4.5 Southwest Region

The NMFS Southwest Region is responsible for the management, conservation, and protection of marine species found off the coast of California in the U.S. EEZ. These waters include the U.S. portion of the California Coastal Current LME, known as one of the major coastal upwelling areas of the world.[1] This nutrient-rich environment supports a wide variety of marine life as well as diverse fisheries. The PFMC, in conjunction with NMFS, is responsible for managing fisheries in the Southwest Region.

4.5.1 Fisheries Overview

A total of 25 commercial fisheries are included in this report on the Southwest Region (Table 4.5.1). These fisheries were valued at approximately $116 million[2] in 2005. Management jurisdiction for Southwest Region fisheries occurs at many levels (Figure 4.5.1) since species and fisheries cross regional and national boundaries. For example, the NMFS Northwest Region manages Federal groundfish fisheries extending the length of the U.S. West Coast, and it also manages Federal salmon fisheries with support from the Southwest Region. Additionally, three Southwest Region HMS fisheries occur in international waters.

Over half of the commercial fisheries prosecuted in the Southwest Region are managed at the state level (Figure 4.5.1). Twenty percent of Southwest Region commercial fisheries are federally managed.

The Southwest Region coordinates with PFMC to provide information necessary to develop and monitor Federal FMPs for the Southwest Region. The PFMC has two FMPs in place in this region: the Coastal Pelagics Species FMP and the U.S. West Coast Fisheries for Highly Migratory Species FMP. The Coastal Pelagics FMP, implemented in 1999, was developed from the PFMC's 1978 Northern Anchovy FMP to manage all CPS. The coastal purse seine fishery for anchovy, mackerel, and sardine is managed under this FMP. The U.S. West Coast Fisheries for Highly Migratory Species FMP (implemented in 2004) regulates catch of tunas, billfish/swordfish, sharks, and other HMS species in West Coast fisheries, e.g., mahi-mahi (*Coryphaena hippurus*), also known as dorado or dolphinfish. Seven of the Southwest Region's fisheries are managed under this FMP. Fisheries managed under this FMP are described in the annual SAFE report published each year by the PFMC (available at http://www.pcouncil.org).

The CDFG is the primary management authority for regional state-managed fisheries. The CDFG works jointly with the Southwest Region to manage fisheries that cross the state/Federal border. Data-sharing agreements are in place for all fisheries. For example, CDFG shares effort and logbook data for state fisheries such as the halibut set gillnet fishery and coastal pelagic purse seine fisheries for squid, anchovy, mackerel, and sardine. The Southwest Region also works with the ODFW to manage the northern portion of the pelagic drift gillnet fishery, where the fishing area includes state and Federal waters.

In international waters, the Eastern Tropical Pacific (ETP) bait-boat and Eastern Pacific Ocean (EPO) tuna purse seine fisheries are regulated by the Inter-American Tropical Tuna Commission (IATTC), whereas the Central Western Pacific tuna purse seine fishery is regulated by the Forum Fisheries Agency (FFA) under a FMP administered by the Western Pacific Fisheries Management Council (WPFMC).

4.5.2 Addressing Regional Bycatch Concerns

Staff at the NMFS Southwest Regional Office, Southwest Fisheries Science Center, and regional NMFS field offices work with staff of the PSMFC (the regional interstate fisheries management commission) and state offices to conserve, manage, and develop the fishery resources of the U.S. West Coast. These partnerships are critical to developing bycatch reduction strategies for West Coast fisheries. Efforts have been concentrated on the dominant fisheries and gear types of the Southwest Region: gillnet, coastal purse seine, and tuna purse seine.

Gillnet

Attention to bycatch in the Southwest Region has been largely limited to three gillnet fisheries with a history of marine mammal interactions: the California/Oregon drift gillnet fishery (mesh size greater than 14 inches) targeting swordfish (*Xiphias gladius*) and thresher shark (*Alopias vulpinus*); the California set gillnet fishery (mesh size up to 14 inches) targeting halibut (*Hippoglossus stenolepis*) and white seabass (*Atractoscion nobilis*); and the California small-mesh drift gillnet fishery (mesh size between 3.5 and 14 inches) targeting yellowtail (*Seriola lalandei*) and white seabass (*Atractoscion nobilis*). Marine mammal bycatch has been estimated for fisheries with observer programs since 1990, as required by the MMPA. Amendments to the MMPA in 1994 required fisheries and management agencies to reduce marine mammal bycatch to sustainable levels. In 1996, the Pacific Offshore Cetacean TRT was created to address bycatch of several marine mammal species in the swordfish and thresher shark gillnet fishery (bycatch reduction efforts are described further in Barlow and Cameron 2003). In 1997, a TRP was implemented. The main technology introduced to reduce cetacean bycatch in this fishery was acoustic pingers. Although cetacean bycatch has been reduced by approximately 50% in the California/Oregon

[1] http://www.lme.noaa.gov/.

[2] Ex-vessel landings value, Fisheries Economics of the U.S., 2006. Available online at http://www.st.nmfs.noaa.gov/st5/publication/fisheries_economics_2006.html. Landings values are for the State of California only.

Table 4.5.1
Southwest Region fisheries included in the U.S. National Bycatch Report. Fisheries are listed alphabetically by management authority and then by individual fishery name. Rows containing fisheries for which bycatch estimates are included in this report are shaded.

Fishery[a]	Management Authority	Federal Fishery Management Plan (FMP)[b]	Gear Type	Target Species (common name)	Data Sources[c]
California Coastal Purse Seine for Tuna	Federal	U.S. West Coast Fisheries for Highly Migratory Species	Purse seine	Pacific bluefin, yellowfin, and skipjack tunas	Observer, logbook, landing receipts
California Pelagic Longline	Federal	U.S. West Coast Fisheries for Highly Migratory Species	Longline, surface, mid-water	Swordfish, bigeye tuna	Observer, logbook, MMPA form[d]
North Pacific Albacore Baitboat: Pole and Line	Federal	U.S. West Coast Fisheries for Highly Migratory Species	Hook and line	Albacore tuna	Observer, logbook
North Pacific Albacore Troll	Federal	U.S. West Coast Fisheries for Highly Migratory Species	Troll lines	Albacore tuna	Observer, logbook
South Pacific Albacore Troll	Federal	U.S. West Coast Fisheries for Highly Migratory Species	Troll lines	Albacore tuna	Observer, logbook
California Coastal Purse Seine for Anchovy, Mackerel, Sardine	Federal, State	Coastal Pelagic Species (PFMC)	Purse seine	Northern anchovy, Pacific mackerel, sardine	Observer, logbook, landing receipts
CA/OR Drift Gillnet (mesh size >14 inches) for Swordfish and Thresher Shark	Federal, State	U.S. West Coast Fisheries for Highly Migratory Species	Gillnet, floating drift	Swordfish and thresher shark	Observer, logbook, MMPA form[d]
California Swordfish Harpoon	Federal, State	U.S. West Coast Fisheries for Highly Migratory Species	Harpoons	Swordfish	Logbook
Central Western Pacific Tuna Purse Seine	International		Purse seine	Yellowfin, bigeye, and skipjack tunas	
Eastern Pacific Ocean (EPO) Tuna Purse Seine	International		Purse seine and fish aggregating devices (FADs)	Yellowfin, bigeye, and skipjack tunas	
Eastern Tropical Pacific (ETP) Baitboat	International		Hook and line	Yellowfin, bigeye, and skipjack tunas	
California Abalone	State		By hand, no scuba diving gear permitted	Abalone	
California Coastal Purse Seine for Squid	State		Purse seine	Market squid	Observer, logbook, landing receipts
California Herring Gillnet	State		Gillnet	Pacific herring	
California Live Fish Hook-and-Line	State		Hook and line	Rockfish	

Table 4.5.1 (continued)

Fishery[a]	Management Authority	Federal Fishery Management Plan (FMP)[b]	Gear Type	Target Species (common name)	Data Sources[c]
California Salmon Enhancement Rearing Pen	State		Aquaculture	Pacific salmon	
California Sea Urchin	State		By hand, diving gear	Sea urchin	
California Set Gillnet (mesh size up to 14 inches)	State		Gillnet, sink anchor	California halibut, white seabass	Observer, logbook
California Set Gillnet (stretched mesh size of 3.5 or less)	State		Gillnet	Barracuda, perch, croaker	
California Small-Mesh Drift Gillnet (mesh size >3.5 in and <14 in)	State		Gillnet, floating drift	White seabass, yellowtail	Observer, logbook
California Squid Dip Net	State		Dip nets	Market squid	
California Trap/Pot	State		Pots and traps	California spiny lobster	
California White Seabass Enhancement Net Pens	State		Aquaculture	White seabass	
CA/OR/WA Bait Pens	State		Aquaculture	Northern anchovy	
CA/OR Hagfish Pot or Trap	State		Pots and traps	Hagfish	

[a] Aquaculture fisheries are listed for consistency with the MMPA List of Fisheries when they occur, but are not analyzed for the U.S. National Bycatch Report. Recreational fisheries are not included in this report.
[b] Note that non-Federal FMPs were not identified through this process.
[c] Bycatch data sources were evaluated only for Federal fisheries and non-Federal fisheries with Federal data-collection programs.
[d] This is the self-reporting form required under the MMPA for any injured or killed marine mammal.

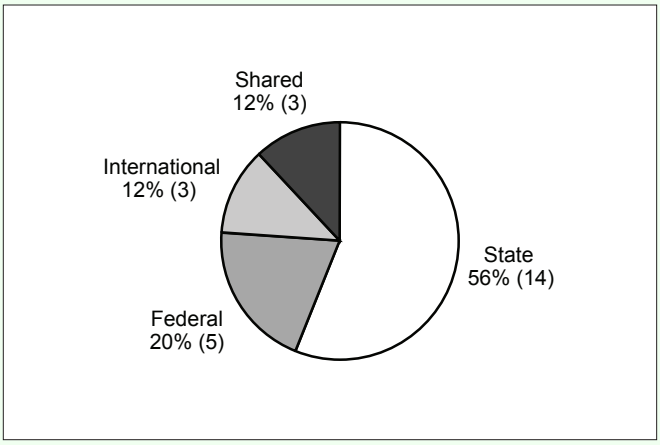

Figure 4.5.1
Management jurisdiction for Southwest Region fisheries (percentages are based on numbers of fisheries, not volume or revenue; *n* = 25). "Shared" indicates fisheries for which international, Federal, state, and/or tribal authorities share management.

drift gillnet fishery (mesh size greater than 14 inches), the TRT still meets to discuss measures that will further reduce bycatch, in an effort to meet ZMRG measures under the MMPA. Gillnet fisheries in this region have also been subject to time and area closures to protect leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) sea turtles and seabird (NMFS 2000). Although other species, such as sharks and finfish, occur as bycatch in Southwest Region gillnet fisheries, efforts to estimate bycatch of these species have only recently been implemented.

Coastal Purse Seine

Purse seine fisheries also operate off the U.S. West Coast, targeting tuna and CPS such as jack mackerel (*Trachurus symmetricus*), market squid (*Loligo opalescens*), northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), and Pacific sardine (*Sardinops sagax*). These fisheries use encircling nets to capture single-species schools of these ecologically important components of the Pacific Coast ecosystem. Many other fish, marine mammal, sea turtle, and seabird populations depend on CPS stocks for food. These CPS fisheries are also subject to observer programs and monitoring. A pilot observer program was initiated in 2004 for the coastal purse seine fishery targeting CPS species operating off California. Trans-boundary stocks of CPS species are exploited in fisheries from northern California to Mexico. West Coast CPS fisheries are generally viewed as healthy and well managed, and even underutilized in some cases (e.g., jack mackerel and northern anchovy). Within the Southwest Region, the federally managed fisheries target primarily anchovy, sardine, and mackerel stocks, while the state-managed coastal purse seine fishery targets squid. Although stocks of ESA-listed salmon species may occasionally occur as bycatch in both Federal and state fisheries, bycatch is negligible overall, primarily consisting of other CPS species. Several measures have been proposed to minimize bycatch (e.g., the use of grates to cover openings of holds through which fish are pumped). A small portion of the Federal fleet also targets bluefin (*Thunnus orientalis*) and yellowfin (*Thunnus albacares*) tuna in southern California waters during warm-water years, and a pilot observer program has also been implemented to monitor these activities.

Tuna Purse Seine

During the 1970s, the EPO tuna purse seine fishery's practice of setting nets around dolphins to capture associated tuna schools resulted in high annual dolphin mortality rates. In 1972, Congress ratified the MMPA, and NMFS began placing fishery observers aboard EPO tuna purse seine vessels to monitor incidental capture rates of dolphins. The tuna–dolphin observer program was turned over to the IATTC in 1995, as U.S. vessel participation in the fishery declined. Bycatch of dolphins by the tuna purse seine fishery is limited by the Agreement on the International Dolphin Conservation Program (AIDCP). Today, U.S. fishery vessel participation in this fishery is extremely low, and no U.S. vessels currently set on dolphins. Under current regulations, all large U.S. vessels carry observers while fishing, and the IATTC tracks estimates of finfish and dolphin mortality for all vessel classes. NMFS continues its efforts to reduce bycatch of dolphins in the ETP by U.S. and foreign vessels through its support of the IATTC and through the certification of "Dolphin Safe" tuna.

4.5.3 Data Sources

Table 4.5.1 lists bycatch data sources available for Southwest Region fisheries that are federally managed or have relevant Federal data-collection programs. Observer programs in the region focus on estimating marine mammal bycatch, although fish discard data are collected by observers as well. Bycatch data may also be collected through Federal and state logbook reporting programs, though the level of underreporting of bycatch through self-reports is typically high.

4.5.3.1 Observer Program

Observer programs conducted in the past 10 years are listed in Table 4.5.2. Observer data include information on the number of fishing sets observed, bycatch per set, fishing location, and oceanographic variables such as sea surface temperature. Fishing gear variables such as net length, presence or absence of acoustic deterrent devices, and extender lengths are also part of the observer database. Biological samples such as teeth, skin, and gonads are collected when possible. In some cases the entire carcass may be retained for analysis. The region's observer data are stored in Microsoft Access files and screened manually, following observer debriefing.

During 2005, the Southwest Region observed 499 sea days of commercial fishing activities and maintained 50% coverage for the pelagic longline fishery. The region has implemented pilot or baseline observer programs for several fisheries (the Pacific albacore troll, California CPS purse seine, Southern California set gillnet, and West Coast HMS recreational charter fisheries). Two of the region's observer programs (California/Oregon pelagic drift gillnet and California pelagic longline) are observed at adequate or near-adequate levels of coverage.

4.5.3.2 Self-Reported Data

Two types of self-reported data are available for use in bycatch estimation: logbook data and landings receipts. Logbooks document catch, fishing effort, and location, as well as some information on fishing gear, and are avail-

Table 4.5.2
Current Southwest Region Federal observer programs (fisheries observed and coverage levels across all fisheries), listed alphabetically by program and then by fishery. Observer programs that ended over 10 years ago are not listed here.

Observer Program	Fisheries	Authority to Place Observers	Program Duration	Coverage Level
California Coastal Pelagic Species Purse Seine	CA coastal purse seine for anchovy, mackerel, sardine	MMPA Cat. II (50 CFR 660.519)	2004–present	2005: 1.5% 2006: 1.5% 2007: 1.5–5% 2008: NA
	CA coastal purse seine forsquid			
California/Oregon Pelagic Drift Gillnet	CA/OR drift gillnet (mesh size >14 inches) for swordfish and thresher shark	MMPA Cat. I, MSA (50 CFR 660.719)	1990–present	2005–07: 20% 2008: 13–14%
California Pelagic Longline	CA pelagic longline	MMPA Cat. II, MSA (50 CFR 660.719)	2001–present	2005: 50% 2006–08: 100%
California Small-Mesh Drift Gillnet	California small mesh drift gillnet (mesh size >3.5 in and < 14 in)	MMPA Cat. II, MSA (50 CFR 660.719)	2002–04	2005–08: NA
California Set Gillnet	California set gillnet (mesh size up to 14 inches)	MMPA Cat. I (50 CFR 229)	2006	2005: NA 2006: <1% 2007–08: NA
Pacific Albacore Troll	North Pacific albacore baitboat: pole and line	MSA (50 CFR 660.719)	1990–2006	2005: <1% 2006: <1% 2007–08: NA
	North Pacific albacore troll			
	South Pacific albacore troll			
Southern California Tuna Purse Seine	CA coastal purse seine for tuna	MSA (50 CFR 660.719)	2004–05	2005: 20% 2006–08: NA
West Coast HMS Recreational Charter Vessels	NA—no recreation fisheries included in this edition of the U.S. National Bycatch Report	MSA (50 CFR 660.719)	2006	2005: NA 2006: 2% 2007–08: NA

able for several Southwest Region fisheries (Table 4.5.1). The Southwest Region and CDFG collect information on catch and discard in jointly managed fisheries including the coastal purse seine fishery for squid, drift gillnet fishery (1981 to present), and the state-managed set gillnet fishery (1990 to present). Logbooks are required for these fisheries, either by the CDFG (for state waters) or by NMFS (for Federal waters). NMFS also requires logbooks for some Federal fisheries, such as the pelagic longline fishery and the coastal purse seine fishery for tuna.

In addition to logbook reporting, there is a requirement under the MMPA marine mammal authorization program (MMAP) that all vessel owners or operators, regardless of the category of fishery they participate in, must report all incidental injuries and mortalities of marine mammals that occur as a result of commercial fishing operations. Reports must be sent to NMFS by mail or fax within 48 hours of the end of a fishing trip in which the serious injury or mortality occurred or, for non-vessel fisheries, within 48 hours of the occurrence. Direct comparisons of self-reported data and observer data for specific fisheries show that the number of self-reports is biased low.

Once received by NMFS, logbook data are entered into a database and edited. Logbook estimates of discard are reported to regional fisheries management organizations (RFMOs) for all international fisheries. NMFS also receives copies of U.S. logbook and observer reports from IATTC.

4.5.3.3 Landings Receipts

Landings data are also available for all the fisheries discussed above, spanning the time period from 1981 to the present, and are used in extrapolating discard estimates to the entire fishery. Landings data are available from the PacFIN system, which houses landing receipt data from California, Oregon, and Washington.

4.5.4 Southwest Region Bycatch Estimation Methods

Estimation of marine mammal, sea turtle, and seabird bycatch in the Southwest Region was accomplished using mean per-unit or ratio estimators (Cochran 1977) and the resulting bycatch estimates have been published in peer-reviewed journals (Julian and Beeson 1998; Forney et al. 2001; Carretta et al. 2005). Estimates of finfish bycatch are currently being developed for select fisheries, and analytical methods will be similar to those used for marine mammals.

Bycatch estimation in the Southwest Region requires a combination of observer program data and estimates of overall fishing effort. Observer data include information on the number of fishing sets observed, bycatch per set, fishing location, and oceanographic variables such as sea surface temperature. Fishing gear variables such as net length, presence or absence of acoustic deterrent devices, and extender lengths are also part of the observer database. Fishing effort estimates may come directly from vessel logbooks, dock surveys of vessel activity, landing receipts, systematic tallies of fishing effort by the observer program contractor with the cooperation of the fishermen, or a combination of all of these sources. Once observer and fishing effort data are in hand, bycatch estimates can be generated.

The Southwest Region uses a mean per-unit or ratio estimator to extrapolate bycatch observations from a small percentage of overall fishing effort to an entire fishery. The critical assumption in this method is that fishing methods are homogeneous across all vessels and areas in the fishery. For this reason, vessels are selected at random so that a representative sample of fishing effort is obtained by the observer program. Some vessels in a fishery are not observable because they may lack berthing space for an observer. In these cases, alternative methods of observation (such as video monitoring systems) may be employed.

Bycatch is estimated annually, rather than within a fishing season, to better overlap with fishery management reporting requirements. No geographic or seasonal strata are used in estimating bycatch rates, because previous studies showed no improvement in mortality estimates or coefficients of variation (CVs) with stratification (Carretta 2001). Yeung (1999) also found that point estimates of marine mammal and sea turtle bycatch were insensitive to stratification, while pooling improved the precision of bycatch estimates. The bycatch ratio for each species is calculated as:

$$(1)\quad \hat{r}_s = \frac{\sum b_s}{\sum d}$$

where b_s is the observed bycatch of species s during a fishing trip and d is the number of days (i.e., sets) observed during the trip. The variance of the bycatch rate (σ^2 of $\hat{r}_s$), is estimated using a bootstrap procedure where one trip represents the sampling unit. Trips are resampled with replacement until each bootstrap sample contains the same number of trips as the actual observed effort level. A bycatch rate is then calculated from each bootstrap sample. This procedure is repeated 1,000 times, from which the bootstrap or bycatch rate sample variance is calculated.

Annual bycatch estimates ($\hat{m}_s$) for species s and the variance of the bycatch estimate (σ^2_m) are estimated for each species using the following formulae:

$$(2)\quad \hat{m}_s = \hat{D}\,\hat{r}_s$$

$$(3)\quad \sigma^2_m = \hat{D}^2\sigma^2_r$$

where

$\hat{D}$ is the estimated maximum number of days (i.e., sets fished,

$\hat{r}_s$ is the kill rate per set for species s, and

σ^2_r is the bootstrap estimate of the kill rate variance.

The precision of a bycatch estimate is typically reported as a CV, where lower values represent increased precision. The CV of a bycatch estimate is calculated simply as the square root of the bycatch estimate variance, divided by the bycatch estimate:

$$(4)\quad \mathrm{CV} = \frac{\sqrt{\sigma^2_m}}{\hat{m}_s}$$

4.5.5 Tier Classification for Southwest Region Fisheries

Data quality and bycatch estimation methods were evaluated for 11 of the 25 fisheries in the Southwest Region. Only Federal fisheries and fisheries with relevant Federal data-collection programs were evaluated. Other data may be available for state, international, and tribal fisheries; how-

ever, these programs were beyond the scope of this initial report. The remaining fisheries were not evaluated due to a lack of data or an absence of bycatch issues (examples are the California abalone and sea urchin fisheries, where target species are collected by hand). Each fishery was given a tier score based on data-collection and estimation methods, through the scoring procedure outlined in Section 3 for fish, marine mammals and other protected species (Table 4.5.3). Two Federal fisheries (North Pacific albacore baitboat pole and line and South Pacific albacore troll) were classified as Tier 0 in all categories (Figure 4.5.2). Of the nine remaining fisheries evaluated, 46% (five) were classified as Tier 1 for the fish category, and 36% (four) were classified as Tier 2. No fisheries were classified as Tier 3 or 4 for fish. In the marine mammal category, 46% (five) of the evaluated fisheries were designated as Tier 3; in the other protected species category, 55% (six) were scored as Tier 3. One additional fishery (California swordfish harpoon) was classified as Tier 0 for both marine mammals and other protected species.

Table 4.5.3
The 2005 fishery tier classifications for the Southwest Region (listed alphabetically, first by management authority and then by fishery). Shaded fisheries were evaluated for this report. Only Federal data-collection programs were evaluated.

Fishery	Management Authority	Fish Tier	Marine Mammals Tier	Other Protected Species Tier
California Coastal Purse Seine forTuna	Federal	2	3	3
California Pelagic Longline	Federal	2	3	3
CA/OR Drift Gillnet (mesh size >14 inches) for Swordfish and Thresher Shark	Federal	2	3	3
North Pacific Albacore Baitboat: Pole and Line	Federal	0	0	0
North Pacific Albacore Troll	Federal	1	1	1
South Pacific Albacore Troll	Federal	0	0	0
California Coastal Purse Seine for Anchovy, Mackerel, and Sardine	Federal, State	1	2	2
California Swordfish Harpoon	Federal, State	1	0	0
Central Western Pacific Tuna Purse Seine	International			
Eastern Pacific Ocean (EPO) Tuna Purse Seine	International			
Eastern Tropical Pacific (ETP) Baitboat	International			
California Abalone	State			
California Coastal Purse Seine for Squid	State	1	2	3
California Hagfish Pot or Trap	State			
California Herring Gillnet	State			
California Live Fish Hook-and-Line	State			
California Salmon Enhancement Rearing Pen	State			
California Sea Urchin	State			
California Set Gillnet (mesh size up to 14 inches)	State	1	3	3
California Set Gillnet (stretched mesh size of 3.5 inches or less)	State			
California Small-Mesh Drift Gillnet (mesh size >3.5 inches and < 14 inches)	State	2	3	3
California Squid Dip Net	State			
California Trap/Pot	State			
California White Seabass Enhancement Net Pens	State			
CA/OR/WA Bait Pens	State			

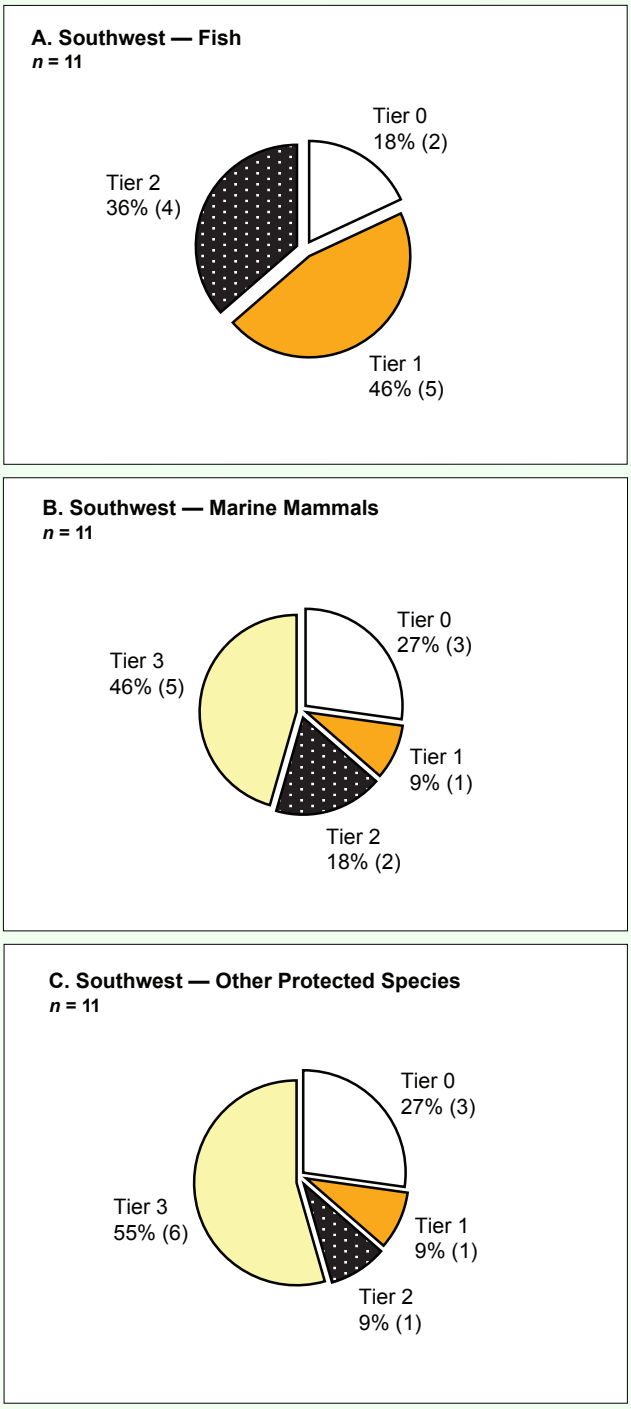

Figure 4.5.2
Southwest Region fishery classifications by number and percentage, for fisheries with Federal management or relevant Federal data-collection programs, for A) fish, B) marine mammals, and C) other protected species. Tier scores are for the year 2005.

Several of the fisheries in the Southwest utilize gear that is known to incidentally capture marine mammals and other protected species, and the region's data-collection programs have been tailored in many cases to address this issue. Methods to estimate fish bycatch using logbook and observer data are in development. The implementation of these methods is expected to increase Southwest Region tier scores in the fish bycatch category.

Fourteen Southwest Region fisheries were not evaluated for this report. The Central Western Pacific tuna purse seine, EPO tuna purse seine, and ETP baitboat fishery were not evaluated because they occur only in international waters, with limited U.S. vessel participation. International data sources are available for these fisheries; however, this report focuses on Federal data-collection programs. Of the remaining fisheries that were not evaluated for this report, three are aquaculture fisheries and the remaining eight fisheries are managed at the state level and have no relevant Federal data-collection programs.

4.5.6 Southwest Region Key Stocks

One hundred and twenty-one key stocks were identified within the Southwest Region (Table 4.5.4). The majority of these stocks (78%) are fish stocks, including 63 FSSI stocks, 27 ESA-listed stocks, and 4 non-FSSI/non-ESA stocks (Figure 4.5.3). No methods were available to estimate bycatch of fish stocks in Southwest Region fisheries, and therefore the quantitative method outlined in Section 3 was not used to identify key regional fish stocks. All fish stocks for which the region has concerns regarding status and bycatch were added through the qualitative process. Listing these fish stocks as key stocks will allow the region to focus on identifying bycatch data deficiencies and information gaps that may stimulate research efforts and development of bycatch estimation methods for inclusion in the second edition of this report.

The remaining 22% of Southwest Region key stocks are protected species populations, including marine mammals, sea turtles, and seabirds (Figure 4.5.3). As in all regions, ESA-listed species were prioritized for inclusion. Nine ESA-listed marine mammal populations (seven cetacean stocks, one pinniped stock, and one mustelid stock, the California sea otter, *Enhydra lutris nereis*) are included as key stocks. Five marine mammal populations were also identified as key stocks through the quantitative process outlined in Section 3; three of these species are cetacean and two are pinnipeds (Table 4.5.4). No marine mammal populations were added through the qualitative process.

All sea turtle species that occur within the Southwest Region were listed as key stocks (Table 4.5.4). The four sea turtle species comprise five separate populations, two of which are endangered: the leatherback sea turtle and Mexico's

Table 4.5.4
Key fish and marine mammal stocks and key sea turtle and seabird populations for the Southwest Region. Overfishing/ overfished status based on 2008 Quarter 1 FSSI report.

Key Fish Stocks Listed by FSSI			
Species/stock name		Overfishing	Overfished
Common name	Scientific name		
Albacore, North Pacific	*Thunnus alalunga*	Unknown	Unknown
Albacore, South Pacific	*Thunnus alalunga*	No	No
Arrowtooth flounder	*Atheresthes stomias*	No	No
Bank rockfish	*Sebastes rufus*	No	No
Bigeye tuna, Pacific	*Thunnus obesus*	Yes	No
Black rockfish, Pacific Coast, north	*Sebastes melanops*	No	No
Blackgill rockfish	*Sebastes melanostomus*	No	No
Blue rockfish	*Sebastes mystinus*	Unknown	Unknown
Blue shark, North Pacific	*Prionace glauca*	No	No
Bluefin tuna, Pacific	*Thunnus orientalis*	Unknown	Unknown
Bocaccio	*Sebastes paucispinis*	No	Yes
Brown rockfish	*Sebastes auriculatus*	Unknown	Unknown
Cabezon	*Scorpaenichthys marmoratus*	No	No
California scorpionfish	*Scorpaena guttata*	Unknown	No
Canary rockfish	*Sebastes pinniger*	No	No—rebuilding
Chilipepper rockfish	*Sebastes goodei*	No	No
Cowcod	*Sebastes levis*	No	Yes
Darkblotched rockfish	*Sebastes crameri*	No	Yes
Dolphinfish, Pacific	*Coryphaena hippurus*	Unknown	Unknown
Dover sole	*Microstomus pacificus*	No	No
English sole	*Parophrys vetulus*	No	No
Gopher rockfish	*Sebastes carnatus*	Unknown	No
Indo-Pacific blue marlin, Pacific	*Makaira mazara*	No	No
Jack mackerel	*Trachurus symmetricus*	No	Undefined
Kawakawa, tropical Pacific	*Euthynnus affinis*	Unknown	Unknown
Kelp greenling	*Hexagrammos decagrammus*	Unknown	No
Lingcod	*Ophiodon elongatus*	No	No
Longnose skate	*Raja rhina*	Unknown	No
Longspine thornyhead	*Sebastolobus altivelis*	No	No
Market squid	*Loligo opalescens*	Unknown	Unknown
Northern anchovy, central subpopulation	*Engraulis mordax*	No	Undefined
Northern anchovy, northern subpopulation	*Engraulis mordax*	Undefined	Undefined
Opah, Pacific	*Lampris guttatus*	Unknown	Unknown

Table 4.5.4 (continued)

Key Fish Stocks Listed by FSSI (cont.)			
Species/stock name		**Overfishing**	**Overfished**
Common name	**Scientific name**		
Pacific chub mackerel	*Scomber japonicus*	No	No
Pacific cod	*Gadus macrocephalus*	Unknown	Unknown
Pacific hake	*Merluccius productus*	No	No
Pacific grenadier	*Coryphaenoides acrolepis*	Unknown	Unknown
Pacific ocean perch	*Sebastes alutus*	No	No—rebuilding
Pacific sanddab	*Citharichthys sordidus*	Unknown	Unknown
Pacific sardine	*Sardinops sagax*	No	No
Petrale sole	*Eopsetta jordani*	No	No
Rex sole	*Glyptocephalus zachirus*	Unknown	Unknown
Rougheye rockfish	*Sebastes aleutianus*	Unknown	Unknown
Sablefish	*Anoplopoma fimbria*	No	No
Sand sole	*Psettichthys melanostictus*	Unknown	Unknown
Shortbelly rockfish	*Sebastes jordani*	No	No
Shortbill spearfish, Pacific	*Tetrapturus angustirostris*	Unknown	Unknown
Shortspine thornyhead	*Sebastolobus alascanus*	No	No
Skipjack tuna, central western Pacific	*Katsuwonus pelamis*	No	No
Skipjack tuna, eastern Pacific	*Katsuwonus pelamis*	No	No
Spiny dogfish	*Squalus acanthias*	Unknown	Unknown
Splitnose rockfish	*Sebastes diploproa*	No	Unknown
Starry flounder	*Platichthys stellatus*	Unknown	No
Striped marlin, central western Pacific	*Tetrapturus audax*	Unknown	Unknown
Striped marlin, eastern Pacific	*Tetrapturus audax*	No	No
Swordfish, North Pacific	*Xiphias gladius*	No	No
Vermilion rockfish	*Sebastes miniatus*	Unknown	Unknown
Wahoo, Pacific	*Acanthocybium solandri*	Unknown	Unknown
Widow rockfish	*Sebastes entomelas*	No	No—rebuilding
Yelloweye rockfish	*Sebastes ruberrimus*	No	Yes
Yellowfin tuna, central Western Pacific	*Thunnus albacares*	Yes	No
Yellowfin tuna, eastern Pacific	*Thunnus albacares*	Yes	No
Yellowtail rockfish	*Sebastes flavidus*	No	No

Table 4.5.4 (continued)

Key Fish Stocks Listed by ESA		
Species/stock name		**Stock status**
Common name	**Scientific name**	
Chinook salmon, California coastal	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, Central Valley spring run	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, Lower Columbia River	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, Puget Sound	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, Sacramento River winter run	*Oncorhynchus tshawytscha*	Endangered
Chinook salmon, Snake River fall run	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, Snake River spring/summer run	*Oncorhynchus tshawytscha*	Threatened
Chinook salmon, upper Columbia River spring run	*Oncorhynchus tshawytscha*	Endangered
Chinook salmon, upper Willamette River	*Oncorhynchus tshawytscha*	Threatened
Chum salmon, Columbia River	*Oncorhynchus keta*	Threatened
Chum salmon, Hood Canal summer run	*Oncorhynchus keta*	Threatened
Coho salmon, central California coast	*Oncorhynchus kisutch*	Threatened
Coho salmon, lower Columbia River	*Oncorhynchus kisutch*	Threatened
Coho salmon, southern Oregon & sorthern California coasts	*Oncorhynchus kisutch*	Threatened
Sockeye salmon, Ozette Lake	*Oncorhynchus nerka*	Threatened
Sockeye salmon, Snake River	*Oncorhynchus nerka*	Endangered
Steelhead, California Central Valley	*Oncorhynchus mykiss*	Threatened
Steelhead, central California coast	*Oncorhynchus mykiss*	Threatened
Steelhead, lower Columbia River	*Oncorhynchus mykiss*	Threatened
Steelhead, middle Columbia River	*Oncorhynchus mykiss*	Threatened
Steelhead, northern California	*Oncorhynchus mykiss*	Threatened
Steelhead, Snake River Basin	*Oncorhynchus mykiss*	Threatened
Steelhead, south-central California coast	*Oncorhynchus mykiss*	Threatened
Steelhead, southern California	*Oncorhynchus mykiss*	Endangered
Steelhead, upper Columbia River	*Oncorhynchus mykiss*	Endangered
Steelhead, upper Willamette River	*Oncorhynchus mykiss*	Threatened
Totoaba	*Totoaba macdonaldi*	Endangered

Table 4.5.4 (continued)

Other Key Fish Stocks		
Species/stock name		**Stock status**
Common name	**Scientific name**	
Basking shark	*Cetorhinus maximus*	Prohibited species in HMS fisheries
Giant sea bass	*Stereolepis gigas*	Protected by State of CA
White shark	*Carcharodon carcharias*	Prohibited species in HMS fisheries
Megamouth shark	*Megachasma pelagios*	Prohibited species in HMS fisheries

Key Marine Mammal Stocks Listed by ESA		
Species/stock name		**Stock status**
Common name	**Scientific name**	
Blue whale	*Balaenoptera musculus*	Endangered
Bowhead whale	*Balaena mysticetus*	Endangered
Fin whale	*Balaenoptera physalus*	Threatened
Guadalupe fur seal	*Arctocephalus townsendi*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Killer whale, Southern Resident	*Orcinus orca*	Endangered
Sea otter, California	*Enhydra lutris nereis*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered

Key Marine Mammal Stocks Not Listed by ESA			
Species/stock name		**ZMRG**	**Stock status [a]**
Common name	**Scientific name**		
California sea lion	*Zalophus californianus*	39.5	Increasing
Common dolphin, long-beaked, CA, OR, WA	*Delphinus capensis*	1.1	Unknown
Harbor seal, California	*Phoca vitulina*	189.6	Stable
Northern right whale dolphin, CA, OR, WA	*Lissodelphis borealis*	11.3	Unknown
Short-finned pilot whale, CA, OR, WA	*Globicephala macrorhynchus*	0.098	Unknown

Key Sea Turtle Populations		
Species/stock name		**Population status**
Common name	**Scientific name**	
Green sea turtle	*Chelonia mydas*	Threatened (except Florida's and Mexico's Pacific Coast breeding colonies, which are Endangered)
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened
Olive ridley sea turtle, Mexico's Pacific Coast breeding colonies	*Lepidochelys olivacea*	Endangered

Table 4.5.4 (continued)

Key Seabird Populations Listed by ESA		
Species/stock name		**Population status**
Common name	**Scientific name**	
Brown pelican, except US (Florida) Atlantic Coast	*Pelecanus occidentalis*	Endangered
California least tern	*Sterna antillarum browni*	Endangered
Hawaiian dark-rumped petrel	*Pterodroma phaeopygia sandwichensis*	Endangered
Least tern, interior population	*Sterna antillarum*	Endangered
Marbled murrelet, CA, OR, WA	*Brachyramphus marmoratus marmoratus*	Threatened
Newell's Townsend's shearwater	*Puffinus auricularis newelli*	Threatened
Short-tailed albatross	*Phoebastria albatrus*	Endangered

Key Seabird Populations Not Listed by ESA			
Species/stock name		**Bycatch concern**	**Population status**
Common name	**Scientific name**		
Ashy storm-petrel	*Oceanodroma homochroa*	Yes	Under review for potential ESA listing as threatened or endangered

[a] Stock status based on NMFS Marine Mammal Stock Assessments (Caretta, Forney, Lowry, et al. 2007).

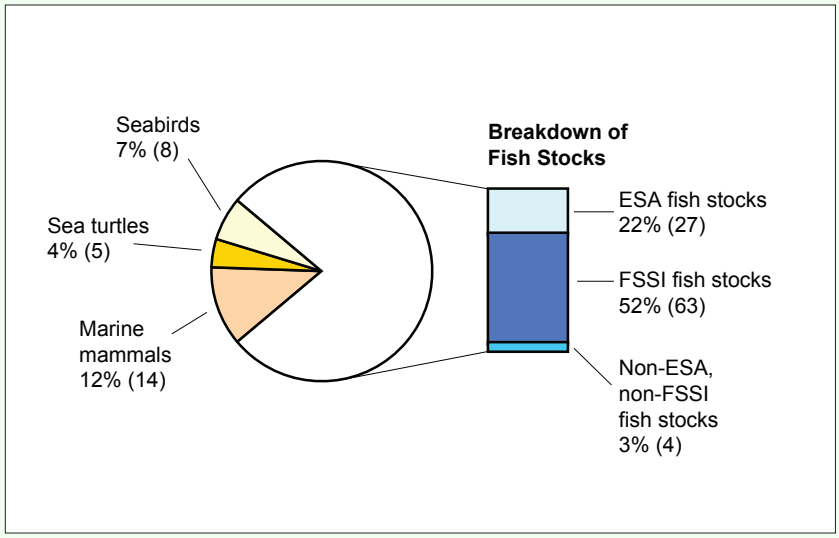

Figure 4.5.3
Numbers and percentages of key stocks for the Southwest Region, by resource type.

Pacific breeding populations of olive ridley (*Lepidochelys olivacea*). Other Southwest Region key populations of olive ridley and green turtles are listed as threatened, as is the loggerhead sea turtle.

Seven ESA-listed seabird populations are listed as key stocks for the Southwest Region. Note that the brown pelican (*Pelecanus occidentalis*) was delisted in 2009 due to its recovery; however, it is listed in this report as an ESA species for consistency with the timeframe of the data and management regulations discussed herein. An eighth seabird species, the ashy storm-petrel (*Oceanodroma homochroa*), is currently being considered for listing under the ESA and was included as a key seabird stock through the qualitative evaluation process. This species is also on the USFWS list of Birds of Conservation Concern.

4.5.7 Southwest Region Bycatch Estimates

Bycatch estimates are currently available for eight marine mammal stocks in the Southwest Region (Appendix 4.5, Table 4.5.A). Marine mammal estimates were provided for three fisheries: the California/Oregon drift gillnet fishery (mesh size >14 inches) for swordfish and thresher shark is an MMPA Category I fishery, whereas the California coastal purse seine fishery for squid and the California small-mesh drift gillnet fishery (mesh size >3.5 inches and < 14 inches) are MMPA Category II fisheries. Stranding evidence also indicates that marine mammal bycatch occurs in currently unobserved or unidentified fisheries in this region. These stranding events represent minimum bycatch numbers, which are reported in the annual Pacific Regional Stock Assessment Reports (Carretta, Forney, Muto, et al. 2007).

Bycatch estimates are provided for one sea turtle stock in the Southwest Region (Table 4.5.B). There was one sea turtle bycatch event in 2005 (an olive ridley turtle), but the fishery is not identified in this report due to data confidentiality restrictions under the MSA. The bycatch of this single turtle occurred outside the U.S. EEZ, but is included here because this species does occur in U.S. waters.

4.5.8 Bycatch Estimate Improvement Plans for Southwest Region Fisheries

Bycatch estimation improvement plans were developed for the three Southwest Region fisheries where bycatch is currently estimated:

- California coastal purse seine fishery for squid
- California/Oregon drift gillnet fishery (mesh size >14 inches) for swordfish and thresher shark
- California small-mesh drift gillnet fishery (mesh size >3.5 inches and < 14 inches)

Bycatch estimation improvement plans for five additional Southwest Region Federal fisheries were also developed. These fisheries were selected due to known bycatch of protected species, potential undocumented bycatch concerns, data confidentiality restrictions on reporting bycatch, and/or less than adequate levels of observer coverage to document the bycatch of rare or sensitive species (Barlow 1989; Babcock and Pikitch 2003; Carretta 2003):

- California coastal purse seine fishery for anchovy, mackerel, and sardine
- California coastal purse seine fishery for tuna
- California pelagic longline fishery
- California set gillnet fishery (mesh size up to 14 inches)
- California swordfish harpoon fishery

In addition to fishery-specific recommendations to address bycatch and data-collection issues, the Southwest Regional team also recommends implementation of the June 2007 SAFE report (PFMC 2007) recommendations to improve data collection for all regional coastal purse seine fisheries. These recommendations included: standardization of data fields, development of fishery-specific observer program manuals, construction of a relational database for observer data, and creation of a statistically reliable sampling plan. The first three recommendations have been implemented, with continued progress on sampling plan designs.

4.5.8.1 Plans for Improving Bycatch Estimation for Southwest Fisheries of Focus

4.5.8.1.1 Fisheries identified through the quantitative process

California Coastal Purse Seine Fishery for Squid

Tier Classes: Fish = 1; Marine Mammals = 2; Other Protected Species = 3

Bycatch and data-collection concerns:

- Bycatch and/or discard of market squid, anchovy, sardine, California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), and ashy storm-petrel (*Oceanodroma homochroa*) have been documented by the observer program.

- Bycatch of other species may occur, but has not been documented.

- Quantitative estimates of fish bycatch are lacking, and observer coverage is too low to reliably detect rare species of management concern that may interact with this fishery.

Recommendations:

- It was recommended to increase observer coverage to adequate levels (at least 10%) to address concerns or confirm that no bycatch concern exists.
- Developing finfish bycatch estimation methods and using these methods to generate initial estimates of bycatch was recommend.

California/Oregon Drift Gillnet Fishery (mesh size >14 inches) for Swordfish and Thresher Shark

Tier Classes: Fish = 2; Marine Mammals = 3; Other Protected Species = 3

Bycatch and data-collection concerns:

- Bycatch of three marine mammal stocks—the long-beaked common dolphin (*Delphinus capensis*), short-finned pilot whale (*Globicephala macrorhynchus*), and Northern right whale dolphin (*Lissodelphis borealis*)—exceeds PBR[3] levels and/or ZMRG. Bycatch of loggerhead sea turtles occurred in 2006,[4] and bycatch of prohibited species such as white shark (*Carcharodon carcharias*), megamouth shark (*Megachasma pelagios*), and basking shark (*Cetorhinus maximus*) has also occurred in the past.
- Some vessel-selection biases exist in this fishery.
- Six of the forty-two active vessels lack berthing space for an observer. These vessels are still required to abide by MMPA take-reduction regulations (e.g., use of pingers on nets, 36-foot extenders).

Recommendations:

- It was recommended that observer coverage should be increased to 30% (currently at 20%) to better document bycatch of rare and sensitive species.
- It was recommended that coverage biases due to unobservable vessels should be reduced through the implementation of a pilot EM system.

California Small-Mesh Drift Gillnet Fishery (mesh size >3.5 inches and < 14 inches)

Tier Classes: Fish = 2; Marine Mammals = 3; Other Protected Species = 3

Bycatch and data-collection concerns:

- Bycatch mortality of long-beaked common dolphin exceeds ZMRG.
- Observer coverage is low and opportunistic (not annual).

Recommendations:

- An increase in observer coverage to above 20% to better document bycatch of rare and sensitive species is recommended.
- It is also recommended to implement year-round observer coverage for this fishery.

4.5.8.1.2 Fisheries identified through the qualitative process

California Coastal Purse Seine Fishery for Anchovy, Mackerel, and Sardine

Tier Classes: Fish = 1; Marine Mammals = 2; Other Protected Species = 3

Bycatch and data-collection concerns:

- Observer coverage of this fishery is too low (2% in 2006) to reliably detect rare species of management concern that may interact with this fishery.
- Quantitative estimates of fish bycatch are lacking; fish bycatch estimation methods have not been developed or peer-reviewed for this fishery.

Recommendations:

- An increase of observer program coverage levels to 10% in order to confirm that no bycatch concern exists was recommended.
- It was also recommended to develop bycatch estimation methods and generate initial estimates of bycatch.

California Coastal Purse Seine Fishery for Tuna

Tier Classes: Fish = 2; Marine Mammals = 3; Other Protected Species = 3

Bycatch and data-collection concerns:

- Quantitative or qualitative estimates of fish bycatch are lacking for this fishery.
- Observer coverage is too low (not observed in 2006, 20%

[3] The PBR level is defined in the MMPA as the maximum number of animals (not including natural mortalities) that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

[4] This estimate is not included as data in this report, but included here for information purposes; this estimate will be included in the next edition of the U.S. National Bycatch Report.

coverage in 2005) to reliably detect rare species of management concern that may interact with this fishery.

- Bycatch of other species may occur but has not been documented.

Recommendations:

- The development of bycatch estimation methods and generation of initial bycatch estimates were recommended for this fishery.
- The HMS management team of the Southwest Region recommended that this fishery be observed at 100%, which is currently feasible, given the small number of vessels (less than 10) landing tuna species.

California Pelagic Longline Fishery

Tier Classes: Fish = 2; Marine Mammals = 3; Other Protected Species = 3

Bycatch and data-collection concerns:

- Due to data confidentiality issues, bycatch cannot be reported for the fishery.

Recommendations:

- It was recommended that bycatch from this fishery should be aggregated with the bycatch of longline fisheries operating out of Hawaii to avoid data confidentiality issues.

California Set Gillnet Fishery (mesh size up to 14 inches)

Tier Classes: Fish = 1; Marine Mammals = 3; Other Protected Species = 3

Bycatch and Data-collection concerns:

- The California set gillnet fishery (mesh size up to 14 inches) has historic bycatch of protected marine mammal and sea turtle species; bycatch of California sea lions and harbor seals has exceeded ZMRG in the past. There has also been highly publicized bycatch of white sharks in this fishery. A pilot observer program was renewed in 2006 for this fishery, with less than 1% observer coverage in 2006. The observer program continued in 2007, with approximately 18% observer coverage.

Recommendations:

- It was recommended to increase observer coverage to at least 20% to better document bycatch of key species with low abundance.

California Swordfish Harpoon Fishery

Tier Classes: Fish = 1; Marine Mammals = 0; Other Protected Species = 0

Bycatch and Data-collection concerns:

- Bycatch of swordfish or other species struck and lost is unknown.
- Bycatch information (struck and lost fish) comes solely from logbook data.

Recommendations:

- It was recommended to implement an observer program for the swordfish harpoon fishery at 10% observer coverage.

4.5.8.2 Southwest Region Recommendations

A total of nine recommendations are made here to improve bycatch data collection and estimation for Federal fisheries and fisheries with relevant Federal data-collection programs in the Southwest Region, with total resource requirements for implementation totaling one full-time staff member and 450 observer DAS (Table 4.5.5). Observer program costs were $0.619M in 2008, with two fisheries observed (the California/Oregon pelagic drift gillnet and California pelagic longline fisheries). For this report, improvement recommendations for Southwest fisheries were based on the most complete year of observer program funding and coverage levels ($1.474M in 2006, with six fisheries observed). In 2006, the deep-set pelagic longline fishery had 100% observer coverage, the large-mesh drift gillnet fishery for swordfish and thresher shark had 18.5% observer coverage, the halibut set gillnet fishery had less than 1% observer coverage, and three purse seine fisheries targeting tunas, market squid, and sardine/anchovy each had less than 5% observer coverage.

If funded and implemented successfully, improvement plan elements would result in improved tier scores for the eight fisheries listed at the beginning of Section 4.5.8. Most tier score improvements would be the direct result of increased or newly initiated observer coverage. The development of fish bycatch estimates for the next edition of this report will also significantly improve regional tier scores.

Table 4.5.5
Summary of Southwest Region recommendations and estimated requirements of implementation in terms of full-time staff and observer DAS. All requirements are annual unless otherwise indicated; ** denotes no additional resource requirements. For further discussion of recommendations, see Section 5.8.

Recommendation[a]	Additional DAS[b]	Feasibility
General Recommendations		
Hire finfish bycatch analyst to generate annual bycatch estimates for multiple fisheries.	NA	High
Fishery-Specific Recommendations		
Increase observer coverage of the California coastal purse seine for anchovy, mackerel, and sardine fishery to 10%.	50	High
Increase observer coverage of the California coastal purse seine fishery for tuna to 100%.	20	High
Increase observer coverage of the California coastal purse seine fishery for squid to at least 10% of all sets.	110	High
Increase observer coverage of the California/Oregon drift gillnet (mesh size >14 inches) fishery targeting swordfish and thresher shark to 30%.	130	High
Aggregate bycatch of the California pelagic longline fishery with that of longline fisheries operating out of Hawaii, to avoid data confidentiality issues.	No cost	High
Increase observer coverage of the California set gillnet (mesh size up to 14 inches) to 20%.	100	High
Increase observer coverage of the California small mesh drift gillnet (mesh size >3.5 inches and <14 inches) to 20%.	20	High
Implement a pilot observer program for the California swordfish harpoon fishery at 10% observer coverage.	20	High
Number of new full-time staff needed to implement all data quality and estimation method improvements recommended by the Southwest region:	1	
Total DAS requirement for all recommendations[c]:	450	

[a] Some recommendations may require additional resource expenditures, such as equipment, which are not itemized.
[b] One observer DAS includes the cost for the observer deployment as well as costs for associated equipment and program administrative functions (staffing).
[c] This amount is in addition to current Southwest Region observer program requirements.

Appendix 4.5 Southwest Region Bycatch Estimates

Table 4.5.A
Subtables showing marine mammal bycatch estimates and associated coefficients of variation (CVs) for Southwest Region fisheries. All bycatch estimates are in number of individuals and include incidental mortality and serious injury. Bycatch estimates reflect an annual average from the years identified. Key stocks and populations are shaded.

Subtable 4.5.A.1

		CALIFORNIA/OREGON DRIFT GILLNET (MESH SIZE >14 INCHES) FOR SWORDFISH AND THRESHER SHARK			
COMMON NAME	**SCIENTIFIC NAME**	**DATA SOURCE**	**AVERAGE NUMBER**	**UNIT**	**CV**
California sea lion, U.S.	*Zalophus californianus*	2000–04	38	Individuals	0.38
Common dolphin, long-beaked, CA, OR, WA	*Delphinus capensis*	2000–04	4.4	Individuals	1.69
Common dolphin, short-beaked, CA, OR, WA	*Delphinus delphis*	2000–04	58	Individuals	0.15
Northern elephant seal, California breeding	*Mirounga angustirostris*	2000–04	8	Individuals	0.4
Northern right whale dolphin, CA, OR, WA	*Lissodelphis borealis*	2000–04	18	Individuals	0.31
Pacific white sided dolphin, CA, OR, WA, north and south	*Lagenorhynchus obliquidens*	2000–04	4.8	Individuals	0.72
Pilot whale, short-finned, CA, OR, WA	*Globicephala macrorhynchus*	2000–04	1	Individuals	1
Risso's dolphin, CA, OR, WA	*Grampus griseus*	2000–04	5.8	Individuals	1.02
TOTAL FISHERY BYCATCH			138	Individuals	5.67

Subtable 4.5.A.2

		CALIFORNIA PURSE SEINE FISHERY — SQUID			
COMMON NAME	**SCIENTIFIC NAME**	**DATA SOURCE**	**AVERAGE NUMBER**	**UNIT**	**CV**
Common dolphin, short-beaked, CA, OR, WA	*Delphinus delphis*	2005	87	Individuals	0.98
TOTAL FISHERY BYCATCH			87	Individuals	0.98

Subtable 4.5.A.3

		CALIFORNIA SMALL MESH DRIFT GILLNET MESH SIZE >3.5 INCHES AND <14 INCHES			
COMMON NAME	**SCIENTIFIC NAME**	**DATA SOURCE**	**AVERAGE NUMBER**	**UNIT**	**CV**
California sea lion, U.S.	*Zalophus californianus*	2003–04	13.5	Individuals	0.57
Common dolphin, long-beaked, CA, OR, WA	*Delphinus capensis*	2002–04	4.7	Individuals	0.98
TOTAL FISHERY BYCATCH			22.5	Individuals	1.24

Table 4.5.A (continued)

Subtable 4.5.A.4 (SUMMARY)		TOTAL SPECIES BYCATCH	
COMMON NAME	**SCIENTIFIC NAME**	**NUMBER**	**UNIT**
California sea lion, U.S.	*Zalophus californianus*	51.5	Individuals
Common dolphin, long-beaked, CA, OR, WA	*Delphinus capensis*	9.1	Individuals
Common dolphin, short-beaked, CA, OR, WA	*Delphinus delphis*	145	Individuals
Northern elephant seal, California breeding	*Mirounga angustirostris*	8	Individuals
Northern right whale dolphin, CA, OR, WA	*Lissodelphis borealis*	18	Individuals
Pacific white sided dolphin, CA, OR, WA, north and south	*Lagenorhynchus obliquidens*	4.8	Individuals
Pilot whale, short-finned, CA, OR, WA	*Globicephala macrorhynchus*	1	Individuals
Risso's dolphin, CA, OR, WA	*Grampus griseus*	5.8	Individuals
TOTAL FISHERY BYCATCH		243.3	Individuals

Table 4.5.B
Subtable showing sea turtle bycatch (observed mortality) for Southwest Region fisheries. Bycatch is reported in number of individuals. Key stocks are shaded.

Subtable 4.5.B.1		ALL WEST COAST FISHERIES			
COMMON NAME	**SCIENTIFIC NAME**	**DATA SOURCE**	**AMOUNT**	**UNIT**	**CV**
Olive ridley sea turtle	*Lepidochelys olivacea*	2005	1	Individuals	
TOTAL FISHERY BYCATCH			1	Individuals	

Subtable 4.5.B.2 (SUMMARY)		TOTAL SPECIES BYCATCH	
COMMON NAME	**SCIENTIFIC NAME**	**NUMBER**	**UNIT**
Olive ridley sea turtle	*Lepidochelys olivacea*	1	Individuals