter-year fluctuations are less pronounced than for juvenile loggerheads.

The green/black sea turtle is the only genus of sea turtle that is mostly herbivorous (Mortimer 1995). Throughout most of its range the green turtle forages primarily on sea grasses and algae when seagrasses are absent (Carr 1952; Pritchard 1971; Burke et al. 1992; Wershoven and Wershoven 1991; Balazs et al. 1994; Forbes 1994; Mortimer 1995). Occasionally green/black turtles will consume macrozooplankton, including jellyfish (Bustard 1976; Mortimer 1995), kelp and sponges (Carr 1952), and mangrove leaves (Pritchard 1971).

Olive Ridley Sea Turtle

The olive ridley sea turtle is distributed circumglobally throughout tropical and warm temperate waters and is widely regarded as the most abundant sea turtle in the world (NMFS/USFWS 1996d). There are no known nesting sites of this species in California (NMFS/USFWS 1996d). The olive ridley has a tropical distribution and is rarely encountered in the waters off southern California and even less so north of Point Conception (Stinson 1984). Olive ridley sea turtles are encountered only rarely in the Sea Range. Stinson (1984) reported only 10 sightings in U.S. waters south of Point Conception. From 1982 to 1993 only 10 additional records were reported to the stranding network. The highest probability of encounter will probably be during the warmest part of the summer around August, but even then encounters will be rare.

Olive ridley turtles are primarily carnivorous and opportunistic. They consume snails and clams, sessile and pelagic tunicates, bottom fish and fish eggs, crabs, oysters, sea urchins, snails, shrimp, pelagic jellyfish and pelagic red crab (Fritts 1981; Marquez 1990; Mortimer 1995). Ridleys can dive and feed at considerable depths (260 to 980 feet [80 to 300 m]) (Eckert 1993, 1995). In the open ocean of the eastern Pacific, olive ridleys are often seen near flotsam, possibly feeding on associated fish and invertebrates (Pitman 1992).

Summary

Only three species of sea turtles are likely to be encountered commonly in the Sea Range: juvenile loggerhead, leatherback, and green/black. Olive ridley turtles are present but rarely encountered. Loggerhead and green/black turtles may be encountered in the Sea Range year-round but the highest frequency of occurrence is during summer. Leatherbacks will rarely be encountered in the Sea Range during winter but will be the most common sea turtle species during summer.

3.6.3 Point Mugu

A significant marine water resource at Point Mugu is Mugu Lagoon (refer to Section 3.4.3.1). Mugu Lagoon is one of the largest salt marshes in southern California. It is relatively undisturbed and provides a habitat for a diverse assemblage of marine organisms.

3.6.3.1 Fish

A - Mugu Lagoon

Common Species and Abundance of Fish

Forty-three species of fish have been identified from samples taken in Mugu Lagoon by MacGinitie and MacGinitie (1969), Baker (1976), Quammen (1980), and Onuf and Quammen (1983, 1987). Baker (1976) set traps at six locations throughout the lagoon almost constantly for a period of 2 years beginning in January 1972. Quammen (1980) and Onuf and Quammen (1983, 1987) sampled four sites in the eastern arm monthly for a period of 5 years beginning in 1977.

The three most common resident species in the lagoon were arrow goby (*Clevlandia ios*), topsmelt (*Atherinopsis affinis*), and staghorn sculpin (*Leptocottus armatus*) (Onuf and Quammen 1987). The arrow goby inhabits the burrows of crabs and shrimp. Staghorn sculpins rest on the bottom, and fry have been collected in Mugu Lagoon (Baker 1976; Onuf and Quammen 1987). Topsmelt form schools of several hundreds to several thousands of individuals in the water column (Baker 1976; Onuf and Quammen 1987). Topsmelt and staghorn sculpin were common throughout the lagoon with the arrow goby common only in the eastern arm.

Shiner surfperch (*Cymatogaster aggregata*), California halibut, and diamond turbot (*Hypsopsetta guttulata*) were the most common species that did not reside in the lagoon year-round. Some of these non-resident species enter the lagoon to spawn or use it as a nursery area.

Depth and cover by eelgrass (*Zostera marina*) were equally important determinants of fish abundance in the eastern arm of the lagoon. Onuf and Quammen (1987) sampled deep and shallow water sites with and without eelgrass cover. Fish catch was smallest at the shallow-bare site, higher at the shallow-eelgrass and deep-bare sites, and highest at the deep site with eelgrass.

There was a strong seasonal effect on abundance of fish in the lagoon. Monthly sampling over a 5-year period showed that numbers of fish in the eastern arm increased from December/January to June by a factor of about 6 and then declined through the summer and fall (Onuf and Quammen 1987). Most of the common species were always present in the lagoon; however, their abundance peaked at different times (Table 3.6-6).

Table 3.6-6. Seasonal Abundance of Fish in Mugu Lagoon[1]

	Month											
Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Speckled sanddab			X	X								
Diamond turbot	X	X	X	X	X	X	X					
Topsmelt					X	X	X	X			X	
Staghorn sculpin					X	X						
Shiner surfperch					X							
Gray smoothhound shark					X	X						
California halibut					X	X	X	X	X			
California tonguefish						X	X	X	X			
Longjaw mudsucker							X	X				
Shovelnose guitarfish								X				
California killfish									X	X	X	
Bay pipefish								X	X	X	X	

[1] Months of peak abundance of the common species in the eastern arm of Mugu Lagoon averaged over a period of 5 years (from Onuf and Quammen 1987).

Fish Breeding in the Lagoon

The shiner surfperch was found to be very common only in late spring and early summer and formed dense schools in eelgrass beds in the eastern arm of the lagoon (Onuf and Quammen 1987). Since it breeds in the lagoon at this time, it may be present only during its breeding season (Baker 1976).

The shovelnose guitarfish (*Rhinobatos productus*) was abundant in the eastern arm in late summer where Baker (1976) observed breeding in the central section of the lagoon and a breeding population of up to 500 individuals in very shallow water. A concentration of round stingrays (*Urophus halleri*) entered the eastern end of the lagoon after the breeding period of the shovelnose guitarfish but Baker (1976) was unable to determine whether they were breeding in the lagoon. The round stingray does move inshore in September to bear young (Eschmeyer and Herald 1983).

The gray smoothhound shark (*Mustelus californicus*) was also observed to breed in the lagoon. The resident species, including arrow gobies, topsmelt, and staghorn sculpin, are assumed to breed in the lagoon (Baker 1976).

Mugu Lagoon as a Fish Nursery

Estuaries and embayments, including Mugu Lagoon, are important nursery areas for California halibut (MMS 1987). Pelagic larvae enter embayments in spring and summer before undergoing metamorphosis, remain there for about 2 years after metamorphosis, and then the juveniles move out to their preferred habitats of sand and mud bottoms off estuaries and embayments. California halibut are present in Mugu Lagoon year-round, but numbers peak in late spring and early summer and remain high through the summer. This species seems to prefer sand/mud bottoms in deeper waters of the lagoon.

Mugu lagoon may also be a nursery area for topsmelt, shiner surfperch, California killfish (*Fundulus parvipinnis*), longjaw mudsucker (*Gillichthys mirabilis*), diamond turbot, staghorn sculpin, starry flounder (*Platichthys stellatus*), and bay pipefish (*Sygnathus* spp.) (Baker 1976).

Rare, Threatened and Endangered Species

The tidewater goby (*Eucyclogobius newberryi*) is listed as endangered by the USFWS (CDFG 1994)[1]. It inhabits coastal lagoons and brackish bays at the mouths of freshwater streams (Eschmeyer and Herald 1983). It has not been recorded in any of the several collections totaling thousands of fish made in Mugu Lagoon.

B - Nearshore Marine Environment off Point Mugu

Sandy Beaches

Grunion (*Leuresthes tenuis*) is the single fish resource that is important on the sandy beaches of Point Mugu. The fish swim onto the beaches to spawn during nighttime spring (as opposed to neap) high tides in spring and summer (Walker 1961). The periodic availability of grunion on the beaches during spring and summer forms the basis for a minor recreational fishery along exposed sandy beaches in southern California. Spawning involves the female fish burying tail-first into the sand along the upper edges of the swash zone at high tide and extruding their eggs into the wet sand several inches below the surface. Meanwhile, beached males release their milt into the film of water beside the buried females, whose wriggling to bury and expel eggs facilitates passage of the milt into the wet sand. When the milt flows down into the sand, it comes in contact with the buried eggs, and fertilization of the eggs occurs. The eggs develop over the ensuing two weeks, hatch when exposed to seawater during the high tides of the next spring tide series, and the larvae swim free of the sand and out to sea.

Nearshore Habitats

Soft substrates are the most common benthic habitat in the SCB, including the area off Point Mugu. Love et al. (1986) sampled three stations at each of three sites that were north and south of Point Mugu. The Ormond site, north of Point Mugu, included sampling stations at Ventura, Mandalay, and Ormond. Queenfish (*Seriphus politus*) and white croaker (*Genyonemus lineatus*) were the dominant species in trawls taken at depths of 20, 40, and 60 feet (6, 12, and 18 m) on soft substrates at the Ormond sites. Northern anchovy, California halibut, and speckled sanddab (*Citharichthys stigmaeus*) were important at all depths. At three sampling sites near Redondo, south of Point Mugu, the dominant species and their corresponding depths were: queenfish, white croaker, and California halibut at 20 feet (6 m), speckled sanddab, white croaker, California halibut, and queenfish at 40 feet (12 m), and speckled sanddab and California halibut at 60 feet (18 m). At the Ormond sites, fish abundance was constant at all three depths, while off Redondo abundance decreased with increasing depth. There were considerable seasonal and annual fluctuations in the abundance of fish. At depths of 20 feet (6 m), fish were scarce during December, abundance increased in April, and peaked in late summer and early fall. The fish may have moved offshore during winter. During the study, from 1982 to 1984, there was an El Niño event (1982-1983) that was associated with a decline in the abundance of many fish species in nearshore waters. The fish may have moved out of warmer, nearshore waters to areas of cooler water.

Inner shelf, soft-substrate species include barred sand bass (*Paralabrax nebulifer*), California halibut, turbot (*Pleuronichthys* spp.), northern anchovy, queenfish, round stingray, speckled sanddab, shovelnose guitarfish, shiner, walleye (*Hyperprosopon argenteum*), white surfperch (*Phanerdon furcatus*), and white croaker (Cross and Allen 1993). Fishes of the outer shelf include calico (*Sebastes dalli*) and stripetail (*S. saxicola*) rockfish, California scorpionfish (*Scorpaena guttata*), bigmouth sole (*Hippoglossina stomata*),

[1] On 24 June 1999, the USFWS proposed to remove the northern populations of the tidewater goby from the list of endangered and threatened wildlife. A Final Rule has not yet been published.

California lizardfish (*Synodus lucioceps*), California tonguefish (*Sympharus atricauda*), curlfin turbot (*Pleuronichthys decurrens*), English sole (*Pleuronectes vetulus*), northern anchovy, and Pacific (*Citharichthys sordidus*) and speckled sanddab (Cross and Allen 1993).

Mean standing crop of fish recorded in beam trawls taken at depths of 20 to 43 feet (6 to 13 m) on soft bottoms between Hermosa Beach and Carlsbad, south of the Sea Range, was 9,778 pounds/NM^2 (12.93 kg/ha) (Allen and Herbinson 1991). Catch along exposed coasts was slightly lower at 8,328 pounds/NM^2 (11.01 kg/ha). Mean standing crop of fish on soft substrates of the outer shelf and slope of the SCB may be about 1,622 pounds/NM^2 (2.14 kg/ha) (Cross and Allen 1993).

Commercial Harvest

There is a substantial commercial harvest in open marine waters off Point Mugu. For the years 1994 and 1995 the average annual commercial catch was 2,144,973 pounds (972,953 kg) in the 62 NM^2 (213 km^2) CDFG statistical block off Point Mugu. The average annual reported landings of 1,157,750 pounds (525,152 kg) in this statistical block for the 5-year period 1991 through 1995 was greater than that in any other statistical block within the Sea Range or along the coast adjacent to the range. For the period 1991 through 1995, the next highest catch was less than half that recorded off Point Mugu and was recorded in one of the largest statistical blocks (758 NM^2 [2,600 km^2]), area 5A.

Pacific sardines comprised 85 percent of the average annual landings. The second most commonly harvested species off Point Mugu was Pacific mackerel. Landings of jack mackerel were high only in 1995 and were taken mainly between July and September. Skipjack and yellowfin tuna were taken from July to September; however, they were abundant only during 2 of the 5 years considered. Northern anchovy were relatively abundant during 4 of the 5 years. The fishery for halibut and rockfish off Point Mugu was relatively small when compared to that of adjoining and other coastal areas. On a per unit area basis, the catch off Point Mugu was much higher than that of any area within or adjacent to the Sea Range (Table 3.6-7). On a per unit area basis, the next-highest catch was recorded in Range Area W1, which is immediately offshore and adjacent to the statistical block off Point Mugu.

Table 3.6-7. Commercial Fish Densities in the Sea Range

Range Area	Pounds/50 NM^2
Off Point Mugu	2,258,205
W1	457,440
3E	377,324
Central Coast	126,953
North Coast	99,491
Channel Islands Waters	87,998
San Nicolas Island Waters	42,648

The high catches in the area off Point Mugu and in adjacent Range Area W1 may be due to the hydrography and bathymetry (ocean bottom contours) of the area. A submarine canyon approaches the shore in this area and may influence the hydrography in such a way that productivity is high and/or food for fish is concentrated. Upwelling would have a greater effect on the hydrography of this nearshore area than in areas with a gently sloping seabed. In addition, there is a freshwater outflow from Mugu Lagoon. This, in combination with the bathymetric influences on hydrography, may cause the kinds of temperature and salinity discontinuities that are generally associated with concentrations of plankton (Marra et al. 1990; Munk et al. 1995). These kinds of discontinuities are evident off the Point Mugu area in satellite imagery presented by Squire (1985) and Laurs et al. (1984).

3.6.3.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off Point Mugu, especially during summer. However, there are no known sea turtle nesting beaches at Point Mugu or anywhere else in the Sea Range.

3.6.4 San Nicolas Island

3.6.4.1 Fish

The offshore islands provide a diversity of habitats for fishes including the nearshore pelagic (midwater) zone, shallow water soft and hard substrates, kelp forests, intertidal sandy beaches, rocky shores, tidepools, and the surf zone. Although some species may be found in several habitats, each of these habitats is occupied by a recognizable community of fishes.

A - Intertidal Habitats

Common inhabitants of the rocky intertidal of the SCB are the wooly sculpin (*Clinocottus maculosus*), reef finspot (*Paraclinus integripinus*), rockpool blenny (*Hypsoblennius gilberti*), spotted kelpfish (*Gibbonisa elegans*), California clingfish (*Gobiesox rhessodon*), juvenile opaleye (*Girella nigricans*), and juvenile dwarf surfperch (*Micrometrus minimus*) (Cross and Allen 1993). These fish usually eat amphipods, isopods, polychaetes, copepods, and gastropods. Some species are specially modified to cling to rocky substrates, can resist desiccation, and use holes, crevices, or algae as protection from turbulence.

B - Nearshore Habitats

Engle (1993) and Cowen and Bodkin (1993) collected fish in nearshore subtidal habitats at San Nicolas Island. Although the fish fauna of San Nicolas Island contains both northern and southern species, many southern species are noticeably absent in the kelp forests (Cowen and Bodkin 1993). "The more removed the site is from the typical current path, the less commonly recruitment of southern species will occur" (Cowen and Bodkin 1993). The southern species are better represented along the mainland and inner islands than they are at San Nicolas Island (Cowen and Bodkin 1993). Engle (1993) classified the subtidal rocky fish fauna of San Nicolas Island as "old intermediate" in that only 45 percent of the relative abundance of species was represented by southern forms. For islands to the south and closer to shore, the relative abundance of southern species was over 70 percent; for San Miguel Island, which is further north and also offshore, it was 21 percent.

Forty-eight species were recorded during the two studies at San Nicolas Island (Cowen and Bodkin 1993; Engle 1993). However, this number under-represents the actual number observed by about 50 percent since sand dwellers, rare and cryptic species, and some species that are hard to identify in the field were not counted (Engle 1993).

As shown in Table 3.6-8, average density of fish at six sampling sites in kelp forests off San Nicolas Island were 170,00 to 392,000/NM^2 (49 to 1,143/ha) (Cowen and Bodkin 1993). Biomass of fish in central California kelp beds has been estimated at 222,000 to 840,000 pounds/NM^2 (29 to 1,110 kg/ha) (Horn 1980). Most of the fish were schooling species with two resident schooling fish, señorita (*Oxyjulis californica*) and blacksmith (*Chromis punctipinnis*), typically accounting for 90 percent of all individuals. These two

Table 3.6-8. Fish Population Densities near San Nicolas Island[1]

Site	Location	Fish/ha Total	Fish/ha Non-Schooling	Number of Species	Number of Samples
NAVFAC	North-central coast	907	113	12	55
WEU	Southwest coast	627	140	16	50
WEK	Southwest coast	577	122	14	40
WDUTCH	South-central coast	1,163	407	18	50
EDUTCH	South-central coast	885	359	16	55
EDAYTONA	Southeast corner	490	158	15	45

[1] Abundance of fish at six subtidal sampling sites in nearshore waters of San Nicolas Island during 1981-86.
Source: Cowen and Bodkin 1993.

species often form large schools of hundreds to thousands of individuals. Jack mackerel, a pelagic, schooling, non-resident species, was encountered rarely but in large numbers.

Excluding the schooling species, two sites on the central southern coast of the island yielded two to four times as many fish as did other San Nicolas Island sampling sites (Cowen and Bodkin 1993). The relative abundance of species collected during the two studies in kelp forests and over soft and rocky bottoms (with and without kelp cover) are shown in Table 3.6-9.

Table 3.6-9. Relative Abundance of Fish Species off San Nicolas Island

	Engle (1993)	Cowen and Bodkin (1993)	Affinity
Smelt	C	-	I
(Calico) kelp bass	A	C	S
Sargo	C	-	S
Opaleye	A	C	S
Halfmoon	C	C	S
Kelp surfperch	A	P	N
Shiner surfperch	P	-	N
Pile surfperch	A	P	N
Black surfperch	A	P	I
Striped surfperch	A	P	N
Rainbow surfperch	A	P	N
Phanerodon spp.	P	P	I
Rubberlip surfperch	C	P	I
Blacksmith	A	A	S
Garibaldi	C	P	S
Rock wrasse	P	P	S
Señorita	A	A	I
California sheephead	A	C	S
Island kelpfish	P	-	S
Kelpfish	C	P	I
Giant kelpfish	C	P	I
Yellowfin fringehead	P	P	I
Blackeye goby	A	C	N
Blueband goby	P	P	S
Zebra goby	P	P	S
California scorpionfish	P	P	S
Kelp rockfish	A	A	I
Gopher rockfish	C	P	N
Copper rockfish	C	P	N
Black & yellow rockfish	C	P	N
Vermilion rockfish	P	C	N
Blue rockfish	A	P	N
Bocaccio	P	-	N
Grass rockfish	C	P	N
Olive rockfish	A	C	N
Treefish	C	P	I
Painted greenling	A	A	N
Coralline sculpin	C	P	N
Lavender sculpin	C	P	S
Snubnose sculpin	C	P	I
Cabezon	C	P	N
Ocean whitefish	P	P	I
Turbot	C	P	N
Jack mackerel	P	P	I
Pacific angel shark	P	P	I
Swell shark	P	P	S
Pacific electric ray	P	P	N
Bat ray	P	P	I

C = common, A = abundant, P = present, N = northern species, S = southern species, and I = intermediate species.
Source: Engle 1993; Cowen and Bodkin 1993.

Overall, Cowen and Bodkin (1993) found that within the kelp forests, areas with the greatest vertical relief supported the greatest numbers and diversity of fish and those with sand the fewest. They did not find that coverage by kelp affected abundance of fish. Most of their rocky sampling sites had enough kelp cover to accommodate fish that associate with kelp. In general, abundance of fish on rock reefs is related to abundance of kelp as well as vertical relief (Cross and Allen 1993). Garibaldi (*Hypsypops rubicundus*), blacksmith, and several rockfish species are abundant only in areas with high bottom relief and are absent from cobble substrates (Larson and DeMartini 1984). Removal of kelp can cause a decline in fish biomass of over 50 percent. Most of the decline is caused by the disappearance of midwater species that associate with the kelp canopy (Bodkin 1988).

Several pelagic species can be found in nearshore waters. These include queenfish, Pacific butterfish (*Peprilus simillimus*), juvenile lingcod (*Ophiodon elongatus*), and white croaker. The following nearshore pelagic species can also be found in the kelp canopy: walleye surfperch, silversides, jack mackerel, northern anchovy, salema (*Xenistius californiensis*), blacksmith, ocean whitefish (*Caulolatius princeps*), Pacific bonito, and Pacific mackerel (Feder et al. 1974).

Year-to-Year Variability in Abundance

Numbers of fish in kelp forests at San Nicolas Island can vary by a factor of three from year to year. This variability may be due to the variability of the influx of juvenile fish. During warm El Niño years, there can be recruitment of southern species that are not normally present at San Nicolas Island. These southern species may then disappear after a few seasons or years. Abundance of northern species may be unaffected by warm periods (Cowen and Bodkin 1993).

C - Pelagic Habitats and Commercial Harvest

Average annual reported landings from the Territorial Waters around San Nicolas Island for the period 1994-1995 were 732,601 pounds (332,306 kg) (Table 3.6-10). The major species taken off San Nicolas Island were Pacific bonito, Pacific sardine, Pacific mackerel, jack mackerel, California sheephead (*Semicossyphus pulcher*), and rockfish. Standardized on a per unit area basis, the catch in Territorial Waters of San Nicolas Island was higher than that taken in non-Territorial Waters but lower than that of other Territorial Waters of the Sea Range.

D - Rare, Threatened, and Endangered Species

Rare, threatened or endangered fish species have not been recorded from marine areas around San Nicolas Island, and such species are unlikely to be found there (CDFG 1994).

3.6.4.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off San Nicolas Island, especially during summer. The kelp beds off western San Nicolas Island may attract some leatherback sea turtles (Stinson 1984) and perhaps green/black sea turtles. However, there are no known sea turtle nesting beaches at San Nicolas Island or anywhere else in the Sea Range.

Table 3.6-10. Seasonal and Average Annual Commercial Fish Totals in Territorial Waters near San Nicolas Island[1]

	Average Landings for 1994 and 1995 (pounds)					Annual Landings (pounds)				
Species	**Total**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**1991**	**1992**	**1993**	**1994**	**1995**
Yellowfin tuna	29	-	-	-	29	-	8,621	-	58	-
Skipjack tuna	44	-	-	-	44	-	30,826	401,383	63	25
Bluefin tuna	585	-	-	555	30	-	76,482	13,231	13	1,157
Other tuna	165	-	-	165	-	-	-	-	-	329
All tuna	**823**	**-**	**-**	**720**	**103**	**-**	**115,929**	**414,614**	**134**	**1,511**
Dover sole	3,535	-	1,222	2,303	10	-	2,555	-	-	7,070
California halibut	522	57	34	425	7	975	1,107	73	439	606
Other flatfish	2,545	16	2,123	404	2	112	829	106	180	4,910
All flatfish	**6,603**	**73**	**3,379**	**3,132**	**19**	**1,087**	**4,491**	**179**	**619**	**12,586**
Red rockfish group	32,235	10,396	3,651	11,417	6,772	7,592	18,736	46,218	50,604	13,866
Other Rockfish	73,474	37,582	11,030	11,087	13,776	24,487	59,989	138,877	104,962	41,986
All rockfish	**105,711**	**47,978**	**14,681**	**22,504**	**20,548**	**32,079**	**79,725**	**185,095**	**155,566**	**55,852**
Pacific bonito	64,145	64,096	-	49	-	146	17	113,135	128,209	81
Pacific mackerel	121,910	52,912	26,821	429	41,748	90,006	-	67,048	4,376	239,445
Jack mackerel	28,508	4,606	-	-	23,902	-	54,825	-	9,211	47,804
Swordfish	7,475	-	202	3,540	3,733	937	1,812	3,411	7,241	7,708
Pacific sardine	346,939	122,929	125,301	-	98,709	-	-	-	2,265	691,612
Northern anchovy	9,130	9,085	-	26	20	-	-	-	39	18,221
Other pelagic fish	945	-	608	301	36	1,128	132	67	823	1,067
Thresher shark	7,855	-	268	2,194	5,393	3,969	-	70	14,647	1,062
Sharks and rays	3,204	269	78	1,982	875	606	3,390	5,192	2,900	3,509
White croaker	378	38	9	210	121	3	-	3	-	757
California sheephead	21,566	4,781	6,985	5,728	4,073	14,844	23,018	18,425	30,415	12,717
Sablefish	3,910	185	1,043	1,882	801	1,026	1,624	617	1,131	6,689
Lingcod	2,430	1,911	6	346	166	315	303	13,844	4,768	92
Other demersal fish	1,067	41	23	410	593	49	-	287	135	1,998
Total	**732,601**	**308,904**	**179,404**	**43,453**	**200,840**	**146,195**	**284,266**	**821,987**	**362,479**	**1,102,711**

[1] Average annual landings in pounds for the period 1994-95 for Territorial Waters around San Nicolas Island and total landings by year for 1991-95.
Source: CDFG 1996a.

3.6.5 Other Channel Islands

3.6.5.1 Fish

A - Common Species and Abundance of Fish

The fish fauna of the northern Channel Islands changes from a typically southern assemblage in the nearshore waters of Santa Cruz Island near the eastern end of the chain to a typically northern assemblage in nearshore waters of San Miguel Island at the western end of the chain (Cross and Allen 1993). Engle (1993) rated the zoogeographic affinities of the rocky subtidal fish fauna of the Channel Islands as follows:

Warm	Santa Catalina, San Clemente
Warm intermediate	Anacapa, Santa Cruz, Santa Barbara
Cold intermediate	Santa Rosa, San Nicolas
Cold	San Miguel

Santa Catalina, San Clemente, and Santa Barbara islands are not within the boundaries of the Sea Range, although Santa Barbara Island is very close. They are included to illustrate the decrease in relative abundance of southern species from the southern (warm) islands to the northern (cooler) islands. The fish faunas of Anacapa, Santa Cruz, and Santa Barbara islands are similar (Engle 1993).

Sixty species of fish have been collected from rocky and sand substrates with and without kelp cover in the offshore islands of the SCB by Engle (1993). However, this number under-represents the actual number observed by about 50 percent. Sand dwellers, rare and cryptic species, and some species that were hard to identify in the field are not included in this estimate. If these fish had been included, total numbers of species observed would have been about 124.

B - Commercial Harvest

Average annual landings for the waters of the Sea Range near the northern Channel Islands for the period 1994-1995 totaled 2,408,854 pounds (1,092,649 kg). The most abundant commercial species around the northern Channel Island chain during 1994-1995 were Pacific sardine, Pacific mackerel, and several species of rockfish. On a per unit area basis, the reported catch off the northern Channel Islands averaged 87,998 pounds/50 NM^2 (39,916 kg/171 km^2), the second highest value of any range area.

C - Rare, Threatened, and Endangered Species

Rare, threatened, or endangered fish species have not been recorded from marine areas around the Channel Islands, and such species are unlikely to be found there (CDFG 1994).

3.6.5.2 Sea Turtles

The occurrence of four species of sea turtles within the Sea Range as a whole is described in Section 3.6.2.2. It is possible that small numbers of sea turtles could be encountered in nearshore waters off Santa Cruz Island or San Miguel Island, especially during summer. However, there are no known sea turtle nesting beaches on these islands or anywhere else in the Sea Range.

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