Estimated Bycatch of Marine Mammals, Seabirds, and Sea Turtles in the 2002-2008 U.S. West Coast Commercial Groundfish Fishery

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TABLE OF CONTENTS

INTRODUCTION **4**
Marine Mammal Protection Act 4
Endangered Species Act 5
Migratory Bird Treaty Act 5
West Coast Groundfish Fishery 5
Groundfish Observer Programs 6

METHODS **8**
Designation of 'take' versus 'non-take' interactions 8
Designation of strata 9
Marine mammals 9
Seabirds 13
Sea turtles 14
Ratio estimator and bycatch estimates 15
At-sea hake sector bycatch estimates 16
Non-hake sector bycatch estimates 19
Sensitivity Analyses 25
Evaluation of Alternative Stratification 25

RESULTS & DISCUSSION **26**
Future work 31

SUMMARY AND CONCLUSIONS **31**

REFERENCES **32**

FIGURES **37**

TABLES **41**

APPENDICES **65**

INTRODUCTION

The marine ecosystem on the United States (US) west coast supports a diversity of marine mammals, seabirds, and sea turtles. For conservation and management purposes, it is important that various sources of mortality for these organisms be identified and their severity be evaluated. The distributions of marine mammals, seabirds, and sea turtles overlap with commercial fisheries operating within the US Exclusive Economic Zone (EEZ). One source of mortality that must therefore be considered is bycatch in commercial fisheries, commonly referred to as incidental takes. This report summarizes interactions between the US west coast groundfish fishery and marine mammals, seabirds, and sea turtles, and presents estimates of fleet-wide bycatch for these species based on data from federal observer programs and from the fishery as a whole from 2002 through 2008.

Currently, there are three key environmental laws in the US that federally regulate actions concerning marine mammals, seabirds, and sea turtles: the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the Migratory Bird Treaty Act (MBTA). The MMPA is explicitly for the protection of marine mammal taxon and the MBTA addresses seabird bycatch specifically. The ESA is relevant to those species identified as threatened or endangered on a species by species basis and offers additional measures for protection of ESA-listed marine mammals and seabirds beyond the MMPA and MBTA. All sea turtles found in US waters are listed as threatened or endangered, and the ESA requires that bycatch of these species be minimized. Sea turtle bycatch is also addressed in the Magnuson-Stevens Fishery Conservation and Management Act (MSA), which governs federal commercial fisheries. Further details of the federal acts relating to marine mammal, seabird, and sea turtle bycatch are described below.

Marine Mammal Protection Act

The MMPA was passed in 1972 and amended in 1994. The Act states that marine mammal species and population stocks should not be permitted to diminish below their optimum sustainable population level and that measures must be taken to replenish depleted species or population stocks. Measures include reduction in the taking of marine mammals in US waters, by US citizens on the high seas, and through the importation of marine mammals and marine mammal products in the US. The MMPA contains specific provisions for reducing marine mammal bycatch in US commercial fisheries.

Effects of US commercial fisheries on marine mammal populations are determined annually and reported in the List of Fisheries (LOF), which is published by the National Marine Fisheries Service (NMFS) as required by section 118 of the MMPA (16 USC 1387 (c) (1)). Each fishery is placed into one of three categories based on the level of marine mammal serious injury and mortality in the fishery, with Category 1 as the highest and Category III the lowest level. The categorization process often relies on Marine Mammal Stock Assessment Reports (SAR) to provide the allowable biological removal of the stock that ensures a sustainable population is maintained. The categorization level of a fishery determines if compliance is required with particular provisions of the MMPA, including registration, observer coverage, and take reduction plans. Category I and Category II commercial fisheries are required to comply with MMPA provisions, while Category III commercial fisheries are not.

The US west coast groundfish fisheries included in this report are all classified as Category III commercial fisheries in the context of the MMPA, with the exception of the sablefish pot sector, which is designated as Category II (74 FR 58859). All US west coast groundfish fisheries are included in the LOF, however, fisheries are grouped differently for management purposes and for the purposes of observer coverage.

Endangered Species Act

The ESA was passed in 1973 to protect and recover imperiled species and the ecosystems upon which they depend. Once a species is listed under the ESA, protective measures are authorized, which may include restrictions on taking, transporting, or selling specimens. NOAA fisheries has jurisdiction over approximately 60 marine and anadromous species that are listed as either threatened or endangered under the ESA (www.nmfs.noaa.gov/pr/species/esa/). These include 9 marine mammal species and 4 sea turtle species known to occur along on the west coast. The US Fish and Wildlife Service (USFWS) manages the protection of seabird species listed under the ESA (www.fws.gov/endangered/). Table 1 presents a list of all marine mammal, sea turtle, and seabird species observed in the US west coast groundfish fishery, along with their ESA status as of December 2009.

Migratory Bird Treaty Act

The MBTA, passed in 1918, is the domestic law that affirms, or implements, the US's commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. The MBTA decreed that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected. Violation of the Act carries criminal penalties and to date, the Act has been applied to the area in US coastal waters extending 3 miles from shore.

West Coast Groundfish Fishery

Although there are many commercial fisheries that operate along the west coast of the US, this report focuses exclusively on marine mammal, seabird, and sea turtle bycatch in the west coast groundfish fishery. The west coast groundfish fishery is a multi-species fishery that utilizes a variety of gear types. The fishery harvests species under the Pacific Coast Groundfish Fishery Management Plan (PFMC 2008) managed by the Pacific Fishery Management Council (PFMC). Over 80 species are designated as groundfish in the FMP, including a variety of rockfish, flatfish, roundfish, skates, and sharks (see Appendix A). These species are found in both federal and state waters. Groundfish are targeted and caught incidentally by trawl nets, hook-and-line gears, and fish pots.

Sectors within the groundfish fishery may be defined based on gear type, target species, permits, or other regulatory factors. Under the FMP, the groundfish fishery is defined as consisting of four management components:

- Limited Entry (LE) – The LE component includes all commercial fishers who hold a federal limited entry permit. The total number of limited entry permits available is capped and permitted vessels are allotted a larger portion of the total allowable catch for commercially desirable species than non-permitted vessels.

- Open Access (OA) – The OA component includes commercial fishers who are not federally permitted. However, state agencies (California Department of Fish and Game and Oregon Department of Fish and Wildlife) have instituted permit programs for certain OA sectors.

- Recreational – This component includes recreational anglers who target or catch groundfish species.

- Tribal – This component includes native tribal commercial fishers in Washington state that have treaty rights to fish groundfish.

These four components can then be further subdivided into sectors based on gear type, target species, and various regulatory factors. Commercial LE and OA sectors have traditionally caught the largest quantities of groundfish and are observed by federal at-sea observer programs.

Groundfish Observer Programs

There are two federal observer programs that collect information aboard groundfish vessels on the US west coast. These are separate programs because they deal with distinctly different components of the groundfish fishery: the federally permitted sector targeting Pacific hake using mid-water trawl gear which processes catch at-sea, and federal and state permitted sectors targeting non-hake species that deliver shoreside.

Observers were first deployed in the at-sea hake sector in the late 1970s under the management of the North Pacific Groundfish Observer Program at NOAA's Alaska Fishery Science Center. The At-Sea Hake Observer Program (A-SHOP), now at NOAA's Northwest Fisheries Science Center, places fishery observers on all vessels that process Pacific hake at-sea. The at-sea hake sector consists of eight to fourteen catcher-processor vessels and motherships that begin fishing in mid-May of each year and continue until the hake quota is reached or until bycatch caps are met. All at-sea hake vessels (catcher-processors and motherships) over 125 feet are required to carry two observers, while vessels under 125 feet carry only one. At-sea hake observers monitor and record catch data in accordance with protocols detailed in the A-SHOP manual (NWFSC 2008a).

Non-hake groundfish sectors are observed by the West Coast Groundfish Observer Program (WCGOP), which was established in May 2001 by NOAA Fisheries (NMFS) in accordance with the Pacific Fishery Management Plan (50 CFR Part 660) (50 FR 20609). This regulation requires that all vessels that catch groundfish in the US EEZ from 3-200 miles offshore to carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has extended NMFS's ability to require that California and Oregon vessels, which only fish in the 0-3 mile state territorial zone, also carry observers. WCGOP observers are stationed along the US west coast from Bellingham, Washington to San Diego, California.

The WCGOP's goal is to improve estimates of total catch and discard by observing shoreside groundfish sectors along the US west coast. Originally, the WCGOP focused observer effort in the LE bottom trawl and LE fixed gear sectors. In 2002, the WCGOP began deploying observers in open access sectors while increasing its coverage of the LE bottom trawl sector. In 2005, the WCGOP increased its coverage of the LE fixed gear sector, and in 2006, the WCGOP improved coverage of the nearshore sector. Currently, the WCGOP coverage goal is to maintain, at a minimum, 20% coverage in the LE bottom trawl and LE fixed gear fisheries by landings, while continuing to improve coverage in the open access sectors of the groundfish fishery. An observer coverage plan from the WCGOP is available at: www.nwfsc.noaa.gov/ research/divisions/fram/ observer/observersamplingplan.pdf.

The A-SHOP and WCGOP programs provide coverage for the following fishery sectors:

- At-sea Pacific hake catcher-processor
- At-sea Pacific hake mothership
- At-sea Pacific hake tribal
- Commercial LE non-midwater trawl
- Commercial LE non-midwater trawl – targeting California halibut
- Commercial OA non-midwater trawl – targeting California halibut
- Commercial fixed gear state-permitted nearshore (Oregon/California)
- Commercial fixed gear LE sablefish primary (endorsed)
- Commercial fixed gear LE non-primary sablefish (non-endorsed and daily trip limit sectors)
- Commercial fixed gear OA daily trip limit
- Commercial state-permitted shrimp trawl

More information on each of these sectors is available in annual reports produced by the A-SHOP and WCGOP (www.nwfsc.noaa.gov/research/divisions/fram/observer/). Furthermore, for a list of groundfish sectors that are not covered by either program, see the description of observer coverage provided by Bellman et al. (2009) in the annual report on estimated total mortality of groundfish species.

The data collected by A-SHOP and WCGOP on marine mammals, seabirds and sea turtles is described in further detail in the Methods section below. Although interactions between the groundfish fleet and protected resource species appear to be infrequent, the data collected by observers represent the primary source of information available on fishery-induced marine mammal, seabird, and sea turtle mortality. Bycatch estimates derived from at-sea observations provide insight into the level of human-induced mortality that may be influencing marine mammal, seabird, and sea turtle populations. As such, they are important for both management and stock assessment purposes.

The purpose of this report is to provide estimates of bycatch for marine mammals, seabirds, and sea turtles in the US west coast groundfish fishery from 2002 through 2008. In addition, it presents a summary of observed incidental takes by year and fishery, and attempts to demonstrate some of the temporal and spatial characteristics of the data. A previous report on the bycatch of marine mammals and seabirds in the groundfish fishery was published, which utilized A-SHOP data from 2002-2006 and WCGOP data from 2002-2005 (NWFSC 2008c).

METHODS

We used a deterministic approach to estimate bycatch of marine mammals, seabirds, and sea turtles in all west coast groundfish fisheries for which observer data are available. Using this approach, the total number of observed takes for each species was stratified temporally and spatially, and then summarized in relation to observed catch. For fishery sectors in which there was less than 100% observer coverage or in which not all observed hauls were monitored for protected resources, observed takes were then expanded to the fleet-wide level based on total fleet catch or landings. Bycatch estimates were only provided when the coinciding coefficient of variation (CV) was less than 80%. These techniques and the information used in their development and implementation are described in further detail below.

Designation of 'take' versus 'non-take' interactions

At-sea hake observer data from 2002-2008 recorded all seabird and marine mammal specimens as mortalities. However, WCGOP observers recorded a variety of fishery interactions with marine mammals, seabirds, and turtles. A standard system for recording interactions is used by both observer programs and includes the following interaction categories; a) killed by gear, b) killed by propeller, c) previously dead, d) lethal removal (trailing gear), e) lethal removal (not trailing gear), f) entangled in gear (trailing gear), g) entangled in gear (not trailing gear), h) feeding on catch, i) deterrence used, j) boarded vessel, k) other, l) unknown.

Based on observer notes, some of these interactions quite obviously resulted in the mortality of the animal and were thus designated as 'takes' prior to further analysis. In other cases, however, the outcome of the interaction was not as clear. In order to designate each of these interactions as a 'take' or 'non-take', we relied upon the legal definitions for a 'take' whenever possible. In some cases, further technical guidance was available to inform this designation. Although the protocol for designating a 'take' differed for different species, the most conservative possible scenario was assumed in all cases.

Under the Marine Mammal Protection Act, a 'take' is defined as any act that harasses, hunts, captures, or kills, or attempts to harass, hunt, capture, or kill a marine mammal. While commercial fisheries are granted an exemption on the prohibition of 'takes' under the MMPA, the Act tasks NMFS with managing serious injuries and mortalities of marine mammals from bycatch in commercial fishing operations. We therefore defined 'takes' of marine mammals to include all interactions that resulted in a mortality or serious injury. Explicit detail of what constitutes a serious injury is not provided in the MMPA, but further guidance was developed by Andersen et al. (2008) during a 2007 workshop. Table 2 presents their recommendations for the designation of serious injuries for large cetaceans, small cetaceans, and pinnipeds under 33 different scenarios. These guidelines were applied directly to WCGOP data to resolve cases in which the animal was injured, but it was unclear whether the animal suffered a mortality as a result of its injury.

When the recommendations from Andersen et al. (2008) were applied, results included serious injury designations for 6 California sea lions, 2 harbor seals, 1 sperm whale and 1 stellar sea lion. While events recorded by the observer were related to recommendations in Table 2 to the greatest extent possible, uncertainty remains for some of these designations. In particular, the sperm whale recorded by the observer was struck by a limited entry fixed gear vessel moving at idle speed. The observer reported that the whale did not appear injured, nor did it exhibit unusual behavior. Andersen et al. (2008) recommend that a collision with a vessel should be considered a serious injury if the vessel is above a certain size and traveling above a certain speed. However, workshop participants did not specify values for these two thresholds, noting that they should be determined based on further veterinary and technical input (Andersen et al. 2008). This interaction was therefore designated to be a take, but it remains uncertain whether it in fact resulted in a serious injury.

For seabirds, take designations differed for species listed under the ESA as threatened or endangered and for species that are not ESA listed. Section 3 of the ESA specifies the term 'take' to mean 'harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct' (16 USC 1532). Any interaction encompassing the ESA definition with an ESA-listed seabird species (Table 1) was identified as a take. For seabirds that are not listed under the ESA, takes were designated for all interactions that were documented as a mortality or were anticipated to have resulted in a mortality. This process was admittedly subjective, but it was informed by specific details in the observer's notes, which are recorded at the time of the interaction. Observers typically detail the nature of the injury and changes in the animal's behavior following its release. Birds documented to have exhibited bleeding, broken bones, or lost feathers were identified as takes. Also, birds that did not fly away or return to normal behavior within a few minutes of the interaction were considered to be takes.

For all species, any specimen that was noted by the observer to have been killed by fishing gear or killed by means of a 'lethal removal' was designated as a take. Lethal removals included any scenario in which the animal was killed by vessel personnel. Only one sea turtle-fishery interaction has been documented by west coast observers from 2002 through 2008. In this case, the turtle was killed by fishing gear and a more involved take designation was not required. Specific criteria for designating sea turtle takes will be defined in the future if additional sea turtles are encountered by observed west coast groundfish vessels.

Designation of strata

Stratification was determined for each species based on a qualitative evaluation of life history traits, population structure, and spatial and temporal differences in abundance. In the sections below, life history characteristics and the selected analyses stratification is provided for each species with observed 'takes'. The introduction of strata is intended to reduce uncertainty in bycatch estimates, but changes in variability associated with different stratification schemes have not been formally tested, primarily due to insufficient sample size to produce informative results.

Marine mammals

Cetaceans

Harbor porpoise (*Phocoena phocoena*) – Harbor porpoises inhabit temperate waters from Cape Flattery, WA to Point Conception, CA (Barlow 1988). Carretta et al. (2001) found that abundance of harbor porpoises declined considerably in depths greater than 60 meters, however, variation in their use of deeper habitats may vary from year to year (Forney 1999).

Concentrations of toxins such as polychlorinated biphenyls (PCBs), dicholordiphenyldichloroethylene (DDE, and hexachlorobenzene (HCB) in blubber samples of harbor porpoises have been shown to differ regionally on the west coast, suggesting their movements are restricted (Calambokidis and Barlow 1991). Initially, stock assessments were conducted for four separate stocks: a Central California stock, Northern California – Southern Oregon stock, Washington - Oregon stock, and Washington Inland Waters stock (Carretta et al. 2009). However, subsequent findings from genetic studies and aerial surveys supported the revision of stock boundaries. Stock assessments are currently conducted for six different stocks on the west coast, including a Morro Bay stock, Monterey Bay Stock, San Francisco – Russian River stock, Northern California - Southern Oregon stock, Oregon - Washington stock, and Washington Inland waters stock (Carretta et al. 2009).

Unfortunately, the quantity of observer data in this analysis does not support such a fine level of stratification. Instead, we employed three latitudinal strata to estimate the bycatch of harbor porpoises in the west coast groundfish fishery: (1) North of Cape Blanco, OR; (2) Between Cape Blanco, OR & Point Arena, CA; and (3) South of Point Arena, CA. Cape Blanco, OR is the latitudinal break used to separate the Oregon - Washington stock from the Northern California - Southern Oregon stock in stock assessments for this species. Point Arena California is used to separate the Northern California -Southern Oregon stock from more finely distributed harbor porpoise stocks in Central California (Carretta et al. 2009). Although the distribution of harbor porpoises does appear to vary by depth (Green et al. 1992), there is no comprehensive information available regarding the depth distribution of the west coast groundfish fishery as a whole. Depth therefore could not be used as a means for stratification, as this variable was not available for data sources used in the expansion of observed bycatch to the fleet-wide level.

Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) – Pacific white-sided dolphins are found throughout the North Pacific Ocean and inhabit the continental shelf and slope areas on the US west coast. Geographic distributions for this species are not well understood, and the population along the entire coast is managed as a single unit (Carretta et al. 2009). Pacific white-sided dolphins are thought to move seasonally in a north-south direction along the US west coast. Forney and Barlow (1998) found that this species was rare off of southern California in the summer, but was present in the winter. Aerial surveys conducted by Green et al. (1992) off the coast of Oregon and Washington indicate that Pacific white-sided dolphins are most abundant in these areas in late spring and early summer. Although these findings suggest seasonal movement, the exact timing of this movement is not clear and may vary from year to year depending on variable water temperatures along the coast or other factors (Forney and Barlow 1998).

We employed latitudinal stratification to attempt to capture seasonal movements of Pacific white-sided dolphins. Two latitudinal strata were used: (1) North of 40˚ 10’ N latitude and (2) South of 40˚ 10’ N latitude. This line is consistent with distinct characteristics in the target species, regulatory characteristics, and fishing behavior observed in the groundfish fishery. It is also intended to correspond with the study areas of surveys conducted by Green et al. (1992) and Forney and Barlow (1998).

Risso's dolphin (*Grampus griseus*) – Risso's dolphins inhabit tropical and warmer temperate waters around the world. They generally favor deeper habitats over the continental shelf but may move inshore in response to seasonal changes in water temperature (Leatherwood et al. 1980). On the US west coast, this species is most abundant off of Southern California (Forney and Barlow 1998). Although Forney and Barlow (1998) found no significant differences in the latitudinal distribution of Risso's dolphins by season, observation of this species off of Oregon and Washington in the late spring and summer suggest that they may move northward in response to warming water temperatures (Green et al. 1992).

We used three latitudinal strata to estimate bycatch of Risso's dolphins in the west coast groundfish fishery: (1) North of 40˚ 10' N latitude; (2) 40˚ 10' N latitude to Point Conception, CA; and (3) South of Point Conception, CA. These were designated to be as consistent as possible with aerial and shipboard survey findings for this species. Data presented by Forney and Barlow (1998) indicated that Risso's dolphin abundance and density was highest in the Southern California Bight, the area south of Point Conception. This additional latitudinal line is intended to address potential seasonal shifts in their distribution, while also coinciding well with logistical and regulatory characteristics in the groundfish fishery, as mentioned previously.

Sperm whale (*Physeter macrocephalus*) – Sperm whales were the only large whale observed to have interacted with commercial groundfish vessels on the west coast. These animals are widely distributed in tropical and temperate waters of the Pacific Ocean. Sperm whales hunt in deep-water habitats and were encountered by observed vessels in deeper areas 50 km or more off-shore. While their distribution may fluctuate in relation to prey abundance (Jaquet et al. 2002, Jaquet et al. 2003), there do seem to be some consistent patterns with respect to their seasonal abundance along the US west coast. In California, sperm whales are found year round, but are most abundant in spring and fall. They appear to inhabit waters off of Oregon and Washington only in non-winter months, from April through November (Carretta et al. 2009).

In order to incorporate these patterns into bycatch estimates for sperm whales, the data were stratified seasonally and spatially. Two seasonal strata were used: winter (Dec – Mar) and non-winter (Apr – Nov). In addition, data were stratified into two areas: (1) North of 40˚ 10' N and (2) South of 40˚ 10' N latitude. This latitudinal line was selected because it is consistent with differences in fishing activity and behavior noted previously and because 40˚ N latitude was indicated by Carretta et al. (2009) as the latitudinal line below which sperm whale abundance was thought to be much greater.

Pinnipeds

California sea lion (*Zalophus californianus*) – Stock assessments for California sea lions identify the population as consisting of three distinct stocks that breed at different locations in southern California and Mexico. The US stock, which breeds on islands in southern California and is distributed as far north as Canada, is genetically distinct from breeding populations in western Baja California and in the Gulf of California, Mexico (Carretta et al. 2009). Breeding takes place between May and August (Odell 1975, Garcia-Aguilar and Aurioles-Gamboa 2003). Following the breeding season, males and juveniles migrate north (Aurioles et al. 1983) while females remain in the area (Lowry et al. 1990).

We employed seasonal stratification to estimate the bycatch of California sea lions, with the breeding season defined as May through August, and the non-breeding season defined as September through April. In addition, latitudinal strata north and south of 40˚ 10' N latitude were also employed in the LE bottom trawl sector because this line represented a clear break in the observed bycatch of California sea lions in this sector. In addition, fishing in the LE bottom trawl sector is generally considered to differ north and south of 40˚ 10' N latitude with respect to target species, trip duration, and other factors.

Harbor seal (*Phoca vitulina*) – Harbor seals are commonly found in estuarine and nearshore habitats along the west coast of North America (Brown and Mate 1983). Although they exhibit some localized movement, radio and satellite tagging studies have demonstrated strong site fidelity at particular haul-out locations (Pitcher and McAllister 1981, Brown and Mate 1983, Lowry et al. 2001). There is considerable evidence indicating geographic structuring among harbor seal populations on the west coast (LaMont et al. 1996). However, it is difficult to identify the exact strata that should be used to separate subpopulations most appropriately. Three separate stocks have been designated for the purposes of stock assessment: a California stock, an outer Oregon - Washington coast stock, and an inland Washington stock (Carretta et al. 2009).

The stratification scheme we employed for estimating bycatch for this species was consistent with that designated for stock assessment, with a latitudinal break applied to the data at the Oregon - California border (42˚ N latitude). Since harbor seals are found in nearshore waters, and commercial nearshore fishing in Washington is prohibited, estimates produced for the area north of the Oregon/California border represent bycatch associated with Oregon nearshore fishing only. Carretta et al. (2009) note that the stock designations they employed were to some extent selected because of "political/jurisdictional convenience." However, we observe clear differences in fishing behavior, target species, catch amounts, gear type, and seasonality between commercial nearshore vessels in Oregon and California, and employ a similar stratification scheme to estimate bycatch for a variety of species in the commercial nearshore sector.

Northern elephant seal (*Mirounga angustirostris*) – Northern elephant seals breed on peninsulas and islands from Baja California to Oregon, but can be found in coastal waters as far north as Alaska (Le Boeuf et al. 2000). The current population of Northern elephant seals is derived from a small group of individuals that survived a significant decline in population abundance due to hunting, and genetic distinctions within the population are not evident (Hoelzel et al. 1993). Breeding takes place during the winter months from December through March (Stewart and Huber 1993). During non-breeding months, Northern elephant seals undergo two annual migrations (Stewart and DeLong 1995). The first of these occurs in early spring, as Northern elephant seals travel north from breeding sites to forage. Considerable dimorphism in the migration route and foraging site of males and females has been observed, with males traveling longer distances to feeding grounds as far as the western Aleutian Islands (Le Boeuf et al. 2000). Males return to shore in the southern part of their range after approximately four months to molt. They then undertake a second migration in late summer to early fall to again reach northern foraging grounds, before returning to rookeries for the start of the next breeding season (Stewart and DeLong 1995, Le Boeuf et al. 2000). Although the migratory route of Northern elephant seals has been tracked using a number of techniques (Brillinger and Stewart 1998, Le Boeuf et al. 2000), it is unclear whether there are specific periods during migratory periods when encounters with fishing gear are more probable.

Only two temporal strata were applied to observer data: (1) the breeding period (December through May); and (2) the non-breeding period (April through November). Migratory routes of individual Northern elephant seals appear to vary considerably (Le Boeuf et al. 2000), complicating the designation of appropriate latitudinal strata for this species.

Steller sea lion (*Eumetopias jubatus*) – This species is primarily found in the North Pacific region and is most abundant in Alaska and the Aleutian Islands. Steller sea lions congregate year-round at haul-out sites on land, and although individuals exhibit large-scale dispersal throughout their range, they are not known to migrate (Raum-Suryan et al. 2002, Carretta et al. 2009). Genetic evidence and other factors suggest that the Steller sea lion population in the North Pacific consists of two stocks: a western stock and an eastern stock (Loughlin 1997). The geographic boundary dividing these two stocks was identified by Loughlin (1997) as Cape Suckling, Alaska (144˚ W longtitude). Raum-Suryan et al. (2002) documented a maximum individual dispersal distance for this species of 1,785 km and bycatch estimates for Steller sea lions on the west coast may thus relate primarily to the eastern stock. Individuals disperse to a lesser extent during the breeding season, which takes place from May through July (Pitcher and Calkins 1981).

We used two seasonal strata to estimate the bycatch of Steller sea lions in the west coast groundfish fishery: (1) the breeding season (May through July) and (2) the non-breeding season (August through April). Given their wide-ranging dispersal behavior, latitudinal stratification was not deemed appropriate for this species.

Seabirds

The US west coast supports of a diversity of seabird species, which exhibit a wide range of life history characteristics. Seabirds for which takes were documented in the west coast groundfish fishery include species that breed locally (termed ‘breeding species’ below), as well as those that pass through the California Current system during migration or foraging periods (termed ‘visiting species’ below).

Breeding species	**Visiting species**
Brandt’s cormorant (*Phalacrocorax penicillatus*) Brown pelican (*Pelecanus occidentalis*) Common murre (*Uria aalge*) Leach’s storm petrel (*Oceanodroma leucorhoa*) Western gull (*Larus occidentalis*)	Black-footed albatross (*Phoebastria nigripes*) Northern fulmar (*Fulmarus glacialis*) Sooty shearwater (*Puffinus griseus*)

While these species differ in many ways, they share the characteristics of being highly mobile and having high metabolic rates that require an abundant food source (Ainley et al. 2005). Because of these shared characteristics, patterns of abundance for multiple seabird species are influenced by the same physical and biological factors, such as oceanic productivity and prey abundance (Tyler et al. 1993, Ainley et al. 2005). Specifically, the seasonal and latitudinal distribution of seabirds is in many ways defined by the intensity of coastal upwelling, which delivers nutrient rich water and supports higher prey biomass in surface waters accessible to seabirds (Tyler et al. 1983). On the US west coast, upwelling is most intense south of Cape Blanco, OR (Bakun et al. 1974, Barth et al. 2000), and this area supports a large percentage of the nesting sites of locally breeding seabirds on the US west coast (Tyler et al. 1993). Tyler et al. (1993) note that the location of stable nesting sites reflects oceanographic conditions that support long-term food availability. Visiting species to the California Current system are also most abundant in areas of strong upwelling intensity and high productivity (Briggs and Chu 1986, Hyrenbach et al. 2002).

In addition to varying by latitude, both coastal upwelling and the distribution of seabirds also vary by season. Three distinct oceanic seasons have traditionally been defined for the US west coast: the Upwelling, Oceanic, and Davidson Current seasons (Ford et al. 2004). The Upwelling season coincides with late spring and summer, when northerly winds transport surface waters southward and away from the coast. The distribution of breeding species in summer largely reflects the location of nesting colonies, which are most prevalent adjacent to the central and northern portion of the California Current system (Tyler et al. 1993, Ford et al. 2004). However, during this time, breeders are outnumbered by visiting species, which are attracted by greater oceanic productivity and prey abundance associated with upwelling. Commonly observed visiting species in summer include the sooty shearwater (*Puffinus griseus*), Northern fulmar (*Fulmarus glacialis*), and black-footed albatross (*Phoebastria nigripes*) (Tyler et al. 1993). In the fall (Oceanic season), northerly winds and upwelling intensity decrease, and sea surface temperature reaches its annual maximum. Several species that nest further south in Mexico and southern California move northward, including the brown pelican (*Pelecanus occidentalis*) and storm-petrels. As winter approaches, these species again return south and breeders from boreal nesting colonies become more abundant, particularly off of California (Tyler et al. 1993). The winter months along the west coast are characterized by warmer water delivered by the Davidson current and reduced levels of primary production (Davidson Current season). Seabird abundance during this time is generally low (Tyler et al. 1993).

We maintained a consistent stratification scheme for all seabird species that was based on findings from aerial and boat surveys synthesized by Tyler et al. (1993). Latitudinal strata were defined in accordance with the gradient in upwelling intensity north and south of Cape Blanco, OR (Bakun et al. 1974, Barth et al. 2000). Three seasonal strata were also defined to coincide with the seasonal trends in upwelling and seabird abudance: (1) winter (January through April); (2) summer (May through August); and (3) fall (September through December).

Sea turtles

Leatherback turtle (*Dermochelys coriacea*) – Leatherback turtles have an extensive geographic distribution, inhabiting tropical and temperate waters in all major oceans. Recent studies in the Atlantic Ocean have demonstrated that leatherbacks are highly migratory, with individuals traveling up to 1,000 km or greater in a single migration (Hays et al. 2004). Off the west coast of North America, leatherback sea turtles have been sited as far north as Alaska (Forney et al. 2007) but are more common off of central California (Benson et al. 2007a). Genetic evidence presented by Dutton et al. (2000) indicates that specimens found on the west coast are actually part of a distinct population originating in the western Pacific. These animals nest on beaches in

Indonesia, Papua New Guinea, and the Solomon Islands during the austral summer, and then migrate across the Pacific to forage in coastal waters off of North America (Benson et al. 2007b). Sightings data from Monterey Bay, California indicate that leatherback turtles are most abundant in late summer and early fall (Starbird et al. 1995). This finding was confirmed by aerial surveys along five transects on the California coast from 1990 to 2003 (Benson et al. 2007a). Benson et al. (2007a) showed a link between leatherback turtle density off of California and the average annual Northern Oscillation Index. Their findings suggest that leatherbacks are more abundant during periods of intense coastal upwelling, which may create favorable foraging conditions (Benson et al. 2007a).

The methodology employed in this analysis did not allow for the incorporation of environmental indicators such as the Northern Oscillation Index. In order to attempt to capture the spatial and temporal variability noted in aerial surveys and sightings data, we employed both seasonal and spatial stratification. Two seasonal strata were specified to reflect periods of presence and absence of leatherback turtles on the US west coast. Summer-fall was defined as June through November, and represented the period during which leatherbacks were present and potentially vulnerable as bycatch in the west coast groundfish fishery. Winter-spring was defined as December through May, coinciding with the migration of leatherbacks returning to the western Pacific. Spatial strata were developed using two latitudinal breaks at Cape Blanco, Oregon (42˚ 50' N latitude) and Point Conception, California (34˚ 27' N latitude). These latitudinal strata were selected because of their relevance to coastal upwelling intensity. Upwelling associated with the California Current system is most intense north of Point Conception, CA (Bakun et al. 1974), but decreases considerably north of Cape Blanco, OR due to inconsistent wind patterns and changes in localized surface currents (Barth et al. 2000).

While these strata were designed with the intention of representing variability in leatherback densities on the west coast most appropriately, the extent to which they achieve this goal is uncertain. A more comprehensive evaluation of the stratification appropriate for this species is inhibited by the paucity of data on leatherback turtles. One leatherback turtle has been recorded by west coast observers from 2002-2008, and this data point alone would not be sufficient to support such an analysis. Given uncertainties in the effectiveness of stratification in isolating variability in leatherback bycatch, we re-computed base estimates of bycatch for this species in three different ways: (1) using seasonal strata only; (2) using latitudinal strata only; and (3) using both seasonal and latitudinal strata (Table 3). None of these approaches resulted in estimates with a CV less than 80%.

Ratio estimator and bycatch estimates

Once the data had been stratified for each species as described above, a ratio estimator was used (Cochran 1977) to expand observed bycatch amounts to the fleet-wide level. This method has been widely used in discard estimation (Stratoudakis et al. 1999, Borges et al. 2005, Walmsley et al. 2007). It relies heavily on the assumption that bycatch is proportional to some metric or proxy of fishing effort, such as fishery landings (Rochet and Trenkel 2005). Rochet and Trenkel (2005) note that this assumption is often not supported by the data, and that in some cases, bycatch may vary nonlinearly or even be unrelated to the ratio estimator denominator. The species of concern in this report are encountered so rarely by the groundfish fishery that it is difficult to assess whether the number of bycatch events is indeed linked to levels of fishing effort. The assumption that bycatch is proportional to fishing effort has not therefore been tested and may bias results if invalid. Certainly, for extremely rare species, particularly those that have been recorded only once during all the years of observer data collection, bycatch estimates produced using ratio estimators should be considered with caution. When the CV for bycatch estimates exceeded 80%, estimates were not included in final summary tables. This threshold was designated based on the frequency distribution of CVs produced for all species under various stratification schemes. This evaluation revealed a definitive break in the distribution of bycatch estimate CVs at 80%. CVs between 10% and 80% are still extremely high and exceed the level of variance that is typically considered acceptable. CVs were large because of a variety of factors, including the excess of zero-valued observations in the data and observer coverage rates in some fishery sectors. Of the variables used in to estimate bycatch, CVs were most closely tied to the level of variance in the number of observed takes, the numerator of bycatch ratios.

For each species, bycatch ratios were computed by sector, year, and selected strata as the number of takes divided by the catch weight recorded in observer data. Bycatch ratios were then expanded to the fleet-wide level based on the total catch or landings from each sector. The denominator used in bycatch ratios differed considerably by fishery sector because of differences in target species and fishing behavior. In addition, variation in sampling protocols by the A-SHOP and WCGOP require that this general approach is applied in slightly different ways during bycatch estimation. The sections below provide more specific details regarding bycatch estimation methodology for each program and fishery sector.

At-sea hake sector bycatch estimates

Observers on at-sea hake vessels take a random sample of the total catch, including both the component that will be retained and that which will be discarded. With one or two observers on-board each vessel, nearly 100% of tows are sampled. However, because of the large volume of catch from each tow, it is only possible to sample 30 to 60% of the total tow catch. When a sample is collected, the various species within it are weighed and recorded (NWFSC 2008a). The resulting data are expanded to the tow level and used to summarize catch by species in the fleet as a whole.

A-SHOP observers monitor for marine mammals and seabirds in two distinct ways. First, if a marine mammal or seabird was caught and is present in the observer's species composition sample, the appropriate information (including weight, length, etc.) is documented. Secondly, observers monitor the dumping of catch from some tows at the deck level to detect the presence of marine mammals, as marine mammals are often too large to make it below deck where the observer normally conducts sampling on these vessels. As sampling total catch for species composition is an observer's highest priority, only approximately 50 to 70% of hauls are monitored on deck during dumping. Observers also record information on all interactions seen between fishing operations and marine mammals and seabirds, and as time allows, document sightings as well. It should be recognized that some incidental marine mammal and seabird interactions resulting in mortality could occur when this fishery's trawl gear is being set or due to collision with the trawl door warp wires while the vessel is fishing. These interactions would be unobserved, as observers do not monitor the setting or fishing of the gear.

Marine mammals – To estimate total bycatch of marine mammal species in the at-sea hake fleet, only those tows that were monitored (on deck) for marine mammals were used. For each marine mammal species, bycatch ratios were computed from monitored tows by strata *i* and year *j*:

$$R_{ij} = \frac{\sum_t y_{ijt}}{\sum_t x_{ijt}}$$

where:

y_{ijt} = the number of takes in stratum *i* and year *j* in tow *t*

x_{ijt} = metric tons of total catch in stratum *i* and year *j* in tow *t*

The variance of R_{ij} was approximated by using the following equation (Cochran 1977):

$$Var(R_{ij}) = \frac{1-f_{ij}}{n_{ij}}\left(\frac{\bar{y}_{ij}}{\bar{x}_{ij}}\right)^2\left(\frac{s^2(y_{ij})}{\bar{y}^2_{ij}} + \frac{s^2(x_{ij})}{\bar{x}^2_{ij}} - 2\left(\frac{\sum_t (y_{ijt}-\bar{y}_{ij})(x_{ijt}-\bar{x}_{ij})}{\bar{y}_{ij}\bar{x}_{ij}}\right)\right)$$

where:

$\bar{y}_{ij}$ and $\bar{x}_{ij}$ = the means of y_{ijt} and x_{ijt}

$s^2(y_{ij})$ and $s^2(x_{ij})$ = the variances of y_{ijt} and x_{ijt}

f_{ij} = the finite population correction factor, defined as the total catch on all observed tows that were monitored for marine mammals divided by the total catch from the entire fishery in stratum *i* and year *j*

n_{ij} = the number of tows in stratum *i* and year *j*

When the sampling fraction in a survey is greater than 5%, variance estimates can be adjusted to account for the added precision associated with sampling a larger portion of the population (Arkin and Colton 1970). The finite population correction factor, f_{ij}, was used here because the number of tows monitored for marine mammals represented a large sample from the total number of tows in the at-sea hake sector. The percentage of tows monitored for marine mammals ranged from 62 to 94% during the study period (2002-2008).

Note that $Var(R_{ij})$ could not be calculated when $\bar{y}_{ij}$ = 0 or $\bar{x}_{ij}$ = 0 for all tows and should be used with extreme caution when R_{ij} is equal to one. One advantage in using this estimator is that it does not assume independence of the numerator and denominator.

Once a bycatch rate was calculated from monitored tows, it was then expanded to the entire fleet using the total fishery catch weight. The fleet-wide bycatch estimate and the variance of the bycatch estimate were calculated as follows:

$$B_{ij} = T_{ij}R_{ij}$$

$$Var(B_{ij}) = T_{ij}^2 \cdot Var(R_{ij})$$

where:

B_{ij} = the bycatch estimates in stratum i and year j
T_{ij} = the weight of the total catch in stratum i and year j

A lognormal approximation (Burnham et al. 1987) was then used to calculate confidence intervals using the following formulas:

$$C_{ij} = \exp\left(z_{\alpha/2} \sqrt{\ln(1 + cv(B_{ij})^2)} \right)$$

$$L_{lower_{ij}} = \frac{B_{ij}}{C_{ij}}$$

$$L_{upper_{ij}} = B_{ij} \cdot C_{ij}$$

where:

$z_{\alpha/2}$ = the wantile from the standard normal distribution corresponding to significance of α
$cv(B_{ij})$ = the coefficient of variation of B_{ij}
L_{ij} = the lower and upper bounds of the confidence interval in stratum i and year j

The advantage in using this approximation is that it captures the skewed nature of the distribution and avoids calculating lower bounds less than zero. The CV for B_{ij} was quite large in most cases and regularly exceeding 10%.

In addition, observers also record data opportunistically when they are informed of a marine mammal interaction on a tow that has not been monitored. The collection protocol for these data is not random, and therefore the opportunistic data was excluded from our analysis. However, a summary of all marine mammal records from unmonitored tows from 2002-2008 is provided in Table 6 for full disclosure and to provide perspective on all marine mammal bycatch observed in this fishery.

Seabirds – Bycatch data for seabirds is primarily recorded during species composition sampling. Seabirds are small enough to make it below deck where the observer samples the catch and are recorded only if they happen to be included in the observer's random species composition sample of a particular tow. Any bycatch of seabirds recorded in a species composition sample must be expanded to the haul level. Often, this results in the observation of one seabird expanding to two seabirds, depending on the observed sample size for that haul. However, since every vessel is observed and close to 100% of the fleet's tows are sampled, the bycatch expansion to the entire at-sea sector is quite small. Note that bycatch of marine mammals, which are not missed due to their large size, do not have to be expanded to the haul level, but were instead expanded to include unmonitored hauls.

To estimate total seabird bycatch in the at-sea hake fishery, all of the sampled tows were used in our analysis. Once the bycatch estimate of seabirds was expanded within each sampled tow, the estimate was then expanded up to the entire fleet. This method for calculating seabird bycatch is the same as the method used to calculate fish bycatch in the at-sea hake sector.

For each seabird species, the total number of takes during each tow was calculated using the following formula:

$$Y_t = y_t \cdot \frac{W_t}{w_t}$$

where:

Y_t = the total number of takes in tow t
y_t = the number of observed takes in the species composition sample of tow t
W_t = the weight of the total catch in tow t
w_t = the weight of the sampled catch in tow t

The total number of takes of each seabird species in the at-sea hake fleet was then calculated using the following formula:

$$B = \sum_t Y_t \left(\frac{C_{total}}{C_{obs}} \right)$$

where:

B = the total estimated bycatch for that species
C_{total} = the total catch from the at-sea hake sector
C_{obs} = the catch all at-sea hake tows that were observed

Seabird bycatch data do not contain the necessary replicates for calculating within tow variation. The only source of uncertainty that could have been evaluated for fleet-wide seabird bycatch estimates was that associated with the variance between tows. Since nearly 100% of tows were sampled, this variation was quite small and not useful for uncertainty.

In addition to seabird data compiled during species composition sampling, observers also record opportunistic data on seabird interactions whenever possible. These are essentially records of seabird takes that were noted by the observer on occasions when they were either informed of an interaction by the crew or happened to observe an interaction while on deck. The collection protocol for these data is not random, and therefore it was not appropriate to include in this analysis. However, a summary of opportunistic seabird data from 2007 - 2008 is presented in Table 6 for full disclosure and to provide perspective on all seabird bycatch observed in this fishery. Additional years of observer data were not provided because the information is currently only available in paper form.

Non-hake sector bycatch estimates

Observer coverage in the non-hake fishery sectors differs considerably than that in the at-sea hake sector. Permits are selected for observation by the WCGOP using a random sampling design without replacement. First, the WCGOP determines the amount of time (based on available resources) it will take to observe the entire fleet; this is termed the selection cycle. Next, the WCGOP aggregates locations along the US west coast into port groups. The permits/vessels in each fishery sector are assigned to a port group based on the location of their previous year's landings. Within each port group, the permits/vessels are randomly selected for coverage. The LE bottom trawl, LE sablefish fixed gear non-endorsed (non-primary), OA fixed gear, Oregon/California nearshore, California halibut, and pink shrimp sectors are selected for one or two month periods, which coincide with cumulative trip limit periods used in management. LE fixed gear sablefish endorsed (primary) permits are selected for the entire sablefish season (April 1 through October 31) until their quota is caught. This selection process is designed to produce a logistically feasible sampling plan with a distribution of observations throughout the entire geographic and temporal range of each fishery sector. Once a permit/vessel has been selected for coverage, the WCGOP attempts to observe all trips and tows/sets that vessel makes during the coverage time period.

The rate of observer coverage in non-hake fishery sectors ranges from 0 to 30%, as defined by the proportion of fishery landings that are observed. These rates vary from one sector to the next, with higher priority sectors receiving the highest observer coverage. A list of fishery sectors in order of coverage priority can be found in the WCGOP manual (NWFSC 2008b).

Fisheries observers monitor and record catch data on commercial fishing vessels by following protocols in the WCGOP manual (NWFSC 2008b). Observer sampling focuses on discarded catch and supplements existing fish ticket landing receipt data to inform weights of retained catch. Observers generally sample 100% of tows/sets made during a trip. On trawlers, the total weight of discarded catch is estimated, and the discarded catch is then sampled for species composition. The species composition sample may be a census or a subsample of all discarded catch. On fixed gear vessels (hook-and-line and pot gears), observers sample total catch (similar to at-sea hake observer sampling methodology) and sample anywhere from 30 to 100% of the catch from each set.

The only available proxy of total fishing effort in the non-hake fishery sectors is landed catch. Logbooks are only available in the LE bottom trawl fleet and only record retained (landed) catch, not total catch. Bycatch rates are therefore computed as the number of observed takes divided by the total weight of retained catch in metric tons. Bycatch rates are computed from all observed tows/sets, and this rate is then expanded up to the fleet-wide level using landed catch weight from fish tickets.

Since marine mammals and sea turtles are large and unlikely to be missed by the observer, the number of takes recorded for these species on each tow/set is used directly to produce the numerator of the bycatch ratio. Seabirds, on the other hand, are smaller and blend more easily with fish catch. Seabirds are often encountered while the observer is conducting species composition sampling, and thus may not be fully accounted for in the sampled portion of the catch alone. It is therefore necessary to expand the bycatch of seabirds within a tow/set prior to computing bycatch rates.

For data from trawl trips, the seabird bycatch is expanded to the tow level using the following equations. First, the total weight of the subsample is computed as:

$$v_k = \sum_s u_{ks}$$

where:

u_{ks} = the observed weight of species s in the subsample of catch category k
v_k = the weight of the subsample from catch category k

A sampling ratio (S_k) is then calculated to determine the proportion of the catch category that was sampled:

$$S_k = v_k / w_k$$

where:

w_k = the total weight of catch category k

The tow-level expanded weight of species s in catch category k is calculated by dividing the species weight in the subsample by the sampling ratio:

$$U_{ks} = u_{ks} / S_k$$

where:

U_{ks} = the weight of species s in catch category k

Tallying the weight (U_{ks}) of species s across all catch categories k within a tow provides the total weight of the species discarded.

For data from fixed-gear trips, the following equation is used to calculate the weight of retained and discarded catch of each species in a set:

$$U_s = u_s \frac{H}{h}$$

where:

U_s = the calculated weight of species s in the set
u_s = the observed weight species s in the subsample
H = the total number of hooks in a set
h = the number of hooks sampled in a set

As an example, suppose an observer monitors 1,400 hooks of a longline set of 2,812 hooks. From the 1,400 sampled hooks, the observer records the take of one Western gull. That one seabird take is expanded to the entire set according to the equations above and the total bycatch of gulls in this set is two. These steps are applied only to seabirds sampled in a species composition sample. If a seabird falls outside of the sampled portion of the catch, that seabird is observed and noted; however, it is not included when calculating bycatch estimates. A summary of seabird takes recorded outside of the species composition sample in non-hake fishery sectors is included in Table 6 for full disclosure and to provide perspective on all seabird bycatch observed.

For the purpose of computing the numerator of a bycatch ratio (the observed landed weight), the weight of all retained species must be further adjusted so that the observed total trip pounds of retained fish in a catch category (as recorded by the observer) matches the total trip pounds on the fish ticket. Doing so ensures that the observed landings are comparable to unobserved landings when expanding bycatch estimates to the entire fleet. To match the total trip pounds, the weight of each observer retained catch category is scaled up or down by the ratio of fish ticket and observer trip weight for that category. The following equation is used to calculate the adjustment factor for this process:

$$A_{mtk} = \frac{r_{mtk}}{\sum_k r_{mtk}}$$

where:

r_{mtk} = the observed retained lbs in catch category k in tow/set t on trip m
A_{mtk} = the adjustment factor used for catch category k in tow/set t on trip m.

The equation used to adjust the retained weight recorded by the observer is:

$$r'_{mtk} = A_{mtk} \cdot L_{mk}$$

where:

r'_{mtk} = the adjusted retained weight (lbs) in catch category k in tow/set t on trip m
L_{mk} = the retained weight (lbs) in catch category k for trip m recorded on the fish ticket.

When a catch category in the WCGOP data cannot be matched to a fish ticket catch category, the WCGOP data are not adjusted. Catch categories found only on the fish tickets are distributed across the observed tows using the proportion of the observed catch per tow divided by the total observed catch per trip using the following equation:

$$P_{mt} = \sum_k \sum_s r_{mtks} \Big/ \sum_t \sum_k \sum_s r_{mtks}$$

$$L_{mtk} = P_{mt} \cdot L_{mk}$$

where:

P_{mt} = the proportion of the observed retained catch in tow t in trip m
L_{mtk} = the total retained weight in catch category k for tow t in trip m recorded on the fish ticket

Once this adjustment has been completed and seabird takes have been expanded to the tow/set level, bycatch ratios for each marine mammal, seabird and sea turtle species are computed from all observed trips within stratum i and year j as:

$$R_{ij} = \frac{\sum_t y_{ijt}}{\sum_t x_{ijt}}$$

where:

y_{ijt} = the number of takes in stratum i and year j in trip t
x_{ijt} = metric tons of retained catch in stratum i and year j in trip t

The variance of R_{ij} was approximated by using the following equation (Cochran 1977):

$$Var(R_{ij}) = \frac{1-f_{ij}}{n_{ij}} \left(\frac{\bar{y}_{ij}}{\bar{x}_{ij}}\right)^2 \left(\frac{s^2(y_{ij})}{\bar{y}^2_{ij}} + \frac{s^2(x_{ij})}{\bar{x}^2_{ij}} - 2\left(\frac{\sum_t (y_{ijt} - \bar{y}_{ij})(x_{ijt} - \bar{x}_{ij})}{\bar{y}_{ij}\bar{x}_{ij}} \right)\right)$$

where:

$\bar{y}_{ij}$ and $\bar{x}_{ij}$ = the means of y_{ijt} and x_{ijt}
$s^2(y_{ij})$ and $s^2(x_{ij})$ = the variances of y_{ijt} and x_{ijt}

f_{ij} = the finite population correction factor, defined as the proportion of the retained (landed) catch that is observed
n_{ij} = the number of trips in stratum *i* and year *j*

Note that $Var(R_{ij})$ could not be calculated when $\bar{y}_{ij}$ = 0 or $\bar{x}_{ij}$ = 0 for all trips and should be used with extreme caution when R_{ij} is equal to one. One advantage in using this estimator is that it does not assume independence of the numerator and denominator. The finite population correction factor, f_{ij}, was used to account for the added precision associated with sampling a relatively large portion of the groundfish fleet (Arkin and Colton 1970).

Marine mammal, seabird, and turtle bycatch data from all groundfish sectors contained a large number of zeroes. However, in sectors with low observer coverage, there was greater uncertainty as to whether zero-valued bycatch rates in some years were truly representative of the fleet. Observer coverage rates from 2002 to 2008 were particularly low (less than 5%) for three non-hake fishery sectors: the LE fixed gear non-endorsed sablefish (non-primary) sector, the OA fixed gear daily trip limit sector, and the state-permitted commercial nearshore sector (Oregon/California). We considered using a pooling approach to avoid zero-valued estimates in low coverage sectors, but decided against this because of the potential to artificially reduce the variance of final bycatch estimates by making the sample size appear larger than it was in actuality.

Once a bycatch rate was calculated from the data for observed trips, it was then expanded to the entire fleet using the total landed catch weight from fish tickets. The fleet-wide bycatch estimate and the variance of the bycatch estimate were calculated as follows:

$$B_{ij} = T_{ij} R_{ij}$$
$$Var(B_{ij}) = T_{ij}^2 \cdot Var(R_{ij})$$

where:
B_{ij} = the bycatch estimates in stratum *i* and year *j*
T_{ij} = the weight of the landed catch in stratum *i* and year *j*

A lognormal approximation (Burnham et al. 1987) was then used to calculate confidence intervals using the following formulas:

$$C_{ij} = \exp\left(z_{\alpha/2} \sqrt{\ln(1 + cv(B_{ij})^2)} \right)$$
$$L_{lower_{ij}} = \frac{B_{ij}}{C_{ij}}$$
$$L_{upper_{ij}} = B_{ij} \cdot C_{ij}$$

where:
$z_{\alpha/2}$ = the quantile from the standard normal distribution corresponding to a significance of α
$cv(B_{ij})$ = the coefficient of variation of B_{ij}
L_{ij} = the lower and upper bounds of the confidence interval in stratum *i* and year *j*

The advantage in using this approximation is that it captures the skewed nature of the distribution and avoids calculating lower bounds less than zero. The CV for B_{ij} was quite large in most cases and regularly exceeding 10%. Bycatch estimates with a CV of more than 80% were excluded from our evaluation and are not provided in summary tables in this report. Uncertainty in these estimates was too great to be considered useful in bycatch quantification. All other summary information is included for these estimates, including the level of observer coverage, number of takes, bycatch ratio, and bycatch ratio standard error (Table 7-9 and Appendix F-H). CVs between 10 and 80% are still considered to be extremely large and underscore that bycatch estimates produced using the current methodology should be considered with caution.

For each species, the total number of takes in each year was calculated by summing bycatch estimates from all strata with a CV of less than 80%. The variance for each year was also calculated by summing the variance estimates from all strata with a CV less than 80%. This assumed independence of strata-specific bycatch and variance estimates.

The specific species included in landed catch weight used in the bycatch ratio denominator and fleet-wide expansion factor differed depending on the targeting behavior in each sector. For the limited entry trawl fleet, this auxiliary variable was defined as the weight of all groundfish listed in the FMP except for Pacific hake (see Appendix B). Pacific hake was excluded because it is inappropriate to include retained hake as a metric of effort in the LE bottom trawl fishery. Vessels that land this species are considered to be targeting Pacific hake exclusively and are thus part of the hake fishery. For the LE and OA fixed gear sectors, retained sablefish weight was used as the auxiliary variable. Retained weights of California halibut and pink shrimp were used in analyses of the California halibut and pink shrimp sectors, respectively. For the state-permitted commercial nearshore sector, bycatch rates and bycatch estimates were computed using the retained weight of nearshore target species as a proxy of fishing effort. A list of species included as target species in the nearshore fishery is provided in Appendix C.

In all cases where multiple species where included in the auxiliary variable, any retained weights that were recorded by the observer but that did not appear on fish tickets were excluded when computing the bycatch ratio. This was necessary to prevent double-counting associated with differences in the species codes used by observers and processors. For instance, while observers may record rockfish catch at the species level, various species of rockfish are often grouped, weighted, and recorded together by the processor under a grouped species code such as NUSP – northern unspecified slope rockfish. In some cases, this difference in species coding prevents observer and fish ticket weights from matching and adjusting properly. Species coding on fish tickets varies considerably between processors and over time, and it is not possible to make assumptions regarding which individual observer-recorded species likely coincide with species grouping codes on fish tickets. Instead, by using only the retained groundfish weight from fish tickets in bycatch ratio denominators, we prevent double-counting of retained weights. This is not a factor when using a single species in the denominator, such as sablefish in the fixed gear fisheries, as any retained weights in observer and fish ticket data that share the same species code will match and adjust properly.

Note that unmatched retained observer data were used during previous analyses of bycatch for marine mammals, seabirds, and sea turtles in non-hake groundfish sectors (NWFSC 2008c). This step and the alternative stratification approach described earlier represent changes in methodology, and may result in slight differences between bycatch estimates provided in this report and those supplied previously. In addition to providing base estimates of marine mammal, seabird and sea turtle bycatch, two subsequent analyses were also conducted to evaluate the potential impact of underestimated bycatch ratios and of alternative stratification schemes on final bycatch estimates. These analyses are described in further detail below.

Sensitivity Analyses

Once base estimates had been computed, a sensitivity analysis was conducted to evaluate how bycatch might differ from base estimates if the observed bycatch rate from the observer data were smaller than the actual rate in the unobserved or unmonitored fleet. In other words, if bycatch of marine mammals, seabirds and sea turtles was somehow minimized while the observer was onboard and monitoring the vessel, to what extent would our bycatch estimates have been underestimated? To evaluate this question, we considered four sensitivity alternatives in which bycatch rates applied to the unobserved portion of the fleet were increased by 10, 50, 100 and 300%. For the WCGOP data, this meant increasing bycatch rates applied to landings from entire trips that were not observed but not to tows or samples within a trip, as all marine mammal, seabird, and sea turtle interactions were assumed known from observed trips. For the A-SHOP data, sensitivities were only conducted for marine mammals and it involved increasing the observed marine mammal bycatch rate that was applied to hauls that were not monitored for marine mammals. Sensitivity analyses were only conducted for species and strata for which base bycatch estimates were already provided. When CVs in base estimates exceeded 80%, neither base estimates nor the results from sensitivity runs were summarized, as they were considered to be too uncertain to be useful. A similar analysis was not conducted for seabirds in the at-sea hake sector because there are no obvious reasons why the unsampled portion of the catch would contain a disproportionately larger quantity of seabirds, given that the acquisition of a random sample is the responsibility of the observer.

Evaluation of Alternative Stratification

The stratification employed in initial estimation was based solely on the life history characteristics, population structure and geographic distribution of marine mammal, seabird, and sea turtle species. It was not based on more extensive modeling of the factors that influence bycatch events. Such an analysis is limited by the large number of zeros in the data, but perhaps may become possible as more data are collected and available. Although these strata are based on the best available information for each species, it is not clear whether they are the most effective stratification schemes with respect to isolating variance of bycatch events in relation to fishing effort.

A myriad of stratification options might be employed. However, we were primarily interested in considering whether the current stratification approach minimizes variance in bycatch estimates and comparing current bycatch estimates with those produced previously under an alternative stratification scheme. For these reasons, we re-ran the analysis with two alternative stratification schemes: (1) when data were stratified into 5 commonly used management areas, and (2) when bycatch was estimated without the use of any spatial or temporal stratification.

The first of these was employed by Perez (2006) and by the WCGOP (NWFSC 2008c) in a previous publication on marine mammal and seabird bycatch. The five latitudinal areas employed in this alternative were originally developed by the International North Pacific Fisheries Commission (INPFC) and evolved into the management areas defined as the following:

Vancouver: Latitude > 47° 30' N
Columbia: Latitude between 43° N and 47° 30' N
Eureka: Latitude between 40° 30' N and 43° N
Monterey: Latitude between 36° N and 40° 30' N
Conception: Latitude < 36° N

The second alternative, estimation without spatial or temporal strata, allowed us to evaluate the benefit gained by employing spatial and/or temporal stratification with respect to reducing variance in final estimates.

RESULTS & DISCUSSION

Overall, 21 marine mammal, seabird, and sea turtle species were caught incidentally, killed, or seriously injured through interactions with fishing vessels, gear, or vessel personnel in the US west coast groundfish fishery. Of these, we produced bycatch estimates for all species for which randomly collected observer data were available (Table 7, 8, and 9). This included 8 marine mammal species, 8 seabird species, and 1 species of turtle. Bycatch estimates with a CV greater than 80% were not provided in summary tables, as these were too uncertain to be considered useful for the evaluation of fleet-wide bycatch. In addition, bycatch estimates were not produced for species that were recorded opportunistically, meaning outside of standard observer sampling protocol (NWFSC 2008a, 2008b), however, these data are provided in Table 6. Bycatch events observed in the at-sea hake fishery sector were all situations in which marine mammals and seabirds were killed by gear. In the non-hake fishery sectors, recorded takes of marine mammals, seabirds, and turtles resulted from a variety of different interaction types, including gear entanglement and lethal removals (Table 1).

From 2002-2008, incidental takes of marine mammals, seabirds, and turtles occurred on less than 2% of observed trips. Although bycatch events for marine mammals, seabirds, and turtles are rare, they remain important from a population dynamics standpoint, particularly for longer-lived species and for highly endangered species, whose populations may be heavily impacted by human-induced sources of mortality.

A sea turtle take was first observed in the US west coast groundfish fishery in 2008. This was a leatherback turtle observed on an open access fixed gear vessel fishing with pot off California in late September 2008. The leatherback was found just below the surface with its flippers entangled in a buoy line, which was connected to a sablefish fish-pot. Although leatherback turtles are known to inhabit waters off of Oregon and California in summer and fall, they have been sighted only twice by west coast observers since September 2001. Leatherbacks travel to North America from their breeding grounds in the western Pacific (Dutton et al. 2000), and are most abundant in this area from June through November (Starbird et al. 1995). Benson et al. (2007a) suggest that leatherback density may be positively correlated with the intensity of coastal upwelling. Although upwelling began earlier than usual in 2008, its intensity was not particularly strong. The lack of atypical findings in environmental data from that year suggests that this rare event was not necessarily driven by a greater abundance of leatherback turtles in the area. With only one data point, it is not possible to evaluate which environmental or fishing-related factors might be most closely linked to leatherback turtle bycatch in the west coast groundfish fishery. It was also not possible to provide bycatch estimates for this species, as CVs surrounding these estimates exceeded 98% regardless of the method of stratification employed. With so much uncertainty, bycatch estimates for leatherback turtles were not considered to be reliable or useful.

Takes were recorded for four different cetacean species during the study period. During 2007, a potentially harmful interaction was recorded with a sperm whale. In this interaction, the vessel collided with the animal while moving at idle speed. The collision took place in August of 2007, near the northern limit of the US EEZ, off the coast of Washington. The vessel was a limited entry fixed gear vessel, fishing with longline gear participating in the sablefish primary fishery. As described further in the methods section, this interaction may not have resulted in the mortality of the sperm whale, as the boat was under 60 feet and moving slowly. However, it was designated as a take because the thresholds for boat size and speed have not yet been specified in the criteria for designating takes of marine mammals that was presented by Andersen et al. (2008).

All other cetacean species recorded by groundfish observers had been killed by fishing gear, and therefore did not require further evaluation to be designated as takes. This included one Pacific white-sided dolphin, which was caught in April 2003 by a limited entry bottom trawl vessel fishing at a mean depth of 300 fathoms off California. In 2008, a harbor porpoise was caught by a federally-permitted California halibut trawl vessel fishing off California at a mean depth of 8 fathoms. A Risso’s dolphin was also caught by a federally-permitted bottom trawler fishing in this vicinity in 2008, but at a mean depth of approximately 160 fathoms, where the vessel was targeting thornyheads and flatfish. Bycatch estimates could not be provided for any of these species because of excessively high estimated CVs (Appendix F). The remaining two cetacean specimens recorded by observers were a Pacific white-sided dolphin and a Dall’s porpoise caught by at-sea hake vessels off of Washington in 2002. These takes occurred during tows that were not monitored for marine mammals. Since data for these two specimens were collected opportunistically, they were not included in bycatch estimation and are instead summarized in Table 6.

For species with only one non-zero data point available, it is quite difficult to provide an accurate and precise estimate of bycatch. Although considerable effort has gone into developing methods that accommodate an excess of zero-valued observations, even the most advanced modeling techniques have limited predictive capacity with only one non-zero data record, as is the case for leatherback turtles and cetaceans. In this analysis, we employed a ratio estimator (Cochran 1977), which assumes that the bycatch of each species is proportional to some proxy of effort (Rochet and Trenkel 2005), in this case fishery landings. For these particularly rare events, it is not possible to test this assumption, as there are not sufficient data. However, it seems quite plausible that any relationship between these events and the amount of landings retained by the fishery would be poor, or even absent entirely.

The 80% CV threshold we applied to determine which bycatch estimates to report was based on an evaluation of the distribution of estimated CVs for all marine mammal, seabird, and turtle species observed. CVs produced under each stratification scheme (original strata based on life history characteristics, IPHC management areas, and no stratification) were plotted as a histogram. Their distribution exhibited a definitive break around 80%. This break was particularly pronounced in the distribution of CVs produced from no stratification. CVs greater than 80% tended to occur when the data included only one non-zero observation and when the observer coverage rate was low. Although we do not provide bycatch estimates in these cases, all other observer data on rare species bycatch events, including the number of takes, observer coverage rate, observed bycatch ratio and bycatch ratio standard error, are provided in Appendices D-H.

In sectors where observer coverage was extremely low, it was extremely difficult to evaluate bycatch even qualitatively. For instance, the leatherback turtle recorded in 2008 was observed in the open access fixed gear sector on a vessel using pot gear. The open access fixed gear sector has an annual coverage rate of between 1 and 3% (Table 5) and observer data from open access pot vessels are particularly sparse. We have no information regarding leatherback turtle bycatch in the unobserved portion of the open access fixed gear sector. No such bycatch events have occurred in other fixed gear sablefish sectors that receive a much greater level of observer coverage and fish with the same gear type. It is unclear whether the bycatch ratio presented for leatherback turtles in Appendix H accurately reflects patterns in the OA open access sector rather than just the small subset of that sector that happened to be observed.

When observer coverage rates are relatively large (greater than 20%), systematic errors in bycatch rates are not anticipated as a result of small sample size, but could occur if observer coverage was not representative of the fleet. This concern is not relevant for the at-sea hake sector, which receives 100% coverage by the A-SHOP. The WCGOP, which observers up to 40% of target species landings depending on the sector, conducts regular evaluations of its sampling design to ensure that observer coverage is representative of the fleet. This includes annual analyses of spatial coverage in relation to fishery logbook information, comparisons of observed and unobserved landings by port, and external reviews to identify sources of bias. To date, these evaluations have not shown significant deviations between the observed and unobserved portions of the non-hake fleet.

Larger observer coverage rates and a larger number of non-zero observations resulted in lower variance estimates for other marine mammals species and several seabirds. Among marine mammals, the highest estimates of bycatch in this study were those generated for the California sea lion. The majority of California sea lions observed in the groundfish fishery were caught by the limited entry bottom trawl and California halibut bottom trawl sectors. Bycatch rates during the breeding and non-breeding season were comparable (Appendix F), indicating that this species is susceptible to bycatch throughout the year. Observed bycatch was greatest south of 40˚ 10’ N latitude, which is consistent with their southerly distribution, particularly during the breeding season (Carretta et al. 2009). Bycatch estimates for this species were highest in 2003, even though bycatch estimates in several strata from that year could not be reported because of their high CV (Table 7 and Appendix F).

Other pinnipeds taken incidentally in the US west coast groundfish fishery included harbor seals, Northern elephant seals, and Steller sea lions. Most of these takes were the result of interactions between pinnipeds and bottom trawl nets, however, there were some instances in which observers recorded California sea lions and harbor seals being hooked or entangled by longline gear. Pinnipeds that were not killed by fishing gear were often released alive and were considered unharmed if they showed no obvious sign of injury and if they were not entangled in fishing gear (see previous section on designation of 'takes'). In two cases, California sea lions were killed by means of lethal removal while an observer was onboard the vessel. These events occurred on limited entry bottom trawl vessels where the animals had been caught and brought onboard alive in the trawl net. Vessel captains cited safety as their reason for shooting these animals.

Among seabirds, bycatch estimates were greatest for the black-footed albatross, which was primarily caught by longlines in the limited entry sablefish endorsed (primary) sector from May through October. Black-footed albatross bycatch ratios exhibited an increasing trend from 2002 to 2007, followed by a slight reduction in 2008 (Appendix G). Takes for this species occur on approximately 2.6% of observed sablefish longline trips, with 1-2 birds typically caught at a time. Bycatch estimates could not be provided for several strata in 2006 and 2007 because of high CVs. Coverage in the limited entry sablefish primary sector was close to 24% in both of these years (Table 5) and the total number of takes in this sector was 13 and 48, respectively (Table 8). However, bycatch events of black-footed albatross in 2006 and 2007 were unusual in that they were concentrated on consecutive sets within the same trip. For instance, one observed vessel caught 32 individuals across several sets off the coast of southern Oregon, representing 2/3 of the total number of observed takes for that year. This resulted in high variance among takes from one trip to the next and produced bycatch estimates with CVs as high as 96% in some strata.

The ESA listing status of black-footed albatrosses is currently under review by the US Fish and Wildlife Service. This species is caught as bycatch in a variety of different longline fisheries and projections indicate a decreasing population trend (Hyrenbach and Dotson 2003). Some longline vessels in the groundfish fishery use streamer lines and other seabird avoidance gear voluntarily. WCGOP observers began documenting the use and characteristics of seabird avoidance gear on fixed gear vessels in 2009, and this information should be available for analyses of bycatch for black footed albatross and other seabird species in future years.

Following black-footed albatrosses, the next most common seabirds caught as bycatch in the US west coast groundfish fishery were shearwaters, gulls, and cormorants (Table 8). Seabird bycatch was most common from April through October. Although bycatch rates for most species were highest in association with longline gear, common murres, cormorants, and storm-petrels were also caught by trawl gear.

None of the seabird species caught incidentally in the US west coast groundfish fishery are currently listed as endangered or threatened under the ESA. Although the brown pelican was listed for many years following population declines associated with DDT, this species was delisted in November 2009. One brown pelican take was observed in the groundfish fishery during our study period. This specimen was caught in the limited entry non-sablefish endorsed (non-primary) sector, which has a low level of observer coverage. The specimen was caught off of southern California by a longline vessel targeting shortspine thornyheads at a depth of about 300 fathoms. The bycatch estimate produced by expanding this single event to the fleet-wide level had a CV of 111% (Appendix G). An estimate for brown pelican bycatch was therefore not reported.

With respect to results for seabirds, it is important to emphasize that bycatch estimates were only produced from seabirds that were recorded during species composition sampling. In accordance with WCGOP sampling protocol, all seabirds that are killed by gear and pulled on deck during gear retrieval are included in species composition sampling of that tow or set. Similarly, A-SHOP observers only include seabirds in their species composition sample if the birds are carried below deck with the rest of the catch. In both programs, data on seabirds are collected during regular catch processing procedures in order to ensure that they are sampled randomly, as some individuals could be missed because of their small size using census sampling. Seabirds that are injured but that are not included in the catch are excluded from this sampling process and recorded opportunistically. Opportunistic data from seabirds are presented in Table 6.

Results from the sensitivity analysis are included adjacent to base bycatch estimates in the summary tables provided for each species (Tables 7, 8, and 9). The sensitivity analysis was intended to evaluate how mean bycatch estimates might be affected if the bycatch ratios in the observed portion of the fleet were negatively biased. Although the WCGOP and A-SHOP programs have found no evidence to suggest that bycatch of marine mammals, seabirds, and turtles is reduced when an observer is onboard, negatively biased bycatch rates might be anticipated if fishermen are able to alter fishing practices when they are observed in a way that reduces the probability of encountering these species. The sensitivity analysis was performed for marine mammals in all sectors, and in the non-hake sectors for seabirds only. Since close to 100% of tows are observed in the at-sea hake sector, and seabirds in that sector are sampled in the species composition sample, there was no comparable unobserved portion of the fleet to which the application of higher bycatch ratios would be appropriate. Results of the sensitivity analysis indicate that bycatch of marine mammals and seabirds on unobserved vessels would have to be considerably larger than that on observed vessels (typically by more than 300%) for the actual bycatch amount to fall outside of estimated 90% confidence intervals.

Plots of the distribution of CVs under each alternative stratification scheme are also provided in Tables 7, 8, and 9. These plots are only included for species for which bycatch estimates were reported, as they are intended for comparison purposes. Results of this evaluation indicate that bycatch estimate CVs tended to be comparable and were consistently large regardless of the stratification scheme employed. The distributions of CVs had a similar range and central tendency when data were post-stratified based on biological characteristics of the species, IPHC management areas, or not at all (Tables 7-9). In some cases, differences in the median CV value were noted. For California sea lions, the median CV was actually highest when strata were determined based on breeding season and lowest when no strata were applied to the data. For the steller sea lion and for unidentified gulls, the use of IPHC management areas appeared to lower bycatch estimate CVs to some extent. Beyond these exceptions, stratification used in base estimates generally produced comparable or slightly lower median CV values than the other two techniques and no particular stratification approach could be identified as superior.

We would like to emphasize that estimates of uncertainty provided in this report relate to variation in observer data only. Several sources of uncertainty were not accounted for in this analysis that could influence final bycatch estimates. These include uncertainty in fishery landings, the appropriateness of 'take' designations, the assignment of fish ticket landings to latitudinal and temporal strata, and others. Currently, it is not possible to quantify the variability in bycatch estimates that are associated with these types of uncertainty.

Future work

This analysis employed a design-based approach to produce bycatch estimates for marine mammals and seabirds in the US west coast groundfish fishery. Design-based estimation techniques are imprecise in the presence of many zeros, thus limiting their utility for rarely encountered species. Although design-based estimates are theoretically unbiased, we post-stratified the data in such a way that deviated from the stratification in the observer program sampling design. This is particularly important to recognize when considering estimates presented for the non-hake sectors, for which observer coverage is well below 100%. The WCGOP program, which observes non-hake sectors, selects vessels within each port group for all trips and sets within a 2 month period or the primary season (sablefish only). However, the sample size in many port groups is insufficient to allow for estimates of uncertainty. Furthermore, some port groups may cover a geographic range that is inconsistent with the distribution and variability of marine mammal and seabird fishery interactions. Post-stratification was therefore deemed more useful than true design-based estimates in the current analysis. However, this approach may introduce bias into variance estimates.

In the future, a model-based approach could be used to evaluate bycatch of marine mammals, seabirds, and turtles in the groundfish fishery. Such an approach would be used to address a variety of different questions, including which factors (gear type, location, sea condition, etc.) are most closely related to bycatch events, and whether the relationship between bycatch and fishery landings is sufficient to warrant the continued use of a ratio estimator. If a ratio estimator is supported by future findings, model-based techniques could also help inform the designation of appropriate stratification. Alternatively, model-based techniques might be adapted to estimate bycatch directly in relation to a series of selected factors. Ideally, future work would also include simulations that identify whether such an approach is more effective than the existing use of ratio estimators, and if so, to what extent.

SUMMARY AND CONCLUSIONS

In this report, we summarized bycatch data for marine mammals, seabirds, and sea turtles provided by onboard federal fisheries observers in the 2002-2008 US west coast groundfish fishery. Bycatch estimates were computed for all fishery sectors with available observer data. However, estimates were only provided when coinciding coefficient of variation (CV) estimates were less than 80%.

- Incidental takes were recorded for 4 cetacean species 4 pinniped species, 8 seabird species, and 1 turtle species.

- Among marine mammals, bycatch estimates were highest for the California sea lion, which was caught primarily in trawl nets in the limited entry trawl and California halibut trawl sectors.

- Among seabirds, bycatch estimates were highest for the black-footed albatross, which was caught primarily by longline gears in the limited entry sablefish primary (endorsed) sector.

- One leatherback turtle was killed by gear on an observed open access pot vessel in 2008. The bycatch estimate based on this data point was extremely uncertain and was excluded from final results due to its high CV.

- Bycatch estimates for all species included in this report were highly uncertain because of the excess number of zero-valued observations in the data and should be considered cautiously.

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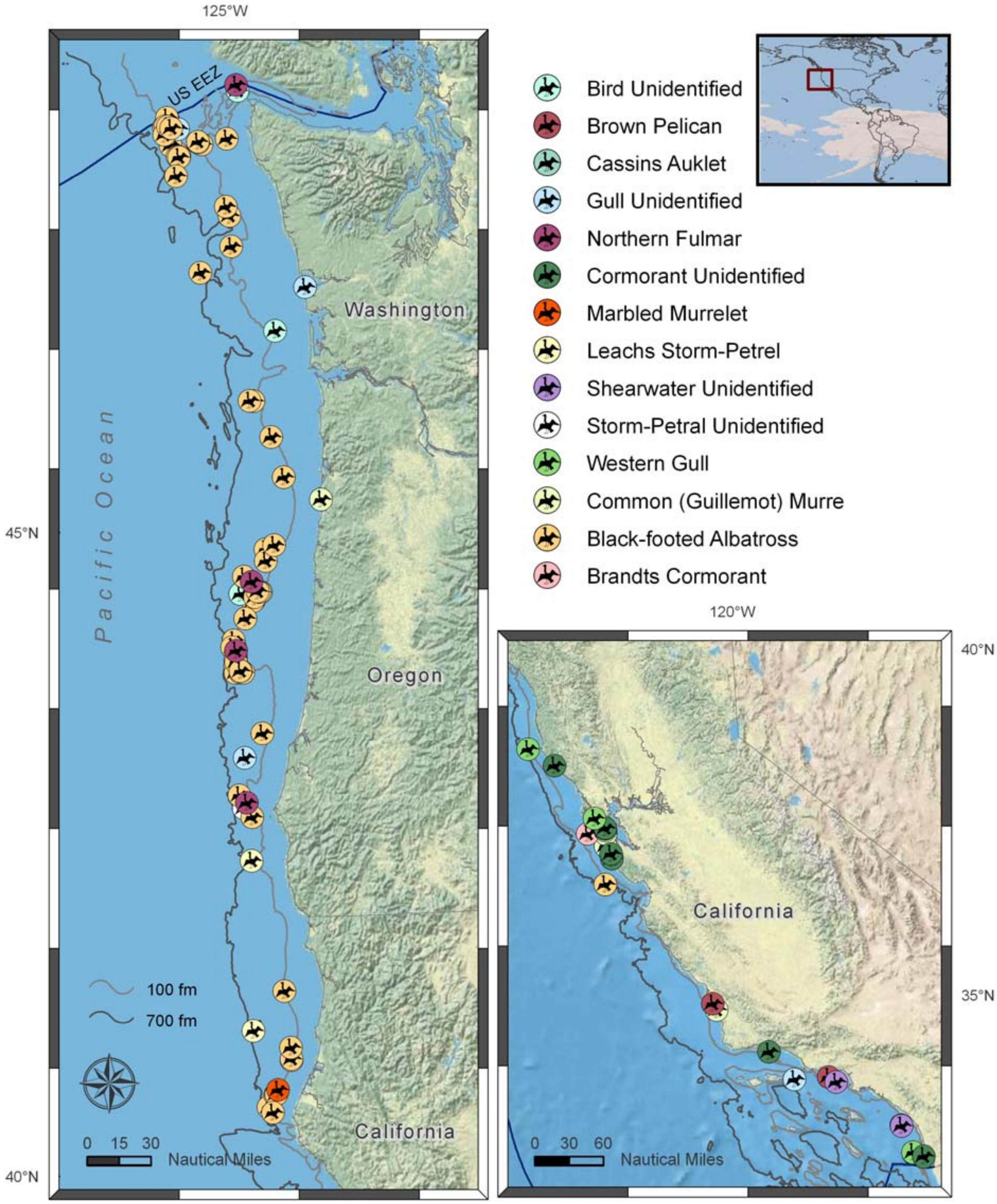
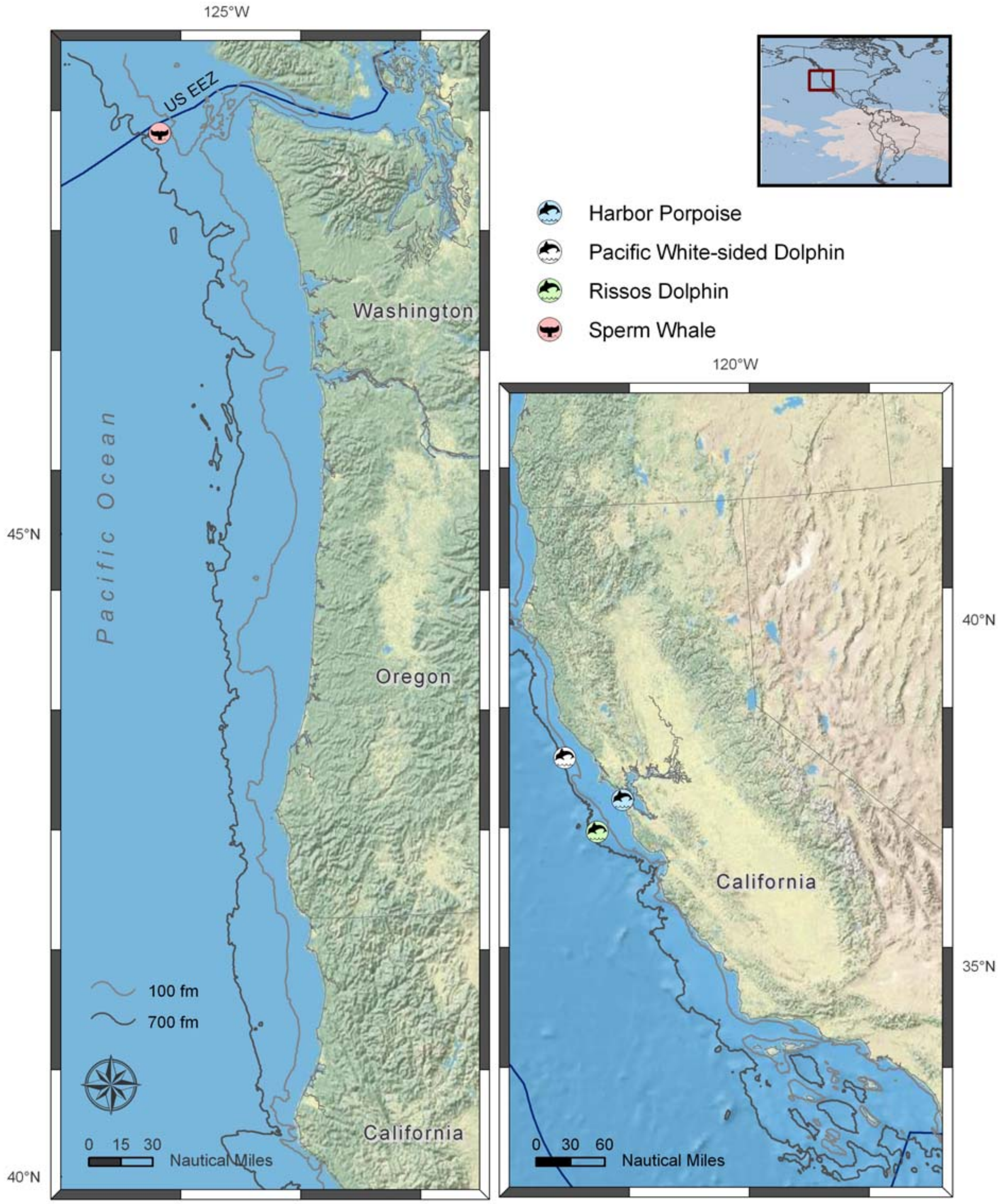
FIGURES

Figure 1. Geographic distribution of observed seabird takes by the West Coast Groundfish Observer Program from 2002 through 2008.



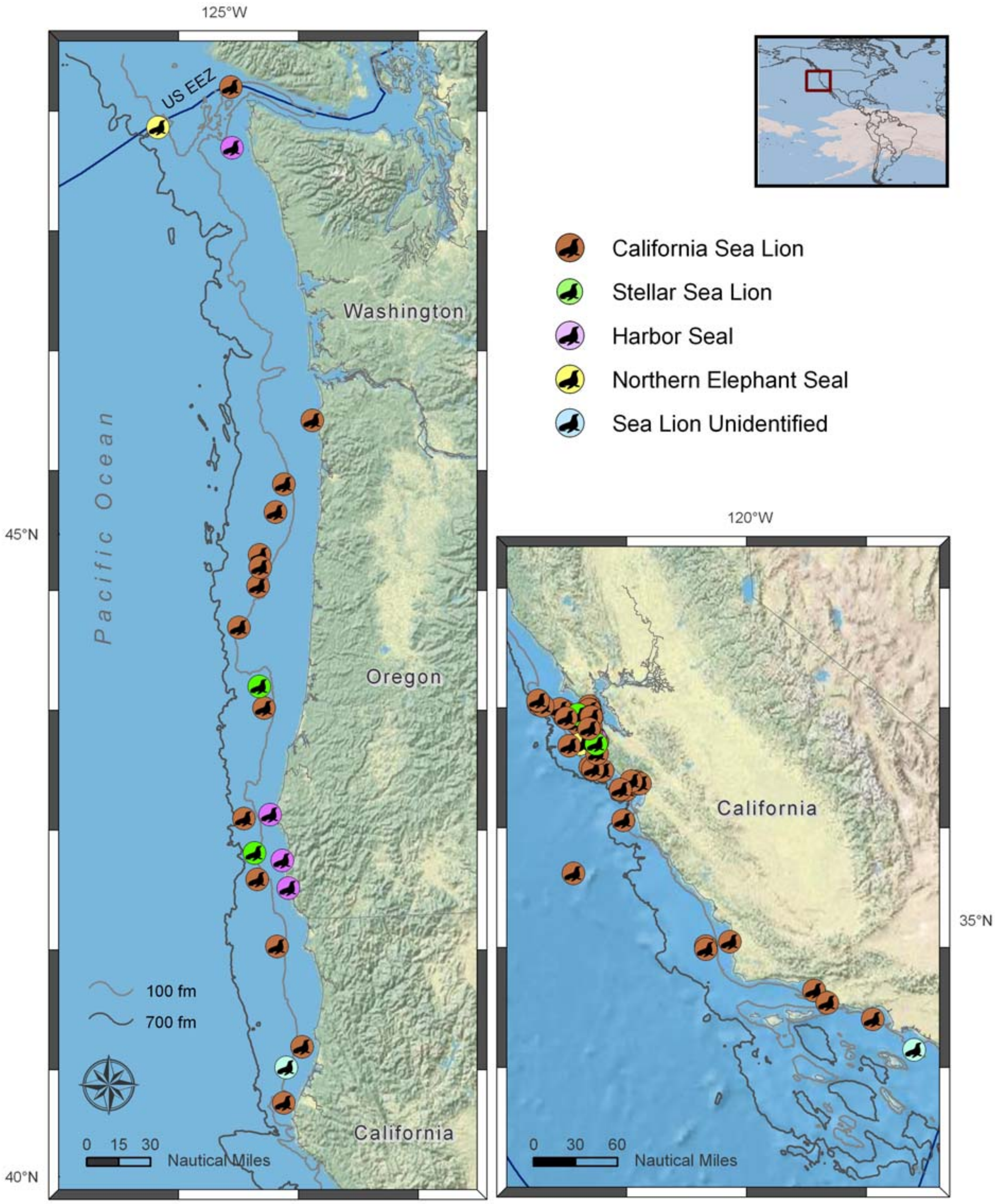
(M. Bellman, Projection: WGS_1984_UTM_Zone_10N, 11/09).

Figure 2. Geographic distribution of observed cetacean takes by the West Coast Groundfish Observer Program from 2002 through 2008.



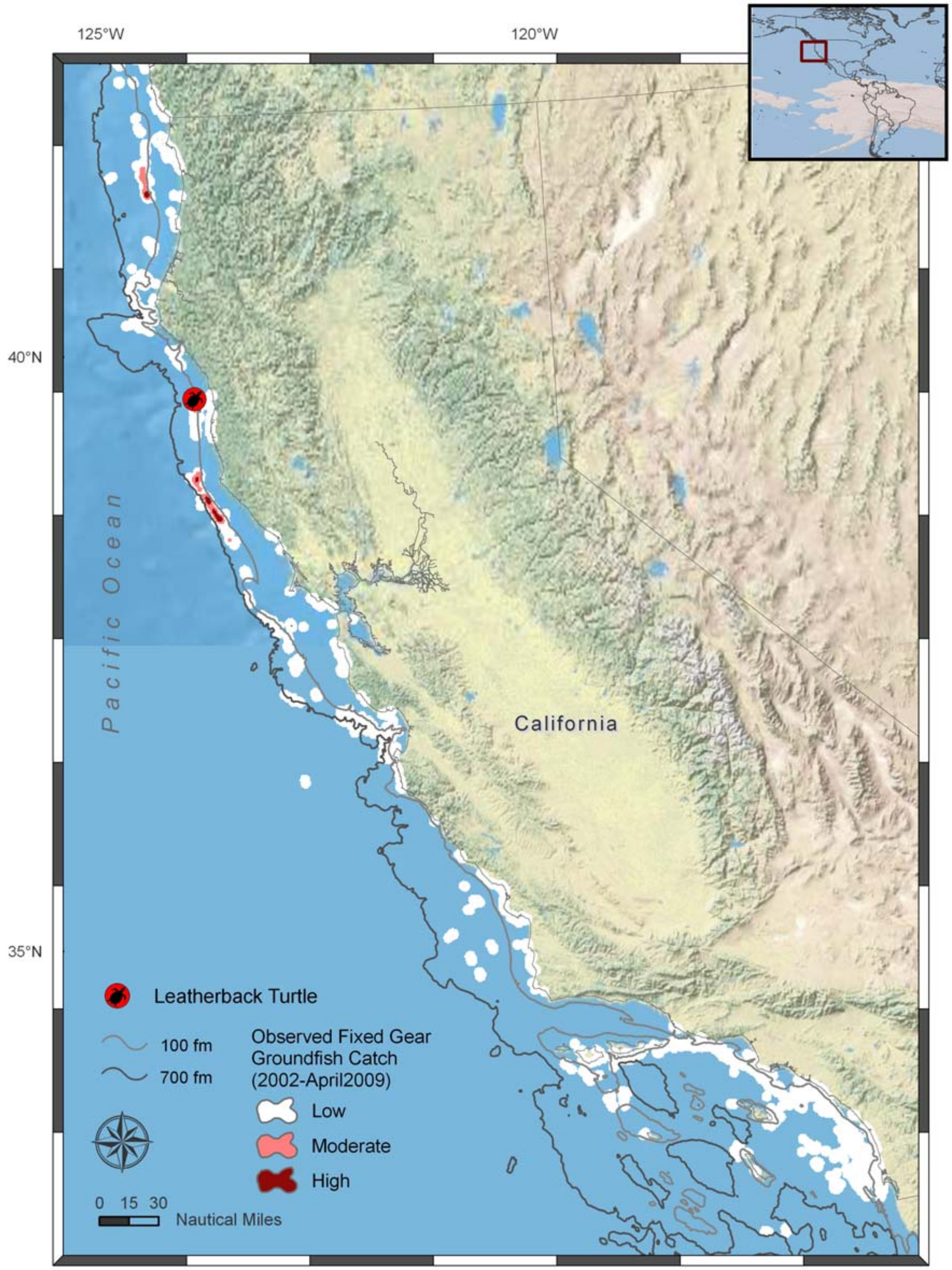
(M. Bellman, Projection: WGS_1984_UTM_Zone_10N, 11/09).

Figure 3. Geographic distribution of observed pinniped takes by the West Coast Groundfish Observer Program from 2002 through 2008.



(M. Bellman, Projection: WGS_1984_UTM_Zone_10N, 11/09).

Figure 4. Geographic distribution of one observed turtle take by the West Coast Groundfish Observer Program from 2002 through 2008. Observed fixed gear fishing effort is represented from 2002 through April 2009, based upon total groundfish catch.



(M. Bellman, Projection: WGS_1984_UTM_Zone_10N, 11/09).

TABLES

Table 1. Species for which takes were observed in the US west coast groundfish fishery. The species listed first are those that were recorded under normal random sampling procedures and included in bycatch estimation. Takes of 4 additional species (shown under 'Other species recorded') were recorded opportunistically and are summarized in Table 6.

Common Name	Scientific name	ESA status	Years observed	Interaction type
Marine mammals				
Cetaceans				
Harbor porpoise	*Phocoena phocoena*		2004	1
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*		2002 - 2003	1
Risso's dolphin	*Grampus griseus*		2008	1
Sperm whale	*Physeter macrocephalus*	Endangered	2007	4
Pinnipeds				
California sea lion	*Zalophus californianus*		2002 - 2008	1, 2, 3
Harbor seal	*Phoca vitulina*		2004 - 2008	1, 2
Northern elephant seal	*Mirounga angustirostris*		2004, 2007-2008	1
Stellar sea lion	*Eumetopias jubatus*	Threatened	2002 - 2008	1, 2
Seabirds				
Black-footed albatross	*Phoebastria nigripes*	Under review	2002 - 2008	1, 2
Brandt's cormorant	*Phalacrocorax penicillatus*		2003	1
Brown pelican	*Pelecanus occidentalis*	Delisted	2004 - 2006	1, 2
Common murre	*Uria aalge*		2003 - 2004	1
Leach's storm petrel	*Oceanodroma leucorhoa*		2002, 2007	1
Northern fulmar	*Fulmarus glacialis*		2002, 2004-2005, 2007-2008	1
Sooty shearwater	*Puffinus griseus*		2005	1
Western gull	*Larus occidentalis*		2002-2003, 2008	1, 2
Sea turtles				
Leatherback turtle	*Dermochelys coriacea*	Endangered	2007	1
Other species recorded opportunistically				
Marine mammals				
Dall's porpoise	*Phocoenoides dalli*		2002	1
Seabirds				
Cassin's auklet	*Ptychoramphus aleuticus*		2004	5
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	2002	5
Short-tailed albatross	*Phoebastria albatrus*	Endangered	2002	6

Interaction types
1 = Killed by gear
2 = Gear entanglement
3 = Lethal removal
4 = Vessel collision
5 = Boarded vessel only
6 = Feeding on catch only

Table 2. Recommended criteria from Andersen et al. (2008) for designating marine mammal serious injuries. Only criteria relevant to interactions in the US west coast groundfish fishery are included. For further detail and explanation, see Andersen et al. (2008).

Criterion	Injury/Information Categories	Large Cetaceans	Small Cetaceans	Pinnipeds
1	Ingestion of gear of hook	SI	SI	SI
3	Gear constricted on any body part, or likely to become constricting as the animal grows	SI	SI	SI
5	Anchored/immobilized (not freed)	SI	SI	SI
7	Hook in mouth (excluding case 9 below), no trailing gear	CBD/case specific	SI	SI
9	Hook confirmed in lip only, no trailing gear	n/a	CBD/case specific	CBD/case specific
10	Gear attached to free-swimming animlar with potential to 1) wrap around pectoral fins/flippers, peduncle, or head; 2) be ingested; or 3) accumulate drag	CBD/case specific	SI	SI
11	Animal freed from gear and released without gear	CBD/case specific	CBD/case specific	CBD/case specific
14	Wrap(s) of gear around pectoral fin/flippers, peduncle, head, abdomen, or chest	CBD/case specific	SI	SI
15	Deep, external cut or laceration to body	CBD/case specific	CBD/case specific	CBD/case specific
23	Entanglement, immobilization, or entrapment of a certain duration before being freed (TBD, species-dependent)	CBD/case specific	CBD/case specific	CBD/case specific
26	Hook in appendage, without trailing gear or with trailing gear that does not have the potential to wrap, be ingested, or accumulate drag	NSI	NSI	NSI
27	Animal brought on vessel deck following entanglement/entrapment	n/a	SI	CBD/case specific
29	Collision with vessel of certain minimum size (TBD, species-specific)	SI	SI	CBD/case specific
30	Collision with vessel traveling at a certain minimum speed (TBD, species-specific)	SI	SI	CBD/case specific
31	Collision with vessel below a certain size threshold (TBD, species-specific)	CBD/case specific	CBD/case specific	CBD/case specific
32	Collision with vessel traveling below a certain speed threshold (TBD, species-specific)	CBD/case specific	CBD/case specific	CBD/case specific

Table 3. Stratification system used to estimate bycatch for marine mammal, seabird, and turtle species. Strata were selected based on the population structure, geographic distribution, and seasonal abundance of each species, and incorporated certain latitudinal lines relating to the fishery when appropriate. Primary literature used as the foundation for selecting strata is noted on the far right, with a more comprehensive explanation detailed in the Methods.

Species	Stratification scheme		Supporting references
	Latitudinal breaks	Seasons	
Marine mammals			
Cetaceans			
Harbor porpoise *(Phocoena phocoena)*			
Latitudinal strata only	Cape Blanco, OR Pt Conception, CA	--	Barlow 1988, Carretta et al. 2009, Calambokidis and Barlow 1991, Forney 1999, Green et al. 1992
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)			
Latitudinal strata only	40˚10' N lat	--	Carretta et al. 2008, Forney and Barlow 1998, Green et al. 1992
Risso's dolphin (*Grampus griseus*)			
Latitudinal strata only	40˚10' N lat Pt Conception, CA	--	Forney and Barlow 1998, Green et al. 1992, Leatherwood et al. 1980
Sperm whale (*Physeter macrocephalus*)			
Latitudinal & seasonal strata	40˚10' N lat	winter (Dec-Mar) non-winter (Apr-Nov)	Carretta et al. 2009, Jaquet et al. 2002, Jaquet et al. 2003
Pinnipeds			
California sea lion (*Zalophus californianus*)			
Seasonal strata; latitudinal strata for LE bottom trawl only	40˚10' N lat - LE bottom trawl only	breeding (May-Aug) non-breeding (Sep-Apr)	Aurioles et al. 1983, Carretta et al. 2009, Garcia-Aguilar and Aurioles-Gamboa 2003, Lowry et al. 1990, Odell 1975
Harbor seal (*Phoca vitulina*)			
Latitudinal strata only	42˚ N lat (OR/CA border)	--	Brown and Mate 1983, Carretta et al. 2009, LaMont et al. 1996, Lowry et al. 2001, Pitcher and McAllister 1981
Northern elephant seal (*Mirounga angustirostris*)			
Seasonal strata only	--	breeding (Dec-Mar) non-breeding (Apr-Nov)	Brillinger and Stewart 1998, Le Boeuf et al. 2000, Hoelzel et al. 1993, Stewart and DeLong 1995 Stewart and Huber 1993
Steller sea lion (*Eumetopias jubatus*)			
Seasonal strata only	--	breeding (May-Jul) non-breeding (Aug-Apr)	Carretta et al. 2009, Loughlin 1997, Pitcher and Calkins 1981, Raum-Suryan et al. 2002
Seabirds			
All species			
Latitudinal & seasonal strata	Cape Blanco, OR	winter (Jan-Apr) summer (May-Aug) fall (Sep-Dec)	Ainley et al. 2005, Bakun et al. 1974, Barth et al. 2000, Briggs and Chu 1986, Ford et al. 2004, Hyrenbach et al. 2002, Tyler et al. 1993
Sea turtles			
Leatherback turtle (*Dermochelys coriacea*)			
Applied 3 approaches: (1) Seasonal strata only (2) Latitudinal strata only (3) Seasonal & latitudinal strata	Cape Blanco, OR Pt Conception, CA	winter/spring (Dec-May) summer/fall (Jun-Nov)	Bakun et al. 1974, Barth et al. 2000, Benson et al. 2007a, Benson et al. 2007b, Dutton et al. 2000, Forney et al. 2007, Hays et al. 2004, Starbird et al. 1995

Table 4. Summary of observer coverage in the at-sea hake fishery sector by the At-Sea Hake Observer Program (A-SHOP). The total catch (mt), number of cruises, number of vessels, and number of tows for the entire at-sea sector is summarized on the far left. Columns to the right present the number and percentage of tows that were observed, followed by the average sampled weight (mt) and total catch weight (mt) on sampled tows, as well as the average percent of total catch on sampled tows.

	Total fleet				Observed hauls		Observer sampling		
Year	Total catch (mt)	Number of cruises	Number of vessels	Number of tows	Number of sampled tows observed	% of tows observed	Avg sampled catch weight per tow (mt)	Avg total catch weight per tow (mt)	Avg % of catch sampled per tow
2002	86408	10	9	1766	1754	99%	18	49	37%
2003	88157	11	10	1844	1825	99%	18	48	38%
2004	122738	17	10	2700	2689	100%	17	45	38%
2005	152857	18	12	3007	2999	100%	24	51	46%
2006	141184	22	15	2938	2883	98%	23	48	49%
2007	127564	23	15	2880	2857	99%	22	44	53%
2008	184631	28	13	3617	3590	99%	25	51	49%

Table 5. Summary of observer coverage in non-hake groundfish sectors by the West Coast Groundfish Observer Program. Total fleet landings (mt) are summarized in the left-hand column, followed by a general description of the geographic area in which the fleet operates, and the geographic area that has been included in observer sampling from 2002 through 2008. In the columns to the right, the observed number of trips, tows/sets, and vessels are reported along with total observed landings of target species (mt) and the percentage of target species landings that was observed in each year and fishery sector. The target species for each sector is listed in italics below the name of that fishery sector.

	Total fleet	Spatial distribution		Observed fleet				
	Landings of target species (mt)	General range of fleet	Range observed	Number of observed trips	Number of observed tows/sets	Number of observed vessels	Observed landings of target species (mt)	Total % observed
Limited Entry Trawl								
Target species *: All FMP groundfish except Pacific hake (see Appendix B)*								
2002	20,418	*Coastwide*	*Coastwide*	585	3416	135	2,952	14.5%
2003	18,830			475	2474	127	2,826	15.0%
2004	17,977			623	3733	103	4,751	26.4%
2005	19,593			527	3674	105	4,534	23.1%
2006	18,040			494	3316	88	3,901	21.6%
2007	20,586			378	2736	89	3,715	18.0%
2008	24,287			493	3638	104	5,433	22.4%
California halibut trawl fishery								
Target species *: California halibut*								
Limited Entry Sector								
2002	112	*Cape Mendicino to Pt Lopez, CA*	*Cape Mendicino to Pt Lopez, CA*	21	57	8	4	3.2%
2003	112			73	219	12	20	18.2%
2004	140			46	185	8	35	25.2%
2005	194			74	239	10	31	15.9%
2006	123			78	230	9	15	11.9%
2007	42			40	81	5	5	12.8%
2008	39			53	149	6	14	35.0%
Open Access Sector								
2002	90	*South of Pt Lopez, CA*	--	0	0	0	-	0.0%
2003	46		*South of Pt Lopez, CA*	18	110	5	2	4.3%
2004	80			54	251	5	5	6.4%
2005	77			60	370	7	8	10.2%
2006	61		--	0	0	0	-	0.0%
2007	39		*South of Pt Lopez, CA*	49	229	8	3	6.9%
2008	50			49	199	7	3	5.2%
Pink shrimp fishery								
Target species *: Pink shrimp*								
2002	25,375	*Northern California, Oregon, Washington*	--	0	0	0	-	0.0%
2003	13,887		--	0	0	0	-	0.0%
2004	8,974		*California & Oregon*	57	1180	22	634	7.1%
2005	10,862			38	638	23	472	4.3%
2006	8,400		--	0	0	0	-	0.0%
2007	10,935		*California & Oregon*	66	1109	30	749	6.9%
2008	15,375			56	911	31	901	5.9%

Table 5 continued.

	Total fleet	Spatial distribution		Observed fleet				
	Landings of target species (mt)	General range of fleet	Range observed	Number of observed trips	Number of observed tows/sets	Number of observed vessels	Observed landings of target species (mt)	Total % observed
Nearshore fixed-gear fishery								
***Target species** : Nearshore target species (see Appendix C)*								
2002	762	*Oregon & California*	--	0	0	0	-	0.0%
2003	550		*California*	108	209	32	9	1.6%
2004	572		*Oregon & California*	373	668	100	36	6.3%
2005	576			311	395	97	27	4.7%
2006	535			352	558	97	30	5.6%
2007	528			308	496	78	30	5.6%
2008	559			231	280	72	22	3.9%
Non-nearshore fixed gear fishery								
***Target species** : Sablefish*								
Limited entry sablefish endorsed sector (longline & pot gear)								
2002	1,448	*Primarily north of 40˚ 10′ N latitude*	*Primarily north of 40˚ 10′ N latitude*	93	669	32	283	19.5%
2003	1,932			89	830	21	409	21.2%
2004	2,180			60	485	19	271	12.4%
2005	2,182			147	1272	32	817	37.4%
2006	2,241			113	821	25	530	23.7%
2007	1,780			108	702	26	423	23.8%
2008	1,681			103	883	24	593	35.3%
Limited entry sablefish non-endorsed sector (longline gear)								
2002	468	*Primarily south of 40˚ 10′ N latitude*	*Primarily south of 40˚ 10′ N latitude*	11	22	4	2	0.4%
2003	503			131	223	17	15	3.0%
2004	393			65	134	15	5	1.2%
2005	535			35	60	11	2	0.5%
2006	456			121	201	21	7	1.5%
2007	478			159	306	36	16	3.4%
2008	688			122	221	32	11	1.5%
Open Access fixed gear sector (hook-and-line and pot gears)								
2002	519	*Coastwide*	--	0	0	0	-	0.0%
2003	814		*California*	60	102	20	11	1.3%
2004	689			136	237	30	24	3.5%
2005	1,059			77	87	24	17	1.6%
2006	983			50	56	24	11	1.1%
2007	582		*Coastwide*	97	142	45	18	3.2%
2008	712			116	147	52	24	3.3%

Table 6. Summary of opportunistic (non-randomly collected) data recorded by A-SHOP and WCGOP observers on marine mammal, seabird and sea turtle interactions, which were *not* included in bycatch estimation. A-SHOP opportunistic data for mammals occur when the observer is alerted of a marine mammal take on an at-sea hake tow that was not monitored for marine mammals. WCGOP observers take a complete census of marine mammal takes, and all data records for marine mammals from non-hake sectors were thus included in bycatch analysis. Seabirds are normally observed as part of the species composition sample in both the A-SHOP and WCGOP programs. Opportunistic data on seabirds result when takes are recorded outside of regular species composition sampling and non-randomly. On at-sea hake vessels, this occurs when the observer notes an interaction that took place on deck. On non-hake vessels, this occurs when there is an interaction that does not result in an immediate mortality or the seabird departs injured. Seabirds that are killed by gear on observed non-hake vessels are always included in species composition sampling under WCGOP protocol.

	At-Sea Hake Observer Program (at-sea hake sector)		West Coast Groundfish Observer Program (non-hake sectors)	
	Number recorded	Years	Number recorded	Years
Marine mammals				
Cetaceans	*All records 2002 - 2008*		*All marine mammals documented by WCGOP - "opportunistic" sampling not applicable*	
Dall's porpoise	1	2002		
Pacific white-sided dolphin	1	2002		
Pinnipeds				
California sea lion	2	2002, 2008		
Seabirds	*Only 2007-2008 available*		*All records 2002 - 2008*	
Black-footed albatross	2	2007	8	2006, 2008
Brown pelican	--		1	2006
Cassin's auklet	--		1	2004
Leach's storm petrel	--		1	2007
Northern fulmar	13	2007-2008	1	2008
Western gull	--		1	2008
Unspecified gull	15	2007	2	2005
Unspecified shearwater	1	2007	--	
Unspecified seabird	--		19	2002, 2005

Table 7. Summary of observed and estimated bycatch for marine mammals. The 'Observed bycatch' table presents the number of takes observed in each fishery sector and the total number of observed takes by year, followed by the number of takes that contributed to final bycatch estimates (produced a CV of 80% or less) and the number that did not contribute to final bycatch estimates (produced a CV greater than 80%). When it was possible to report bycatch estimates, a lower 'Estimated bycatch' table was also included to present (1) base bycatch estimates and 90% confidence intervals summed from all strata with a CV less than 80% (left), (2) bycatch estimates from sensitivity analyses in which the bycatch ratio applied to the unobserved portion of the fleet was increased by X%, and (3) a graph of the range of CV values produced by each alternative stratification scheme. Cetaceans are reported first, followed by pinnipeds.

7a. Harbor porpoise (*Phocoena phocoena*)

Observed bycatch

(*number of animals*)

	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	1*	0	0	0	0	0	0	0	1	0	1
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

7b. Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	1*	0	0	0	0	0	0	0	0	1	0	1
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

7c. Risso's dolphin (*Grampus griseus*)

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	1*	0	0	0	0	0	0	0	0	1	0	1

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

7d. Sperm whale (*Physeter macrocephalus*)

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	1*	0	0	0	0	1	0	1
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

7e. Unspecified sea lions

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	1*	0	0	0	0	0	0	0	0	1	0	1
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	1*	0	0	0	1	0	1
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

7f. California sea lions (*Zalophus californianus*)

Observed bycatch
(*number of animals*)

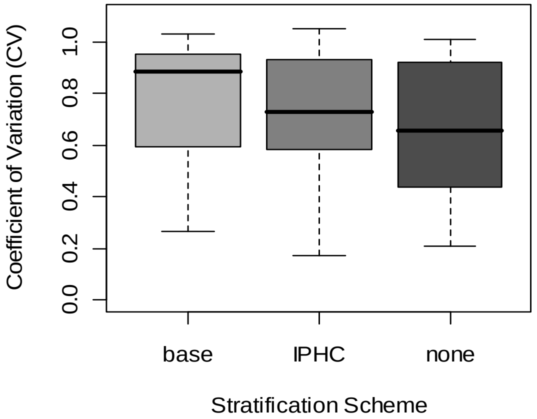
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	3*	2	0	0	0	0	0	0	0	5	2	3
2003	14*	14	0	0	1*	0	0	0	2	31	21	10
2004	1*	2	1*	0	1*	1*	0	0	2	8	4	4
2005	4*	1*	4*	0	5	0	0	0	0	14	7	7
2006	4*	14*	0	0	0	0	0	1*	2	21	16	5
2007	3*	4	0	0	0	1*	0	0	0	8	4	4
2008	1*	5	1*	0	0	0	0	0	0	7	5	2

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(number of animals)

	Base estimate			Sensitivity analyses (Unobserved discard ratio increased by X%)			
	Y	90% CI lower	90% CI upper	X = 10%	X = 50%	X = 100%	X = 300%
2002	46	17	119	50	68	90	179
2003	116	57	249	125	163	211	401
2004	13	5	35	14	18	23	42
2005	21	10	47	23	29	36	66
2006	95	41	223	103	135	175	334
2007	31	10	98	34	45	58	113
2008	13	6	25	14	17	21	38

CVs under alternative stratification



7g. Harbor seal (*Phoca vitulina*)

Observed bycatch

(number of animals)

	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	1	1	1	0
2005	0	0	0	0	0	0	0	0	1	1	1	0
2006	0	1*	0	0	0	0	0	1*	1	3	1	2
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	2	2	4	4	0

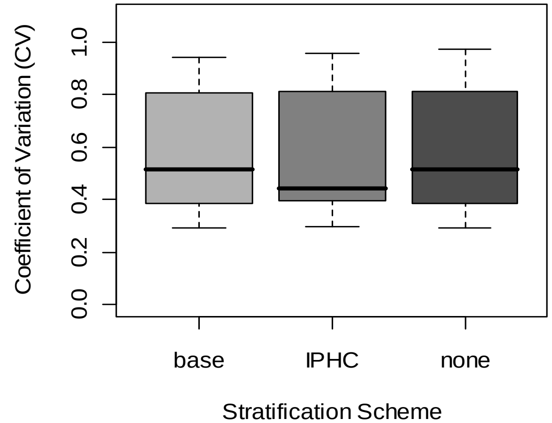
** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch

(number of animals)

	Base estimate			Sensitivity analyses (Unobserved discard ratio increased by X%)			
	Y	90% CI lower	90% CI upper	X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	1	0	1	1	1	1	1
2005	1	0	3	1	1	1	2
2006	1	0	2	1	1	1	1
2007	0	0	0	0	0	0	0
2008	29	11	78	32	42	54	105

CVs under alternative stratification



7h. Northern elephant seal (*Mirounga angustirostris*)

Observed bycatch
(*number of animals*)

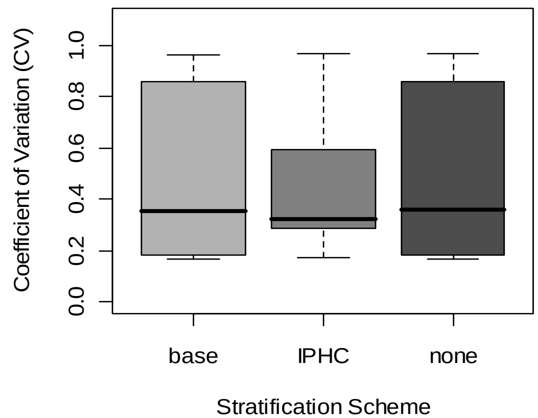
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	3	3	3	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	1*	0	0	0	0	1	0	1
2007	0	1*	0	0	0	0	0	0	2	3	2	1
2008	0	0	0	0	0	0	0	0	7	7	7	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(number of animals)

	Base estimate			Sensitivity analyses (Unobserved discard ratio increased by X%)			
	Y	90% CI lower	90% CI upper	X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	3	2	4	3	3	3	4
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	2	1	4	2	2	3	4
2008	9	6	12	9	10	11	15

CVs under alternative stratification



7i. Steller sea lion (*Eumetopias jubatus*)

Observed bycatch

(*number of animals*)

	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	2	0	0	0	0	0	0	0	1	3	3	0
2003	0	0	0	0	0	0	0	0	1	1	1	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	2	2	2	0
2006	0	0	0	0	0	0	0	0	3	3	3	0
2007	0	1*	0	0	0	0	0	0	3	4	3	1
2008	0	1	0	0	0	0	0	0	1	2	2	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch

(*number of animals*)

	Base estimate			Sensitivity analyses (*Unobserved discard ratio increased by X%*)			
	Y	90% CI lower	90% CI upper	X = 10%	X = 50%	X = 100%	X = 300%
2002	14	5	37	15	20	25	48
2003	1	0	2	1	1	1	1
2004	0	0	0	0	0	0	0
2005	2	1	5	3	3	3	5
2006	3	2	5	3	4	4	6
2007	4	2	6	4	4	5	7
2008	3	1	11	4	4	5	9

CVs under alternative stratification

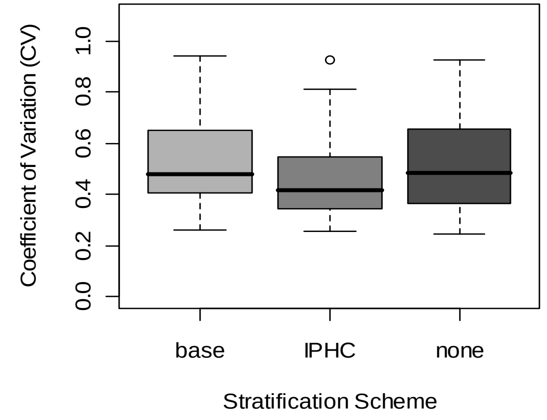


Table 8. Summary of observed and estimated bycatch for seabirds. The 'Observed bycatch' table presents the number of takes observed in each fishery sector and the total number of observed takes by year, followed by the number of takes that contributed to final bycatch estimates (produced a CV of 80% or less) and the number that did not contribute to final bycatch estimates (produced a CV greater than 80%). When it was possible to report bycatch estimates, a lower 'Estimated bycatch' table was also included to present (1) base bycatch estimates and 90% confidence intervals summed from all strata with a CV less than 80% (left), (2) bycatch estimates from sensitivity analyses in which the bycatch ratio applied to the unobserved portion of the fleet was increased by X%, and (3) a graph of the range of CV values produced by each alternative stratification scheme. Species with bycatch estimates that could not be reported (8a) are presented first, followed by species for which expanded bycatch estimates could be reported (8b-8h). The last three species groups were recorded in the at-sea hake sector, which has close to 100% observer coverage, and therefore were not expanded to the fleet-wide level. Species for which bycatch estimates could not be reported are presented first, followed by species with reported bycatch estimates. The last four species groups presented where primarily observed in the at-sea hake sector, and there are not sufficient replicates in at-sea hake data to comute uncertainty. Bycatch estimates for these species are therefore equivalent to the observed number of takes in the at-sea hake sector.

8a. Brown pelican (*Pelecanus occidentalis*)

Observed bycatch
(*number of animals*)

	LE Trawl	**CA Halibut trawl**		**Pink shrimp**	**Non-nearshore fixed gear**			**Nearshore fixed gear**	**At-sea hake**	**Total**	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	1*	0	0	0	1	0	1
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

8b. Black-footed albatross (*Phoebastria nigripes*)

Observed bycatch

(number of animals)

	LE Trawl	CA Halibut trawl: LE sector	CA Halibut trawl: OA sector	Pink shrimp	Non-nearshore fixed gear: LE Primary	Non-nearshore fixed gear: LE Non-Primary	Non-nearshore fixed gear: OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	0	0	0	0	1*	0	0	0	0	1	0	1
2003	0	0	0	0	8	0	0	0	3	11	11	0
2004	0	0	0	0	4	0	0	0	0	4	4	0
2005	0	0	0	0	23	0	0	0	2	25	25	0
2006	0	0	0	0	13*	0	0	0	2	15	5	10
2007	0	0	0	0	48*	0	1*	0	0	49	38	11
2008	0	0	0	0	26	0	0	0	1	27	27	0

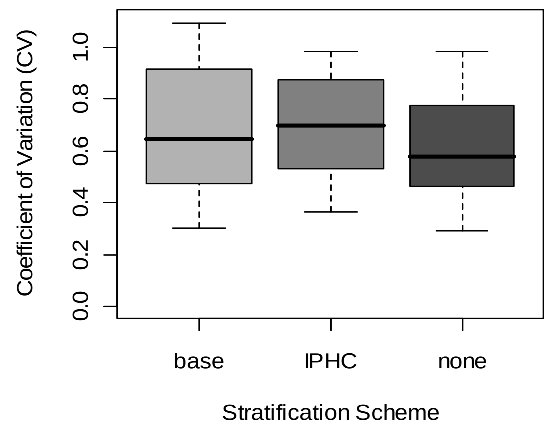
** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch

(number of animals)

	Base estimate: Y	Base estimate: 90% CI lower	Base estimate: 90% CI upper	Sensitivity analyses (Unobserved discard ratio increased by X%): X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	39	19	84	42	53	67	124
2004	47	18	123	51	69	90	176
2005	65	31	141	69	86	106	187
2006	32	19	55	35	46	59	114
2007	76	35	164	80	96	115	193
2008	91	47	181	98	124	156	284

CVs under alternative stratification



8c. Brandt's cormorant (*Phalacrocorax penicillatus*) and unspecified cormorant species

Observed bycatch
(*number of animals*)

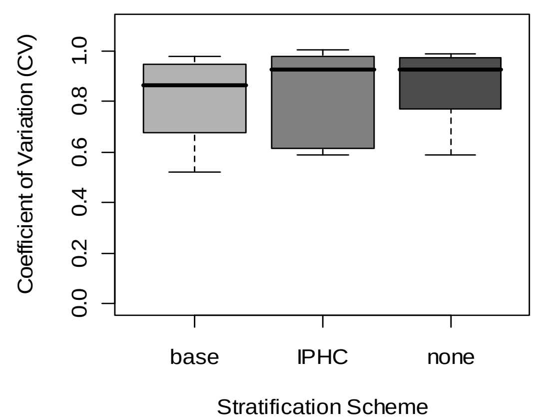
	LE Trawl	CA Halibut trawl: LE sector	CA Halibut trawl: OA sector	Pink shrimp	Non-nearshore fixed gear: LE Primary	Non-nearshore fixed gear: LE Non-Primary	Non-nearshore fixed gear: OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	0	0	0	0	1	0	0	0	0	1	1	0
2003	0	3*	0	0	0	1*	0	0	0	4	2	2
2004	0	2	0	0	0	0	0	0	0	2	2	0
2005	0	0	1*	0	0	0	0	0	0	1	0	1
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	1*	0	0	0	0	1*	0	2	0	2
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(*number of animals*)

	Base estimate: Y	Base estimate: 90% CI lower	Base estimate: 90% CI upper	Sensitivity analyses (*Unobserved discard ratio increased by X%*): X = 10%	X = 50%	X = 100%	X = 300%
2002	6	2	18	6	9	11	22
2003	9	3	25	10	13	17	32
2004	5	2	11	5	6	8	14
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0

CVs under alternative stratification



8d. Common murre (*Uria aalge*)

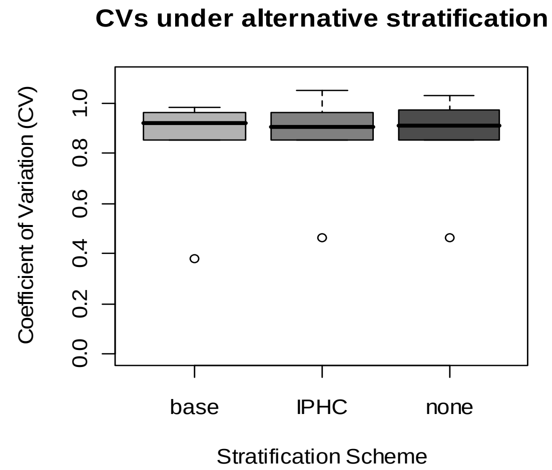
Observed bycatch
(*number of animals*)

	LE Trawl	CA Halibut trawl: LE sector	CA Halibut trawl: OA sector	Pink shrimp	Non-nearshore fixed gear: LE Primary	Non-nearshore fixed gear: LE Non-Primary	Non-nearshore fixed gear: OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	36*	1*	0	0	0	0	0	0	37	0	37
2004	1*	5	0	0	0	0	0	1*	3	10	8	2
2005	0	0	0	0	0	0	0	0	2	2	2	0
2006	0	0	0	0	0	0	0	1*	0	1	0	1
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(*number of animals*)

	Base estimate: Y	Base estimate: 90% CI lower	Base estimate: 90% CI upper	Sensitivity analyses (Unobserved discard ratio increased by X%): X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	15	10	26	16	19	23	39
2005	2	2	2	2	2	2	2
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0



8e. Western gull (*Larus occidentalis*) and unspecified gull species

Observed bycatch
(*number of animals*)

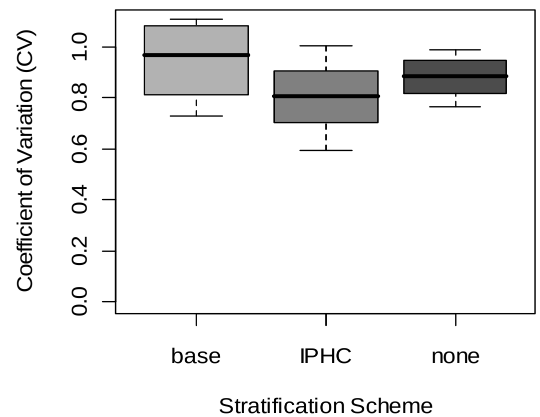
	LE Trawl	CA Halibut trawl: LE sector	CA Halibut trawl: OA sector	Pink shrimp	Non-nearshore fixed gear: LE Primary	Non-nearshore fixed gear: LE Non-Primary	Non-nearshore fixed gear: OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	0	0	0	0	4	0	0	0	0	4	4	0
2003	0	0	0	0	0	1*	0	0	0	1	0	1
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	2*	0	0	0	0	2	0	2
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	3*	0	0	0	3	0	3

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(*number of animals*)

	Base estimate: Y	Base estimate: 90% CI lower	Base estimate: 90% CI upper	Sensitivity analyses (*Unobserved discard ratio increased by X%*): X = 10%	X = 50%	X = 100%	X = 300%
2002	25	8	74	27	36	47	90
2003	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0

CVs under alternative stratification



8f. Northern fulmar (*Fulmarus glacialis*)

Observed bycatch
(*number of animals*)

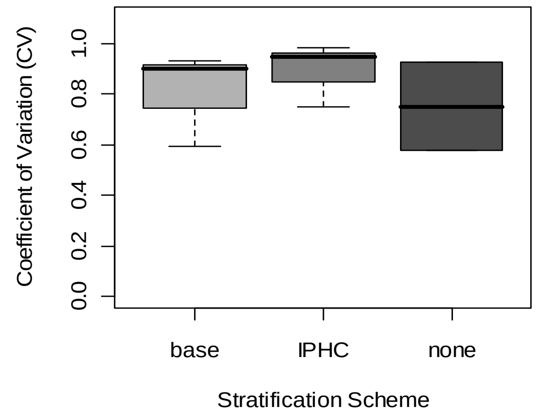
	LE Trawl	CA Halibut trawl: LE sector	CA Halibut trawl: OA sector	Pink shrimp	Non-nearshore fixed gear: LE Primary	Non-nearshore fixed gear: LE Non-Primary	Non-nearshore fixed gear: OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	1*	0	0	0	0	0	0	0	0	1	0	1
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	21	21	21	0
2005	0	0	0	0	0	0	0	0	2	2	2	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	2*	0	0	0	51	53	52	1
2008	0	0	0	0	0	0	0	0	2	2	2	0

* *Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(*number of animals*)

	Base estimate: Y	Base estimate: 90% CI lower	Base estimate: 90% CI upper	Sensitivity analyses (Unobserved discard ratio increased by X%): X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	21	21	21	21	21	21	21
2005	2	2	2	2	2	2	2
2006	0	0	0	0	0	0	0
2007	53	51	56	53	53	54	56
2008	2	2	2	2	2	2	2

CVs under alternative stratification



8g. Leach's storm petrel (*Oceanodroma leucorhoa*) and unspecified storm petrel species

Observed bycatch
(*number of animals*)

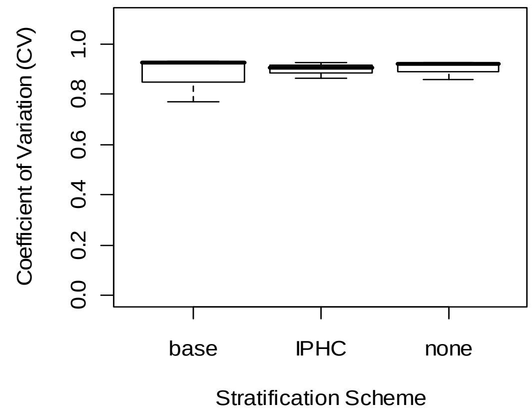
	LE Trawl	CA Halibut trawl LE sector	CA Halibut trawl OA sector	Pink shrimp	Non-nearshore fixed gear LE Primary	Non-nearshore fixed gear LE Non-Primary	Non-nearshore fixed gear OA	Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
2002	6*	0	0	0	0	0	0	0	0	6	0	6
2003	1*	0	0	0	0	0	0	0	0	1	0	1
2004	1	0	0	0	0	0	0	0	0	1	1	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Estimated bycatch
(number of animals)

	Base estimate Y	Base estimate 90% CI lower	Base estimate 90% CI upper	Sensitivity analyses (*Unobserved discard ratio increased by X%*) X = 10%	X = 50%	X = 100%	X = 300%
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	2	0	7	2	3	3	6
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0

CVs under alternative stratification



8h. Sooty shearwater (*Puffinus griseus*) and unspecified shearwater species

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	8	8	8	0
2005	0	0	0	0	0	0	0	0	2	2	2	0
2006	0	0	0	0	0	19*	0	0	0	19	0	19
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	1*	0	0	0	1	0	1

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

8i. Unspecified tubenose species

	Observed bycatch (*number of animals*)											
	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	2	2	2	0

8j. Unspecified alcid species

Observed bycatch (*number of animals*)

	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	3	3	3	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0

8k. Unidentified seabird

Observed bycatch (*number of animals*)

	LE Trawl	CA Halibut trawl		Pink shrimp	Non-nearshore fixed gear			Nearshore fixed gear	At-sea hake	Total	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	1*	0	0	0	0	1	0	1
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	2	2	2	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	4	4	4	0

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

Table 9. Summary of observed bycatch for the leatherback turtle (*Dermochelys coriacea*). The 'Observed bycatch' table presents the number of takes observed in each fishery sector and the total number of observed takes by year, followed by the number of takes that contributed to final bycatch estimates (produced a CV of 80% or less) and the number that did not contribute to final bycatch estimates (produced a CV greater than 80%).

	Observed bycatch (*number of animals*)											
	LE Trawl	**CA Halibut trawl**		**Pink shrimp**	**Non-nearshore fixed gear**			**Nearshore fixed gear**	**At-sea hake**	**Total**	# included in estimation	# excluded in estimation
		LE sector	OA sector		LE Primary	LE Non-Primary	OA					
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	1*	0	0	1	0	1

** Includes observations that produced bycatch estimates with a coefficient of variation greater than 80%.*

APPENDIX A

Common and scientific names of species included in the Pacific Coast Groundfish Fishery Management Plan, as amended through Amendment 19 (PFMC 2008).

SHARKS
Big skate, *Raja binoculata*
California skate, *R. inornata*
Leopard shark, *Triakis semifasciata*
Longnose skate, *R. rhina*
Soupfin shark, *Galeorhinus zyopterus*
Spiny dogfish, *Squalus acanthias*

RATFISH
Ratfish, *Hydrolagus colliei*

MORIDS
Finescale codling, *Antimora microlepis*

GRENADIERS
Pacific rattail, *Coryphaenoides acrolepis*

ROUNDFISH
Cabezon, *Scorpaenichthys marmoratus*
Kelp greenling, *Hexagrammos decagrammus*
Lingcod, *Ophiodon elongatus*
Pacific cod, *Gadus macrocephalus*
Pacific whiting, (hake) *Merluccius productus*
Sablefish, *Anoplopoma fimbria*

FLATFISH
Arrowtooth flounder, (turbot) *Atheresthes stomias*
Butter sole, *Isopsetta isolepis*
Curlfin sole, *Pleuronichthys decurrens*
Dover sole, *Microstomus pacificus*
English sole, *Parophrys vetulus*
Flathead sole, *Hippoglossoides elassodon*
Pacific sanddab, *Citharichthys sordidus*
Petrale sole, *Eopsetta jordani*
Rex sole, *Glyptocephalus zachirus*
Rock sole, *Lepidopsetta bilineata*
Sand sole, *Psettichthys melanostictus*
Starry flounder, *Platichthys stellatus*

ROCKFISH
Includes all genera and species of the family Scopaenidae, even if not listed, that occur in the Washington, Oregon, and California area. The Scopaenidae genera are *Sebastes*, *Scorpaena*, *Sebastolobus*, and *Scorpaenodes*.

Aurora, *Sebastes. aurora*
Bank, *S. rufus*
Black, *S. melanops*
Black-and-yellow, *S. chrysolmelas.*
Blackgill, *S. melanostomus*
Blue, *S. mystinus*
Bocaccio, *S. paucispinis*
Bronzespotted, *S. gilli*
Brown, *S. auriculatus*
Calico, *S. dalli*
California scorpionfish, *Scorpaena guttata*
Canary, *Sebastes pinniger*
Chameleon, *S. phillipsi*
Chilipepper, *S. goodei*
China, *S. nebulosus*
Copper, *S. caurinus*
Cowcod, *S. levis*
Darkblotched, *S. crameri*
Dusky, *S. ciliatus*
Dwarf-red, *S. rufianus*
Flag, *S. rubrivinctus*
Freckled, *S. lentiginosus*
Gopher, *S. carnatus*
Grass, *S. rastrelliger*
Greenblotched, *S. rosenblatti*
Greenspotted, *S. chlorostictus*
Greenstriped, *S. elongatus*
Halfbanded, *S. semicinctus*
Harlequin, *S. variegatus*
Honeycomb, *S. umbrosus*
Kelp, *S. atrovirens*
Longspine thornyhead, *Sebastolobus altivelis*
Mexican, *Sebastes. macdonaldi*
Olive, *S. serranoides*
Pink, *S. eos*
Pinkrose, *S. simulator*
Pygmy, *S. wilsoni*
Pacific ocean perch, *S. alutus*
Quillback, *S. maliger*
Redbanded, *S. babcocki*
Redstripe, *S. proriger*
Rosethorn, *S. helvomaculatus*
Rosy, *S. rosaceus*
Rougheye, *S. aleutianus*
Sharpchin, *S. zacentrus*

Shortbelly, *S. jordani*
Shortraker, *S. borealis*
Shortspine thornyhead, *Sebastolobus alascanus*
Silvergray, *Sebastes. brevispinus*
Speckled, *S. ovalis*
Splitnose rockfish, *S. diploproa*
Squarespot, *S. hopkinsi*
Starry, *S. constellatus*
Stripetail, *S. saxicola*
Swordspine, *S. ensifer*
Tiger, *S. nigorcinctus*
Treefish, *S. serriceps*
Vermilion, *S. miniatus*
Widow, *S. entomelas*
Yelloweye, *S. ruberrimus*
Yellowmouth, *S. reedi*
Yellowtail, *S. flavidus*

APPENDIX B

Species indentification codes used in the Pacific Coast Fisheries Information Network (PacFIN) database and assigned to WCGOP observer data, with aggregated species groups used in this report for the non-nearshore sectors of the groundfish fishery.

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
ALBC	ALBACORE	Other nongroundfish	Other nongroundfish	
APLC	ALASKA PLAICE	Other non-FMP flatfish	Other non-FMP flatfish	
ARR1	NOM. AURORA ROCKFISH	Other slope rockfish	Other slope rockfish	yes
ARRA	AURORA ROCKFISH	Other slope rockfish	Other slope rockfish	yes
ART1	NOM. ARROWTOOTH FLOUNDER	Arrowtooth flounder	Arrowtooth flounder	yes
ARTH	ARROWTOOTH FLOUNDER	Arrowtooth flounder	Arrowtooth flounder	yes
ASRK	PACIFIC ANGEL SHARK	Other nongroundfish	Other nongroundfish	
BABL	BLACK ABALONE	Other nongroundfish	Other nongroundfish	
BANK	BANK ROCKFISH	Other slope rockfish	Bank rockfish (Remaining rockfish)	yes
BCAC	BOCACCIO	Bocaccio (Remaining rockfish)	Bocaccio	yes
BCC1	NOM. BOCACCIO	Bocaccio (Remaining rockfish)	Bocaccio	yes
BCLM	BUTTER CLAM	Other nongroundfish	Other nongroundfish	
BGL1	NOM. BLACKGILL ROCKFISH	Other slope rockfish	Blackgill (Remaining rockfish)	yes
BKCR	BLUE KING CRAB	Other nongroundfish	Other nongroundfish	
BLCK	BLACK ROCKFISH	Black rockfish	Black rockfish	yes
BLGL	BLACKGILL ROCKFISH	Other slope rockfish	Blackgill (Remaining rockfish)	yes
BLK1	NOM. BLACK ROCKFISH	Black rockfish	Black rockfish	yes
BLU1	NOM. BLUE ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
BLUR	BLUE ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
BMCK	BULLET MACKEREL	Other nongroundfish	Other nongroundfish	
BMRL	BLUE MARLIN	Other nongroundfish	Other nongroundfish	
BMSL	BLUE OR BAY MUSSEL	Other nongroundfish	Other nongroundfish	
BNK1	NOM. BANK ROCKFISH	Other slope rockfish	Bank rockfish (Remaining rockfish)	yes
BRNZ	BRONZESPOTTED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
BRW1	NOM. BROWN ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
BRWN	BROWN ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
BRZ1	NOM. BRONZESPOTTED RK	Other shelf rockfish	Other shelf rockfish	yes
BSJK	BLACK SKIPJACK	Other nongroundfish	Other nongroundfish	
BSKT	BIG SKATE	Big skate	Big skate	yes
BSOL	BUTTER SOLE	Other flatfish	Other flatfish	yes
BSRK	BLUE SHARK	Other nongroundfish	Other nongroundfish	
BSRM	UNSP. BAIT SHRIMP	Other nongroundfish	Other nongroundfish	
BTCR	BAIRDI TANNER CRAB	Tanner crab	Tanner crab	
BTNA	BLUEFIN TUNA	Other nongroundfish	Other nongroundfish	
BTRY	BAT RAY	Other nongroundfish	Other nongroundfish	
BYEL	BLACK-AND-YELLOW ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
BYL1	NOM. BLACK-AND-YELLOW RK	Other nearshore rockfish	Other nearshore rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
CBZ1	NOM. CABEZON	Other groundfish	Cabezon	yes
CBZN	CABEZON	Other groundfish	Cabezon	yes
CEEL	SPOTTED CUSK-EEL	Other nongroundfish	Other nongroundfish	
CHL1	NOM. CALIFORNIA HALIBUT	California halibut	California halibut	
CHLB	CALIFORNIA HALIBUT	California halibut	California halibut	
CHN1	NOM. CHINA ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
CHNA	CHINA ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
CHNK	CHINOOK SALMON	Other nongroundfish	Other nongroundfish	
CHUM	CHUM SALMON	Other nongroundfish	Other nongroundfish	
CKLE	BASKET COCKLE	Other nongroundfish	Other nongroundfish	
CLC1	NOM. CALICO ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
CLCO	CALICO ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
CLP1	NOM. CHILIPEPPER	Chilipepper (Remaining rockfish)	Chilipepper	yes
CLPR	CHILIPEPPER	Chilipepper (Remaining rockfish)	Chilipepper	yes
CMCK	CHUB MACKEREL	Other nongroundfish	Other nongroundfish	
CMEL	CHAMELEON ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
CML1	NOM. CHAMELEON ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
CMSL	CALIFORNIA MUSSEL	Other nongroundfish	Other nongroundfish	
CNR1	NOM. CANARY ROCKFISH	Canary rockfish	Canary rockfish	yes
CNRY	CANARY ROCKFISH	Canary rockfish	Canary rockfish	yes
COHO	COHO SALMON	Other nongroundfish	Other nongroundfish	
COP1	NOM. COPPER ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
COPP	COPPER ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
CPLN	CAPELIN	Other nongroundfish	Other nongroundfish	
CSKT	CALIFORNIA SKATE	Unspecified skate	Unspecified skate	yes
CSOL	CURLFIN SOLE	Other flatfish	Other flatfish	yes
CTRB	C-O SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
CUDA	PACIFIC BARRACUDA	Other nongroundfish	Other nongroundfish	
CWC1	NOM. COWCOD ROCKFISH	Other shelf rockfish	Cowcod	yes
CWCD	COWCOD ROCKFISH	Other shelf rockfish	Cowcod	yes
DBR1	NOM. DARKBLOTCHED ROCKFISH	Darkblotched rockfish	Darkblotched rockfish	yes
DBRK	DARKBLOTCHED ROCKFISH	Darkblotched rockfish	Darkblotched rockfish	yes
DCRB	DUNGENESS CRAB	Dungeness crab	Dungeness crab	
DFLT	UNSP. DEEP FLOUNDERS	Other flatfish	Other flatfish	yes
DOVR	DOVER SOLE	Dover sole	Dover sole	yes
DRDO	DORADO	Other nongroundfish	Other nongroundfish	
DSOL	DEEPSEA SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
DSRK	SPINY DOGFISH	Spiny dogfish	Spiny dogfish	yes
DTRB	DIAMOND TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
DUSK	DUSKY ROCKFISH	Other groundfish	Other groundfish	yes
DVR1	NOM. DOVER SOLE	Dover sole	Dover sole	yes
DWRF	DWARF-RED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
EELS	UNSPECIFIED EELS	Other nongroundfish	Other nongroundfish	
EGL1	NOM. ENGLISH SOLE	English sole	English sole	yes
EGLS	ENGLISH SOLE	English sole	English sole	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
ESTR	EASTERN OYSTER	Other nongroundfish	Other nongroundfish	
ETNA	BIGEYE TUNA	Other nongroundfish	Other nongroundfish	
EULC	EULACHON	Eulachon	Eulachon	
EURO	EUROPEAN OYSTER	Other nongroundfish	Other nongroundfish	
FLAG	FLAG ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
FLG1	NOM. FLAG ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
FNTS	FANTAIL SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
FRCK	FRECKLED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
FSOL	FLATHEAD SOLE	Other flatfish	Other flatfish	yes
GABL	GREEN ABALONE	Other nongroundfish	Other nongroundfish	
GBAS	GIANT SEA BASS	Other nongroundfish	Other nongroundfish	
GBL1	NOM. GREENBLOTCHED RK	Other shelf rockfish	Other shelf rockfish	yes
GBLC	GREENBLOTCHED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
GCLM	GAPER CLAM	Other nongroundfish	Other nongroundfish	
GDUK	GEODUCK	Other nongroundfish	Other nongroundfish	
GKCR	GOLDEN KING CRAB	Other nongroundfish	Other nongroundfish	
GPH1	NOM. GOPHER ROCKFISH	Other nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
GPHR	GOPHER ROCKFISH	Other nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
GPRW	GOLDEN PRAWN	Other nongroundfish	Other nongroundfish	
GRAS	GRASS ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
GRDR	UNSP. GRENADIERS	Unspecified grenadiers	Unspecified grenadiers	yes
GRS1	NOM. GRASS ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
GSP1	NOM. GREENSPOTTED RK	Other shelf rockfish	Other shelf rockfish	yes
GSPT	GREENSPOTTED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
GSQD	GIANT SQUID	Other nongroundfish	Other nongroundfish	
GSR1	NOM. GREENSTRIPED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
GSRK	GREENSTRIPED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
GSRM	GHOST SHRIMP	Other nongroundfish	Other nongroundfish	
GSTG	GREEN STURGEON	Green sturgeon	Green sturgeon	
GTRB	GREENLAND TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
HBRK	HALFBANDED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
HCLM	HORSE CLAMS	Other nongroundfish	Other nongroundfish	
HLQN	HARLEQUIN ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
HNY1	NOM. HONEYCOMB ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
HNYC	HONEYCOMB ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
HTRB	HORNYHEAD TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
ISRK	BIGEYE THRESHER SHARK	Other nongroundfish	Other nongroundfish	
JCLM	CALIFORNIA JACKKNIFE CLAM	Other nongroundfish	Other nongroundfish	
JMCK	JACK MACKEREL	Other nongroundfish	Other nongroundfish	
KFSH	GIANT KELPFISH	Other nongroundfish	Other nongroundfish	
KGL1	NOM. KELP GREENLING	Kelp greenling	Kelp greenling	yes
KLP1	NOM. KELP ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
KLPG	KELP GREENLING	Kelp greenling	Kelp greenling	yes
KLPR	KELP ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
KMKA	KAMCHATKA FLOUNDER	Other non-FMP flatfish	Other non-FMP flatfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40° 10' N latitude	Species Group - South of 40° 10' N latitude	FMP
KSTR	KUMAMOTO OYSTER	Other nongroundfish	Other nongroundfish	
LCD1	NOM. LINGCOD	Lingcod	Lingcod	yes
LCLM	NATIVE LITTLENECK	Other nongroundfish	Other nongroundfish	
LCOD	LINGCOD	Lingcod	Lingcod	yes
LDAB	LONGFIN SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
LDB1	NOM. LONGFIN SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
LOBS	CALIF. SPINY LOBSTER	Other nongroundfish	Other nongroundfish	
LSKT	LONGNOSE SKATE	Longnose skate	Longnose skate	yes
LSP1	NOM. LONGSPINE THORNYHEAD	Longspine thornyhead	Longspine thornyhead	yes
LSPN	LONGSPINE THORNYHEAD	Longspine thornyhead	Longspine thornyhead	yes
LSRK	LEOPARD SHARK	Other groundfish	Other groundfish	yes
LSTR	OLYMPIA OYSTER	Other nongroundfish	Other nongroundfish	
LUVR	LOUVAR	Other nongroundfish	Other nongroundfish	
MACL	MUD CLAMS	Other nongroundfish	Other nongroundfish	
MAKO	SHORTFIN MAKO SHARK	Other nongroundfish	Other nongroundfish	
MCLM	MANILA CLAM	Other nongroundfish	Other nongroundfish	
MEEL	MONKEYFACE EEL	Other nongroundfish	Other nongroundfish	
MISC	MISC. FISH/ANIMALS	Other nongroundfish	Other nongroundfish	
MOLA	COMMON MOLA	Other nongroundfish	Other nongroundfish	
MRLN	STRIPED MARLIN	Other nongroundfish	Other nongroundfish	
MSC2	MISCELLANEOUS FISH	Other nongroundfish	Other nongroundfish	
MSHP	PLAINFIN MIDSHIPMAN	Other nongroundfish	Other nongroundfish	
MSQD	MARKET SQUID	Other nongroundfish	Other nongroundfish	
MSRM	MUD SHRIMP	Other nongroundfish	Other nongroundfish	
MXR1	NOM. MEXICAN ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
MXRF	MEXICAN ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
NANC	NORTHERN ANCHOVY	Other nongroundfish	Other nongroundfish	
NRCK	NORTHERN ROCKFISH	Other groundfish	Other groundfish	yes
NSHR	NORTHERN NEAR-SHORE RK	Other nearshore rockfish	Other nearshore rockfish	yes
NSLF	NORTHERN SHELF ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
NSLP	NORTHERN SLOPE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
NUSF	NOR. UNSP. SHELF ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
NUSP	NOR. UNSP. SLOPE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
NUSR	NOR. UNSP. NEAR-SHORE RK	Other nearshore rockfish	Other nearshore rockfish	yes
OABL	OTHER ABALONE	Other nongroundfish	Other nongroundfish	
OANC	OTHER ANCHOVY	Other nongroundfish	Other nongroundfish	
OBAS	OTHER BASS	Other nongroundfish	Other nongroundfish	
OCLM	OTHER CLAM	Other nongroundfish	Other nongroundfish	
OCRB	OTHER CRAB	Other nongroundfish	Other nongroundfish	
OCRK	OTHER CROAKER	Other nongroundfish	Other nongroundfish	
OCTP	UNSP. OCTOPUS	Other nongroundfish	Other nongroundfish	
ODSR	OTHER DEMERSAL RKFSH	Other groundfish	Other groundfish	yes
OECH	OTHER ECHINODERM	Other nongroundfish	Other nongroundfish	
OFLT	OTHER FLATFISH	Other flatfish	Other flatfish	yes
OGRN	OTHER GROUNDFISH	Other groundfish	Other groundfish	yes
OLV1	NOM. OLIVE ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
OLVE	OLIVE ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
OMSK	OTHER MOLLUSKS	Other nongroundfish	Other nongroundfish	
OPLG	OTHER PELAGIC RKFSH	Other groundfish	Other groundfish	yes
ORCK	OTHER ROCKFISH	Other slope rockfish (>150 fm)	Other slope rockfish (>150 fm)	yes
ORCK	OTHER ROCKFISH	Other shelf rockfish (<150 fm)	Other shelf rockfish (<150 fm)	yes
ORND	OTHER ROUNDFISH	Other groundfish	Other groundfish	yes
OSCL	OTHER SCALLOP	Other nongroundfish	Other nongroundfish	
OSKT	OTHER SKATES	Unspecified skate	Unspecified skate	yes
OSLR	OTHER SLOPE RKFSH	Other slope rockfish	Other slope rockfish	yes
OSRK	OTHER SHARK	Other nongroundfish	Other nongroundfish	
OSRM	OTHER SHRIMP	Other nongroundfish	Other nongroundfish	
OSTR	OTHER OYSTER	Other nongroundfish	Other nongroundfish	
OTCR	OPILIO TANNER CRAB	Tanner crab	Tanner crab	
OTNA	OTHER TUNA	Other nongroundfish	Other nongroundfish	
OURC	OTHER SEA URCHINS	Other nongroundfish	Other nongroundfish	
OWFS	OCEAN WHITEFISH	Other nongroundfish	Other nongroundfish	
PABL	PINK ABALONE	Other nongroundfish	Other nongroundfish	
PBNT	PACIFIC BONITO	Other nongroundfish	Other nongroundfish	
PBTR	PACIFIC BUTTERFISH	Other nongroundfish	Other nongroundfish	
PCLM	PISMO CLAM	Other nongroundfish	Other nongroundfish	
PCOD	PACIFIC COD	Pacific cod	Other groundfish	yes
PDAB	PACIFIC SANDDAB	Other flatfish	Other flatfish	yes
PDB1	NOM. PACIFIC SANDDAB	Other flatfish	Other flatfish	yes
PGMY	PYGMY ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
PHLB	PACIFIC HALIBUT	Pacific halibut	Pacific halibut	
PHRG	PACIFIC HERRING	Other nongroundfish	Other nongroundfish	
PINK	PINK SALMON	Other nongroundfish	Other nongroundfish	
PLCK	WALLEYE POLLOCK	Other groundfish	Other groundfish	yes
PNK1	NOM. PINK ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
PNKR	PINK ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
POMF	PACIFIC POMFRET	Other nongroundfish	Other nongroundfish	
POP	PACIFIC OCEAN PERCH	Pacific ocean perch	Other slope rockfish	yes
POP1	GEN. SHELF/SLOPE RF	Other slope rockfish	Other slope rockfish	yes
POP2	NOMINAL POP	Pacific ocean perch	Other slope rockfish	yes
PRCL	PURPLE CLAM	Other nongroundfish	Other nongroundfish	
PROW	PROWFISH	Other nongroundfish	Other nongroundfish	
PRR1	NOM. PINKROSE ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
PRRK	PINKROSE ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
PSDN	PACIFIC SARDINE	Other nongroundfish	Other nongroundfish	
PSHP	PINK SHRIMP	Other nongroundfish	Other nongroundfish	
PSRK	PELAGIC THRESHER SHARK	Other nongroundfish	Other nongroundfish	
PSTR	PACIFIC OYSTER	Other nongroundfish	Other nongroundfish	
PTR1	NOM. PETRALE SOLE	Petrale sole	Petrale sole	yes
PTRL	PETRALE SOLE	Petrale sole	Petrale sole	yes
PUGT	PUGET SOUND ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
PWHT	PACIFIC WHITING	Pacific hake	Pacific hake	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
QCLM	NORTHERN QUAHOG CLAM	Other nongroundfish	Other nongroundfish	
QFSH	QUEENFISH	Other nongroundfish	Other nongroundfish	
QLB1	NOM. QUILLBACK ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
QLBK	QUILLBACK ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
RABL	RED ABALONE	Other nongroundfish	Other nongroundfish	
RATF	SPOTTED RATFISH	Other groundfish	Other groundfish	yes
RCK1	BOCACCIO+CHILIPEPPER RK	Other shelf rockfish	Other shelf rockfish	yes
RCK2	UNSP. BOLINA RCKFSH	Other nearshore rockfish	Other nearshore rockfish	yes
RCK3	UNSP. DPWTR REDS RCKFSH	Other slope rockfish	Other slope rockfish	yes
RCK4	UNSP. REDS RCKFSH	Other groundfish	Other groundfish	yes
RCK5	UNSP. SMALL REDS RCKFSH	Other groundfish	Other groundfish	yes
RCK6	UNSP. ROSEFISH RCKFSH	Other groundfish	Other groundfish	yes
RCK7	UNSP. GOPHER RCKFSH	Other nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
RCK8	CANARY+VERMILION RCKFSH	Canary rockfish	Canary rockfish	yes
RCK9	BLACK+BLUE ROCKFISH	Black rockfish	Black rockfish	yes
RCKG	ROCK GREENLING	Other nongroundfish	Other nongroundfish	
RCLM	RAZOR CLAM	Other nongroundfish	Other nongroundfish	
RCRB	ROCK CRAB	Other nongroundfish	Other nongroundfish	
RDB1	NOM. REDBANDED ROCKFISH	Other slope rockfish	Other slope rockfish	yes
RDBD	REDBANDED ROCKFISH	Other slope rockfish	Other slope rockfish	yes
REDS	REDSTRIPE ROCKFISH	Redstripe rockfish (Remaining rockfish)	Other shelf rockfish	yes
REX	REX SOLE	Other flatfish	Other flatfish	yes
REX1	NOM. REX SOLE	Other flatfish	Other flatfish	yes
REYE	ROUGHEYE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
RFLT	REMAINING FLATFISH	Other flatfish	Other flatfish	yes
RGL1	NOM. ROCK GREENLING	Other nongroundfish	Other nongroundfish	
RGRN	REMAINING GROUNDFISH	Other groundfish	Other groundfish	yes
RHRG	ROUND HERRING	Other nongroundfish	Other nongroundfish	
RKCR	RED KING CRAB	Other nongroundfish	Other nongroundfish	
ROS1	NOM. ROSY ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
ROSY	ROSY ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
RPRW	RIDGEBACK PRAWN	Other nongroundfish	Other nongroundfish	
RRCK	REMAINING ROCKFISH	Other groundfish	Other groundfish	yes
RRND	REMAINING ROUNDFISH	Other groundfish	Other groundfish	yes
RSL1	NOM. ROCK SOLE	Other flatfish	Other flatfish	yes
RSOL	ROCK SOLE	Other flatfish	Other flatfish	yes
RST1	NOM. ROSETHORN ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
RSTN	ROSETHORN ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
RURC	RED SEA URCHIN	Other nongroundfish	Other nongroundfish	
RZCL	ROSY RAZOR CLAM	Other nongroundfish	Other nongroundfish	
SABL	SABLEFISH	Sablefish	Sablefish	yes
SAIL	SAILFISH	Other nongroundfish	Other nongroundfish	
SARY	PACIFIC SAURY	Other nongroundfish	Other nongroundfish	
SBL1	NOM. SHORTBELLY ROCKFISH	Shortbelly rockfish	Shortbelly rockfish	yes
SBLY	SHORTBELLY ROCKFISH	Shortbelly rockfish	Shortbelly rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
SCLM	SOFT-SHELLED CLAM	Other nongroundfish	Other nongroundfish	
SCLP	UNSP. SCULPIN	Other nongroundfish	Other nongroundfish	
SCOR	CALIFORNIA SCORPIONFISH	Other groundfish	Other nearshore rockfish	yes
SCR1	NOM. CALIF. SCORPIONFISH	Other groundfish	Other nearshore rockfish	yes
SDB1	NOM. SPECKLED SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
SFL1	NOM. STARRY FLOUNDER	Starry flounder	Starry flounder	yes
SFLT	UNSP. SHALLOW FLOUNDERS	Other flatfish	Other flatfish	yes
SHAD	UNSPECIFIED SHAD	Other nongroundfish	Other nongroundfish	
SHP1	NOM. CALIFORNIA SHEEPHEAD	Other nongroundfish	Other nongroundfish	
SHPD	CALIFORNIA SHEEPHEAD	Other nongroundfish	Other nongroundfish	
SHRP	SHARPCHIN ROCKFISH	Sharpchin rockfish (Remaining rockfish)	Sharpchin - south	yes
SKCR	SCARLET KING CRAB	Other nongroundfish	Other nongroundfish	
SLGR	SILVERGREY ROCKFISH	Silvergrey rockfish (Remaining rockfish)	Other shelf rockfish	yes
SLNS	SLENDER SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
SMLT	UNSP. SMELT	Other nongroundfish	Other nongroundfish	
SNOS	SPLITNOSE ROCKFISH	Splitnose rockfish (Remaining rockfish)	Splitnose rockfish	yes
SNS1	NOM. SPLITNOSE ROCKFISH	Splitnose rockfish (Remaining rockfish)	Splitnose rockfish	yes
SOCK	SOCKEYE SALMON	Other nongroundfish	Other nongroundfish	
SPK1	NOM. SPECKLED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SPKL	SPECKLED ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SPRW	SPOTTED PRAWN	Other nongroundfish	Other nongroundfish	
SQID	UNSP. SQUID	Other nongroundfish	Other nongroundfish	
SQR1	NOM. SQUARESPOT	Other shelf rockfish	Other shelf rockfish	yes
SQRS	SQUARESPOT ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SRFP	SURFPERCH SPP.	Other nongroundfish	Other nongroundfish	
SRKR	SHORTRAKER ROCKFISH	Other slope rockfish	Other slope rockfish	yes
SSCL	SHARPNOSE SCULPIN	Other nongroundfish	Other nongroundfish	
SSDB	SPECKLED SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
SSHR	SOUTHERN NEAR-SHORE RK	Other nearshore rockfish	Other nearshore rockfish	yes
SSLF	SOUTHERN SHELF ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SSLP	SOUTHERN SLOPE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
SSO1	NOM. SAND SOLE	Other flatfish	Other flatfish	yes
SSOL	SAND SOLE	Other flatfish	Other flatfish	yes
SSP1	NOM. SHORTSPINE THORNYHEAD	Shortspine thornyhead	Shortspine thornyhead	yes
SSPN	SHORTSPINE THORNYHEAD	Shortspine thornyhead	Shortspine thornyhead	yes
SSRD	Deep So. Nearshore RF	Other nearshore rockfish	Other nearshore rockfish	yes
SSRK	SOUPFIN SHARK	Other groundfish	Other groundfish	yes
SSRS	Shallow So. Nearshore RF	Other nearshore rockfish	Other nearshore rockfish	yes
STAR	STARRY ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
STL1	NOM. STRIPETAIL ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
STLH	STEELHEAD	Other nongroundfish	Other nongroundfish	
STNA	SKIPJACK TUNA	Other nongroundfish	Other nongroundfish	
STR1	NOM. STARRY ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
STRK	STRIPETAIL ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
STRY	STARRY FLOUNDER	Starry flounder	Starry flounder	yes
SUSF	SOU. UNSP. SHELF ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SUSP	SOU. UNSP. SLOPE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
SUSR	SOU. UNSP. NEAR-SHORE RK	Other nearshore rockfish	Other nearshore rockfish	yes
SWRD	SWORDFISH	Other nongroundfish	Other nongroundfish	
SWS1	NOM. SWORDSPINE ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
SWSP	SWORDSPINE ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
TCOD	PACIFIC TOMCOD	Other nongroundfish	Other nongroundfish	
TGR1	NOM. TIGER ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
THD1	NOM. THORNYHEADS	Mixed thornyheads	Mixed thornyheads	yes
THDS	THORNYHEADS (MIXED)	Mixed thornyheads	Mixed thornyheads	yes
TIGR	TIGER ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
TRE1	NOM. TREEFISH	Other nearshore rockfish	Other nearshore rockfish	yes
TREE	TREEFISH	Other nearshore rockfish	Other nearshore rockfish	yes
TSRK	COMMON THRESHER SHARK	Other nongroundfish	Other nongroundfish	
UABL	UNSPECIFIED ABALONE	Other nongroundfish	Other nongroundfish	
UCLM	UNSPECIFIED CLAM	Other nongroundfish	Other nongroundfish	
UCRB	UNSPECIFIED CRAB	Other nongroundfish	Other nongroundfish	
UDAB	UNSP. SANDDABS	Other flatfish	Other flatfish	yes
UDF1	UNSP. DEEP-91 FLOUNDERS	Other flatfish	Other flatfish	yes
UDF2	UNSP. DEEP-95 FLOUNDERS	Other flatfish	Other flatfish	yes
UDM1	UNSP. DEMERSAL-91	Other groundfish	Other groundfish	yes
UDNR	UNSP. DEEP NEAR-SHORE RF	Other nearshore rockfish	Other nearshore rockfish	yes
UDSR	UNSP. DEMERSAL RKFSH	Other groundfish	Other groundfish	yes
UDW1	SHORTRAKER+ROUGHEYE	Other slope rockfish	Other slope rockfish	yes
UECH	UNSPECIFIED ECHINODERM	Other nongroundfish	Other nongroundfish	
UFL1	FLOUNDERS (NO FSOL)	Other flatfish	Other flatfish	yes
UFLT	UNSP. FLATFISH	Other flatfish	Other flatfish	yes
UGRN	UNSP. GROUNDFISH	Other groundfish	Other groundfish	yes
UHAG	UNSPECIFIED HAGFISH	Other nongroundfish	Other nongroundfish	
UHLB	UNSPECIFIED HALIBUT	Other nongroundfish	Other nongroundfish	
UJEL	UNSP. JELLYFISH	Other nongroundfish	Other nongroundfish	
UKCR	UNSP. KING CRAB	Other nongroundfish	Other nongroundfish	
UMCK	UNSP. MACKEREL	Other nongroundfish	Other nongroundfish	
UMSK	UNSPECIFIED MOLLUSKS	Other nongroundfish	Other nongroundfish	
UPLG	UNSP. PELAGIC RKFSH	Other groundfish	Other groundfish	yes
UPOP	UNSP. POP GROUP	Pacific ocean perch	Other slope rockfish	yes
URCK	UNSP. ROCKFISH	Other slope rockfish (>150 fm)	Other slope rockfish (>150 fm)	yes
URCK	UNSP. ROCKFISH	Other shelf rockfish (<150 fm)	Other shelf rockfish (<150 fm)	yes
URK1	SRKR+REYE+NRCK+SHRP	Other slope rockfish	Other slope rockfish	yes
URND	UNSP. ROUNDFISH	Other groundfish	Other groundfish	yes
USCL	UNSPECIFIED SCALLOP	Other nongroundfish	Other nongroundfish	
USCU	UNSP. SEA CUCUMBERS	Other nongroundfish	Other nongroundfish	
USF1	UNSP. SHALLOW-91 FLOUNDERS	Other flatfish	Other flatfish	yes
USHR	UNSP. NEAR-SHORE ROCKFISH	Other nearshore rockfish	Other nearshore rockfish	yes
USKT	UNSP. SKATE	Unspecified skate	Unspecified skate	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	FMP
USLF	UNSP. SHELF ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
USLP	UNSP. SLOPE ROCKFISH	Other slope rockfish	Other slope rockfish	yes
USLR	UNSP. SLOPE RKFSH	Other slope rockfish	Other slope rockfish	yes
USMN	UNSP. SALMON	Other nongroundfish	Other nongroundfish	
USR1	UNSP. SLOPE-91	Other groundfish	Other groundfish	yes
USR2	UNSP. SLOPE-93	Other groundfish	Other groundfish	yes
USRK	UNSP. SHARK	Other nongroundfish	Other nongroundfish	
USRM	UNSP. OCEAN SHRIMP	Other nongroundfish	Other nongroundfish	
USTG	UNSP. STURGEON	Other nongroundfish	Other nongroundfish	
USTR	UNSPECIFIED OYSTER	Other nongroundfish	Other nongroundfish	
UTCR	UNSP. TANNER CRAB	Tanner crab	Tanner crab	
UTNA	UNSPECIFIED TUNA	Other nongroundfish	Other nongroundfish	
UTRB	UNSP. TURBOTS	Other flatfish	Other flatfish	yes
UURC	UNSP. SEA URCHINS	Other nongroundfish	Other nongroundfish	
VRM1	NOM. VERMILLION ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
VRML	VERMILION ROCKFISH	Other shelf rockfish	Other shelf rockfish	yes
WABL	WHITE ABALONE	Other nongroundfish	Other nongroundfish	
WBAS	WHITE SEABASS	Other nongroundfish	Other nongroundfish	
WCLM	WASHINGTON CLAM	Other nongroundfish	Other nongroundfish	
WCRK	WHITE CROAKER	Other nongroundfish	Other nongroundfish	
WDOW	WIDOW ROCKFISH	Widow rockfish	Widow rockfish	yes
WDW1	NOM. WIDOW ROCKFISH	Widow rockfish	Widow rockfish	yes
WEEL	WOLF EEL	Other nongroundfish	Other nongroundfish	
WHOO	WAHOO	Other nongroundfish	Other nongroundfish	
WSTG	WHITE STURGEON	Other nongroundfish	Other nongroundfish	
YEY1	NOM. YELLOWEYE ROCKFISH	Yelloweye rockfish	Yelloweye rockfish	yes
YEYE	YELLOWEYE ROCKFISH	Yelloweye rockfish	Yelloweye rockfish	yes
YLTL	YELLOWTAIL	Other nongroundfish	Other nongroundfish	
YMTH	YELLOWMOUTH ROCKFISH	Yellowmouth rockfish (Remaining rockfish)	Other slope rockfish	yes
YSOL	YELLOWFIN SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
YTNA	YELLOWFIN TUNA	Other nongroundfish	Other nongroundfish	
YTR1	NOM. YELLOWTAIL ROCKFISH	Yellowtail rockfish	Yellowtail rockfish (Remaining rockfish)	yes
YTRK	YELLOWTAIL ROCKFISH	Yellowtail rockfish	Yellowtail rockfish (Remaining rockfish)	yes

APPENDIX C

Species identification codes used in the Pacific Coast Fisheries Information Network (PacFIN) database and assigned to WCGOP observer data, with aggregated species groups used in this report for the nearshore fixed gear sector of the groundfish fishery.

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
ALBC	ALBACORE	Other nongroundfish	Other nongroundfish	
APLC	ALASKA PLAICE	Other non-FMP flatfish	Other non-FMP flatfish	
ARR1	NOM. AURORA ROCKFISH	Minor slope rockfish	Minor slope rockfish	
ARRA	AURORA ROCKFISH	Minor slope rockfish	Minor slope rockfish	
ART1	NOM. ARROWTOOTH FLOUNDER	Arrowtooth flounder	Arrowtooth flounder	
ARTH	ARROWTOOTH FLOUNDER	Arrowtooth flounder	Arrowtooth flounder	
ASRK	PACIFIC ANGEL SHARK	Other nongroundfish	Other nongroundfish	
BABL	BLACK ABALONE	Other nongroundfish	Other nongroundfish	
BANK	BANK ROCKFISH	Minor slope rockfish	Bank rockfish (Remaining rockfish)	
BCAC	BOCACCIO	Bocaccio (Remaining rockfish)	Bocaccio	
BCC1	NOM. BOCACCIO	Bocaccio (Remaining rockfish)	Bocaccio	
BCLM	BUTTER CLAM	Other nongroundfish	Other nongroundfish	
BGL1	NOM. BLACKGILL ROCKFISH	Minor slope rockfish	Blackgill (Remaining rockfish)	
BKCR	BLUE KING CRAB	Other nongroundfish	Other nongroundfish	
BLCK	BLACK ROCKFISH	Black rockfish	Black rockfish	yes
BLGL	BLACKGILL ROCKFISH	Minor slope rockfish	Blackgill (Remaining rockfish)	
BLK1	NOM. BLACK ROCKFISH	Black rockfish	Black rockfish	yes
BLU1	NOM. BLUE ROCKFISH	Blue rockfish	Blue rockfish	yes
BLUR	BLUE ROCKFISH	Blue rockfish	Blue rockfish	yes
BMCK	BULLET MACKEREL	Other nongroundfish	Other nongroundfish	
BMRL	BLUE MARLIN	Other nongroundfish	Other nongroundfish	
BMSL	BLUE OR BAY MUSSEL	Other nongroundfish	Other nongroundfish	
BNK1	NOM. BANK ROCKFISH	Minor slope rockfish	Bank rockfish (Remaining rockfish)	
BRNZ	BRONZESPOTTED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
BRW1	NOM. BROWN ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
BRWN	BROWN ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
BRZ1	NOM. BRONZESPOTTED RK	Minor shelf rockfish	Minor shelf rockfish	
BSJK	BLACK SKIPJACK	Other nongroundfish	Other nongroundfish	
BSKT	BIG SKATE	Big skate	Big skate	
BSOL	BUTTER SOLE	Other flatfish	Other flatfish	
BSRK	BLUE SHARK	Other nongroundfish	Other nongroundfish	
BSRM	UNSP. BAIT SHRIMP	Other nongroundfish	Other nongroundfish	
BTCR	BAIRDI TANNER CRAB	Tanner crab	Tanner crab	
BTNA	BLUEFIN TUNA	Other nongroundfish	Other nongroundfish	
BTRY	BAT RAY	Other nongroundfish	Other nongroundfish	
BYEL	BLACK-AND-YELLOW ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
BYL1	NOM. BLACK-AND-YELLOW RK	Other minor nearshore rockfish	Shallow nearshore rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
CBZ1	NOM. CABEZON	Cabezon	Cabezon	yes
CBZN	CABEZON	Cabezon	Cabezon	yes
CEEL	SPOTTED CUSK-EEL	Other nongroundfish	Other nongroundfish	
CHL1	NOM. CALIFORNIA HALIBUT	California halibut	California halibut	
CHLB	CALIFORNIA HALIBUT	California halibut	California halibut	
CHN1	NOM. CHINA ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
CHNA	CHINA ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
CHNK	CHINOOK SALMON	Other nongroundfish	Other nongroundfish	
CHUM	CHUM SALMON	Other nongroundfish	Other nongroundfish	
CKLE	BASKET COCKLE	Other nongroundfish	Other nongroundfish	
CLC1	NOM. CALICO ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
CLCO	CALICO ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
CLP1	NOM. CHILIPEPPER	Chilipepper (Remaining rockfish)	Chilipepper	
CLPR	CHILIPEPPER	Chilipepper (Remaining rockfish)	Chilipepper	
CMCK	CHUB MACKEREL	Other nongroundfish	Other nongroundfish	
CMEL	CHAMELEON ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
CML1	NOM. CHAMELEON ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
CMSL	CALIFORNIA MUSSEL	Other nongroundfish	Other nongroundfish	
CNR1	NOM. CANARY ROCKFISH	Canary rockfish	Canary rockfish	
CNRY	CANARY ROCKFISH	Canary rockfish	Canary rockfish	
COHO	COHO SALMON	Other nongroundfish	Other nongroundfish	
COP1	NOM. COPPER ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
COPP	COPPER ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
CPLN	CAPELIN	Other nongroundfish	Other nongroundfish	
CSKT	CALIFORNIA SKATE	Unspecified skate	Unspecified skate	
CSOL	CURLFIN SOLE	Other flatfish	Other flatfish	
CTRB	C-O SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
CUDA	PACIFIC BARRACUDA	Other nongroundfish	Other nongroundfish	
CWC1	NOM. COWCOD ROCKFISH	Minor shelf rockfish	Cowcod	
CWCD	COWCOD ROCKFISH	Minor shelf rockfish	Cowcod	
DBR1	NOM. DARKBLOTCHED ROCKFISH	Darkblotched rockfish	Darkblotched rockfish	
DBRK	DARKBLOTCHED ROCKFISH	Darkblotched rockfish	Darkblotched rockfish	
DCRB	DUNGENESS CRAB	Dungeness crab	Dungeness crab	
DFLT	UNSP. DEEP FLOUNDERS	Other flatfish	Other flatfish	
DOVR	DOVER SOLE	Dover sole	Dover sole	
DRDO	DORADO	Other nongroundfish	Other nongroundfish	
DSOL	DEEPSEA SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
DSRK	SPINY DOGFISH	Spiny dogfish	Spiny dogfish	
DTRB	DIAMOND TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
DUSK	DUSKY ROCKFISH	Other groundfish	Other groundfish	
DVR1	NOM. DOVER SOLE	Dover sole	Dover sole	
DWRF	DWARF-RED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
EELS	UNSPECIFIED EELS	Other nongroundfish	Other nongroundfish	
EGL1	NOM. ENGLISH SOLE	English sole	English sole	
EGLS	ENGLISH SOLE	English sole	English sole	
ESTR	EASTERN OYSTER	Other nongroundfish	Other nongroundfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
ETNA	BIGEYE TUNA	Other nongroundfish	Other nongroundfish	
EULC	EULACHON	Eulachon	Eulachon	
EURO	EUROPEAN OYSTER	Other nongroundfish	Other nongroundfish	
FLAG	FLAG ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
FLG1	NOM. FLAG ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
FNTS	FANTAIL SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
FRCK	FRECKLED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
FSOL	FLATHEAD SOLE	Other flatfish	Other flatfish	
GABL	GREEN ABALONE	Other nongroundfish	Other nongroundfish	
GBAS	GIANT SEA BASS	Other nongroundfish	Other nongroundfish	
GBL1	NOM. GREENBLOTCHED RK	Minor shelf rockfish	Minor shelf rockfish	
GBLC	GREENBLOTCHED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
GCLM	GAPER CLAM	Other nongroundfish	Other nongroundfish	
GDUK	GEODUCK	Other nongroundfish	Other nongroundfish	
GKCR	GOLDEN KING CRAB	Other nongroundfish	Other nongroundfish	
GPH1	NOM. GOPHER ROCKFISH	Other minor nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
GPHR	GOPHER ROCKFISH	Other minor nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
GPRW	GOLDEN PRAWN	Other nongroundfish	Other nongroundfish	
GRAS	GRASS ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
GRDR	UNSP. GRENADIERS	Unspecified grenadiers	Unspecified grenadiers	
GRS1	NOM. GRASS ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
GSP1	NOM. GREENSPOTTED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
GSPT	GREENSPOTTED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
GSQD	GIANT SQUID	Other nongroundfish	Other nongroundfish	
GSR1	NOM. GREENSTRIPED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
GSRK	GREENSTRIPED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
GSRM	GHOST SHRIMP	Other nongroundfish	Other nongroundfish	
GSTG	GREEN STURGEON	Green sturgeon	Green sturgeon	
GTRB	GREENLAND TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
HBRK	HALFBANDED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
HCLM	HORSE CLAMS	Other nongroundfish	Other nongroundfish	
HLQN	HARLEQUIN ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
HNY1	NOM. HONEYCOMB ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
HNYC	HONEYCOMB ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
HTRB	HORNYHEAD TURBOT	Other non-FMP flatfish	Other non-FMP flatfish	
ISRK	BIGEYE THRESHER SHARK	Other nongroundfish	Other nongroundfish	
JCLM	CALIFORNIA JACKKNIFE CLAM	Other nongroundfish	Other nongroundfish	
JMCK	JACK MACKEREL	Other nongroundfish	Other nongroundfish	
KFSH	GIANT KELPFISH	Other nongroundfish	Other nongroundfish	
KGL1	NOM. KELP GREENLING	Kelp greenling	Kelp greenling	yes
KLP1	NOM. KELP ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
KLPG	KELP GREENLING	Kelp greenling	Kelp greenling	yes
KLPR	KELP ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
KMKA	KAMCHATKA FLOUNDER	Other non-FMP flatfish	Other non-FMP flatfish	
KSTR	KUMAMOTO OYSTER	Other nongroundfish	Other nongroundfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
LCD1	NOM. LINGCOD	Lingcod	Lingcod	yes
LCLM	NATIVE LITTLENECK	Other nongroundfish	Other nongroundfish	
LCOD	LINGCOD	Lingcod	Lingcod	yes
LDAB	LONGFIN SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
LDB1	NOM. LONGFIN SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
LOBS	CALIF. SPINY LOBSTER	Other nongroundfish	Other nongroundfish	
LSKT	LONGNOSE SKATE	Longnose skate	Longnose skate	
LSP1	NOM. LONGSPINE THORNYHEAD	Longspine thornyhead	Longspine thornyhead	
LSPN	LONGSPINE THORNYHEAD	Longspine thornyhead	Longspine thornyhead	
LSRK	LEOPARD SHARK	Other groundfish	Other groundfish	
LSTR	OLYMPIA OYSTER	Other nongroundfish	Other nongroundfish	
LUVR	LOUVAR	Other nongroundfish	Other nongroundfish	
MACL	MUD CLAMS	Other nongroundfish	Other nongroundfish	
MAKO	SHORTFIN MAKO SHARK	Other nongroundfish	Other nongroundfish	
MCLM	MANILA CLAM	Other nongroundfish	Other nongroundfish	
MEEL	MONKEYFACE EEL	Other nongroundfish	Other nongroundfish	
MISC	MISC. FISH/ANIMALS	Other nongroundfish	Other nongroundfish	
MOLA	COMMON MOLA	Other nongroundfish	Other nongroundfish	
MRLN	STRIPED MARLIN	Other nongroundfish	Other nongroundfish	
MSC2	MISCELLANEOUS FISH	Other nongroundfish	Other nongroundfish	
MSHP	PLAINFIN MIDSHIPMAN	Other nongroundfish	Other nongroundfish	
MSQD	MARKET SQUID	Other nongroundfish	Other nongroundfish	
MSRM	MUD SHRIMP	Other nongroundfish	Other nongroundfish	
MXR1	NOM. MEXICAN ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
MXRF	MEXICAN ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
NANC	NORTHERN ANCHOVY	Other nongroundfish	Other nongroundfish	
NRCK	NORTHERN ROCKFISH	Other groundfish	Other groundfish	
NSHR	NORTHERN NEAR-SHORE RK	Other minor nearshore rockfish	Northern nearshore rockfish	yes
NSLF	NORTHERN SHELF ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
NSLP	NORTHERN SLOPE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
NUSF	NOR. UNSP. SHELF ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
NUSP	NOR. UNSP. SLOPE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
NUSR	NOR. UNSP. NEAR-SHORE RK	Other minor nearshore rockfish	Northern nearshore rockfish	yes
OABL	OTHER ABALONE	Other nongroundfish	Other nongroundfish	
OANC	OTHER ANCHOVY	Other nongroundfish	Other nongroundfish	
OBAS	OTHER BASS	Other nongroundfish	Other nongroundfish	
OCLM	OTHER CLAM	Other nongroundfish	Other nongroundfish	
OCRB	OTHER CRAB	Other nongroundfish	Other nongroundfish	
OCRK	OTHER CROAKER	Other nongroundfish	Other nongroundfish	
OCTP	UNSP. OCTOPUS	Other nongroundfish	Other nongroundfish	
ODSR	OTHER DEMERSAL RKFSH	Other groundfish	Other groundfish	
OECH	OTHER ECHINODERM	Other nongroundfish	Other nongroundfish	
OFLT	OTHER FLATFISH	Other flatfish	Other flatfish	
OGRN	OTHER GROUNDFISH	Other groundfish	Other groundfish	
OLV1	NOM. OLIVE ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
OLVE	OLIVE ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
OMSK	OTHER MOLLUSKS	Other nongroundfish	Other nongroundfish	
OPLG	OTHER PELAGIC RKFSH	Other groundfish	Other groundfish	
ORCK	OTHER ROCKFISH	Minor slope rockfish	Minor slope rockfish	
ORCK	OTHER ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
ORND	OTHER ROUNDFISH	Other groundfish	Other groundfish	
OSCL	OTHER SCALLOP	Other nongroundfish	Other nongroundfish	
OSKT	OTHER SKATES	Unspecified skate	Unspecified skate	
OSLR	OTHER SLOPE RKFSH	Minor slope rockfish	Minor slope rockfish	
OSRK	OTHER SHARK	Other nongroundfish	Other nongroundfish	
OSRM	OTHER SHRIMP	Other nongroundfish	Other nongroundfish	
OSTR	OTHER OYSTER	Other nongroundfish	Other nongroundfish	
OTCR	OPILIO TANNER CRAB	Tanner crab	Tanner crab	
OTNA	OTHER TUNA	Other nongroundfish	Other nongroundfish	
OURC	OTHER SEA URCHINS	Other nongroundfish	Other nongroundfish	
OWFS	OCEAN WHITEFISH	Other nongroundfish	Other nongroundfish	
PABL	PINK ABALONE	Other nongroundfish	Other nongroundfish	
PBNT	PACIFIC BONITO	Other nongroundfish	Other nongroundfish	
PBTR	PACIFIC BUTTERFISH	Other nongroundfish	Other nongroundfish	
PCLM	PISMO CLAM	Other nongroundfish	Other nongroundfish	
PCOD	PACIFIC COD	Pacific cod	Pacific cod	
PDAB	PACIFIC SANDDAB	Other flatfish	Other flatfish	
PDB1	NOM. PACIFIC SANDDAB	Other flatfish	Other flatfish	
PGMY	PYGMY ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
PHLB	PACIFIC HALIBUT	Pacific halibut	Pacific halibut	
PHRG	PACIFIC HERRING	Other nongroundfish	Other nongroundfish	
PINK	PINK SALMON	Other nongroundfish	Other nongroundfish	
PLCK	WALLEYE POLLOCK	Other groundfish	Other groundfish	
PNK1	NOM. PINK ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
PNKR	PINK ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
POMF	PACIFIC POMFRET	Other nongroundfish	Other nongroundfish	
POP	PACIFIC OCEAN PERCH	Pacific ocean perch	Minor slope rockfish	
POP1	GEN. SHELF/SLOPE RF	Minor slope rockfish	Minor slope rockfish	
POP2	NOMINAL POP	Pacific ocean perch	Minor slope rockfish	
PRCL	PURPLE CLAM	Other nongroundfish	Other nongroundfish	
PROW	PROWFISH	Other nongroundfish	Other nongroundfish	
PRR1	NOM. PINKROSE ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
PRRK	PINKROSE ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
PSDN	PACIFIC SARDINE	Other nongroundfish	Other nongroundfish	
PSHP	PINK SHRIMP	Other nongroundfish	Other nongroundfish	
PSRK	PELAGIC THRESHER SHARK	Other nongroundfish	Other nongroundfish	
PSTR	PACIFIC OYSTER	Other nongroundfish	Other nongroundfish	
PTR1	NOM. PETRALE SOLE	Petrale sole	Petrale sole	
PTRL	PETRALE SOLE	Petrale sole	Petrale sole	
PUGT	PUGET SOUND ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
PWHT	PACIFIC WHITING	Pacific hake	Pacific hake	
QCLM	NORTHERN QUAHOG CLAM	Other nongroundfish	Other nongroundfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
QFSH	QUEENFISH	Other nongroundfish	Other nongroundfish	
QLB1	NOM. QUILLBACK ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
QLBK	QUILLBACK ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
RABL	RED ABALONE	Other nongroundfish	Other nongroundfish	
RATF	SPOTTED RATFISH	Other groundfish	Other groundfish	
RCK1	BOCACCIO+CHILIPEPPER RCKFSH	Minor shelf rockfish	Minor shelf rockfish	
RCK2	UNSP. BOLINA RCKFSH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
RCK3	UNSP. DPWTR REDS RCKFSH	Minor slope rockfish	Minor slope rockfish	
RCK4	UNSP. REDS RCKFSH	Other groundfish	Other groundfish	
RCK5	UNSP. SMALL REDS RCKFSH	Other groundfish	Other groundfish	
RCK6	UNSP. ROSEFISH RCKFSH	Other groundfish	Other groundfish	
RCK7	UNSP. GOPHER RCKFSH	Other minor nearshore rockfish	Gopher rockfish (Remaining rockfish)	yes
RCK8	CANARY+VERMILION RCKFSH	Canary rockfish	Canary rockfish	
RCK9	BLACK+BLUE ROCKFISH	Black rockfish	Black rockfish	yes
RCKG	ROCK GREENLING	Other nongroundfish	Other nongroundfish	
RCLM	RAZOR CLAM	Other nongroundfish	Other nongroundfish	
RCRB	ROCK CRAB	Other nongroundfish	Other nongroundfish	
RDB1	NOM. REDBANDED ROCKFISH	Minor slope rockfish	Minor slope rockfish	
RDBD	REDBANDED ROCKFISH	Minor slope rockfish	Minor slope rockfish	
REDS	REDSTRIPE ROCKFISH	Redstripe rockfish (Remaining rockfish)	Minor shelf rockfish	
REX	REX SOLE	Other flatfish	Other flatfish	
REX1	NOM. REX SOLE	Other flatfish	Other flatfish	
REYE	ROUGHEYE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
RFLT	REMAINING FLATFISH	Other flatfish	Other flatfish	
RGL1	NOM. ROCK GREENLING	Other nongroundfish	Other nongroundfish	
RGRN	REMAINING GROUNDFISH	Other groundfish	Other groundfish	
RHRG	ROUND HERRING	Other nongroundfish	Other nongroundfish	
RKCR	RED KING CRAB	Other nongroundfish	Other nongroundfish	
ROS1	NOM. ROSY ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
ROSY	ROSY ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
RPRW	RIDGEBACK PRAWN	Other nongroundfish	Other nongroundfish	
RRCK	REMAINING ROCKFISH	Other groundfish	Other groundfish	
RRND	REMAINING ROUNDFISH	Other groundfish	Other groundfish	
RSL1	NOM. ROCK SOLE	Other flatfish	Other flatfish	
RSOL	ROCK SOLE	Other flatfish	Other flatfish	
RST1	NOM. ROSETHORN ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
RSTN	ROSETHORN ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
RURC	RED SEA URCHIN	Other nongroundfish	Other nongroundfish	
RZCL	ROSY RAZOR CLAM	Other nongroundfish	Other nongroundfish	
SABL	SABLEFISH	Sablefish	Sablefish	
SAIL	SAILFISH	Other nongroundfish	Other nongroundfish	
SARY	PACIFIC SAURY	Other nongroundfish	Other nongroundfish	
SBL1	NOM. SHORTBELLY ROCKFISH	Shortbelly rockfish	Shortbelly rockfish	
SBLY	SHORTBELLY ROCKFISH	Shortbelly rockfish	Shortbelly rockfish	
SCLM	SOFT-SHELLED CLAM	Other nongroundfish	Other nongroundfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
SCLP	UNSP. SCULPIN	Other nongroundfish	Other nongroundfish	
SCOR	CALIFORNIA SCORPIONFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
SCR1	NOM. CALIF. SCORPIONFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
SDB1	NOM. SPECKLED SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
SFL1	NOM. STARRY FLOUNDER	Starry flounder	Starry flounder	
SFLT	UNSP. SHALLOW FLOUNDERS	Other flatfish	Other flatfish	
SHAD	UNSPECIFIED SHAD	Other nongroundfish	Other nongroundfish	
SHP1	NOM. CALIFORNIA SHEEPHEAD	California sheephead	California sheephead	yes
SHPD	CALIFORNIA SHEEPHEAD	California sheephead	California sheephead	yes
SHRP	SHARPCHIN ROCKFISH	Sharpchin rockfish (Remaining rockfish)	Sharpchin rockfish (Remaining rockfish)	
SKCR	SCARLET KING CRAB	Other nongroundfish	Other nongroundfish	
SLGR	SILVERGREY ROCKFISH	Silvergray rockfish (Remaining rockfish)	Minor shelf rockfish	
SLNS	SLENDER SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
SMLT	UNSP. SMELT	Other nongroundfish	Other nongroundfish	
SNOS	SPLITNOSE ROCKFISH	Splitnose rockfish (Remaining rockfish)	Splitnose rockfish	
SNS1	NOM. SPLITNOSE ROCKFISH	Splitnose rockfish (Remaining rockfish)	Splitnose rockfish	
SOCK	SOCKEYE SALMON	Other nongroundfish	Other nongroundfish	
SPK1	NOM. SPECKLED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SPKL	SPECKLED ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SPRW	SPOTTED PRAWN	Other nongroundfish	Other nongroundfish	
SQID	UNSP. SQUID	Other nongroundfish	Other nongroundfish	
SQR1	NOM. SQUARESPOT	Minor shelf rockfish	Minor shelf rockfish	
SQRS	SQUARESPOT ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SRFP	SURFPERCH SPP.	Other nongroundfish	Other nongroundfish	
SRKR	SHORTRAKER ROCKFISH	Minor slope rockfish	Minor slope rockfish	
SSCL	SHARPNOSE SCULPIN	Other nongroundfish	Other nongroundfish	
SSDB	SPECKLED SANDDAB	Other non-FMP flatfish	Other non-FMP flatfish	
SSHR	SOUTHERN NEAR-SHORE RK	Southern nearshore rockfish	Deeper nearshore rockfish	yes
SSHR	SOUTHERN NEAR-SHORE RK	Southern nearshore rockfish	Shallow nearshore rockfish	yes
SSLF	SOUTHERN SHELF ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SSLP	SOUTHERN SLOPE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
SSO1	NOM. SAND SOLE	Other flatfish	Other flatfish	
SSOL	SAND SOLE	Other flatfish	Other flatfish	
SSP1	NOM. SHORTSPINE THORNYHEAD	Shortspine thornyhead	Shortspine thornyhead	
SSPN	SHORTSPINE THORNYHEAD	Shortspine thornyhead	Shortspine thornyhead	
SSRD	Deep So. Nearshore RF	Southern nearshore rockfish	Deeper nearshore rockfish	yes
SSRK	SOUPFIN SHARK	Other groundfish	Other groundfish	
SSRS	Shallow So. Nearshore RF	Southern nearshore rockfish	Shallow nearshore rockfish	yes
STAR	STARRY ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
STL1	NOM. STRIPETAIL ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
STLH	STEELHEAD	Other nongroundfish	Other nongroundfish	
STNA	SKIPJACK TUNA	Other nongroundfish	Other nongroundfish	
STR1	NOM. STARRY ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
STRK	STRIPETAIL ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
STRY	STARRY FLOUNDER	Starry flounder	Starry flounder	
SUSF	SOU. UNSP. SHELF ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SUSP	SOU. UNSP. SLOPE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
SUSR	SOU. UNSP. NEAR-SHORE RK	Southern nearshore rockfish	Deeper nearshore rockfish	yes
SUSR	SOU. UNSP. NEAR-SHORE RK	Southern nearshore rockfish	Shallow nearshore rockfish	yes
SWRD	SWORDFISH	Other nongroundfish	Other nongroundfish	
SWS1	NOM. SWORDSPINE ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
SWSP	SWORDSPINE ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
TCOD	PACIFIC TOMCOD	Other nongroundfish	Other nongroundfish	
TGR1	NOM. TIGER ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
THD1	NOM. THORNYHEADS	Mixed thornyheads	Mixed thornyheads	
THDS	THORNYHEADS (MIXED)	Mixed thornyheads	Mixed thornyheads	
TIGR	TIGER ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
TRE1	NOM. TREEFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
TREE	TREEFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
TSRK	COMMON THRESHER SHARK	Other nongroundfish	Other nongroundfish	
UABL	UNSPECIFIED ABALONE	Other nongroundfish	Other nongroundfish	
UCLM	UNSPECIFIED CLAM	Other nongroundfish	Other nongroundfish	
UCRB	UNSPECIFIED CRAB	Other nongroundfish	Other nongroundfish	
UDAB	UNSP. SANDDABS	Other flatfish	Other flatfish	
UDF1	UNSP. DEEP-91 FLOUNDERS	Other flatfish	Other flatfish	
UDF2	UNSP. DEEP-95 FLOUNDERS	Other flatfish	Other flatfish	
UDM1	UNSP. DEMERSAL-91	Other groundfish	Other groundfish	
UDNR	UNSP. DEEP NEAR-SHORE RF	Other minor nearshore rockfish	Deeper nearshore rockfish	yes
UDSR	UNSP. DEMERSAL RKFSH	Other groundfish	Other groundfish	
UDW1	SHORTRAKER+ROUGHEYE	Minor slope rockfish	Minor slope rockfish	
UECH	UNSPECIFIED ECHINODERM	Other nongroundfish	Other nongroundfish	
UFL1	FLOUNDERS (NO FSOL)	Other flatfish	Other flatfish	
UFLT	UNSP. FLATFISH	Other flatfish	Other flatfish	
UGRN	UNSP. GROUNDFISH	Other groundfish	Other groundfish	
UHAG	UNSPECIFIED HAGFISH	Other nongroundfish	Other nongroundfish	
UHLB	UNSPECIFIED HALIBUT	Other nongroundfish	Other nongroundfish	
UJEL	UNSP. JELLYFISH	Other nongroundfish	Other nongroundfish	
UKCR	UNSP. KING CRAB	Other nongroundfish	Other nongroundfish	
UMCK	UNSP. MACKEREL	Other nongroundfish	Other nongroundfish	
UMSK	UNSPECIFIED MOLLUSKS	Other nongroundfish	Other nongroundfish	
UPLG	UNSP. PELAGIC RKFSH	Other groundfish	Other groundfish	
UPOP	UNSP. POP GROUP	Pacific ocean perch	Minor slope rockfish	
URCK	UNSP. ROCKFISH	Minor slope rockfish	Minor slope rockfish	
URCK	UNSP. ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
URK1	SRKR+REYE+NRCK+SHRP	Minor slope rockfish	Minor slope rockfish	
URND	UNSP. ROUNDFISH	Other groundfish	Other groundfish	
USCL	UNSPECIFIED SCALLOP	Other nongroundfish	Other nongroundfish	
USCU	UNSP. SEA CUCUMBERS	Other nongroundfish	Other nongroundfish	
USF1	UNSP. SHALLOW-91 FLOUNDERS	Other flatfish	Other flatfish	
USHR	UNSP. NEAR-SHORE ROCKFISH	Other minor nearshore rockfish	Deeper nearshore rockfish	yes

PacFIN Species ID	PacFIN Common Name	Species Group - North of 40˚ 10' N latitude	Species Group - South of 40˚ 10' N latitude	NS Species
USHR	UNSP. NEAR-SHORE ROCKFISH	Other minor nearshore rockfish	Shallow nearshore rockfish	yes
USKT	UNSP. SKATE	Unspecified skate	Unspecified skate	
USLF	UNSP. SHELF ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
USLP	UNSP. SLOPE ROCKFISH	Minor slope rockfish	Minor slope rockfish	
USLR	UNSP. SLOPE RKFSH	Minor slope rockfish	Minor slope rockfish	
USMN	UNSP. SALMON	Other nongroundfish	Other nongroundfish	
USR1	UNSP. SLOPE-91	Other groundfish	Other groundfish	
USR2	UNSP. SLOPE-93	Other groundfish	Other groundfish	
USRK	UNSP. SHARK	Other nongroundfish	Other nongroundfish	
USRM	UNSP. OCEAN SHRIMP	Other nongroundfish	Other nongroundfish	
USTG	UNSP. STURGEON	Other nongroundfish	Other nongroundfish	
USTR	UNSPECIFIED OYSTER	Other nongroundfish	Other nongroundfish	
UTCR	UNSP. TANNER CRAB	Tanner crab	Tanner crab	
UTNA	UNSPECIFIED TUNA	Other nongroundfish	Other nongroundfish	
UTRB	UNSP. TURBOTS	Other flatfish	Other flatfish	
UURC	UNSP. SEA URCHINS	Other nongroundfish	Other nongroundfish	
VRM1	NOM. VERMILLION ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
VRML	VERMILION ROCKFISH	Minor shelf rockfish	Minor shelf rockfish	
WABL	WHITE ABALONE	Other nongroundfish	Other nongroundfish	
WBAS	WHITE SEABASS	Other nongroundfish	Other nongroundfish	
WCLM	WASHINGTON CLAM	Other nongroundfish	Other nongroundfish	
WCRK	WHITE CROAKER	Other nongroundfish	Other nongroundfish	
WDOW	WIDOW ROCKFISH	Widow rockfish	Widow rockfish	
WDW1	NOM. WIDOW ROCKFISH	Widow rockfish	Widow rockfish	
WEEL	WOLF EEL	Other nongroundfish	Other nongroundfish	
WHOO	WAHOO	Other nongroundfish	Other nongroundfish	
WSTG	WHITE STURGEON	Other nongroundfish	Other nongroundfish	
YEY1	NOM. YELLOWEYE ROCKFISH	Yelloweye rockfish	Yelloweye rockfish	
YEYE	YELLOWEYE ROCKFISH	Yelloweye rockfish	Yelloweye rockfish	
YLTL	YELLOWTAIL	Other nongroundfish	Other nongroundfish	
YMTH	YELLOWMOUTH ROCKFISH	Yellowmouth rockfish (Remaining rockfish)	Minor slope rockfish	
YSOL	YELLOWFIN SOLE	Other non-FMP flatfish	Other non-FMP flatfish	
YTNA	YELLOWFIN TUNA	Other nongroundfish	Other nongroundfish	
YTR1	NOM. YELLOWTAIL ROCKFISH	Yellowtail rockfish	Yellowtail rockfish (Remaining rockfish)	
YTRK	YELLOWTAIL ROCKFISH	Yellowtail rockfish	Yellowtail rockfish (Remaining rockfish)	

APPENDIX D

Bycatch calculations and estimates by strata for marine mammals in the at-sea hake sector, observed by the At-Sea Hake Observer Program.

Species / Strata / Year	Total landings (mt)	Number of hauls	Number of hauls monitored for marine mammals	Number of marine mammals observed	Bycatch rate *(per 10,000 mt)* R	s(R)	Bycatch estimate *(number of animals)* Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
California sea lion (*Zalophus californianus*)											
North of 40˚ 10' N latitude											
Breeding season (May-Aug)											
2002	78,114	1662	1039	0	0.00		0.00				
2003	74,470	1580	1275	2	0.32	0.09	2.41	0.71	0.29	1.51	3.87
2004	87,668	2065	1962	1	0.12	0.03	1.08	0.28	0.26	0.70	1.65
2005	118,534	2445	1486	0	0.00		0.00				
2006	118,811	2486	1986	2	0.21	0.07	2.53	0.82	0.32	1.51	4.26
2007	90,523	2139	1491	0	0.00		0.00				
2008	96,905	2116	1642	0	0.00		0.00				
Non-breeding season (Jan-Apr / Sep-Dec)											
2002	*confidential*	--	--	--	--	--	0.00				
2003	13,688	264	262	0	0.00		0.00				
2004	35,071	635	581	1	0.33	0.11	1.14	0.40	0.35	0.65	2.00
2005	34,324	562	518	0	0.00		0.00				
2006	22,373	452	440	0	0.00		0.00				
2007	37,041	741	624	0	0.00		0.00				
2008	87,727	1501	1104	0	0.00		0.00				
Harbor seal (*Phoca vitulina*)											
Washington / Oregon											
2002	86,408	1766	1094	0	0.00		0.00				
2003	88,157	1844	1537	0	0.00		0.00				
2004	122,738	2700	2543	1	0.09	0.03	1.09	0.32	0.29	0.68	1.75
2005	152,857	3007	2004	1	0.09	0.05	1.36	0.70	0.52	0.61	3.03
2006	141,184	2938	2426	1	0.09	0.04	1.22	0.52	0.42	0.62	2.39
2007	127,564	2880	2115	0	0.00		0.00				
2008	184,631	3617	2746	2	0.14	0.05	2.62	0.90	0.34	1.51	4.54
Northern elephant seal (*Mirounga angustirostris*)											
Non-breeding season (Apr-Nov)											
2002	86,408	1766	1094	0	0.00		0.00				
2003	88,157	1844	1537	0	0.00		0.00				
2004	122,738	2700	2543	3	0.27	0.04	3.28	0.55	0.17	2.49	4.32
2005	152,857	3007	2004	0	0.00		0.00				
2006	141,184	2938	2426	0	0.00		0.00				
2007	124,978	2841	2103	2	0.21	0.07	2.66	0.94	0.35	1.52	4.67
2008	168,838	3361	2557	7	0.54	0.10	9.13	1.67	0.18	6.78	12.30
Stellar sea lion (*Eumetopias jubatus*)											
Breeding season (May - Jul)											
2002	61,787	1331	910	1	0.22	0.11	1.35	0.69	0.51	0.61	2.98
2003	61,882	1338	1063	1	0.20	0.09	1.23	0.53	0.43	0.62	2.43
2004	73,164	1764	1661	0	0.00		0.00				
2005	104,745	2216	1348	2	0.29	0.12	2.99	1.21	0.41	1.57	5.68
2006	110,831	2298	1846	3	0.34	0.09	3.78	0.99	0.26	2.47	5.78
2007	90,523	2139	1491	3	0.47	0.14	4.22	1.31	0.31	2.56	6.96
2008	81,981	1827	1390	0	0.00		0.00				

Species / Strata / Year	Total landings (mt)	Number of hauls	Number of hauls monitored for marine mammals	Number of marine mammals observed	Bycatch rate (per 10,000 mt) R	s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Stellar sea lion (*Eumetopias jubatus*) (continued)											
Non-breeding season (Jan-Apr / Aug-Dec)											
2002	24,621	435	184	0	0.00		0.00				
2003	26,275	506	474	0	0.00		0.00				
2004	49,574	936	882	0	0.00		0.00				
2005	48,113	791	656	0	0.00		0.00				
2006	30,353	640	580	0	0.00		0.00				
2007	37,041	741	624	0	0.00		0.00				
2008	102,651	1790	1356	1	0.13	0.06	1.30	0.62	0.48	0.61	2.75

APPENDIX E

Bycatch calculations and estimates by strata for seabirds in the at-sea hake sector, observed by the At-Sea Hake Observer Program.

Species / Strata / Year	Total landings (mt)	Number of hauls	Number of hauls sampled	Mean % of catch sampled *(on sampled hauls)*	Number of seabirds observed	Bycatch rate *(per 10,000 mt)* R	s(R)	Bycatch estimate *(number of animals)* Y
Auklet / murrelet - unidentified								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	3	0.86	0.86	3.01
2005	34,324	562	560	48%	0	0.00		0.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	0	0.00		0.00
2008	87,727	1501	1481	47%	0	0.00		0.00
Black-footed albatross (*Phoebastria nigripes*)								
North of Cape Blanco								
Summer (May - Aug)								
2002	45,262	1012	1002	36%	0	0.00		0.00
2003	69,907	1509	1490	39%	3	0.43	0.43	3.04
2004	81,011	1955	1947	38%	0	0.00		0.00
2005	113,618	2345	2339	46%	2	0.18	0.18	2.00
2006	93,474	1990	1938	49%	2	0.22	0.22	2.04
2007	90,042	2129	2112	56%	0	0.00		0.00
2008	67,263	1489	1483	54%	1	0.15	0.15	1.00
Common murre (*Uria aalge*)								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	3	0.86	0.86	3.01
2005	34,324	562	560	48%	2	0.58	0.58	2.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	0	0.00		0.00
2008	87,727	1501	1481	47%	0	0.00		0.00
Northern fulmar (*Fulmarus glacialis*)								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	21	6.00	2.83	21.05
2005	34,324	562	560	48%	2	0.58	0.58	2.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	51	13.79	3.00	51.09
2008	87,727	1501	1481	47%	2	0.23	0.23	2.03

Species / Strata / Year	Total landings (mt)	Number of hauls	Number of hauls sampled	Mean % of catch sampled *(on sampled hauls)*	Number of seabirds observed	Bycatch rate *(per 10,000 mt)* R	s(R)	Bycatch estimate *(number of animals)* Y
Seabird - unidentified								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	0	0.00		0.00
2005	34,324	562	560	48%	2	0.58	0.58	2.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	0	0.00		0.00
2008	87,727	1501	1481	47%	2	0.23	0.23	2.03
South of Cape Blanco								
Summer (May - Aug)								
2002	32,851	650	648	40%	0	0.00		0.00
2003	4,563	71	71	43%	0	0.00		0.00
2004	6,656	110	110	34%	0	0.00		0.00
2005	4,916	100	100	50%	0	0.00		0.00
2006	25,337	496	494	51%	0	0.00		0.00
2007	481	10	10	64%	0	0.00		0.00
2008	29,641	627	626	46%	2	0.68	0.68	2.01
Shearwater - unidentified								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	2	0.57	0.57	2.01
2005	34,324	562	560	48%	0	0.00		0.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	0	0.00		0.00
2008	87,727	1501	1481	47%	0	0.00		0.00
North of Cape Blanco								
Summer (May - Aug)								
2002	45,262	1012	1002	36%	0	0.00		0.00
2003	69,907	1509	1490	39%	0	0.00		0.00
2004	81,011	1955	1947	38%	6	0.74	0.52	6.01
2005	113,618	2345	2339	46%	0	0.00		0.00
2006	93,474	1990	1938	49%	0	0.00		0.00
2007	90,042	2129	2112	56%	0	0.00		0.00
2008	67,263	1489	1483	54%	0	0.00		0.00
Sooty shearwater (*Puffinus griseus*)								
North of Cape Blanco								
Summer (May - Aug)								
2002	45,262	1012	1002	36%	0	0.00		0.00
2003	69,907	1509	1490	39%	0	0.00		0.00
2004	81,011	1955	1947	38%	0	0.00		0.00
2005	113,618	2345	2339	46%	2	0.18	0.18	2.00
2006	93,474	1990	1938	49%	0	0.00		0.00
2007	90,042	2129	2112	56%	0	0.00		0.00
2008	67,263	1489	1483	54%	0	0.00		0.00

Species / Strata / Year	Total landings (mt)	Number of hauls	Number of hauls sampled	Mean % of catch sampled *(on sampled hauls)*	Number of seabirds observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*
						R	s(R)	Y
Tubenoses - unidentified								
North of Cape Blanco								
Fall (Sep - Dec)								
2002	*confidential*	--	--	--	--	--	--	0.00
2003	13,688	264	264	33%	0	0.00		0.00
2004	35,071	635	632	41%	0	0.00		0.00
2005	34,324	562	560	48%	0	0.00		0.00
2006	22,373	452	451	50%	0	0.00		0.00
2007	37,041	741	735	48%	0	0.00		0.00
2008	87,727	1501	1481	47%	2	0.23	0.23	2.03

APPENDIX F

Bycatch calculations and estimates by strata for marine mammals in non-hake groundfish fishery sectors observed by the West Coast Groundfish Observer Program.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate (per 10,000 mt) R	s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI	90% CI
California sea lion (*Zalophus californianus*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area - Season*											
North of 40˚ 10' N latitude											
Breeding season (May-Aug)											
2002 *	6,142	9%	164	1	17.39	16.64	--		0.96		
2003	4,753	14%	107	0	0.00		0.00				
2004 *	5,396	20%	173	1	9.30	8.37	--		0.90		
2005 *	6,718	25%	198	1	5.99	5.20	--		0.87		
2006	6,519	22%	180	0	0.00		0.00				
2007	6,029	19%	118	0	0.00		0.00				
2008	6,717	26%	137	0	0.00		0.00				
Non-breeding season (Jan-Apr / Sep-Dec)											
2002	9,291	17%	282	0	0.00		0.00				
2003 *	9,512	16%	220	1	6.39	5.86	--		0.92		
2004	8,607	29%	275	0	0.00		0.00				
2005	9,522	22%	202	2	9.61	5.99	9.15	5.70	0.62	3.57	23.48
2006 *	8,891	22%	200	1	5.20	4.61	--		0.89		
2007	11,880	16%	169	0	0.00		0.00				
2008	14,569	20%	218	0	0.00		0.00				
South of 40˚ 10' N latitude											
Breeding season (May-Aug)											
2002 *	1,792	18%	55	1	31.07	28.78	--		0.93		
2003	1,607	14%	74	5	227.23	156.36	36.51	25.12	0.69	13.11	101.66
2004	1,648	22%	67	0	0.00		0.00				
2005 *	1,262	23%	66	1	33.99	30.13	--		0.89		
2006	1,092	24%	85	3	113.02	58.61	12.35	6.40	0.52	5.53	27.55
2007 *	1,113	15%	38	1	60.24	57.39	--		0.95		
2008	1,065	24%	51	0	0.00		0.00				
Non-breeding season (Jan-Apr / Sep-Dec)											
2002 *	3,192	13%	84	1	24.01	22.24	--		0.93		
2003 *	2,959	10%	74	8	266.78	249.82	--		0.94		
2004	2,327	29%	108	0	0.00		0.00				
2005	2,092	19%	61	0	0.00		0.00				
2006	1,538	12%	29	0	0.00		0.00				
2007 *	1,564	26%	53	2	48.77	42.34	--		0.87		
2008 *	1,936	21%	87	1	24.91	22.36	--		0.90		

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
California sea lion (*Zalophus californianus*) (continued)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Season*											
Limited Entry Sector											
Breeding season (May-Aug)											
2002	28	0%	3	0	0.00		0.00				
2003	28	15%	20	3	7227.41	4277.92	20.14	11.92	0.59	8.18	49.61
2004	52	39%	24	0	0.00		0.00				
2005	50	39%	45	0	0.00		0.00				
2006 *	38	8%	31	3	9990.63	9603.71	--		0.96		
2007	10	13%	18	4	30824.68	24274.02	31.50	24.80	0.79	10.05	98.74
2008	3	*confidential*	--	--	--	--	0.00				
Non-breeding season (Jan-Apr / Sep-Dec)											
2002	84	4%	18	2	5497.14	3467.04	46.25	29.17	0.63	17.85	119.81
2003	84	19%	53	11	6752.78	2097.48	57.05	17.72	0.31	34.63	93.99
2004	89	17%	22	2	1291.23	898.90	11.44	7.96	0.70	4.07	32.17
2005 *	143	8%	29	1	902.16	857.18	--		0.95		
2006	85	14%	47	11	9501.71	5368.08	80.77	45.63	0.56	33.98	191.95
2007	32	13%	22	0	0.00		0.00				
2008	36	37%	49	5	3662.82	1523.25	13.35	5.55	0.42	6.92	25.75
Open Access Sector											
Breeding season (May-Aug)											
2002	30										
2003	12	*confidential*	--	--	--	--	0.00				
2004	42	*confidential*	--	--	--	--	0.00				
2005 *	44	13%	28	1	1817.18	1737.37	--		0.96		
2006	38	0%									
2007	25	8%	31	0	0.00		0.00				
2008	21	6%	20	0	0.00		0.00				
Non-breeding season (Jan-Apr / Sep-Dec)											
2002	59										
2003	34	0%	4	0	0.00		0.00				
2004 *	39	2%	19	1	11017.49	11043.66	--		1.00		
2005 *	34	7%	32	3	12489.10	10623.81	--		0.85		
2006	23										
2007	14	5%	18	0	0.00		0.00				
2008 *	29	5%	29	1	7616.78	7518.74	--		0.99		
Nearshore Fixed Gear											
Target Species: *Nearshore target species (see Appendix C)*											
Stratification: *Season*											
Breeding season (May-Aug)											
2002	408										
2003	326	2%	70	0	0.00		0.00				
2004	334	6%	238	0	0.00		0.00				
2005	295	5%	179	0	0.00		0.00				
2006 *	278	6%	196	1	648.73	632.06	--		0.97		
2007	284	6%	186	0	0.00		0.00				
2008	285	4%	138	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
California sea lion (*Zalophus californianus*) (continued)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Season*											
Sablefish Primary Sector											
Longline gear											
Breeding season (May-Aug)											
2002	606	11%	35	0	0.00		0.00				
2003 *	764	20%	36	1	64.79	58.44	--		0.90		
2004 *	848	8%	21	1	144.86	146.01	--		1.01		
2005	954	40%	74	5	132.29	53.20	12.62	5.08	0.40	6.68	23.86
2006	1,053	17%	48	0	0.00		0.00				
2007	912	18%	49	0	0.00		0.00				
2008	815	30%	58	0	0.00		0.00				
Sablefish Non-Primary Sector											
Longline gear											
Non-breeding season (Jan-Apr / Sep-Dec)											
2002	353	0%	11	0	0.00		0.00				
2003	350	1%	36	0	0.00		0.00				
2004 *	280	0%	21	1	7958.84	8206.88	--		1.03		
2005	427	0%	20	0	0.00		0.00				
2006	308	2%	98	0	0.00		0.00				
2007 *	331	2%	84	1	1364.30	1369.07	--		1.00		
2008	458	1%	78	0	0.00		0.00				
Harbor porpoise (*Phocoena phocoena*)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Area*											
Limited Entry Sector											
South of Point Arena, CA											
2002	112	3%	21	0	0.00		0.00				
2003	112	18%	73	0	0.00		0.00				
2004 *	140	25%	46	1	282.37	247.20	--		0.88		
2005	194	16%	74	0	0.00		0.00				
2006	123	12%	78	0	0.00		0.00				
2007	42	13%	40	0	0.00		0.00				
2008	39	35%	53	0	0.00		0.00				
Harbor seal (*Phoca vitulina*)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Area*											
Limited Entry Sector											
California											
2002	112	3%	21	0	0.00		0.00				
2003	112	18%	73	0	0.00		0.00				
2004	140	25%	46	0	0.00		0.00				
2005	194	16%	74	0	0.00		0.00				
2006 *	123	12%	78	1	685.89	638.02	--		0.93		
2007	42	13%	40	0	0.00		0.00				
2008	39	35%	53	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
Harbor seal (*Phoca vitulina*) (continued)											
Nearshore Fixed Gear											
Target Species: *Nearshore target species (see Appendix C)*											
Stratification: *Area*											
Washington / Oregon											
2002	307	0%									
2003	242	0%									
2004	225	5%	113	0	0.00		0.00				
2005	228	5%	138	0	0.00		0.00				
2006 *	180	11%	249	1	498.60	470.78	--		0.94		
2007	188	9%	165	0	0.00		0.00				
2008	196	7%	153	2	1372.09	938.27	26.86	18.37	0.68	9.70	74.39
Northern elephant seal (*Mirounga angustirostris*)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Season*											
Limited Entry Sector											
Non-breeding season (Apr-Nov)											
2002	51	2%	10	0	0.00		0.00				
2003	56	14%	46	0	0.00		0.00				
2004	69	30%	30	0	0.00		0.00				
2005	76	28%	54	0	0.00		0.00				
2006	61	19%	65	0	0.00		0.00				
2007 *	17	16%	28	1	3664.47	3524.30	--		0.96		
2008	11	23%	20	0	0.00		0.00				
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Season*											
Sablefish Primary Sector											
Longline gear											
Non-breeding season (Apr - Nov)											
2002	1,088	18%	67	0	0.00		0.00				
2003	1,285	18%	49	0	0.00		0.00				
2004	1,545	12%	46	0	0.00		0.00				
2005	1,558	34%	108	0	0.00		0.00				
2006 *	1,619	20%	73	1	30.91	26.58	--		0.86		
2007	1,345	25%	77	0	0.00		0.00				
2008	1,250	28%	79	0	0.00		0.00				
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area*											
South of 40˚ 10' N latitude											
2002	4,984	15%	139	0	0.00		0.00				
2003 *	4,565	11%	148	1	19.23	18.15	--		0.94		
2004	3,974	26%	175	0	0.00		0.00				
2005	3,354	20%	127	0	0.00		0.00				
2006	2,630	17%	114	0	0.00		0.00				
2007	2,677	22%	91	0	0.00		0.00				
2008	3,001	22%	138	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
Risso's dolphin (*Grampus griseus)*											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area*											
40˚ 10' N latitude to Pt Conception											
2002	4,185	18%	139	0	0.00		0.00				
2003	3,753	14%	148	0	0.00		0.00				
2004	3,178	32%	175	0	0.00		0.00				
2005	2,948	23%	127	0	0.00		0.00				
2006	2,591	17%	114	0	0.00		0.00				
2007	2,650	22%	91	0	0.00		0.00				
2008 *	2,835	23%	138	1	15.31	13.27	--		0.87		
Sperm whale (*Physeter macrocephalus*)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Primary Sector											
Longline gear											
North of 40˚10' N latitude											
Non-winter (Apr-Nov)											
2002	981	19%	65	0	0.00		0.00				
2003	1,134	19%	45	0	0.00		0.00				
2004	1,386	12%	39	0	0.00		0.00				
2005	1,431	36%	94	0	0.00		0.00				
2006	1,530	21%	72	0	0.00		0.00				
2007 *	1,237	25%	68	1	31.72	26.76	--		0.84		
2008	1,145	30%	77	0	0.00		0.00				
Stellar sea lion (*Eumetopias jubatus*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Season*											
Non-breeding season (Jan-Apr / Aug-Dec)											
2002	14,280	15%	426	2	9.12	5.94	13.03	8.49	0.65	4.90	34.66
2003	13,936	15%	341	0	0.00		0.00				
2004	12,784	28%	446	0	0.00		0.00				
2005	13,922	22%	338	0	0.00		0.00				
2006	12,599	21%	309	0	0.00		0.00				
2007	15,326	18%	260	0	0.00		0.00				
2008	18,205	20%	346	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of marine mammals observed	Bycatch rate (per 10,000 mt)		Bycatch estimate (number of animals)				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
Stellar sea lion (*Eumetopias jubatus*) (continued)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Season*											
Limited Entry Sector											
Non-breeding season (Jan-Apr / Aug-Dec)											
2002	95	4%	18	0	0.00		0.00				
2003	96	18%	61	0	0.00		0.00				
2004	113	25%	36	0	0.00		0.00				
2005	158	10%	51	0	0.00		0.00				
2006	102	13%	70	0	0.00		0.00				
2007 *	35	12%	22	1	2426.28	2288.00	--		0.94		
2008	37	37%	49	1	732.56	582.30	2.68	2.13	0.79	0.85	8.47
Unidentified sea lion											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *None*											
2002 *	20,418	14%	585	1	3.50	3.25	--		0.93		
2003	18,830	15%	475	0	0.00		0.00				
2004	17,977	26%	623	0	0.00		0.00				
2005	19,593	23%	527	0	0.00		0.00				
2006	18,040	21%	494	0	0.00		0.00				
2007	20,586	18%	378	0	0.00		0.00				
2008	24,287	22%	493	0	0.00		0.00				
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear*											
Sablefish Non-Primary Sector											
Longline gear											
2002	462	0%	11	0	0.00		0.00				
2003	494	3%	131	0	0.00		0.00				
2004	387	1%	65	0	0.00		0.00				
2005	531	0%	35	0	0.00		0.00				
2006	455	2%	121	0	0.00		0.00				
2007 *	474	3%	159	1	607.22	603.63	--		0.99		
2008	673	2%	122	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

APPENDIX G

Bycatch calculations and estimates by strata for seabirds in non-hake groundfish fishery sectors observed by the West Coast Groundfish Observer Program.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt)		Bycatch estimate (number of animals)				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Black footed albatross (*Phoebastria nigripes*)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Primary Sector											
Longline gear											
North of Cape Blanco, OR											
Summer (May - Aug)											
2002	515	12%	28	0	0.00		0.00				
2003	624	22%	30	8	583.73	306.19	36.40	19.09	0.52	16.18	81.90
2004	729	9%	21	5	651.86	413.19	47.53	30.13	0.63	18.27	123.63
2005	794	37%	52	20	665.92	307.35	52.87	24.40	0.46	25.66	108.92
2006 *	860	16%	41	6	436.06	414.79	--		0.95		
2007 *	718	20%	35	9	657.00	581.98	--		0.89		
2008	636	30%	45	16	822.40	366.21	52.27	23.28	0.45	25.97	105.22
Fall (Sep - Dec)											
2002	256	43%	26	0	0.00		0.00				
2003	254	25%	5	0	0.00		0.00				
2004	501	18%	14	0	0.00		0.00				
2005	393	29%	12	2	172.93	114.04	6.80	4.49	0.66	2.53	18.28
2006 *	405	31%	17	4	313.32	266.49	--		0.85		
2007	314	49%	17	38	2450.72	1197.24	76.87	37.55	0.49	35.91	164.52
2008	314	29%	13	6	644.54	196.52	20.23	6.17	0.30	12.39	33.03
South of Cape Blanco, OR											
Summer (May - Aug)											
2002	91	*confidential*	--	--	--	--	0.00				
2003	140	*confidential*	--	--	--	--	0.00				
2004	119										
2005	160	48%	22	2	262.88	191.52	4.21	3.07	0.73	1.44	12.32
2006	193	*confidential*	--	--	--	--	30.76	10.51	0.34	17.81	53.13
2007 *	195	10%	14	1	509.66	489.43	--		0.96		
2008	179	27%	13	5	1028.02	548.02	18.44	9.83	0.53	8.10	41.98
Fall (Sep - Dec)											
2002 *	116	16%	6	1	551.55	603.26	--		1.09		
2003	189	3%	5	0	0.00		0.00				
2004	157	12%	9	0	0.00		0.00				
2005	143	17%	11	0	0.00		0.00				
2006	137	*confidential*	--	--	--	--	0.00				
2007	71	*confidential*	--	--	--	--	0.00				
2008	33										

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Black footed albatross (*Phoebastria nigripes*) (continued)											
Open Access Sector											
Hook-and-line gears											
South of Cape Blanco, OR											
Summer (May - Aug)											
2002	58										
2003	103	1%	4	0	0.00		0.00				
2004	56	*confidential*	--	--	--	--	0.00				
2005	75	*confidential*	--	--	--	--	0.00				
2006	104	*confidential*	--	--	--	--	0.00				
2007 *	56	3%	8	1	5205.67	5274.40	--		1.01		
2008	113	2%	17	0	0.00		0.00				
Brandt's cormorant (*Phalacrocorax penicillatus*)											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Area - Season*											
Limited Entry Sector											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	56	7%	18	0	0.00		0.00				
2003 *	62	21%	30	1	781.03	725.73	--		0.93		
2004	63	25%	21	0	0.00		0.00				
2005	130	7%	19	0	0.00		0.00				
2006	78	12%	39	0	0.00		0.00				
2007	27	11%	13	0	0.00		0.00				
2008	27	41%	38	0	0.00		0.00				
Brown Pelican (*Pelecanus occidentalis*)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Non-Primary Sector											
Longline gear											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	114	*confidential*	--	--	--	--	0.00				
2003	148	1%	31	0	0.00		0.00				
2004	123	*confidential*	--	--	--	--	0.00				
2005 *	105	1%	6	1	13935.52	15514.11	--		1.11		
2006	99	1%	33	0	0.00		0.00				
2007	114	2%	45	0	0.00		0.00				
2008	125	1%	38	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt) R	s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Common Murre (*Uria aalge*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area - Season*											
North of Cape Blanco, OR											
Summer (May - Aug)											
2002	5,104	9%	122	0	0.00		0.00				
2003	3,292	11%	51	0	0.00		0.00				
2004 *	4,245	20%	145	1	11.72	10.55	--		0.90		
2005	5,590	26%	164	0	0.00		0.00				
2006	5,255	23%	154	0	0.00		0.00				
2007	4,596	18%	88	0	0.00		0.00				
2008	5,342	25%	103	0	0.00		0.00				
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Area - Season*											
Limited Entry Sector											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	56	7%	18	0	0.00		0.00				
2003 *	62	21%	30	36	28116.91	24010.58	--		0.85		
2004	63	25%	21	0	0.00		0.00				
2005	130	7%	19	0	0.00		0.00				
2006	78	12%	39	0	0.00		0.00				
2007	27	11%	13	0	0.00		0.00				
2008	27	41%	38	0	0.00		0.00				
Summer (May - Aug)											
2002	28	0%	3	0	0.00		0.00				
2003	28	15%	20	0	0.00		0.00				
2004	52	39%	24	5	2509.37	960.17	12.97	4.96	0.38	7.06	23.82
2005	50	39%	45	0	0.00		0.00				
2006	38	8%	31	0	0.00		0.00				
2007	10	13%	18	0	0.00		0.00				
2008	3	*confidential*	--	--	--	--	0.00				
Open Access Sector											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	31										
2003 *	28	*0%*	3	1	77626.76	73178.61	--		0.94		
2004	24	*confidential*	--	--	--	--	0.00				
2005	25	7%	30	0	0.00		0.00				
2006	21										
2007	3	14%	11	0	0.00		0.00				
2008	14	*confidential*	--	--	--	--	0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt) R	Bycatch rate (per 10,000 mt) s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Common Murre (*Uria aalge*) (continued)											
Nearshore Fixed Gear											
Target Species: *Nearshore target species (see Appendix C)*											
Stratification: *Area - Season*											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	203										
2003	97	1%	13	0	0.00		0.00				
2004 *	96	7%	69	1	1506.07	1478.60	--		0.98		
2005	89	5%	48	0	0.00		0.00				
2006	62	3%	39	0	0.00		0.00				
2007	88	6%	56	0	0.00		0.00				
2008	108	5%	50	0	0.00		0.00				
Summer (May - Aug)											
2002	365										
2003	283	3%	70	0	0.00		0.00				
2004	300	6%	210	0	0.00		0.00				
2005	250	5%	153	0	0.00		0.00				
2006 *	251	5%	153	1	791.80	760.77	--		0.96		
2007	255	5%	127	0	0.00		0.00				
2008	259	4%	111	0	0.00		0.00				
Cormorants, unidentified											
California Halibut Trawl Fishery											
Target Species: *California halibut*											
Stratification: *Sector - Area - Season*											
Limited Entry Sector											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	56	7%	18	0	0.00		0.00				
2003	62	21%	30	2	1562.05	983.17	9.71	6.11	0.63	3.75	25.11
2004	63	25%	21	0	0.00		0.00				
2005	130	7%	19	0	0.00		0.00				
2006	78	12%	39	0	0.00		0.00				
2007	27	11%	13	0	0.00		0.00				
2008	27	41%	38	0	0.00		0.00				
Summer (May - Aug)											
2002	28	0%	3	0	0.00		0.00				
2003	28	15%	20	0	0.00		0.00				
2004	52	39%	24	2	1003.75	522.07	5.19	2.70	0.52	2.32	11.60
2005	50	39%	45	0	0.00		0.00				
2006	38	8%	31	0	0.00		0.00				
2007	10	13%	18	0	0.00		0.00				
2008	3	*confidential*					0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate *(per 10,000 mt)* R	s(R)	Bycatch estimate *(number of animals)* Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Cormorants, unidentified (continued)											
<u>Open Access Sector</u>											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	31	0%	0								
2003	28	*confidential*					0.00				
2004	24	*confidential*					0.00				
2005 *	25	7%	30	1	5425.16	4375.04	--		0.81		
2006	21	0%	0								
2007 *	3	14%	11	1	22313.76	20616.46	--		0.92		
2008	14	*confidential*					0.00				
Nearshore Fixed Gear											
Target Species: *Nearshore target species (see Appendix C)*											
Stratification: *Area - Season*											
South of Cape Blanco, OR											
Summer (May - Aug)											
2002	365										
2003	283	3%	70	0	0.00		0.00				
2004	300	6%	210	0	0.00		0.00				
2005	250	5%	153	0	0.00		0.00				
2006	251	5%	153	0	0.00		0.00				
2007 *	255	5%	127	1	803.75	785.88	--		0.98		
2008	259	4%	111	0	0.00		0.00				
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
<u>Sablefish Primary Sector</u>											
Longline gear											
South of Cape Blanco, OR											
Fall (Sep - Dec)											
2002	116	16%	6	1	551.55	401.29	6.41	4.66	0.73	2.19	18.73
2003	189	3%	5	0	0.00		0.00				
2004	157	12%	9	0	0.00		0.00				
2005	143	17%	11	0	0.00		0.00				
2006	137	*confidential*					0.00				
2007	71	*confidential*					0.00				
2008	33	0%	0								
<u>Sablefish Non-Primary Sector</u>											
Longline gear											
South of Cape Blanco, OR											
Summer (May - Aug)											
2002	97										
2003 *	131	8%	92	1	1011.20	976.98	--		0.97		
2004	95	3%	44	0	0.00		0.00				
2005	91	1%	15	0	0.00		0.00				
2006	125	2%	23	0	0.00		0.00				
2007	119	8%	75	0	0.00		0.00				
2008	171	2%	44	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt)		Bycatch estimate (number of animals)				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Gulls, unidentified											
<u>Sablefish Primary Sector</u>											
Longline gear											
North of Cape Blanco, OR											
Summer (May - Aug)											
2002	515	12%	28	0	0.00		0.00				
2003	624	22%	30	0	0.00		0.00				
2004	729	9%	21	0	0.00		0.00				
2005	794	37%	52	0	0.00		0.00				
2006	860	16%	41	2	145.35	117.86	12.50	10.14	0.81	3.88	40.26
2007	718	20%	35	0	0.00		0.00				
2008	636	30%	45	0	0.00		0.00				
<u>Sablefish Non-Primary Sector</u>											
Longline gear											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	114	*confidential*	--	--	--	--	0.00				
2003	148	1%	31	0	0.00		0.00				
2004	123	*confidential*	--	--	--	--	0.00				
2005	105	*confidential*	--	--	--	--	0.00				
2006	99	1%	33	0	0.00		0.00				
2007	114	2%	45	0	0.00		0.00				
2008 *	125	1%	38	1	5905.71	6537.44	--		1.11		
Fall (Sep - Dec)											
2002	143	1%	10	0	0.00		0.00				
2003	123	*confidential*	--	--	--	--	0.00				
2004	118	1%	17	0	0.00		0.00				
2005	178	0%	14	0	0.00		0.00				
2006	164	2%	65	0	0.00		0.00				
2007	144	3%	35	0	0.00		0.00				
2008 *	186	2%	36	2	5888.20	6371.80	--		1.08		
Leach's storm petrel (*Oceanodroma leucorhoa*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area - Season*											
South of Cape Blanco, OR											
Fall (Sep - Dec)											
2002 *	2,352	12%	59	7	228.12	212.62	--		0.93		
2003	2,511	14%	72	0	0.00		0.00				
2004	2,028	29%	64	0	0.00		0.00				
2005	1,605	18%	37	0	0.00		0.00				
2006	1,961	22%	48	0	0.00		0.00				
2007	2,728	19%	66	0	0.00		0.00				
2008	2,734	22%	84	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt) R	s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Northern Fulmar (*Fulmarus glacialis*)											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area - Season*											
North of Cape Blanco, OR											
Fall (Sep - Dec)											
2002 *	2,490	18%	92	1	22.34	20.15	--		0.90		
2003	2,846	12%	43	0	0.00		0.00				
2004	3,172	22%	74	0	0.00		0.00				
2005	2,722	15%	35	0	0.00		0.00				
2006	3,831	16%	59	0	0.00		0.00				
2007	4,409	15%	63	0	0.00		0.00				
2008	5,417	22%	85	0	0.00		0.00				
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Primary Sector											
Longline gear											
North of Cape Blanco, OR											
Summer (May - Aug)											
2002	515	12%	28	0	0.00		0.00				
2003	624	22%	30	0	0.00		0.00				
2004	729	9%	21	0	0.00		0.00				
2005	794	37%	52	0	0.00		0.00				
2006	860	16%	41	0	0.00		0.00				
2007 *	718	20%	35	1	69.89	65.16	--		0.93		
2008	636	30%	45	0	0.00		0.00				
Fall (Sep - Dec)											
2002	256	43%	26	0	0.00		0.00				
2003	254	25%	5	0	0.00		0.00				
2004	501	18%	14	0	0.00		0.00				
2005	393	29%	12	0	0.00		0.00				
2006	405	31%	17	0	0.00		0.00				
2007	314	49%	17	1	64.49	38.13	2.02	1.20	0.59	0.82	4.98
2008	314	29%	13	0	0.00		0.00				
Seabird, unidentified											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Primary Sector											
Longline gear											
North of Cape Blanco, OR											
Summer (May - Aug)											
2002	515	12%	28	0	0.00		0.00				
2003 *	624	22%	30	1	72.97	66.79	--		0.92		
2004	729	9%	21	0	0.00		0.00				
2005	794	37%	52	0	0.00		0.00				
2006	860	16%	41	0	0.00		0.00				
2007	718	20%	35	0	0.00		0.00				
2008	636	30%	45	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate (per 10,000 mt) R	s(R)	Bycatch estimate (number of animals) Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Shearwater, unidentified											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Non-Primary Sector											
Longline gear											
South of Cape Blanco, OR											
Fall (Sep - Dec)											
2002	143	1%	10	0	0.00		0.00				
2003	123	*confidential*	--	--	--	--	0.00				
2004	118	1%	17	0	0.00		0.00				
2005	178	0%	14	0	0.00		0.00				
2006 *	164	2%	65	19	56881.32	57892.65	--		1.02		
2007	144	3%	35	0	0.00		0.00				
2008 *	186	2%	36	1	2944.10	3192.13	--		1.08		
Storm petrel, unidentified											
Limited Entry Trawl Sector											
Target Species: *All FMP groundfish except Pacific hake (See Appendix B)*											
Stratification: *Area - Season*											
South of Cape Blanco, OR											
Winter (Jan - Apr)											
2002	3,379	16%	116	0	0.00		0.00				
2003	2,711	16%	77	0	0.00		0.00				
2004	1,742	40%	107	1	14.30	11.05	2.49	1.92	0.77	0.81	7.68
2005	2,555	23%	65	0	0.00		0.00				
2006	1,576	19%	34	0	0.00		0.00				
2007	1,988	21%	39	0	0.00		0.00				
2008	2,770	18%	71	0	0.00		0.00				
Fall (Sep - Dec)											
2002	2,352	12%	59	0	0.00		0.00				
2003 *	2,511	14%	72	1	29.09	26.91	--		0.93		
2004	2,028	29%	64	0	0.00		0.00				
2005	1,605	18%	37	0	0.00		0.00				
2006	1,961	22%	48	0	0.00		0.00				
2007	2,728	19%	66	0	0.00		0.00				
2008	2,734	22%	84	0	0.00		0.00				
Western gull (*Larus occidentalis*)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear - Area - Season*											
Sablefish Primary Sector											
Longline gear											
South of Cape Blanco, OR											
Fall (Sep - Dec)											
2002	116	16%	6	4	2206.20	1605.14	25.64	18.66	0.73	8.78	74.92
2003	189	3%	5	0	0.00		0.00				
2004	157	12%	9	0	0.00		0.00				
2005	143	17%	11	0	0.00		0.00				
2006	137	*confidential*					0.00				
2007	71	*confidential*					0.00				
2008	33	0%	0								

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

Species Fishery Strata Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of seabirds observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI lower	90% CI upper
Western gull (*Larus occidentalis*) (continued)											
Sablefish Non-Primary Sector											
Longline gear											
South of Cape Blanco, OR											
Summer (May - Aug)											
2002	97										
2003 *	131	8%	92	1	1011.20	976.98	--		0.97		
2004	95	3%	44	0	0.00		0.00				
2005	91	1%	15	0	0.00		0.00				
2006	125	2%	23	0	0.00		0.00				
2007	119	8%	75	0	0.00		0.00				
2008	171	2%	44	0	0.00		0.00				

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.

APPENDIX H

Bycatch calculations for sea turtles using a variety of stratification alternatives.

Species / Fishery / Strata / Year	Total landings (of target species)	% of landings observed	Number of trips observed	Number of sea turtles observed	Bycatch rate *(per 10,000 mt)*		Bycatch estimate *(number of animals)*				
					R	s(R)	Y	s(Y)	cv(Y)	90% CI	90% CI
Leatherback turtle (*Dermochelys coriacea*)											
Non-Nearshore Fixed Gear											
Target Species: *Sablefish*											
Stratification: *Sector - Gear (See note in italics)*											
Open Access Fixed Gear Sector											
Pot gear											
No Seasonal or Latitudinal Strata											
Summer / Fall (June - Nov)											
2002	128										
2003	244	1%	19	0	0.0		0				
2004	198	9%	96	0	0.0		0				
2005	389	3%	43	0	0.0		0				
2006	463	2%	38	0	0.0		0				
2007	265	3%	46	0	0.0		0				
2008 *	251	4%	55	1	968.4	956.8	--		0.99		
2 Seasonal Strata: *Summer/Fall and Winter/Spring*											
Summer / Fall (June - Nov)											
2002	67										
2003	120	1%	6	0	0.0		0				
2004	91	9%	39	0	0.0		0				
2005	251	2%	15	0	0.0		0				
2006	265	1%	16	0	0.0		0				
2007	165	3%	27	0	0.0		0				
2008 *	131	4%	26	1	1874.0	1871.7	--		1.00		
3 Latitudinal Strata: *North of Cape Blanco, Cape Blanco - Pt Conception, South of Pt Conception*											
Cape Blanco - Pt Conception											
2002	94										
2003	155	2%	12	0	0.0		0				
2004	160	7%	45	0	0.0		0				
2005	274	3%	28	0	0.0		0				
2006	176	4%	23	0	0.0		0				
2007	115	6%	31	0	0.0		0				
2008 *	139	6%	37	1	1166.4	1146.9	--		0.98		
Seasonal Strata & Latitudinal Strata											
Summer / Fall (June - Nov)											
Cape Blanco - Pt Conception											
2002	47										
2003	84	1%	6	0	0.0		0				
2004	80	7%	19	0	0.0		0				
2005	177	2%	10	0	0.0		0				
2006	77	5%	11	0	0.0		0				
2007	64	7%	19	0	0.0		0				
2008 *	78	6%	17	1	2287.0	2297.7	--		1.00		

* Bycatch estimate not provided due to the high coefficient of variation for that estimate.