Risk assessment of U.S. West Coast groundfish fisheries to threatened and endangered seabirds

August 24, 2011 review draft

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1 Prepared by the Northwest Fisheries Science Center, Conservation Biology Division and Fishery Resource Analysis and Monitoring Division; and the NMFS Northwest Regional Office, Sustainable Fisheries Division; with contributions by Washington Sea Grant.

2 This report consists of an excerpt from a larger report currently in preparation on the effects of West Coast groundfish fisheries on ESA-listed seabirds, fish, mammals, and turtles. The final report is expected to be available by January 2012.
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Introduction

The purpose of this report is to evaluate risks from the U.S. West Coast Groundfish Fisheries (WCGF) on Endangered Species Act (ESA) listed seabirds found off the West Coast (Table 1).

Table 1 – List of ESA-listed species evaluated in this report
- Short-tailed albatross (*Phoebastria albatrus*)
- California least tern (*Sterna antillarum browni*)
- Marbled murrelet (*Brachyramphus marmoratus*)

The context for the report is to help inform the Pacific Fisheries Management Council (PFMC) and the National Marine Fisheries Service (NMFS) Northwest Regional Office with an evaluation of the WCGF under section 7 of the ESA. Section 7 of the ESA requires that federal agencies consult with NMFS on proposed actions that have the potential to harm listed species. Consultations are required for all federal fishery management plans, including the Pacific Coast Groundfish Fishery Management Plan (FMP). This report therefore summarizes the scientific information currently available to characterize the degree of risk imposed by the WCGF fishery on the species listed in Table 1.

Description of the fisheries

Introduction

This section describes the federally managed Pacific coast groundfish fisheries that may interact with ESA listed species and their critical habitat. The fishery description sets the context for assessing direct and indirect effects in later sections. Of primary concern here are those attributes that influence the exposure of listed species to the fishery and potential outcomes including:

- Gear Type and Target Species - configuration of gear, including the potential for direct interaction with listed species and their critical habitat.
- Seasonality and Geographic Extent - when and where the gear is deployed for comparison with the distribution of listed species.
- Fishing Effort - The amount of fishing effort, particularly in areas of overlap with listed species.

Additional consideration is given to monitoring strategies, data sources, and management jurisdiction.
Overview of the Groundfish Fishery

The West Coast Groundfish Fishery is diverse and includes over 90 different fish species in the Pacific Coast Groundfish Fishery Management Plan (FMP) that are caught by multiple commercial and recreational fisheries using many different gear types along the entire coast.

The target species of the fishery include the following:

- **Rockfish.** The plan covers 64 different species of rockfish, including widow, yellowtail, canary, shortbelly, and vermilion rockfish; bocaccio, chilipepper, cowcod, yelloweye, thornyheads, and Pacific Ocean perch.
- **Flatfish.** The plan covers 12 species of flatfish, including various soles, starry flounder, turbot, and sanddab.
- **Roundfish.** The six species of roundfish included in the fishery management plan are lingcod, cabezon, kelp greenling, Pacific cod, Pacific whiting (hake), and sablefish.
- **Sharks and skates.** The six species of sharks and skates are leopard shark, soupfin shark, spiny dogfish, big skate, California skate, and longnose skate.
- **Other species.** These include ratfish, finescale codling, and Pacific rattail grenadier.

The National Marine Fisheries Service manages the fishery in partnership with the Pacific Fishery Management Council, and the states of California, Oregon, and Washington. The current fishery management strategy is focused on rebuilding overfished species. A management framework is used that includes a variety of fixed elements and routine management measures that may be adjusted through a biennial harvest specifications process. The management measures are intended to constrain the total fishing mortality to within Annual Catch Limits (ACL). Additionally, they are designed to achieve other goals and objectives that pertain to socioeconomics and equitable utilization of the resource.

Regulations for the groundfish fishery are set by the Pacific Fishery Management Council (PFMC) and implemented by NMFS. Active management of the fishery began in the early 1980’s with the establishment of optimum yields (OY’s) for several managed species and trip limits for widow rockfish, the Sebastes complex, and sablefish. The objective of trip limits has been to slow the pace of landings to maintain year-round fishing, processing, and marketing opportunities. Since the 1980’s, regulations have evolved to further separate individual groundfish species for management purposes and led to the current use of cumulative two-month trip limits for most species (PFMC 2008). Cumulative trip limits are a specified weight of 3 Adapted from PFMC 2011, pp. xiii-ix and West Coast Observer Program reports: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/datareport/index.cfm
fish that can be landed during a particular time period.

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 Fishery Sectors**

Managers identify groundfish fishery sectors, around which regulations are structured. Commercial fisheries are identified based on the regulatory status, gear types, and target strategy of the vessels comprising each sector. From a regulatory standpoint, groundfish fisheries are identified based on whether vessels possess a Federal groundfish limited access (“limited entry”) permit, and the particular endorsements on that permit. In addition, Washington coastal Indian Tribes prosecute groundfish fisheries based on treaty rights. Given their sovereign status these fisheries are considered separately from other commercial fishery sectors.

An important reason for identifying fishery sectors relates to the allocation of catch opportunity. Overall catch limits by management unit (a stock, stock complex, or geographic subdivision of either) determined by the ACL may be divided among sectors for the purpose of management. These allocations may be “formal” or “informal.” Formal allocations identified in the regulations and management measures are generally crafted in order to ensure that a sector has the opportunity to catch the portion of the ACL determined by an allocation. Informal or implicit allocations are a function of the particular management measures established as part of the biennial process for stocks that do not have a formal allocation. The way
in which these management measures constrain catch opportunities create functional allocations of the stocks available for harvest. In addition to allocations, managers also consider set asides and “catch sharing.” These divisions of harvest opportunity play more of a bookkeeping function so that managers can estimate the total catch that is likely to occur during the management period. Set asides are a straightforward accounting device, applying primarily to research catches and fisheries prosecuted under an exempted fishing permit (see below). Treaty fisheries are also accorded a set aside, because the sovereign status of these groups means that their fisheries are independently managed in coordination with the Council. Catch sharing plans are like short-term allocations, but are distinguished from these because managers have more flexibility to adjust management measures in a way that changes harvest opportunity associated with these plans. In this sense they lie somewhere between the formal and informal allocations described above.

The following provides a list of sectors comprising the groundfish fishery and are further described below. An analysis of anticipated changes is included at the end of this section. The following non-Tribal commercial fishery sectors are identified for the purposes of management and further described below:

1. Catcher-processor vessels targeting Pacific whiting using midwater trawl gear and processing their catch at sea.
2. Catcher vessels targeting Pacific whiting with midwater trawl gear and delivering to at-sea mothership processors (referred to as the mothership sector).
3. Catcher vessels targeting Pacific whiting with midwater trawl gear and delivering to processing plants on land (referred to as the shoreside whiting sector).
4. Vessels using bottom trawl gear to target groundfish species other than Pacific whiting, with their catch landed onshore (referred to as the non-whiting trawl sector).
5. Vessels using longline or pots (referred to as fixed gear) to target groundfish and possessing a Federal limited entry permit with this gear endorsement (referred to as the limited entry fixed gear sector).
6. Vessels using legal groundfish gear other than trawl (principally longline and pot gear) to target groundfish but not possessing a limited entry permit (referred to as the “directed open access sector”).
7. Vessels using a variety of gear types that catch groundfish incidentally, usually defined by catch composition rather than regulatory status (referred to as the “incidental open access sector”).

In addition to the above-mentioned sectors, a variety of fisheries are considered in the groundfish management process as follows:
• The exempted trawl fisheries—pink shrimp, spot prawn, ridgeback prawn, and California halibut—incidentally catch groundfish. Vessels in this sector (often referred to as the “incidental open access sector,”) are subject to the same trip limits and management measures imposed on the directed open access sector and special measures may apply to particular fisheries, such as pink shrimp and California halibut trawl.

• Recreational groundfish fisheries including charter vessels (commercial passenger fishing vessels (CPFVs)) and private recreational vessels, that is, individuals fishing from their own or rented boats.

• Tribal fisheries are those fisheries prosecuted by Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) in their usual and accustomed grounds and stations, under treaties with the Federal government.

• Exempted Fishing Permit are allocated groundfish harvest to authorize a vessel to engage in an activity that is otherwise prohibited by the MSA or other fishery regulations for the purpose of collecting limited experimental data.

Pacific Whiting

Pacific whiting form dense semi-pelagic schools so that vessels targeting the species generally encounter only small amounts of bycatch. However, overfished rockfish can be caught incidentally, either because they co-occur with Pacific whiting or because vessels mistakenly set the gear on the wrong species. The whiting sectors are managed through a season and quota structure. The season opens around May 1 each year (and occasionally a few weeks earlier off of central California). Pacific whiting is allocated among the three whiting sectors after a portion is set aside for expected catch in Tribal fisheries. The season for each sector then runs until its allocation is used up. As with other groundfish fisheries, catch limits on overfished rockfish have created a bigger constraint on whiting fisheries, resulting in a “race for bycatch”—competition among the whiting sectors to catch their target species quota before limits on overfished species were reached. As a result, beginning with the 2009-2010 management period, sector-specific bycatch limits have been put in place for canary rockfish, darkblotched rockfish, and widow rockfish.

The Pacific whiting fisheries encompass the first three sectors described above; however, beginning in 2011, the shoreside whiting sector is combined with the non-whiting trawl sector and managed with Individual Fishing Quotas (IFQ). The mothership sector is managed through a co-op structure with catcher vessels within a co-op delivering to a specified mothership. The catcher-processor sector operates as a voluntary co-op. Prior to 2011, most vessels in the shoreside fishery operated under Exempted Fishing Permits (EFP, see below) where participants dumped unsorted catch directly into refrigerated tanks, rather than sorting the catch on deck.

Commercial Limited Entry Bottom Trawl
The LE groundfish bottom trawl fishery off the west coast of the United States operates from the Canadian border to Morro Bay, California. In 2009, there were 178 LE trawl permits. Groundfish bottom trawl vessels range in size from 35 to 95 feet, with an average length of 65 feet. Vessels fish throughout the year in a wide range of depths and deliver catch to shoreside processors. Bottom trawlers often target species assemblages, which can result in diverse catch. A single groundfish bottom trawl tow often includes fifteen to twenty species. Fish size and weight of the total catch has vary widely however is expected to stabilize under the new IFQ system (see below).

**Commercial Limited Entry and Open Access Bottom Trawl – Targeting California Halibut**

Vessels that participate in the California halibut trawl fishery can belong to either the LE or OA sector of the federal groundfish trawl fishery. Some vessels with a federal limited entry groundfish trawl permit also have a state California Halibut Bottom Trawl Vessel Permit and these vessels primarily operate in federal waters out of the ports of Monterey and San Francisco. Federal LE groundfish permitted vessels targeting California halibut are subject to federal groundfish regulations, depth-based conservation area closures, trip limits for groundfish, and must participate in a vessel monitoring system for enforcement purposes.

The California halibut trawl fishery generally operates out of U.S. ports from San Francisco to Los Angeles. Commercial bottom trawling is prohibited in California state waters, with the exception of the CHTG. The fishing season within the CHTG covers two calendar years. Regulations for vessels operating in the CHTG include minimum mesh sizes of 7.5 inches in length to reduce bycatch, a three-month closed season during California halibut spawning (March 15 - June 15), a 500 pound possession limit on the incidental take of fish other than California halibut, a 22 inch minimum size limit for retained California halibut, and mandated federal observer coverage. A comprehensive review of the California halibut bottom trawl fishery in the CHTG was published by the California Department of Fish and Game (CDFG 2008). In federal waters, trawling for California halibut can occur year-round, but a state permit is required (as of 2006) to land more than 150 pounds of California halibut per trip.

Vessels range in size from 29 to 71 feet, with an average length of 46 feet. Fishing generally occurs in less than 30 fathoms of water and fishers deliver their catch to shore-based processors.

**Commercial Fixed Gear Sectors**

There are four major sectors in the fixed gear groundfish fishery; the LE sablefish-endorsed sector, the LE non-sablefish-endorsed sector, the federal open access sector, and the state-permitted nearshore fisheries. There were 227 LE fixed gear
permits in 2009. LE fixed gear permits are either sablefish-endorsed or non-sablefish-endorsed. In addition, all LE fixed gear permits have gear endorsements (longline, pot/trap, or both). Of the 227 LE fixed gear permits in 2009, 164 had sablefish-endorsements. Of these, 132 were associated with longline gear, 32 were associated with pot/trap gear, and 4 were associated with both longline and pot/trap gear. The remaining 63 limited entry non-sablefish-endorsed permits were all associated with longline gear. The open access fixed gear sector does not require federal or state permits. Therefore, the total number of participants varies widely from year to year. Open access vessels can use any type of hook-and-line or pot/trap gear, including longline, fishing pole, and vertical longline.

Limited Entry Sablefish Primary Tier-Endorsed Fixed Gear

Vessels participating in the LE sablefish-endorsed sector range in size from 33 to 95 feet and operate primarily out of ports in Oregon and Washington. Fishing generally occurs in depths greater than 80 fathoms. Nearly all of the vessels participating in this sector deliver their iced catch to shoreside processors. Catch in the LE sablefish-endorsed fishery is composed mostly of sablefish, with bycatch primarily composed of spiny dogfish shark, Pacific halibut, rockfish species, and skates. LE sablefish-endorsed permits provide the permit holder with an annual share of the sablefish catch. Sablefish-endorsed permits are assigned to Tier 1, 2 or 3. Each Tier 1 permit receives 1.4% of the sablefish allocation, with Tiers 2 and 3 receiving 0.64% and 0.36%, respectively. Each year, these shares are translated into amounts of catch (in pounds), or “tier limits”, which could be caught during the primary fishery. Regulations allow for up to three LE sablefish-endorsed permits to be ‘stacked’ on a single vessel. Permit stacking was implemented to increase the economic efficiency of the fleet and promote fleet capacity reduction. Stacking more than one sablefish-endorsed permit on a vessel allows the vessel to land sablefish up to the sum of the associated tier limits. However, permit stacking does not convey additive landing limits for any other species. LE sablefish-endorsed primary season fishing currently takes place over a seven-month period from April 1 to October 31. The seven-month season was first implemented in 2002. Permit holders land their tier limits at anytime during the seven-month season. Once the primary season opens, all sablefish landed by a sablefish-endorsed permit is counted toward attainment of its tier limit. Vessels that have LE sablefish-endorsed permits can fish in the LE non-sablefish-endorsed fishery under daily/weekly trip limits once their quota of primary season sablefish has been caught or when the primary season is closed, from November 1 through March 31.

Limited Entry Non-Sablefish-Endorsed Fixed Gear

The LE non-sablefish-endorsed fixed gear sector operates primarily out of southern California ports. The fishery operates year-round but the majority of fishing activity occurs during the summer months when weather conditions improve. Vessels in the LE non-sablefish-endorsed sector range in size from 17 to 60 feet, with an average length of 34 feet. Vessels catch a variety of groundfish species, including
thornyheads, sablefish, rockfish, and flatfish. The fleet typically fishes in depths greater than 80 fathoms. Nearly all of the vessels participating in this fishery deliver their iced catch to fresh fish markets. LE non-sablefish-endorsed fixed gear permits are subject to daily and weekly trip limits for sablefish, thornyheads, and other groundfish species.

Open Access Fixed Gear

As the open access sector of the fixed gear groundfish fishery does not require federal or state permits, characterizing the participants can be difficult. Vessels range in size from 10 to 97 feet, with an average length of 33 feet. Vessels catch a variety of groundfish species, including sablefish, spiny dogfish, and skates. Vessels operate out of all three states and generally fish in waters from 35 to 600 fathoms. Open access fixed gear vessels are subject to daily and weekly trip limits for sablefish, spiny dogfish shark, and other groundfish species. Flatfish species, including dover sole, arrowtooth flounder, petrale sole, English sole, starry flounder, and all other flatfish are managed as a single group for the open access fishery.

State-Permitted Nearshore Fixed Gear

The state-permitted nearshore groundfish sectors operate from northern Oregon to southern California. Historically, nearshore fisheries were accessible to everyone. However, due to the increasing number of participants and concerns of overcapacity, California and Oregon began requiring state permits in 2003 and 2004, respectively. Regulations for the nearshore fisheries are set by both the PFMC and the states. The PFMC sets the optimum yield (OY) for groundfish species and harvest guidelines. Vessels that participate in the state-permitted nearshore fixed gear fisheries can belong to either the federal limited entry or open access fixed gear sectors.

In addition to regulations set by the PFMC, each state manages its nearshore fishery independently by issuing state regulations on the cumulative trip limits of nearshore species in their state waters. Cumulative trip limits are a specified weight of fish that can be landed during a particular time period, usually two-months. Often, cumulative trip limits set by the states are more restrictive than the federal limits. Additional management measures for each state are highlighted in the sections below. Further information on state nearshore fishery regulations can also be found online for Oregon at: (www.dfw.state.or.us/fish/commercial/) and for California at: (www.dfg.ca.gov/marine/regulations.asp#commercial).

Vessels participating in the nearshore fisheries range in size from 10 to 50 feet, with an average length of 25 feet. They use a variety of fixed gear including hand-lines, cable gear, fishing poles, and pots. In shallow water, fishers often fish in coves or drift along a reef. They set and retrieve their gear multiple times a day and generally land their fish on a daily basis. Quotas for the nearshore fisheries are small; generally between 100 to 2,000 lbs every two months. Many of those who
fish in shallow water participate in the live fish market, necessitating careful handling of retained fish.

**Washington**

The State of Washington does not allow commercial fishing within its territorial waters (0-3 miles from the coastline). This prohibition removes fishing grounds from access by commercial nearshore fishers.

**Oregon**

Oregon's nearshore commercial fishery typically occurs in shallow water (< 30 fathoms) and targets species such as black rockfish, blue rockfish, china rockfish, copper rockfish, quillback rockfish, grass rockfish, cabezon, and greenlings. Oregon's nearshore permitting process assigns permits to vessels. State nearshore management employs minimum size limits for many nearshore species, as well as two month cumulative trip limits and annual landing caps (maximum landed weight in a 12 month period). Black rockfish trip limits are tied to four latitudinal Oregon Black Rockfish Zones. In 2004, Oregon began requiring that nearshore fishers complete a vessel logbook.

In 2009, Oregon issued 55 black/blue rockfish permits, which allow for the landing of black rockfish and blue rockfish, and 72 black/blue rockfish permits with a nearshore endorsement, which allows landing of black rockfish and blue rockfish along with 21 additional Oregon designated nearshore groundfish species. In 2010, Oregon issued 56 black/blue rockfish permits and 69 black/blue rockfish permits with a nearshore endorsement.

**California**

California state management designates four geographic zones along the coastline. In 2009, state management closed the three areas south of 40° 10' N. latitude during March and April. The north coast area (north of 40° 10' N. latitude to the Oregon-California border) remained open year-round, except for seasonal closures of cabezon, greenlings, and California sheephead.

The state of California issues two permits for fishing within the nearshore area: a shallow nearshore species fishery permit and a deeper nearshore species fishery permit. In 2009, there were a total of 319 California nearshore permits and in 2010, there were 304 permits. The permits are assigned to an individual person and can only be used in the one regional management area specified on the permit. Fishers can either have a single nearshore permit (deeper or shallow) or hold both types of permits. A trap endorsement can also be tied to a shallow nearshore permit to allow for the use of trap gear when fishing for nearshore species. In addition, a nearshore fishery bycatch permit can be issued for trawl gear or entangling nets to allow for small amounts of nearshore landings per trip, but only in two management zones.
The deeper nearshore permit is required for landing black rockfish, blue rockfish, brown rockfish, calico rockfish, copper rockfish, olive rockfish, quillback rockfish, and treefish. The shallow nearshore permit is required for landing black-and-yellow rockfish, cabezon, California scorpionfish, California sheephead, china rockfish, gopher rockfish, grass rockfish, greenlings, and kelp rockfish. Lingcod is also commonly targeted with shallow nearshore permit species. Most live fish landings consist of species in the shallow nearshore group. State nearshore management employs minimum size limits for many nearshore species and two month cumulative trip limits. A limit on the number of hooks per vessel or line also exists for certain areas. California instituted a voluntary nearshore logbook program in 2005.

Recreational Fisheries

Recreational fisheries are primarily managed by the states, so catch and effort data are often grouped by state and sub-state region. A distinction is also made between charter vessels (commercial passenger fishing vessels, or CPFVs) and private recreational vessels, that is, individuals fishing from their own or rented boats. As would be expected, participation is higher during warmer months. The number of marine angler trips peaks in the July-August period, but the seasonal concentration is more pronounced in northern areas. For example in 2003, Washington State saw no trips recorded in November-December and 36 percent of trips were in July-August, while in Southern California the proportions for the same periods were 12 percent and 30 percent, respectively (PFMC 2011).

Tribal Groundfish Fisheries

The tribal sector comprises fisheries prosecuted by Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) in their usual and accustomed grounds and stations, under treaties with the Federal government. The tribes participate in groundfish bottom trawl, whiting trawl, and fixed gear fisheries. Tribal Pacific halibut allocations are divided into a tribal commercial component and the year-round ceremonial and subsistence component. Under treaty arrangements, tribes manage fisheries prosecuted by their members. Their management is coordinated through the Council process so catches can be accounted for when developing management measures. West coast treaty tribes in Washington State have formal allocations for sablefish, black rockfish, and Pacific whiting. For other groundfish species without formal allocations, the tribes propose trip limits to the Council, which the Council tries to accommodate while ensuring that catch limits are not exceeded. Whether formally allocated or not, tribal catches are accounted through set asides, which are amounts taken “off the top” of the overall catch limit.
Table 2: Distribution of vessels engaged in Tribal groundfish fisheries (Source PFMC 2011).

<table>
<thead>
<tr>
<th>Treaty Tribe</th>
<th>Number of Vessels in Groundfish Fishery</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longline (length in ft)</td>
<td>Whiting (length in ft)</td>
</tr>
<tr>
<td>Makah</td>
<td>31 (33'-62')</td>
<td>5 (95'-124')</td>
</tr>
<tr>
<td>Hoh</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Quileute</td>
<td>8 (45'-68')</td>
<td>-</td>
</tr>
<tr>
<td>Quinault</td>
<td>15 (38'-62')</td>
<td>-</td>
</tr>
</tbody>
</table>

Exempted Fishing Permits

An Exempted Fishing Permit (EFP) is a NMFS-issued Federal permit that authorizes a vessel to engage in an activity that is otherwise prohibited by the MSA or other fishery regulations for the purpose of collecting limited experimental data. EFPs can be issued to Federal or state agencies, marine fish commissions, or other entities, including individuals.

The specific objectives of a proposed exempted fishery may vary. The Groundfish FMP provides for EFPs to promote increased utilization of underutilized species, realize the expansion potential of the domestic groundfish fishery, and increase the harvest efficiency of the fishery consistent with the MSA and the management goals of the FMP. However, EFPs are commonly used to explore ways to reduce effort on depressed stocks, encourage innovation and efficiency in the fisheries, provide access to constrained stocks while directly measuring the bycatch associated with those fishing strategies, and to evaluate current and proposed management measures. Proposed EFPs are considered by the Council at the June meeting of the management year to allow the Council the opportunity to set-aside OY for EFPs it has tentatively approved. Final approval of EFPs for any given year occurs at the November Council meeting. For additional information on EFP protocols, visit the Council website and review Council Operating Procedure 19 at: [www.pcouncil.org/operations/cops.html](http://www.pcouncil.org/operations/cops.html).

Seasonality

Groundfish are commercially harvested year-round with changes in effort related to management and markets. Seasonality of the groundfish fisheries varies by sector and is shown in Table 3. As described above, the seasonality of Pacific whiting fisheries is driven by regulations which open the season around May 1 each year (and occasionally a few weeks earlier off of central California). The season for each Pacific whiting sector then runs until its allocation is used up.
Table 3: Seasonality of non-whiting commercial groundfish landings – average in metric tons over 2005-2009 timeframe per 2-month seasons by sector (excerpted from PFMC 2011, p. F-14)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Jan-Feb</th>
<th>Mar-Apr</th>
<th>May-Jun</th>
<th>Jul-Aug</th>
<th>Sep-Oct</th>
<th>Nov-Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoreside Non-whiting Trawl</td>
<td>3,637.56</td>
<td>3,672.64</td>
<td>3,918.75</td>
<td>3,988.75</td>
<td>3,788.83</td>
<td>2,659.96</td>
</tr>
<tr>
<td>Limited Entry Fixed Gear</td>
<td>101.90</td>
<td>261.88</td>
<td>678.20</td>
<td>759.48</td>
<td>718.41</td>
<td>119.06</td>
</tr>
<tr>
<td>Open Access Fixed Gear</td>
<td>101.82</td>
<td>142.69</td>
<td>266.89</td>
<td>280.65</td>
<td>289.08</td>
<td>187.65</td>
</tr>
<tr>
<td>Incidentally Caught</td>
<td>25.58</td>
<td>23.40</td>
<td>37.23</td>
<td>48.43</td>
<td>37.08</td>
<td>10.70</td>
</tr>
<tr>
<td>Tribal Shoreside Nonwhiting Groundfish</td>
<td>68.71</td>
<td>427.75</td>
<td>362.38</td>
<td>304.72</td>
<td>299.57</td>
<td>172.77</td>
</tr>
</tbody>
</table>

Recreational effort tends to peak during warmer months, particularly in Oregon and Washington where weather is more variable. Figure 1 shows the seasonal distribution of recreational fishing activity off the West coast.

![Figure 1: Seasonal distribution of marine angler trips in 2003 (Source PFMC 2011).](image-url)
Geographic Extent

Groundfish are harvested coastwide in State and Federal waters. The fishery is constrained in some cases by established Marine Protected Areas, such as those to protect groundfish Essential Fish Habitat (EFH) (PFMC 2005). In other cases, area closures are implemented through the harvest specification process to protect overfished species (PFMC 2011). Table 4 shows groundfish landings by port group during 2009 (excerpted from PFMC 2011, p. F-24). Figure 2 shows several maps of commercial fishing effort for west coast groundfish fisheries.

Table 4: Commercial groundfish landings (mt) by sector and port group for 2009 (excerpted from PFMC 2011, p. F-24)

<table>
<thead>
<tr>
<th>Port Group</th>
<th>Shoreside Whiting Trawl</th>
<th>Shoreside Nonwhiting Trawl</th>
<th>Limited Entry Fixed Gear</th>
<th>Open Access Fixed Gear</th>
<th>Incidentally Caught Groundfish</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puget Sound</td>
<td>1,295.5</td>
<td>257.4</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Washington Coast</td>
<td>x</td>
<td>220.2</td>
<td>23.1</td>
<td>1.7</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>South &amp; Central</td>
<td>10,090.9</td>
<td>1,346.2</td>
<td>308.6</td>
<td>41.0</td>
<td>3.8</td>
<td>11,790.6</td>
</tr>
<tr>
<td>Washington Coast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astoria</td>
<td>14,085.8</td>
<td>8,406.4</td>
<td>148.3</td>
<td>16.5</td>
<td>5.1</td>
<td>22,662.2</td>
</tr>
<tr>
<td>Tillamook</td>
<td>x</td>
<td>34.5</td>
<td>0.2</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newport</td>
<td>12,993.0</td>
<td>3,774.6</td>
<td>525.1</td>
<td>42.4</td>
<td>11.8</td>
<td>17,347.0</td>
</tr>
<tr>
<td>Coos Bay</td>
<td>X</td>
<td>3,619.1</td>
<td>191.4</td>
<td>85.2</td>
<td>6.5</td>
<td>x</td>
</tr>
<tr>
<td>Brookings</td>
<td>1,201.1</td>
<td>263.5</td>
<td>276.9</td>
<td>1.8</td>
<td>1,743.3</td>
<td></td>
</tr>
<tr>
<td>Crescent City</td>
<td>1,489.4</td>
<td>982.5</td>
<td>108.0</td>
<td>81.4</td>
<td>0.4</td>
<td>2,661.7</td>
</tr>
<tr>
<td>Eureka</td>
<td>X</td>
<td>2,678.7</td>
<td>101.8</td>
<td>73.0</td>
<td>x</td>
<td>3,162.0</td>
</tr>
<tr>
<td>Fort Bragg</td>
<td>1,684.1</td>
<td>154.6</td>
<td>102.9</td>
<td>0.6</td>
<td>1,942.3</td>
<td></td>
</tr>
<tr>
<td>Bodega Bay</td>
<td>x</td>
<td>x</td>
<td>17.2</td>
<td>3.8</td>
<td>81.4</td>
<td></td>
</tr>
<tr>
<td>San Francisco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monterey</td>
<td>x</td>
<td>108.2</td>
<td>72.3</td>
<td>0.7</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Morro Bay</td>
<td>x</td>
<td>202.0</td>
<td>568.8</td>
<td>2.1</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Santa Barbara</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>San Diego</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40,580.1</td>
<td>26,164.7</td>
<td>x</td>
<td>1,571.1</td>
<td>104.7</td>
<td>71,314.5</td>
</tr>
</tbody>
</table>
Figure 2: The figure demonstrates the general spatial distribution of fishing effort from 2002-2009 (as cumulative hours gear was deployed) in various sectors of the groundfish fishery for which spatial fishing effort information is available. Fixed represents the limited entry sablefish primary, limited entry non-sablefish endorsed, open access fixed gear, and state-permitted nearshore fixed gear sectors. Hake represents all at-sea hake sectors. Trawl represents the limited entry bottom trawl sector.
Gear Fished in the Groundfish Fishery

Many different types of fishing gear are used in West Coast fisheries and specifically in commercial, tribal, and recreational fisheries. Gear types include trawl nets, gillnets, longline, troll, jig, rod and reel, vertical hook and line, pots (also called traps) and other gear (e.g. spears, throw nets). Technical descriptions of each type of gear used on the West Coast (groundfish and non-groundfish fisheries) are available in the West Coast Observer Program Training Manual (NWFSC 2011) and incorporated by reference. Table 5 summarizes the gear types used in West Coast fisheries.

For this iteration of the risk assessment focused on seabirds, increased attention is given to longline and trawl gear due to the potential for incidental take as a result of seabirds diving on bait and ingesting hooks for longline gear or incidental contact with cables for trawl gear (see later sections on seabirds).

Longline fisheries involve the setting out of a horizontal line to which other lines (gangions) with baited hooks are attached. This horizontal line is secured between anchored lines and identified by floating surface buoys, bamboo poles and flags. The longline may be laid along or just above the ocean floor (a bottom longline) or may be fished in the water column (floating or pelagic longline). Figure 3 shows typical bottom longline gear deployed in the groundfish fishery.

Trawling involves the towing of a funnel shaped net or nets behind a fishing vessel. The trawl gear varies depending on the species sought and the size and horsepower of the boats used. Trawl gear may be fished on the bottom, near the bottom, or up in the water column to catch a large variety of species. Figure 4 shows trawl gear as it is generally deployed on the West Coast.

<p>| Table 5: Gear Types Used in West Coast Fisheries (Source PFMC 2005). |
|---------------------------------|----------------|----------------|------------------|
|                                 | Nets            | Longline, Pot, Hook and Line Gears | Other Gears |
| <strong>Limited Entry</strong>               | Bottom Trawl    | Pot                                           |               |
|                                 | Mid-water Trawl | Longline                                       |               |
|                                 | Whiting Trawl   | Vertical hook/line                             |               |
|                                 | Scottish Seine  | Rod and reel                                    |               |
|                                 |                 | Troll/dinglebar                                 |               |
|                                 |                 | Jig                                             |               |
|                                 |                 | Stick Gear                                      |               |
| <strong>Open Access – Directed</strong>     | Set Gillnet     | Pot                                            |               |
|                                 | Sculpin Trawl   | Longline                                       |               |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Methods</th>
<th>Vertical hook/line</th>
<th>Rod and reel</th>
<th>Troll/dinglebar</th>
<th>Jig</th>
<th>Stick Gear</th>
<th>Pot (Dungeness crab, sheephead, spot prawn)</th>
<th>Longline</th>
<th>Rod and reel</th>
<th>Troll</th>
<th>Dive/spear</th>
<th>Dive/hook and line</th>
<th>Poke pole</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Open Access – Incidental</strong></td>
<td>Exempted Trawl (pink shrimp, spot and ridgeback prawn, Calif. halibut, sea cucumber)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Tribal</strong></td>
<td>As above</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><strong>Recreational</strong></td>
<td>Dip net</td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Throw net</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hook and Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pots</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Figure 3: Schematic of groundfish longline gear (source NWFSC 2011).**

To reduce take of seabirds, streamer lines (also called bird lines or tori lines) are sometimes deployed as the gear is set in the water (see Figure 5). A streamer line is a 50-fathom (or 90 meter) line that extends from a high point near the stern of the vessel to a drogue (usually a buoy with a weight). As the vessel moves forward the drogue creates tension in the line producing a span from the stern where the streamer line is aloft. The aloft section includes streamers made of UV protected, brightly colored tubing spaced every 16 feet (5 meters). Streamers must be heavy enough to maintain a near-vertical fence in moderate to high winds. Individual streamers should extend to the water, to prevent aggressive birds from getting to the groundline. When deployed in pairs – one from each side of the stern – streamer
lines create a moving fence around the sinking groundline eliminating birds (Melvin 2000). Streamer lines have been effective at reducing seabird bycatch in Alaskan fisheries (USFWS 2008; Ed Melvin, personal communication; and, http://www.afsc.noaa.gov/Quarterly/amj2011/divrptsREFM4.htm). Seabird mitigation is not currently required in West Coast groundfish fisheries, although Washington Sea Grant has recently initiated a NMFS-funded program to promote voluntary use of streamer lines (WA Sea Grant 2011).

Figure 4: Typical activity on a groundfish trawl vessel (source NWFSC 2011).
Establishing a standardized bycatch reporting methodology and limiting bycatch to the extent practicable are mandates of the Magnuson-Stevens Fishery Conservation and Management Act, referred to as the Magnuson-Stevens Act (MSA). Effective bycatch accounting and control mechanisms are also critical for staying within target total catch ACLs. The first element in limiting bycatch is accurately measuring bycatch rates by time, area, depth, gear type, and fishing strategy.

At its November 2005 meeting, the Council approved Amendment 18 to the Groundfish FMP. The Council recommendation addresses National Standard 9 and Section 303(a)(11) of the MSA, which require practicable means to minimize bycatch and bycatch mortality and a standardized bycatch reporting methodology. The purpose of FMP Amendment 18 is to clearly and comprehensively describe measures that address these requirements, which have been established through long-term regulations and the biennial management process. The amendment also describes new measures that could be implemented by future regulatory or amendment actions. For additional information on Amendment 18 see the Council web page at: [www.pcouncil.org/groundfish/gffmp/gfa18.html](http://www.pcouncil.org/groundfish/gffmp/gfa18.html).

Various state, Federal, and tribal catch monitoring systems are used in west coast

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4 This Section Excerpted from Chapter 4 of PFMC 2008 with minor adaptations.

5 For more information on bycatch, including NMFS’ definition of bycatch, see: [http://www.nmfs.noaa.gov/by_catch/SPO_final_rev_12204.pdf](http://www.nmfs.noaa.gov/by_catch/SPO_final_rev_12204.pdf)
groundfish management. There are two components to total catch: (1) catch landed in port, and (2) catch discarded at-sea. A description of the relevant data systems used to monitor total catch and discards in commercial and recreational groundfish sectors follows.

**Data Collection Programs – Commercial sectors**

**Monitoring Commercial Landings**

Sorting requirements are now in place for all species with trip limits, harvest guidelines, or ACLs including all depleted species. This provides accounting for the weight of landed depleted species when catches are hailed at-sea or landed. Limited entry groundfish trawl fishermen are also required to maintain state logbooks to record the start and haul locations, time, and duration of trawl tows, as well as the total catch by species market category (i.e., those species and complexes with sorting requirements). Landings are recorded on state fish receiving tickets. Fishtickets are designed by the individual states’, PSMFC coordinates record-keeping requirements between state and Federal managers. Poundage by sorted species category, area of catch, vessel identification number, and other data elements are required on fishtickets. Landings are also sampled in port by state personnel to collect species composition data, otoliths for ageing, lengths, and other biological data. A suspension of at-sea sorting requirements coupled with full retention of catch is allowed in the whiting fishery (by FMP Amendment 10 and an annual EFP in the Shoreside Whiting sector). Fishticket landings, logbook data, and state port sampling data are reported inseason to the regional commercial catch monitoring database, the Pacific Fisheries Information Network (PacFIN), managed by PSMFC (www.psmfc.org/pacfin/index.html).

The Groundfish Management Team (advisory body to the PFMC) and PSMFC manage the Quota Species Monitoring (QSM) dataset reported in PacFIN for the purpose of informing inseason management. All landings of groundfish stocks of concern (depleted stocks and stocks below BMSY) and target stocks and stock complexes in west coast fisheries are tracked in QSM reports of landed catch. The GMT recommends prescribed landing limits and other inseason management measures to the Council to attain, but not exceed, total catch ACLs of QSM species. Stock and complex landing limits are modified inseason to control total fishing-related mortality; QSM reports and landed catch forecasts are used to control the landed catch component.

**At-Sea Hake Observer Program (A-SHOP)**

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 sectors 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 sectors in the late 1970s under the management of the North Pacific Groundfish Observer Program at NOAA’s Alaska Fishery Science Center. NMFS made observer coverage mandatory for at-sea processors in July 2004 (65 FR 31751). 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, along with the associated catcher vessels, 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. As of January 2011, all catcher vessels delivering to at-sea processor/vessels require 100% observer coverage as well. At-sea hake observers monitor and record catch data in accordance with protocols detailed in the A-SHOP manual.

To increase the utilization of bycatch otherwise discarded as a result of trip limits, Amendment 13 to the Groundfish FMP implemented an increased utilization program on June 1, 2001, which allows catcher/processors and motherships in the whiting fishery to exceed groundfish trip limits without penalty, providing specific conditions are met. These conditions include provisions for 100 percent observer coverage, non-retention of prohibited species, and either donation of retained catch in excess of cumulative trip limits to a bona fide hunger relief agency or processing of retained catch into mince, meal, or oil products.

**West Coast Groundfish Observer Program (WCGOP)**

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 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. In 2010, the WCGOP coverage goal was to maintain, at a
minimum, 20% coverage in the LE bottom trawl and LE fixed gear sectors by landings, while continuing to improve coverage in the open access sectors of the groundfish fishery. In 2011, WCGOP coverage of the LE bottom trawl sector increased to 100% under the catch share management structure with IFQs. An observer coverage plan from the WCGOP is available at: www.nwfsc.noaa.gov/research/divisions/fram/observer/observersamplingplan.pdf.

Additionally, the NWFSFSC has worked closely with the Council and NMFS NWR to coordinate the availability of WCGOP results into the management regime. The WCGOP has released annual reports since 2003 which describe the analysis of observer data for various fishery sectors and species collected under the program. These reports and background materials on the WCGOP are available on the Northwest Fisheries Science Center website at: (www.nwfsc.noaa.gov/research/divisions/fram/observer/datareport/index.cfm).

**Shore-based Pacific Whiting Observation Program**

The Shoreside Hake Observation Program (SHOP) was established in 1992 to provide information for evaluating bycatch in the directed Pacific whiting fishery and for evaluating conservation measures adopted to limit the catch of salmon, other groundfish, and prohibited species. Though instituted as an experimental monitoring program, it has been continued annually to account for all catch in targeted whiting trip landings, enumerate potential discards, and accommodate the landing and disposal of non-sorted catch from these trips. Initially, the SHOP included at-sea samplers aboard shore-based whiting vessels. However, when an ODFW analysis of bycatch determined no apparent difference between vessels with and without samplers, sampler coverage was reduced to shoreside processing plants. In 1995, the SHOP's emphasis changed from a high observation rate (50 percent of landings), to a lower rate (10 percent of landings), and increased emphasis on collection of biological information (e.g., otoliths, length, weight, sex, and maturity) from Pacific whiting and selected bycatch species (yellowtail rockfish, widow rockfish, sablefish, chub (Pacific) mackerel (*Scomber japonicus*), and jack mackerel (*Trachurus symmetricus*). The required observation rate was decreased as studies indicated that fishtickets were a good representation of what was actually landed. Focus shifted again due to 1997 changes in the allocation of yellowtail rockfish and increases in yellowtail bycatch rates. Since then, yellowtail and widow bycatch in the shoreside whiting fishery has been dramatically reduced because of increased awareness by fishermen of the bycatch and allocation issues involved in the SHOP program.

The SHOP is a cooperative effort between the fishing industry and state and Federal management agencies to sample and collect information on directed Pacific whiting landings at shoreside processing plants. Participating vessels apply for and carry an EFP issued by NMFS. Permit terms require vessels to retain all catch and land unsorted catch at designated shoreside processing plants. Permitted vessels are not penalized for landing prohibited species (e.g., Pacific salmon, Pacific halibut,
Dungeness crab), nor are they held liable for overages of groundfish trip limits. For additional information and complete reports go to: (www.dfw.state.or.us/MRP/hake/).

Since inception, an EFP has been adopted annually to allow suspension of at-sea sorting requirements in the shore-based whiting fishery enabling full retention and subsequent port sampling of the entire catch. However, EFPs are intended to provide for limited testing of a fishing strategy, gear type, or monitoring program that may eventually be implemented on a larger fleet-wide scale and are not a permanent solution to the monitoring needs of the shore-based Pacific whiting fishery. In 2007 the Council and NMFS adopted a monitoring program which will be implemented in 2008 to provide a maximized retention opportunity without the use of the EFP process. Electronic monitoring of catches through the use of deck cameras and human at-sea observers were used, prior to catch share implementation, will be used to ensure maximized retention of catch at-sea. Currently 100% observer coverage has replaced electronic deck monitoring. Data quality managers will be stationed at shoreside processing plants to ensure catch is sorted and weighed to federally defined standards and to help obtain biological samples of delivered catch.

**Data Collection Programs – Recreational sectors**

**Monitoring Recreational Catch**

Recreational catch is monitored by the states as it is landed in port. These data are compiled by the PSMFC in the RecFIN database. The types of data compiled in RecFIN include sampled biological data, estimates of landed catch plus discards, and economic data. Descriptions of the RecFIN program, state recreational fishery sampling programs in Oregon and Washington, and the most recent data available to managers, assessment scientists, and the general public, can be found on the PSMFC web site at: (www.psmfc.org/recfin).

The Marine Recreational Fisheries Statistics Survey (MRFSS) has been an integral part of the RecFIN program. Traditionally, there have been two primary components of the survey; field intercept surveys (administered under supervision of PSMFC) and a random phone survey of coastal populations (administered by a third party contracted by NMFS). The field intercept surveys have been used to estimate catch, and the phone survey has been used to estimate effort. The results of these two efforts are combined in the RecFIN data system maintained by PSMFC, and estimates of total effort and fishing mortality are produced along with other data potentially useful for management and stock assessments. However, MRFSS was not designed to estimate catch and effort at the level of precision needed for management or assessment; it was designed to provide a broad picture look of national fisheries. Comparison with independent and more precise estimation procedures has shown wide variance in catch estimates. Inseason management of
recreational fisheries using MRFSS has been compromised by inseason variance of catch estimates.

In recent years, efforts have been made to improve MRFSS for use in inseason management. Observing a growing concern with the use of MRFSS program data on the west coast, California and policy representatives from the west coast recommended the development of a new program to replace MRFSS. In response, staff from the CDFG and the PSMFC designed the California Recreational Fishing Survey (CRFS), a new program for sampling California’s recreational fisheries which incorporated both the comprehensive coverage of the MRFSS program and the high frequency on-site sampling of CDFG’s Ocean Salmon Project. Additionally, in 2001 PSMFC, with support from NMFS, began a new survey to estimate Commercial Passenger Fishing Vessel (CPFV) fishing effort in California.

Washington and Oregon use the MRFSS system as a supplement to the extensive port sampling programs they use to derive most of their recreational catch estimates are derived. The Washington Ocean Sampling Program and the Oregon Boat Survey both operate annually from approximately April through October and focus on recreational finfish (including salmon, groundfish, halibut, and tuna) from private and charter fishing vessels.

Central California Marine Sport Fish Project

The CDFG has been collecting angler catch data from the CPFV industry intermittently for several decades in order to assess the status of the nearshore California recreational fishery. The project has focused primarily on rockfish and lingcod angling and has not sampled salmon trips. Reports and analyses from these projects document trends by port area in species composition, angler effort, catch, and, for selected species, CPUE, mean length, and length frequency. In addition, total catch and effort estimates are made based on adjustments of logbook data by sampling information. Before 1987, catch information was primarily obtained on a general port basis from dockside sampling of CPFVs, also called party boats. This did not allow documentation of specific areas of importance to recreational anglers and was not sufficient to assess the status of rockfish populations at specific locations.

CPFV operators are required by law to record total catch and location for all fishing trips in logbooks provided by the CDFG. However, the required information is too general for use in assessing the status of the multispecies rockfish complex on a reef by reef basis. Rockfish catch data are not reported by species and information on location is only requested by block number (a block is an area of 100 square miles). Many rockfishes tend to be residential, underscoring the need for site specific data. Thus, there is a strong need to collect catch information on board CPFVs at-sea. However, locations of specific fishing sites are often not revealed for reasons of confidentiality.
In May 1987, the Central California Marine Sport Fish Project began on-board sampling of the CPFV fleet. Data collection continued until June 1990, when state budgetary constraints temporarily precluded further sampling, resumed in August 1991, and continued through 1994. The program depends on the voluntary cooperation of CPFV owners and operators. Angler catches on-board central and northern California CPFVs were sampled from fourteen ports, ranging from Crescent City in the north to Port San Luis (Avila Beach) in the south. For additional information on this program, see the PSMFC website at: (www.psmfc.org/recfin/ccmsp.htm).

Oregon Marine Recreational Observation Program

In response to depleted species declarations and increasing concerns about fishery interactions with these species, ODFW started this program to improve understanding of recreational impacts. There were three objectives to this program: (1) document the magnitude of canary rockfish discard in the Oregon recreational fishery; (2) improve the biological database for several rockfish and groundfish species; and (3) gather reef location information for future habitat mapping. A seasonal sampler was stationed in each of the ports of Garibaldi, Newport, and Charleston to ride recreational groundfish charter vessels coastwide in Oregon from July through September, 2001. The Garibaldi sampler covered boats out of Garibaldi, the Newport sampler covered both Newport and Depoe Bay, and the Charleston sampler covered Charleston, Bandon, and Brookings charter vessels. During a typical day the sampler would ride a five to eight hour recreational groundfish charter trip and spend the remainder of the day gathering biological and genetic data dockside from several rockfish and groundfish species for which little is known mostly due to their infrequency in the catch. When allowed by the captain, the sampler also obtained Global Positioning System (GPS) locations of fishing sites for future use by the Habitat Mapping Project of the ODFW Marine Resources Program. Results from this program have been incorporated into recreational fishery modeling by ODFW. This program has continued and expanded to document the magnitude of discard of all groundfish species, not just canary rockfish. For more information on this program as well as other fishery research and survey programs see the ODFW Marine Program website at: (www.dfw.state.or.us/MRP/).

WDFW Groundfish At-Sea Data Collection Program

The WDFW At-Sea Data Collection Program was initiated in 2001 to allow fishery participants access to healthier groundfish stocks while meeting the rebuilding targets of depleted stocks and to collect bycatch data through an at-sea sampler program. The data collected in these programs could assist with future fishery management by producing valuable and accurate data on the amount, location, and species composition of the bycatch of rockfish associated with these fisheries, rather than using calculated bycatch assumptions. These data could also allow the Council
to establish trip limits in the future that maximize fishing opportunities on healthy stocks while meeting conservation goals for depleted stocks.

In recent years, WDFW has implemented its At-Sea Data Collection Program through the use of Federal EFPs. In 2001, 2002, 2003, and 2004, WDFW sponsored and administered a trawl EFP for arrowtooth flounder and petrale sole, and in 2002, WDFW also sponsored a midwater trawl EFP for yellowtail rockfish. The primary objective for these experimental fisheries was to measure bycatch rates for depleted rockfish species associated with these trawl fisheries. Fishery participants were provided access to healthier groundfish stocks and were constrained by individual vessel bycatch caps. State-sponsored samplers were used to collect data on the amount of rockfish bycatch caught on a per tow basis and to ensure the vessel complied with the bycatch cap; therefore, vessels participating in the EFP were required to have 100 percent sampler coverage. In 2003 and 2004, WDFW sponsored a longline EFP for spiny dogfish that also required 100 percent sampler coverage to measure the bycatch rate of depleted rockfish species associated with directed dogfish fishing.

**WDFW Ocean Sampling Program**

In addition to the At-Sea Data Collection Program, WDFW collects at-sea data through the Ocean Sampling Program. The at-sea portion is not intended to be an observer program for the purposes of enumerating the bycatch alone, but is coupled with shore-based sampling of anglers to calculate an estimated discard weight. At-sea samplers record biological information from discarded species. Shore-based creel surveys of anglers provide the estimate of total number of discards. Combining these two data sources yields estimates of the weight of total fishery discard by species.

**Data Collection Programs – Tribal sectors**

**Tribal Observer Program**

Tribal directed groundfish fisheries are subject to full rockfish retention. For some rockfish species where the tribes do not have formal allocations, trip limits proposed by the tribes are adopted by the Council to accommodate incidental catch in directed fisheries (i.e., Pacific halibut, sablefish, and yellowtail rockfish). These trip limits are intended to constrain direct catches while allowing for small incidental catches. Incidental catch and discard of depleted species is minimized through the use of full rockfish retention, shore based sampling, observer coverage, and shared information throughout the fleets regarding areas of known interactions with species of concern. Makah trawl vessels often participate in paired tows in close proximity where one vessel has observer coverage. If landings on the observed vessel indicate higher than anticipated catches of depleted species, the vessels relocate and inform the rest of the fleet of the results (Joner 2004). Fleet communication in order to avoid depleted species is practiced by all tribal fleets.
Additional Relevant Data Collection Programs

Stranding network

NMFS oversees a national marine mammal stranding program (see https://mmhsrp.nmfs.noaa.gov/msdbs/class/seahorse_public.htm). The program involves compilation of marine mammal stranding information supplied by a network of volunteers and other organizations. In addition to strandings, the program also compiles information on opportunistic sightings of dead, injured or entangled marine mammals at sea. On the west coast, the program is coordinated from the Southwest and Northwest Regional Offices.

Fishery Enforcement Monitoring

Enforcement of fishery regulations has become increasingly complex with the addition of large closed areas, smaller cumulative trip limits and bag limits, and depth-based closures for commercial and recreational fisheries. At the same time, decreased ACLs and the need to rebuild depleted stocks has placed additional importance on controlling and monitoring fishery-related mortality. Enforcement agencies continue to use traditional methods to ensure compliance with groundfish fishery regulations including dockside sampling, at-sea patrols, and air surveillance. Vessel Monitoring Systems (VMS) enhances, rather than replaces, traditional enforcement techniques. Recent declines in enforcement agency budgets, combined with increased regulatory complexity, have stressed the ability to adequately monitor fisheries for regulatory compliance. In response, NMFS implemented a VMS monitoring program, which includes satellite tracking of vessel positions and a declaration system for those vessels legally fishing within an RCA. VMS was initially implemented on January 1, 2004, and is currently required on all vessels participating in the groundfish fishery with a limited entry permit. In November 2005, the Council recommended expansion of VMS requirements to all commercial vessels that take and retain, possess or land federally-managed groundfish species taken in Federal waters or in state waters prior to transiting Federal waters. Additionally, to enhance enforcement of closed areas for the protection of groundfish essential fish habitat, the Council recommends requiring VMS on all non-groundfish trawl vessels including those targeting pink shrimp, California halibut, sea cucumber, and ridgeback prawn. Implementation of expanded VMS requirements is recommended to coincide with implementation of regulations for the protection of groundfish habitat but, no sooner than January 1, 2007.

Detailed descriptions of VMS and the analyses of VMS monitoring alternatives are contained in an EA prepared by NMFS and presented to the Council in support of decisions to first implement and later expand the VMS monitoring program (NMFS 2003). Additional information on VMS, including links to the supporting NEPA documentation, can be found on the Council web site at:
**Anticipated Fishing Effort Changes**

Most of our information on interactions between the WCGF and ESA-listed species has been obtained over the period from 2002 – 2010, corresponding to initiation of federal observer programs (see above). However, fishing effort patterns and the associated exposure of listed species to fishery effects is subject to change through a variety of factors including the population dynamics of fish species and behavioral drivers of fishing fleets through economic factors such as fuel prices, market dynamics, and regulations. Of these, regulatory drivers are the most foreseeable and an assessment of how listed species exposure may be impacted is provided below. Due to limitations in predictive capability, the assessment is qualitative. Precise characterization of effort shifts is a function of monitoring and performed through retrospective analysis. NMFS and the Council tracks changes in the fishery through the monitoring programs described in this document. The information is compiled in reports submitted throughout the year to the Council and available for public review. In addition, the response of fishing behavior to individual quota programs as implemented under amendments 20 and 21 is an area of increased research that is expected to be refined over time and may lead to improvements in predicting effort shifts (for example, see Toft et al. 2011; Kaplan unpublished; and Marchal et al. 2009).

**Regulatory Induced Effort Shifts**

NMFS and the Council implemented a trawl rationalization program in January 2011 that represents a significant change to management of the groundfish fishery. Of importance to listed species are potential changes in fishing effort profiles by time, area, and gear type. The trawl rationalization program is a limited access privilege program designed to reduce capacity and improve the management, accountability, economic, and environmental stability of the groundfish fishery by vesting the conditional privilege of catch shares for a predetermined quantity of fish with permit holders. The program was implemented in 2011 by amendments 20 and 21 to the FMP and accompanying regulations. The Council’s goal for the program is to:

> Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch.

The objectives supporting this goal are to:
- provide a mechanism for total catch accounting;
- provide for a viable, profitable, and efficient groundfish fishery;
- promote practices that reduce bycatch and discard mortality, and minimize ecological impacts;


- increase operational flexibility; minimize adverse effects from the program on fishing communities and other fisheries to the extent practical;
- promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry;
- provide quality product for the consumer; and,
- increase safety in the fishery.

The trawl rationalization program is in its earliest stages; however, it may influence the exposure of listed species to the fishery by incentivizing fishermen to change their historical fishing patterns relative to gear type and the time and location where it is deployed. The trawl rationalization program is also expected to reduce the overall amount of groundfish trawl effort by 50% to 66%; however, this reduction may be unevenly distributed (Lian et al. 2009). The program components that are most likely to influence effort patterns are allocation, gear switching, qualifying years, and quota transfer between fishermen. These components are discussed below.

**Allocation**

Amendment 21 allocates fixed percentages of allowable harvest by species to sectors. Because sectors are defined primarily by gear type, allocation may have the general effect of increasing or decreasing listed species exposure to a specific fishing gear and its associated impact potential. For the most part however, this is not expected to be the case. In general, the allocations are based on catch history from 2003-2005. This time period is recent enough that no significant changes are expected. There are three exceptions: starry flounder; “other flatfish;” and chilipepper rockfish south of 40°10’ N. latitude, for which amendment 21 allocates a higher percentage to the non-trawl sector than accounted for during the qualifying period. This may result in an increase in pot and bottom-longline gear fishing effort; however, it is impossible to predict the magnitude of such an increase given available data. As described above, NMFS is actively monitoring changes in the fishery that result from the trawl rationalization program and producing reports that will be incorporated into the ESA consultation process as it unfolds.

**Gear Switching**

Within the trawl rationalization program, vessels are no longer required to use a specific gear type. Vessels that have been limited to trawl gear may now opt to use non-trawl gear. As with other elements of the trawl rationalization program, it is unknown how this will influence fishing effort profiles. Market analysis suggests it may be economically beneficial for some fishermen to harvest sablefish by bottom-longline instead of trawl; however, it is not yet known if this will occur or, if it does, the magnitude of change. As mentioned above, starry flounder, “other flatfish,” and chilipepper rockfish south of 40°10’ N. latitude have been allocated to non-trawl fisheries in excess of historical amounts. Similar to sablefish, it is not possible to determine if this will result in a net increase in non-trawl effort. NMFS is actively monitoring changes in the fishery that result from the trawl rationalization program and producing reports that will be incorporated into the ESA consultation process as it unfolds.
Qualifying Years

Determination of “qualifying years” for trawl rationalization has the potential to create geographic shifts that may influence interactions with listed species. Qualifying years are the period of time that a permit must have been active to be eligible for participation in the trawl rationalization program. After considering several possible time periods to serve as the qualifying period, the Council recommended the years 1994-2003 for non-overfished species. These years represent the period of time from the beginning of the license limitation period through the announcement of the trawl rationalization control date. Dates prior to 1994 would not have permit histories because the Limited Entry system under which the permits were issued was not implemented until 1994. Other potential start dates between 1994 and 2003 were considered, including 1997 (the first year of fixed allocations among the three whiting sectors), 1998 (to exclude older histories), 1999 (the year of the first major reductions in response to overfished determinations), and 2000 (the year disaster was declared and fishing opportunities were significantly constrained and modified). The Council also considered 2004 as a later end date to the qualifying period, but determined that using 2004 would reward speculative entrants who chose to ignore the control date, create perceptions of inequity, and undermine the ability of the Council to use control dates in the future. The recommended range of years from 1994-2003 would include fishing patterns from under a variety of circumstances, would recognize long-time users of the fishery, and is intended to mitigate disruptive effects experienced by communities as a result of geographic effort shifts.

Quota Transfer

Permit holders with individual quotas may sell or transfer quota under the new program rather than harvest it themselves. Early research indicates this may reduce overall effort as quota is transferred to the most efficient and profitable operations and consolidate effort in areas with high relative catch rates (Toft et al. 2011). The extent to which these changes manifest are a function of monitoring and tracked through the data collection programs described above.

Summary of Potential Shifts in Fishing Effort

Fishing patterns are a function of multiple variables, the most significant of which is a recent implementation of the trawl rationalization program. The program may incentivize fishermen to increase fixed gear effort in patterns that deviate from historical norms. The magnitude of this deviation is not predictable; however, NMFS and the Council actively monitor fishing effort and produce periodic reports that will be available as the ESA consultation process unfolds.
Short-tailed albatross (Phoebastria albatrus)

General biology

Short-tailed albatrosses are large, pelagic seabirds with long narrow wings adapted for soaring just above the water surface. Fledged juveniles are dark brown-black, but they soon develop pale bills and legs. Their white heads develop a yellow-gold crown and nape over several years. Their bills are large and pink with a bluish hooked tip, a conspicuous thin black line around the base, and as in other Procellariiformes (tube-nosed marine birds) conspicuous external nostrils. They are the largest of the three species of North Pacific albatross, with a body length of 33-37 in (84-94 cm) and a wingspan of 84-90 in (213-229 cm) (Harrison 1985). Short-tailed albatross adults weigh 3.7-6.6 kg (USFWS 2008).

Birds breed at 5-6 years of age; a colonial, annually breeding species, individuals arrive on Torishima Island (main breeding colony) in Japan in October, but 25% of breeding age adults may forego breeding in a given year. A single egg is laid in late October to late November (Austin 1949), and both parents incubate over a 64-65 day period. Hatching occurs from late December through January (Hasegawa and DeGange 1982). Chicks begin to fledge in late May-early June (Austin 1949), when adults begin abandoning the colony site (Hasegawa and DeGange 1982, Suryan et al. 2008). There is no detailed information on timing of breeding on the other colonies.

Short-tailed albatross are central place foragers and bring food back to nestlings after surface feeding on primarily squid ([Todarodes pacificus]), shrimp, fish (including bonitos [Sarda sp.], flying fishes [Exocoetidae] and sardines [Clupeidae]), flying fish eggs, and other crustaceans (Hasegawa and DeGange 1982, Tickell 1975, Tickell 2000). There is little information on non-breeding diet, but it is thought that squids, crustaceans, and fishes are important prey (Hasegawa and DeGange 1982).

Range, migratory behavior and stock structure

Breeding Range

The short-tailed albatross once ranged throughout most of the North Pacific Ocean and Bering Sea (Figure 6). A recent discovery of a fossil breeding site on Bermuda confirms that the species also formerly nested in the North Atlantic during the mid-Pleistocene (420-362 thousand years ago; Olson and Hearty, 2003). In the North Pacific, short-tailed albatross historically bred on few colonies from the Izu, Bonin, Daito, Senkaku, and western volcanic groups in Japan, and Agincourt Island and the Pescadore Islands in Taiwan (Hasegawa 1984). Of the known historical breeding colonies, only two are now

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active. The vast majority (80-85%) of the known breeding short-tailed albatross nest on colonies on Torishima Island (Izu group), which is an active volcano. The remaining known breeding birds nest on Minami-kojima (Senkaku Islands), whose ownership is under dispute among Japan, China, and Taiwan.

Figure 6 -- Former and current breeding sites and at-sea range of short-tailed albatross. The species’ at-sea range overlaps with three Regional Fishery Management Organizations (RFMOs), but the majority of the time spent at sea is within the Western and Central Pacific Fisheries Commission area. Map by Wieslawa Misiak (from USFWS 2008).

In 2011, the USFWS reported that a short-tailed albatross chick was hatched on Midway Atoll, at the northwestern end of the Hawaiian Archipelago, marking the first confirmed hatching of a short-tailed albatross outside of the islands surrounding Japan in recorded history (USFWS News Release PINWR-11-01; RO-11-03). Prior to that, observations of infertile short-tailed albatross eggs and reports from the 1930s suggested that short-tailed albatross may have nested there in the past. Nesting attempts had been observed, but there had never been more than two short-tailed albatross individuals reported on the Atoll during the same year, and no successful nesting had been confirmed until 2011.

Marine Range
At-sea sightings since the 1940s indicate that short-tailed albatross are distributed widely throughout their historic foraging range in the temperate and subarctic North Pacific Ocean (Sanger 1972). While observations are concentrated along the edge of the continental shelf, in the northern Gulf of Alaska, Aleutian Islands, and Bering Sea (McDermond and Morgan 1993, Sherburne 1993), individual short-tailed albatross have been recorded along the west coast of North America as far south as the Baja Peninsula, Mexico (Palmer 1962).

From December through April, short-tailed albatross foraging is primarily concentrated near the breeding colonies, although individual trips may extend hundreds of miles or more from the colony sites. During the non-breeding season, short-tailed albatross range
along the Pacific Rim from southern Japan to northern California, primarily along continental shelf margins (Figure 7). Post-breeding birds either disperse rapidly north to the western Aleutian Islands or stay within the coastal waters of northern Japan and the Kuril Islands throughout the summer, moving in early September into the western Aleutian Islands; once in the Aleutians, most birds travel east toward the Gulf of Alaska (Suryan et al. 2006).

![Figure 7 -- Satellite track lines for adults, sub-adults and juveniles captured at sea near Seguam Pass, Alaska (from USFWS 2008).](image)

Juveniles and sub-adults are prevalent off the west coasts of Canada and the US (Environment Canada 2008). In late September, large flocks of short-tailed albatross have been observed over the Bering Sea canyons (Piatt et al. 2006); these are the only known concentrations of this species away from their breeding islands. Short-tailed albatross forage extensively along continental shelf margins, spending the majority of time within national EEZs, particularly the U.S. off Alaska, Russia, and Japan, rather than over international waters (Suryan et al. 2007a, Suryan et al. 2007b).

In general, short-tailed albatross show philopatry, returning to their natal colony as breeding adults. However, social attraction techniques (use of decoys and recorded playback of breeding colony sounds) have been used successfully to expand breeding colonies to other parts of Torishima Island; starting in 2008, efforts expanded to another Japanese island, 250 miles to the south of Torishima on Mukojima Island (www.fakr.noaa.gov/protectedresources/seabirds/usfws_stal_translocation_%20factsheet).
Little information is available on the genetic structure of this species, but preliminary analyses of mtDNA sequences suggest extremely high genetic diversity as well as genetic separation of Torishima and Minami-kojima populations (Kuro-o et al. 2010). Additional genetic analyses, especially of newly created breeding populations, are necessary to explore potential bottleneck and founder effects.

**Habitat use**

At sea, short-tailed albatross individuals spend much of their time feeding in continental shelf-break areas (200-1000 m depth) east of Honshu, Japan during breeding, and in shelf (0-200 m depth) and shelf break areas of the Bering Sea, Aleutian chain and in other Alaskan, Japanese and Russian waters.

During the brood-rearing period, most foraging bouts are along the eastern coastal waters of Honshu Island, Japan (Suryan et al. 2008). Parents forage primarily off the east coast of Honshu Island, Japan, almost entirely north of Torishima and south of Ishinomaki, Japan (Figure 5) (Suryan et al. 2008), where the warm Kuroshio current from the south collides with the cold Oyashio current from the north). During the non-breeding season, short-tailed albatross range along the Pacific Rim from southern Japan to northern California, primarily along continental shelf margins. During their post-breeding migration, females may have a prolonged exposure to fisheries in Japanese and Russian waters compared to males, which spent more time within the Aleutian Islands and Bering Sea. Juvenile birds have greater exposure to fisheries on the Bering Sea shelf and off the west coasts of Canada and the US (Suryan et al. 2007a).

Short-tailed albatrosses are considered “continental shelf-edge specialists;” they can be relatively common nearshore, but only where upwelling hotspots occur (Piatt et al. 2006). Telemetry studies have also reinforced ship-based observations of individuals in central gyres rather than dispersed widely throughout the subarctic North Pacific and Bering Sea (Suryan et al. 2006, McDermond and Morgan 1993). This association with shelf-break and slope regions may result from the distribution of squids (Suryan et al. 2006).

Because short-tailed albatross forage extensively along continental shelf margins, they spend the majority of their time within EEZs, particularly the U.S. (off Alaska), Russia, and Japan, rather than over international waters (Suryan et al. 2007a, Suryan et al. 2007b). Overall, short-tailed albatross spent the greatest proportion of time off Alaska, and secondarily Russia, during the post-breeding season, regardless of whether the birds were tagged in Japan or Alaska. During the non-breeding season, short-tailed albatross range along the Pacific Rim from southern Japan to northern California, primarily along continental shelf margins.

**Critical habitat**
Critical habitat has not been designated for this species. In the 2000 final rule, the USFWS determined that designation of Critical Habitat was not prudent, due to the lack of habitat-related threats to the species, the lack of specific areas in U.S. jurisdiction that could be identified as meeting the definition of Critical Habitat, and the lack of recognition or educational benefits accruing to the American people as a result of such designation (65 FR 147:46651-46653).

**Status**

The short-tailed albatross was originally listed in 1970, under the Endangered Species Conservation Act of 1969, prior to the passage of today’s Endangered Species Act (35 FR 8495). Due to an administrative error, the species was listed as endangered throughout its range except within the United States (50 CFR 17.11). The error was corrected on July 31, 2000, when the U.S. Fish and Wildlife Service published a final rule listing the short-tailed albatross as endangered under the ESA throughout its range, including the United States (65 FR 147:46643-46654). The Short-tailed Albatross Recovery Plan was finalized for this species in 2008 (USFWS 2008).

**Abundance and trend**

As of spring 2011, the global population estimate of short-tailed albatross was 3,463 individuals (P. Sievert and H. Hasegawa, unpubl. data). Pre-exploitation global population estimates of short-tailed albatross are not known, but Dr. Hiroshi Hasegawa estimated there were at least 300,000 breeding pairs on Torishima alone. From 1881 to 1903, an estimated five million short-tailed albatross were harvested from the breeding colony on Torishima, and harvest into the 1930s (except for a few years following a 1903 volcanic eruption); by 1949, there were no short-tailed albatross breeding at any of the historically known breeding sites, including Torishima, and the species was thought to be extinct (Austin 1949).

Population estimates derived from Torishima colony counts of adults, eggs, chicks, and productivity estimates made by Hiroshi Hasegawa and staff of the Yamashina Institute suggest the Torishima colony has grown to 686 breeding adults (H. Hasegawa unpubl. report, November 2007). Overall population estimates include breeding adults on the Minami-kojima colony, breeding-age adults that do not return to breed each year (assumed to be 25%), and sub-adults. The Torishima Island population growth rate, determined by annual increases in adults observed, eggs laid, and chicks fledged, has been estimated at an annual rate of 6.5-8.0% (H. Hasegawa, unpubl. data, cited in in USFWS 2008).
Threats (from recovery plan (USFWS 2008) or listing documents)

Short-tailed albatross face significant threats on breeding colonies and at sea. The major threat of over-exploitation that led to the species’ original endangered status no longer occurs. Current threats listed in the recovery plan include catastrophic events such as a volcanic eruption on the main breeding site on Torishima Island. Other catastrophic events, particularly monsoons, can also threaten habitat and nesting success. Past volcanic activity has restricted breeding to sparsely vegetated and steep slopes of loose volcanic soil, and monsoon rains result in frequent mudslides and severe erosion, which can reduce habitat, destroy nests, and reduce breeding success. Global threats may also include indirect adverse effects related to climate change and oceanic regime shifts. While known and potential threats from commercial fishing include U.S. and international demersal longline, pelagic longline, gillnet, jig/troll, and trawl fisheries, short-tailed albatross populations are not declining due to seabird bycatch in commercial fisheries (USFWS 2008). Other threats include contamination from organochlorines, pesticides, metals, and oil, and consumption of plastics. There has been an observed increase in the occurrence of plastics in birds on Torishima Island over the last decade, but the effect on survival and population growth is not known (USFWS 2008).

Fishery impacts

Fisheries have the potential to impact short-tailed albatross populations primarily through bycatch of individuals (USFWS 2008). Albatross, like many seabirds, attack baited hooks of longlines after the hooks are deployed; if they get hooked or snagged, they can be pulled underwater with the rest of the gear and drown (USFWS 2008). Short-tailed albatross may also potentially interact with trawl fisheries. Seabirds, including other albatrosses, fly behind vessels or float in offal plumes that trail beyond vessels, where they can strike the trawl cables (warps) or the sonar cable (third wire) attached to the net (NOAA 2006) or become entangled on the outside of nets towed at or near the surface; those striking cables are very unlikely to show up on the vessels deck to be sampled (USFWS 2008). To date, no short-tailed albatross have been observed to taken in trawl fisheries, but they have been observed near trawl vessels and the more abundant black-footed albatross has been observed to be taken in west coast groundfish trawl fisheries (see further discussion below).

Seabird bycatch in commercial fisheries is a known or potential threat for U.S. and international demersal and pelagic longline fisheries, gillnet fisheries, jig/troll fisheries, and trawl fisheries. Biological opinions issued by the U.S. Fish and Wildlife Service currently limit incidental take of short-tailed albatross in Alaska fisheries to two birds in two years for the Pacific halibut longline fishery, four birds in two years for the groundfish longline fishery, and two birds over the time period in which the current biological opinion remains in effect for the trawl fishery (USFWS 2003).
Impacts, all fisheries

There have been 16 reported lethal takes of short-tailed albatross in commercial fisheries since 1983; most of these were in hook-and-line fisheries, although some were in net fisheries (Table 6). The most recent reports—two takes in the Alaskan cod longline fishery and one take in the West Coast sablefish longline fishery—were the first reported in U.S. fisheries since 1998.

California, Oregon, Washington – One known lethal take of short-tailed albatross has been reported off the west coast of the continental U.S. In April 2011, a single short-tailed albatross juvenile was reported caught by longline gear in the limited entry sablefish fishery approximately 65 kilometers off the Oregon coast (WCGOP, unpubl. data).

Japan, Russia - There is virtually no seabird bycatch information reported from Japanese fisheries although it is likely that take has occurred in pelagic fisheries in Japan’s Exclusive Economic Zone (EEZ); during brood rearing, adults forage for food off the east coast of Honshu, and individuals on Torishima Island have been observed with fishhooks in their mouths of the same type used in Japanese commercial fisheries (USFWS 2008). There is also inadequate seabird bycatch information from Russian fisheries, although demersal longline fisheries in the Russian EEZ are a known threat to short-tailed albatross (USFWS 2008), and short-tailed albatross have been taken in driftnet fisheries that still operate in the Russian EEZ (see Table 6).

Alaska and Hawaii – No known takes of short-tailed albatross have been reported in domestic pelagic longline fisheries in the North Pacific. Demersal longline fisheries in the U.S. EEZ off Alaska (Bering Sea/Aleutian Islands area and Gulf of Alaska) are a known threat to short-tailed albatross, with almost all known takes occurring in demersal longline groundfish fisheries; none has been reported in groundfish trawl or pot fisheries. Two separate analyses for the demersal groundfish longline fisheries have estimated that, on average, one short-tailed albatross is taken in the Bering Sea hook-and-line fishery each year (Stehn et al. 2001), and mitigation measures have likely reduced this rate since those estimates were developed. U.S.-based pelagic longline swordfish and tuna fisheries in the vicinity of the Hawaiian Islands have the potential to affect short-tailed albatross; overall seabird (and albatross) bycatch rates have declined in Hawaii’s pelagic longline fishery since bycatch reduction regulations were promulgated (Gilman and Kobayashi 2007, NMFS 2011). A recent analysis of the continued operation of the Hawaii-based pelagic longline fisheries (NMFS 2011) calculated rates of incidental take of short-tailed albatross of one/year for both the shallow-set longline and deep-set longline fisheries. The rate of incidental takes of seabirds in general and albatross in particular has declined markedly in Alaskan demersal longline fisheries since bycatch reduction regulations were instituted (USFWS 2008).
Table 6 -- Known short-tailed albatross mortalities associated with North Pacific and West Coast fishing activities since 1983. Data from USFWS (2008), NOAA Fisheries Information Bulletin 10-93 (2010), Yamashina Institute of Ornithology (YIO), and the West Coast Groundfish Observer Program (WCGOP). “In sample” refers to whether a specimen was in a sample of catch analyzed by a fisheries observer. n/a = not applicable

<table>
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<th>Date</th>
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<th>In sample?</th>
<th>Bird age</th>
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<td>Net</td>
<td>No</td>
<td>n/a</td>
<td>4 months</td>
<td>Bering Sea</td>
<td>USFWS (2008)</td>
</tr>
<tr>
<td>10/1/1987</td>
<td>Halibut</td>
<td>No</td>
<td>n/a</td>
<td>6 months</td>
<td>Gulf of Alaska</td>
<td>USFWS (2008)</td>
</tr>
<tr>
<td>8/28/1995</td>
<td>IFQ sablefish</td>
<td>Yes</td>
<td>No</td>
<td>1 year</td>
<td>Aleutian Islands</td>
<td>USFWS (2008)</td>
</tr>
<tr>
<td>10/8/1995</td>
<td>IFQ sablefish</td>
<td>Yes</td>
<td>No</td>
<td>3 years</td>
<td>Bering Sea</td>
<td>USFWS (2008)</td>
</tr>
<tr>
<td>1/8/1997</td>
<td>?</td>
<td>n/a</td>
<td>n/a</td>
<td>8 months</td>
<td>Pacific Ocean, Japan</td>
<td>YIO (unpubl. data)</td>
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<td>4/23/1998</td>
<td>Russian salmon drift net</td>
<td>n/a</td>
<td>n/a</td>
<td>Hatch-year</td>
<td>Bering Sea, Russia</td>
<td>USFWS (2008)</td>
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<tr>
<td>7/8/1998</td>
<td>Russian salmon drift net</td>
<td>n/a</td>
<td>n/a</td>
<td>3 months</td>
<td>Bering Sea, Russia</td>
<td>YIO (unpubl. data)</td>
</tr>
<tr>
<td>7/11/2002</td>
<td>Russian ?</td>
<td>n/a</td>
<td>n/a</td>
<td>3 months</td>
<td>Sea of Okhotsk, Russia</td>
<td>YIO (unpubl. data)</td>
</tr>
<tr>
<td>8/29/2003</td>
<td>Russian ?</td>
<td>n/a</td>
<td>n/a</td>
<td>3 years</td>
<td>Bering Sea, Russia</td>
<td>YIO (unpubl. data)</td>
</tr>
<tr>
<td>8/31/2006</td>
<td>Russian ?</td>
<td>n/a</td>
<td>n/a</td>
<td>1 year</td>
<td>Kuril Islands, Russia</td>
<td>YIO (unpubl. data)</td>
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<tr>
<td>8/27/2010</td>
<td>Cod freezer longline</td>
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<td>Yes</td>
<td>Sub-adult</td>
<td>Bering Sea/Aleutian Islands</td>
<td>NOAA Fisheries (2010)</td>
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<td>9/14/2010</td>
<td>Cod freezer longline</td>
<td>Yes</td>
<td>Yes</td>
<td>3-year old</td>
<td>Bering Sea/Aleutian Islands</td>
<td>NOAA Fisheries (2010)</td>
</tr>
<tr>
<td>4/7/2011</td>
<td>Sablefish demersal longline</td>
<td>Yes</td>
<td>Yes</td>
<td>1-year old</td>
<td>Pacific Ocean/Oregon</td>
<td>WCGOP (unpubl. data)</td>
</tr>
</tbody>
</table>
**Impacts, West Coast Groundfish Fisheries**

Since 2002, there have been three interactions reported between short-tailed albatross and West Coast groundfish fisheries. From 2002-2009, there were two observed fishery interactions with short-tailed albatross reported by the West Coast Groundfish Observer Program (Figure 8). Both interactions in 2002 were recorded opportunistically as “feeding on catch only” and were not recorded as resulting in mortality (Table 1 in Jannot et al. 2011). In 2011, a single short-tailed albatross was reported caught and killed by longline in the limited entry sablefish fishery approximately 65 kilometers off the Oregon coast (WCGOP, unpubl. data).

Overlap does occur between the West Coast groundfish fisheries and areas and habitat that short-tailed albatross use, so there is potential for impacts from bycatch (Figure 9). However, there is a paucity of information on short-tailed albatross distribution, which makes risk assessment and impact analysis particularly challenging. When certain endangered species are too rare for quantifying the effects of an activity, a surrogate species may be used (USFWS and NOAA Fisheries Endangered Species Consultation Handbook, p. 4-47). Patterns of North Pacific distribution and habitat use (Fischer et al. 2009) support using black-footed albatross as a proxy for short-tailed albatross. Albatrosses are vulnerable in the North Pacific to longline fishing wherever they co-occur, and takes of both species have occurred in similar habitats and areas to date; the majority of black-footed albatross takes in observed fisheries (limited entry sablefish primary fixed gear and at-sea hake sectors have also occurred along the shelf-break and north of Cape Mendocino (see Figure 8). Black-footed albatross and short-tailed albatross occupy similar geographic ranges, are similar in size, and exhibit similar feeding behavior, and both have been documented as bycatch in West Coast fisheries (Jannot et al. 2011) and other U.S. fisheries. Black-footed albatross are thus appropriate surrogates to assess the effects of a proposed action and estimate take on endangered short-tailed albatross (USFWS 2004a, NMFS 2011).

Recent analyses by Washington Sea Grant scientists reinforce the use of information on black-footed albatross as a proxy or surrogate for short-tailed albatross (Guy et al. unpubl. data). The authors compiled satellite telemetry data, fisheries-independent surveys, and fisheries-dependent at-sea surveys to examine distribution of short-tailed, black-footed, and Laysan albatross of the west coast of the U.S. Satellite telemetry data suggested that black-footed and short-tailed albatross spent similar proportions of time among NMFS management areas delineated in PFMC (2008) as well as among depth strata (shelf: <200m, shelf-break: 200m-1000m, slope-pelagic: >1000m); by contrast, a third species, Laysan albatross, spent proportionally more time in slope and less time in shelf-break habitats as well as proportionally greater time in the southernmost NMFS management areas (Guy et al., unpubl. data). Fisheries-independent surveys of black-footed albatross showed similar spatial patterns to the satellite telemetry data as well as considerable spatial overlap (both among depth strata and NMFS management zones) with west coast groundfish fishery effort, particularly the fixed gear, Pacific hake midwater trawl, and limited entry bottom trawl fishery sectors (Guy et al., unpubl. data).
Figure 8 -- Geographic distribution of black-footed takes and short-tailed albatross interactions by the West Coast Groundfish Observer Program and the At-Sea Hake Observer Program from 2002-2009 (Adapted from Jannot et al. 2011). Takes are either randomly observed (i.e., contribute to bycatch estimates), recorded opportunistically (i.e., non-random, do not contribute to bycatch estimate), or both. Both of the short-tailed albatross interactions were recorded as “feeding on catch only” and did not result in mortality.
Opportunistic sightings by fisheries observers of short-tailed albatross also support use of black-footed albatross as a surrogate; data collected by West Coast groundfish fisheries observer programs (Figure 9) show a distribution of sightings largely along the shelf-break that is very similar to the observed takes of black-footed albatross (Figure 8).

**Figure 9** -- Geographic distribution of opportunistic sightings of short-tailed albatross by the West Coast Groundfish Observer Program from 2001-July 2011.
Finally, the proportion of opportunistic sightings of short-tailed albatross among NMFS management zones (Figure 10) and depth strata (Figure 11) were similar to that found for black-footed and short-tailed albatross satellite telemetry data and fisheries-independent survey data for black-footed albatross (Troy Guy, pers. comm.).

**Figure 10** -- Short-tailed albatross opportunistic sightings in five NMFS management areas. Data from WCGOP fisheries from 2001 to May 2011. Colors delineate management area boundaries; shading delineates bathymetric zones. Figure prepared by Troy Guy, Washington Sea Grant.

**Figure 11** -- Short-tailed albatross opportunistic sightings in three bathymetric zones. Data from WCGOP fisheries from 2001 to May 2011. Colors delineate management area boundaries; shading delineates bathymetric zones. Figure prepared by Troy Guy, Washington Sea Grant.
Short-tailed albatross incidental take estimate based on black-footed albatross mortality rates

West Coast Groundfish Observer Program observers have been deployed aboard vessels since 2001 to document protected species interactions, collect fishery-related information, and perform other biological sampling. The probability of a hooked seabird being observed is a function of observer coverage, the prioritization of the observers’ duties onboard the vessels, and the observation skills and reporting accuracy of these individuals (USFWS 2004a, NMFS 2011).

Some groundfish fishery sectors (i.e., non-nearshore fixed gear/limited entry sablefish endorsed) have less than 100% observer coverage from 2002-2009, so observed interactions must be expanded beyond the observer coverage (~9-37% of landings) to estimate fleet-wide interactions (Jannot et al. 2011). This makes estimation of mortality of rare species, such as short-tailed albatross, very difficult, because estimates based on a combination of low observer coverage and small numbers observed takes are typically very uncertain (Jannot et al. 2011). Obtaining a reliable estimate of take when the observed number of takes is 0 or 1 is obviously particularly problematic, and the West Coast Observer Program does not attempt to estimate a fishery wide take level in such situations.

Because short-tailed albatross take has been too rare for accurately quantifying levels of take in the WCGF, we used black-footed albatross as a surrogate species to estimate the annual mortality rate of short-tailed albatross by the WCGF (see also USFWS 2004a, NMFS 2011). Black-footed albatross are much more common than short-tailed albatross, and annual observed levels of take of this species in WCGF (both fixed gear and trawl) have ranged from 0-48 from 2002-2009, with estimated take from 0-91 (Jannot et al. 2011). Black-footed albatross are similar to short-tailed albatross in size and feeding behaviors, as well as their patterns of distribution documented in surveys and via telemetry studies (see discussion in previous section), making them a reasonable proxy for the much less common short-tailed albatross.

Even with 100% observer coverage, all interactions might not be recorded because animals that become hooked on gear may fall off while the gear is in the water, and thus not be observed (Ward et al. 2004, Gilman et al. 2005). These “drop-offs,” along with post-hooking mortality, are often referred to as “unseen mortality.” Previous modeling efforts (USFWS 2004a, NMFS 2011) included a correction factor of 31% for drop-offs citing studies of pelagic longline fisheries (Ward et al. 2004, Gilman et al. 2005). Ward et al. (2004) demonstrated that drop-off rates in pelagic longline fisheries may underestimate seabird mortality by as much as 45% on the portions of a set that have soaked the longest. At present, drop-off rates for demersal longline fisheries have not been estimated for West Coast Groundfish Fisheries or for demersal longline fisheries in general (S. Fitzgerald, pers. comm.). In addition, the ratio of observed to unobserved take in trawl fisheries is also unknown, but there is likely to be unobserved take (S. Fitzgerald, pers. Comm.; Ed Melvin pers. Comm.). To take into account uncertainty in this factor, a range of correction factors from 0 to 45%, including the 31% used
previously (USFWS 2004a, NMFS 2011) was used here to bracket estimates of short-tailed albatross incidental take.

The short-tailed albatross take ($T$) estimate for the West Coast groundfish fisheries is calculated as follows (following the approach of NMFS 2011):

$$T = M \times A \times N$$

Where:

- $M$ = Fishing mortality of surrogate species (black-footed albatross) = (annual mean estimated number of black-footed albatross in West Coast groundfish fisheries) + (annual mean estimated number of black-footed albatross in West Coast groundfish fisheries * drop-off adjustment) / black-footed albatross global population estimate
- $A$ = correction factor to account for differences in distribution between the species
- $N$ = Short-tailed albatross population estimate

The annual population level fishing mortality rate in the WCGF ($M$) for black-footed albatross is based on the 8-year (2002-2009) average of the estimated annual mortality of black-footed albatross by the West Coast groundfish fisheries reported in Jannot et al. (2011) (43.75 birds/year), adjusted by a drop-off or removal rate of 31% (USFWS 2004a, NMFS 2011), and divided by the estimated black-footed albatross population size (245,234 in 2009; Flint 2009).

$$M = \frac{43.75 + 43.75 \times 0.31}{245,234} = 0.00023/\text{year}.$$  

When previously applied in Hawaiian fisheries, the at-risk area fraction ($A$) was a multiplier that accounted for the fraction of the short-tailed albatross range that overlaps with the fisheries of interest. In the case of the Hawaiian longline fisheries, the black-footed albatross ranged completely overlapped with the fishery in question, so the at-risk fraction (0.245) was simply derived by dividing the longline fisheries area by the short-tailed albatross range. In our case, black-footed and short-tailed albatross ranges both overlap with the West Coast groundfish fisheries to a similar extent and both species are traveling distances to enter the area, thus no multiplier is needed to account for differences between the species.

$$A = 1$$

$N$ is the most recent population estimate for short-tailed albatross, which is 3,463 (P. Sievert and H. Hasegawa, unpubl. data).

Therefore,

$$T = M \times A \times N$$

$$T = 0.00023 \times 1 \times 3,463$$

$$T = 0.8$$
The estimated short-tailed albatross take in the West Coast groundfish fisheries is 0.8 individuals/year.

**Sensitivity analyses**

This estimate can be influenced by uncertainty in the bycatch estimates of black-footed albatross, the assumed drop-off rate, and the population sizes of the two species. Here, we evaluate the sensitivity of the estimate to the first two sources of uncertainty. Using the lower 90% (21.13/year) and upper 90% (93.5/year) confidence limits for mean annual bycatch estimates of black-footed albatross and a range of drop-off rate scenarios results in a range of values of short-tailed albatross take (T) between 0.30 and 1.91 (Table 7).

**Table 7** — Sensitivity analyses of the influence of varying bycatch drop-off rates and black-footed bycatch estimates on estimates of T for short-tailed albatross. Drop-off rates from discussion in NMFS (2011) and mean annual black-footed albatross bycatch rates for 2002-2009 from Jannot et al. (2011) were incorporated into calculations of M for black-footed albatross and then T for short-tailed albatross.

<table>
<thead>
<tr>
<th>Drop-off rate</th>
<th>T (short-tailed albatross/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
</tr>
<tr>
<td>0%</td>
<td>0.62</td>
</tr>
<tr>
<td>27%</td>
<td>0.78</td>
</tr>
<tr>
<td>31%</td>
<td>0.81</td>
</tr>
<tr>
<td>45%</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Several additional factors could also potentially bias this estimate. With an increasing global short-tailed albatross population (H. Hasegawa, unpubl. data), interactions with fisheries are likely to increase, all else being equal. Opportunistic sightings have been increasing since the observer program began in 2001 (see paragraph below). Exposure to risk could be affected by time spent over the year in the West Coast fisheries areas as opposed to open ocean areas where transiting largely occurs. Exposure could be influenced by temporal overlap of the fisheries and short-tailed albatross presence off the west coast. Most importantly, the estimates presented here are predicated on black-footed albatross being used as a surrogate for short-tailed albatross. This assumes that the two albatross species have the same mortality rates in the fisheries in question, the same distribution throughout the area (i.e., of the total populations of each species, the same proportion of each species occurs within the West Coast groundfish fisheries area), the same behavior with respect to interacting with vessels (taking bait, etc.), and the same mortality rate once hooked or otherwise impacted.

As additional data are collected or compiled and analyzed (e.g., black-footed albatross bycatch estimates for 2010 and 2011), it may be possible to explore additional methods of estimated short-tailed albatross take. For example, it may be possible to use ratios of STAL/BFAL abundance in the WGCF action area or the take ratio of the two species in other fisheries to obtain another semi-independent estimate of short-tailed albatross take.
Higher levels of observer coverage would also be valuable for improving take estimates of this and other rare species.

The level of take estimated using this proxy method, 0.8/year, is generally consistent with both the observed take (considering the level of observer coverage) and the co-occurrence of short-tailed albatross near the WCGF (Figure 9). Sightings of short-tailed albatross by WCGF observers are relatively common compared to some other fisheries. For example, in Hawaiian longline fisheries, 100% observer coverage has yielded 16 sightings over the last 11 years--one in 2000, two in 2004, three in 2007, three in 2008, three in 2009, and four in 2010 (NMFS unpubl. data); considerably lower observer coverage in the West Coast groundfish fisheries has yielded 95 short-tailed albatross sightings over the last 11 years--four in 2001, 14 in 2002, five in 2003, five in 2004, five in 2005, four in 2006, three in 2007, two in 2008, 16 in 2009, 18 in 2010, and 19 through July 2011 (WCGOP, unpubl. data; Figure 9).

The short-tailed albatross take estimates presented here are based on black-footed albatross bycatch data collected largely in the absence of seabird bycatch mitigation measures. While some longline vessels in the groundfish fishery use streamer lines and other seabird avoidance gear voluntarily, organized efforts promoting the use of streamer lines have only begun in the last two years. Washington Sea Grant initiated a NMFS-supported streamer line distribution pilot program with tribal fisheries in 2009 and the major longline ports in the Oregon and Washington West Coast Groundfish Observer Program in 2010 (WA Sea Grant 2011). West Coast Groundfish Observer Program observers began documenting the use and characteristics of seabird avoidance gear on fixed gear vessels in 2009, and this information should be available for future analyses of bycatch of short-tailed and black footed albatross in future years (Jannot et al. 2011).

**Habitat and trophic effects**

West Coast groundfish fisheries target relatively large, commercially valuable fish species, including rockfish, hake, and various mid-water and bottom fish (see “Description of the fisheries” above). Short-tailed albatross feed on squid, small fish (including bonitos [Sarda sp.], flying fishes [Exocoetidae] and sardines [Clupeidae]), flying fish eggs, and crustaceans, which are generally not targeted by demersal and trawl fisheries (USFWS 2003). Indirect trophic effects of the West Coast groundfish fisheries are also expected to be minor and in fact may positively affect the abundance of squid and small fishes through removal of their predators (Kaplan 2009).

**Impact of WCGF fisheries on population growth rate**

Based on the information summarized above, West Coast groundfish fisheries are imposing some additional (non-natural) mortality on short-tailed albatross. The number of takes per year is very likely to be higher than the number of takes observed (one lethal take over the period of 2002-2011), and based on the black-footed albatross mortality rate is probably ~1/year and unlikely to be >2/year (Table 7). On its own, this level of mortality is very small compared to the annual growth rate of the population (~6.5%);
currently >200 birds/year). Even when combined with known mortality from other fisheries (Table 6), we see no reason to change the conclusion from the recovery plan that mortality from fishing is not a significant impediment to the growth and recovery of the species (USFWS 2008). Analyses of the impacts of Alaskan trawl mortality on the Torishima short-tailed albatross population suggest that trawl-related bycatch exceeding the current expected incidental take in that fishery (two takes in any 5-year period) by even a factor of 10 would have little impact on when the species’ proposed recovery goals are achieved (Zador et al. 2008). Our analysis quantifies the level of mortality in another set of fisheries, but does not change the basic conclusion that, at present, the level of estimated fishing mortality is small compared to the annual growth rate of the population. Use of mitigation measures such as streamer lines or integrated weighted lines, such as have been employed in Alaskan fisheries, would be expected to reduce take even further (USFWS 2008, WA Sea Grant 2011).
California least tern (*Sterna antillarum browni*)

**General biology**

The California least tern is the smallest of the North American terns and is found along the Pacific Coast of California, from San Francisco southward to Baja California. California least terns nest in colonies on relatively open beaches kept free of vegetation by natural scouring from tidal action. The typical colony size is 25 pairs. Most individuals begin breeding in their third year. Their nest is a simple scrape in the sand or shell fragments. A typical clutch is 2 eggs, and both parents incubate and care for the young. They can re-nest up to two times if eggs or chicks are lost early in the breeding season. They are very gregarious and forage, roost, nest and migrate in colonies. Fall migration commences the last week of July and first week of August. Several weeks before fall migration, adults and young wander along marine coastlines, congregating at prime fishing sites.

Birds breed at 2-3 years. Lays clutch of usually 2-3 eggs, mostly May-June (July-August nests are likely re-nesting attempts). Incubation usually lasts 20-25 days and is primarily done by the female. Young are tended by both parents, brooded for several days, fly at about 3-4 weeks, and are dependent for a few weeks more. The expected breeding life of an adult (once it has first bred) may be up to 9 years.

The species eats mainly small fishes (generally less than 9 cm long, such as anchovy, topsmelt, surf-perch, killifish, and mosquitofish), obtained by diving from air into shallow water. When breeding, California least terns forage within a few hundred meters of the colony.

**Range, migratory behavior and stock structure**

*Breeding Range*

The California least tern breeding range today is the Pacific Coast of Baja and Alta California, south of the San Francisco Bay Area. Nesting has also occurred sporadically but increasingly at inland sites in the Bay-Delta and Central Valley (USFWS 2009a).

*Marine Range*

There is scant information, but the non-breeding range is presumed to be the Pacific Coast of North America from central Mexico south to Panama (USFWS 2009a).

**Habitat use**

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California least terns forage primarily in near shore ocean waters and in shallow estuaries and lagoons. Some adults also feed close to shore in ocean waters. At colonies where feeding activities have been studied, the birds foraged mostly within 3.2 km of the breeding colony and primarily in near shore ocean waters less than 18.3 m deep.

**Critical habitat**

Critical habitat has not been designated for this species.

**Status**

The California least tern was originally listed as Endangered in 1970 (FR notice: 35 FR 8491). The California least tern recovery plan was issued September 27, 1985, which was a revised version of a 1980 revision. A recent status review recommended that the species be down listed to “threatened” status (USFWS 2006).

**Abundance and trend**

Historically abundant, California least tern numbers had declined to about 600 pairs in the United States at the time of listing. Since then, mostly through active management, the numbers have increased about ten-fold. Breeding numbers of California least terns increased in California from about 600 pairs in the mid-1970s to about 1200 pairs in 1983, declined by about 25% to around 1000 pairs from 1984 to 1987 (possibly due to El Nino effects), increased to about 2,800 pairs through about 1994, and increased to approximately 7,100 pairs by 2005 (USFWS 2006).

The California least tern has been concentrated in Los Angeles, Orange, and San Diego counties. The Santa Margarita River mouth in San Diego County generally has supported the largest numbers of terns in recent years. Between Ventura County and the San Francisco Bay area, only Purisma Point and Mussel Rock Dunes (formerly called Guadalupe Dunes), and Vandenberg have been used regularly. Although the annual rate of population change has been variable and sometimes negative, the net result has been a population increase.

**Threats (from action plan (USFWS 2009a) or 5-year review (USFWS 2006)**

California least tern face significant threats, although these are primarily confined to factors affecting breeding colonies on land. These threats include:

- destruction of nest sites and curtailment of foraging areas by coastal and marine development; modification of nest site habitat by invasive plant species.
- predation of eggs and chicks.
disturbance at nest sites; reduction in food availability due to climate cycles (e.g., El Nino) and global climate change; flooding of nest sites due to sea level rise; oil spills; increased predators (types and density) due to urbanization.

Major problems: human use and development of nesting habitat and predation on adults, eggs, and young by birds (e.g., kestrels, night-herons) and mammals (foxes, skunks, domestic cats and dogs; reduced number of suitable nesting areas which limits or eliminates tern's anti-predator strategy of shifting among different nesting areas in different years; contaminant levels in eggs and El Nino conditions may adversely affect population dynamics (NatureServe 2011).

**Fishery impacts**

Fisheries are unlikely to impact California least tern populations directly through bycatch of individuals. California least terns forage primarily in estuaries, lagoons, and in nearshore environments, inshore of most commercial fisheries. They are also surface feeding birds, preying on a variety of small fishes in shallow waters. When breeding, they forage within a few hundred meters of the colony in waters < 18 m deep.

Interactions with fisheries are not mentioned as a threat to the species in the most recent status review (USFWS 2006).

**Impacts, all fisheries**

There have been no reported lethal takes of California least tern in commercial fisheries.

**Impacts, West Coast Groundfish Fisheries**

There have been no reported lethal takes of California least tern in West Coast groundfish fisheries. There have been no reports of entangled individuals of this species in California beach monitoring surveys (Moore et al. 2009).

Some overlap does occur between West Coast groundfish fisheries and areas and habitat California least tern use, so there is potential for interaction. However, any potential interactions would be confined to fisheries prosecuted in nearshore areas in southern California and no interactions have been recorded from 2002-2009 in any of the groundfish sectors observed by the West Coast Groundfish Observer Program (Jannot et al. 2011).

Recent compilation of fisheries-independent surveys by Washington Sea Grant scientists (Guy et al., unpubl. data) found that sightings of California least terns were rare and largely confined to the California Bight.
Habitat and trophic effects

West coast groundfish fisheries target relatively large, commercially valuable fish species, including rockfish, hake, and various mid-water and bottom fish (see “Description of fisheries”). California least tern feed on mainly small fishes (generally less than 9 cm long, such as anchovy, topsmelt, surf-perch, killifish, and mosquitofish), obtained by diving from air into shallow water, which are generally not targeted by demersal and trawl fisheries. Indirect trophic effects of the west coast groundfish fisheries are also expected to be minor and in fact may positively affect the abundance of squid and small fishes through removal of their predators (Kaplan 2009).

Impact of WCGF fisheries on population growth rate

Based on the information summarized above, west coast groundfish fisheries are not imposing additional (non-natural) mortality on California least tern.
Marbled murrelet (*Brachyramphus marmoratus*)

**General biology**

The marbled murrelet is a small seabird that inhabits the coastal forests and nearshore marine environment along the Pacific coast of North America from southern California to southern Alaska and the Aleutian Islands.

Marbled murrelets lay a single egg clutch, with incubation and rearing occurring from late March (in California) or late April (Pacific Northwest) through the summer. Fledging ranges from late May (California) or late June (Pacific Northwest) through late summer and early fall (McShane et al. 2004 and references therein).

Marbled murrelets feed on a large variety of small fishes and invertebrates. From McShane et al. (2004): “In general, small schooling fish and large pelagic crustaceans (euphausiids, mysids, amphipods) represent main prey items for marbled murrelets, with Pacific sand lance (*Ammodytes hexapterus*), northern anchovy (*Engraulis mordax*), immature Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), and smelt (*Osmeridae*) documented as the most common prey species taken.” Foraging occurs primarily in shallow water (< 98 feet), and feeding has been observed at depths from 9.8 to 89 feet (McShane et al. 2004 and references therein).

**Range, migratory behavior and stock structure and habitat use**

The marbled murrelet breeding range extends from the Aleutian Islands to central California. Throughout most of its breeding range the marbled murrelet uses old-growth forests for nesting and near shore marine environments for foraging. In the Pacific Northwest and California, murrelets tend forage within 2 km of the coast during the breeding season, with somewhat greater dispersal during the non-breeding season.

**Critical habitat**

Critical habitat was originally designated for the marbled murrelet in Washington, Oregon, and California on May 24, 1996 (61 FR 26256). Federal and non-Federal lands totaling 3,887,800 acres were designated to protect nesting habitats. The U.S. Fish and Wildlife Service proposed to revise critical habitat for the marbled murrelet in June 2008 by removing ~250,000 acres in northern California and Oregon from the 1996 designation, based on new information indicating the areas did not meet the definition of critical habitat. This proposed rule has not been finalized and critical habitat for the...
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murrelet remains unchanged from the 1996 designation. Critical marine habitat has not been designated.

**Status**

The Washington, Oregon, and California Distinct Population Segment of the marbled murrelet was originally listed as Threatened in 1992 (FR notice: 57 FR 45328). The marbled murrelet recovery plan “Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon and California” was issued 24 September 1997. A recent 5-year status review in 2009 recommended no changes to the threatened status, noting the listed portion of the species had declined in abundance since the prior (2004) status review and that the recovery criteria for the species had not been met (USFWS 2009b).

**Abundance and trend**

The total marbled murrelet abundance in North America is estimated to be >900,000, but most of these occur in Alaska (Table 3.2-1 of McShane et al. 2004). The most recent abundance estimate of the listed portion of the species (WA, OR, CA) is 17,700 (95% CI: 14,600 – 21,000) from northern California to Washington and 174 (91-256) in central California (USFWS 2009b and references therein). The listed portion of the population has been declining since the initiation of monitoring programs in 2000, with a decline of 2.4-4.3% annually in northern CA, OR and WA, and 15% annually in central CA (USFWS 2009b).

**Threats**

Original reasons for decline and threats as of the listing included loss of nesting habitat, poor breeding success, predation, gill-net mortality, oil spills and other marine pollution, and possible changes in prey abundance and distribution (USFWS 1997). Changes in threats were reported in the 2004 5-year review, including a declining rate of annual habitat loss, particularly on Federal lands, improved regulatory mechanisms due to federal and state listings and other state and federal regulation, especially the Northwest Forest Plan, new gill-netting regulations in northern California and Washington which reduced the threat to murrelets; some threats continued or were assumed to be unchanged, including the lack of development of new habitat to replace historic loss/modification of habitat, predation, and threats from oil spills (USFWS 2004b).

The most recent 5-year review (USFWS 2009b) listed continuing and emerging threats. Terrestrial threats to marbled murrelet populations include the historic and ongoing loss and modification of nesting habitat through commercial timber harvests, human-induced fires, and land conversions, and to a lesser degree, through natural causes such as wild fires and wind storms. Marine threats to marbled murrelets include changes in the food
web and prey quantity and quality (declining prey populations, commercial and recreational fisheries for some stocks, some continued (but not quantified) gill-net mortality in northern Washington, high body loads of PCBs in Pacific herring in Puget Sound, HABs, and marine dead zones. Climate change is likely to exacerbate many of these threats result in terrestrial and marine environments.

**Fishery impacts**

**Impacts, all fisheries**

Marbled murrelets have been observed to be killed by entanglement in gill-nets, primarily when set in shallow water areas favored by the murrelets (see extensive discussion in McShane et al. (2004). McShane et al. (2004, and references cited therein) estimated that a minimum of 30 marbled murrelets per year were killed in gill net fisheries in Washington’s inland marine waters from 1993 – 2003, which was estimated to be 0.05 – 0.11% of the northern Washington population. Gillnet mortality was reported to be substantial in central California prior to 1987, but low to zero after that due to changed fishery regulations (McShane et al. 2004). There are no marine gill net fisheries in Oregon. Some mortality likely continues to occur in inland Washington marine waters and the northern Washington coast, but has not been recently quantified (USFWS 2009b).

**Impacts, West Coast Groundfish Fisheries**

There has been no reported mortality of marbled murrelets in West Coast groundfish fisheries, and these fisheries are not mentioned or discussed as a threat in the recent status reviews (McShane et al. 2004, USFWS 2009b). The WCGOP reported single interactions with marbled murrelets in 2001 and 2002 in northern California. Both of these occurred in the limited entry trawl sector, and were reported as “boarded vessel only” (Table 1 and Figure 1 from Jannot et al. 2011; J. Jannot pers. comm.). Other alcids were reported as bycatch in WCGF fisheries, however, including the common murre (*Uria aalge*) and unidentified alcid species (Table 8 of Jannot et al. 2011). Bycatch occurred in the at-sea hake, the CA halibut, limited entry trawl, and nearshore fixed gear sectors. The total level of take was relatively low however. For example, the estimated common murre take for the WCGF was only 3.4/year from 2002-2009 (with some years not reported), and take of unidentified alcids averaged <1/year (Jannot et al. 2011).

**Habitat and trophic effects**

West coast groundfish fisheries target relatively large, commercially valuable fish species, including rockfish, hake, and various mid-water and bottom fish (see “Description of fisheries”). Marbled murrelet are small, pursuit diving birds, preying mainly on small fishes and euphausiids, species not targeted by demersal fixed gear and trawl fisheries. Indirect trophic effects of the west coast groundfish fisheries are also expected to be minor and in fact may positively affect the abundance of squid and small fishes through removal of their predators (Kaplan 2009).
Impact of WCGF fisheries on population growth rate

Based on the information summarized above, west coast groundfish fisheries do not appear to be imposing additional (non-natural) mortality on marbled murrelets. However, some components of the fishery occur in the nearshore areas frequented by murrelets, and a much more common species with similar foraging behavior and diet, the common murre, has been occasionally reported as bycatch in these fisheries. The west coast population of the common murre is ~62X as abundant as the marbled murrelet, however, (estimated population size of 1.1million in 1988-89 as reported in Carter et al. 2001) and likely forages over a broader marine area (Manuwal et al. 2001). The relatively low rate of bycatch of common murres (average of 3.4/year; Jannot et al. 2011) in WCGF suggests that bycatch of marbled murrelets in these fisheries, although not impossible, is expected to be very rare.
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