**Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Section 7(a)(2) "Not Likely to Adversely Affect" Determination**

**Continuing Operation of the Pacific Coast Groundfish Fishery**

**PCTS Number: NWR-2012-876**

**Action Agency: National Marine Fisheries Service**

**Affected Species and Determinations:**

| ESA-Listed Species | Status | Is Action Likely to Adversely Affect Species or Critical Habitat? | Is Action Likely To Jeopardize the Species? | Is Action Likely To Destroy or Adversely Modify Critical Habitat? |
|---|---|---|---|---|
| Green Sturgeon (*Acipenser medirostris*) | Threatened | Yes | No | No |
| Eulachon (*Thaleichthys pacificus*) | Threatened | Yes | No | No |
| Humpback whales (*Megaptera novaeangliae*) | Endangered | Yes | No | N/A |
| Steller sea lions (*Eumetopias jubatus*) | Threatened | Yes | No | No |
| Leatherback sea turtles (*Dermochelys coriacea*) | Endangered | Yes | No | No |

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

**Issued By:**

for William W. Stelle, Jr.
Regional Administrator

**Date:** December 7, 2012

**List of Acronyms**

| | |
|---|---|
| ACL | Annual Catch Limits |
| AKR | Alaska Region |
| A-SHOP | At-Sea Hake Observer Program |
| BRT | Biological Review Team |
| BRD | Bycatch Reduction Device |
| CA/OR/WA | California/Oregon/Washington |
| CDFG | California Department of Fish and Game |
| CI | Confidence Interval |
| COSEWIC | Committee on the Status for Endangered Wildlife in Canada |
| CPFVs | Commercial Passenger Fishing Vessels |
| CPUE | Catch Per Unit Effort |
| DPS | Distinct Population Segment |
| DQA | Data Quality Act |
| DU | Designatable Unit |
| EEZ | Exclusive Economic Zone |
| EFH | Essential Fishing Habitat |
| EFPs | Exempt Fishing Permits |
| ESA | Endangered Species Act |
| ESU | Evolutionarily Significant Unit |
| FL | Fork Length |
| FMP | Fishery Management Plan |
| GCID | Glenn-Colusa Irrigation District |
| GMT | Groundfish Management Team |
| IFQ | Individual Fishing Quota |
| ISAB | Independent Scientific Advisory Board |
| ITS | Incidental Take Statement |
| LE | Limited Entry |
| MMPA | Marine Mammal Protection Act |
| MMHSRP | Marine Mammal Health and Stranding Response Program |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act |
| NEPA | National Environmental Policy Act |
| NID | Negligible Impact Determination |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NWFSC | Northwest Fisheries Science Center |
| NWR | Northwest Region |
| OA | Open Access |
| ODCC | Oregon Dungeness Crab Commission |
| ODFW | Oregon Department of Fish and Wildlife |
| OYs | Optimum Yields |
| PacFIN | Pacific Fisheries Information Network |
| PBR | Potential Biological Removal |
| PCE | Primary Constituent Element |
| PCGF | Pacific Coast Groundfish Fishery |
| PCGW | Pacific Coast Groundfish and Endangered Species Workgroup |

| | |
|---|---|
| PFMC | Pacific Fishery Management Council |
| PIT | Passive Integrated Transponder |
| PRD | Protected Resources Division |
| PSMFC | Pacific States Marine Fisheries Commission |
| QSM | Quota Species Monitoring |
| RBDD | Red Bluff Diversion Dam |
| RCA | Rockfish Conservation Area |
| RecFIN | Recreational Fisheries Information System |
| SARA | Species at Risk Act |
| SDPS | Southern Distinct Population Segment (of green sturgeon) |
| SFD | Sustainable Fisheries Division |
| SHOP | Shoreside Hake Observation Program |
| SRP | Scientific Research Permit |
| SWR | Southwest Region |
| SWFSC | Southwest Fisheries Science Center |
| TL | Total length |
| USBR | United States Bureau of Reclamation |
| USFWS | United States Fish and Wildlife Service |
| VMS | Vessel Monitoring Systems |
| WDFW | Washington Department of Fish and Wildlife |
| WCGOP | West Coast Groundfish Observer Program |

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# 1. INTRODUCTION

This section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

## 1.1 Background

The biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq.*), and implementing regulations at 50 CFR 402.

The opinion and incidental take statement are each in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) *et seq.*) and both underwent pre-dissemination review.

## 1.2 Consultation History

This biological opinion is based on information provided by NMFS Northwest Region (NWR) Sustainable Fisheries Division (SFD) to NWR Protected Resources Division (PRD) in a June 14, 2012 biological assessment and additional information was received by August 13, 2012. Additional resources provided include a final risk assessment from NMFS Northwest Fisheries Science Center (NWFSC) dated January 13, 2012, a report on changes in fishing effort during the 2011-2012 timeframe, a progress update on implementation of the 2012 biological opinion, and an assessment of eulachon abundance from the NWFSC eulachon workgroup dated July 6, 2012. Because of the location of the Pacific Coast Groundfish Fishery, presence of listed species, and history of past interactions, NMFS SFD determined that the fishery is likely to adversely affect the following listed species and critical habitat:

- Humpback whales (*Megaptera novaeangliae*),
- Steller sea lions (*Eumetopias jubatus*),
- Eulachon (*Thaleichthys pacificus*),
- Green sturgeon (*Acipenser medirostris*) and their critical habitat, and
- Leatherback sea turtles (*Dermochelys coriacea*) and their critical habitat.

NMFS SFD has also determined that the fishery is not likely to adversely affect the following listed species and critical habitat:

- Green sea turtles (*Chelonia mydas*),
- Olive ridley sea turtles (*Lepidochelys olivacea*),
- Loggerhead sea turtles (*Caretta caretta*),
- Sei whales (*Balaenoptera borealis*),

- North Pacific right whales (*Eubalaena japonica*),
- Blue whales (*Balaenoptera musculus*),
- Fin whales (*Balaenoptera physalus*),
- Sperm whales (*Physter macrocephalus*),
- Southern Resident killer whales (*Orcinus orca*),
- Guadalupe fur seals (*Arctocephalus townsendi*), and
- Critical habitat of Steller sea lions.

Therefore, NMFS SFD initiated consultation. NMFS has conducted past consultations on the effects of the Pacific Coast Groundfish Fishery on ESA-listed salmonids. The most recent consultation on effects to ESA-listed salmonids was completed in 2006 and remains current (NMFS 2006a). A complete record of this consultation is on file at NMFS NWR in Seattle, WA. NMFS has also conducted a recent consultation on the effects of the Pacific Coast Groundfish Fishery in 2012 on the species identified above (NMFS 2012a). A complete record of this consultation is also on file at NMFS NWR in Seattle, WA. In March 2006, NMFS approved a plan to establish and protect over 130,000 square miles off the West Coast as essential fish habitat (EFH) for groundfish (72 Fed. Reg. 27408; Amendment 19 to the Pacific Coast Groundfish Fishery Management Plan (FMP)). NMFS works with the Pacific Fishery Management Council (PFMC) to periodically review EFH components of the fishery management plans, and to revise these provisions based on available information.

### 1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. There are no interrelated or interdependent actions of the proposed action. The action proposed here is the continuing implementation of the Pacific Coast Groundfish Fishery Management Plan. The FMP regulates fishing in the Exclusive Economic Zone (EEZ) with respect to species listed in Section 3.1 of the FMP. The duration of the consultation is the foreseeable future. The regulated fisheries may affect ESA-listed species and their critical habitat. The following discussion describes all of the groundfish fisheries governed by the FMP that are the subject of this consultation. We describe all of these fisheries to provide context for assessing the direct and indirect effects of the Federal actions covered by this consultation. The discussion focuses on those attributes of the Pacific Coast Groundfish Fishery 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.
- Catch – Indirect effects of fishery catch and bycatch on the prey base of listed species.

Additional consideration is given to monitoring strategies, data sources, and management jurisdiction.

### 1.3.1 Overview of the Groundfish Fishery[1]

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

Managed species include the following:

- Rockfish – The plan covers 64 different species of rockfish, including widow, yellowtail, canary, shortbelly, vermilion, bocaccio, chilipepper, cowcod, yelloweye, thornyheads, and Pacific Ocean perch.
- Flatfish – The plan covers 12 species of flatfish, including various soles, starry flounder, arrowtooth flounder, 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.

NMFS manages the fishery in partnership with the PFMC, and the states of California, Oregon, and Washington. A major emphasis of the current fishery management framework is focused on rebuilding overfished species. The management framework 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.

The groundfish FMP is implemented through regulations that are generally recommended by the PFMC and adopted by NMFS. Active management of the fishery began in the early 1980s with the establishment of optimum yields (OYs) 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 1980s, management has evolved to further separate individual groundfish species for management purposes and led to the current use of cumulative two-month trip limits and individual fishing quotas for most species (PFMC 2008). Cumulative trip limits are a specified weight of fish that can be landed during a particular time period.

Under the FMP, the groundfish fishery is defined as consisting of four management components:

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[1] 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

- 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 fisheries.
- Recreational – This component includes recreational anglers who target or catch groundfish species.
- Tribal – This component includes native tribal treaty fisheries in Washington State.

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.

Fisheries that impact groundfish but are not directly regulated through the FMP are managed by the coastal states. These include nearshore fixed gear fisheries which target some of the same species included in the FMP fisheries that target species not included in the FMP and that incidentally catch species in the FMP. Examples of the latter include the California halibut fishery and the pink shrimp fishery. The FMP and its implementing regulations do limit the catch of groundfish in these fisheries and require observer coverage to enforce those limits, but do not directly regulate the harvest of the target species. The nearshore fixed gear fisheries occur between 0 to 3 miles offshore and are regulated by the states. These state-managed fisheries are not part of this proposed action, as they are not directly managed under the FMP. In addition, they are neither interrelated or interdependent with the federally-managed groundfish fisheries covered by the FMP. They have independent utility and are not dependent on the federally-managed fisheries for their justification. Therefore, this consultation does not address the effects of these fisheries on listed species nor does it provide incidental take coverage for them. Their effects are addressed in the Environmental Baseline and Cumulative Effects sections. However, because certain of these fisheries are observed by the Federal observer programs with regard to their catch of federally-managed groundfish, that observation is covered by this consultation.

### 1.3.2 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, managers identify tribal groundfish fisheries based on sovereign treaty rights of the Washington coastal Indian Tribes.

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 creates functional allocations of the stocks available for harvest. In addition to allocations, managers also consider “set asides.” These divisions of harvest opportunity are a bookkeeping function that allows managers to estimate the total catch that is likely to occur during the management period. Set asides are an accounting device applied primarily to research catches and fisheries prosecuted under an exempted fishing permit (see below).

The following provides a list of sectors comprising the groundfish fishery, which are further described later in the section. 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:

1. Catcher-processor vessels targeting Pacific whiting using mid-water trawl gear and processing their catch at sea.
2. Catcher vessels targeting Pacific whiting using mid-water trawl gear and delivering to at-sea mothership processors (referred to as the mothership sector).
3. Catcher vessels targeting Pacific whiting using mid-water 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 pot gear under gear switching provisions in the individual fishing quota (IFQ) program.
6. Vessels using longline or pot gear (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).
7. Vessels using legal groundfish gear other than trawl (principally longline and pot gear) to target groundfish but not possessing a Federal limited entry permit (referred to as the “directed open access sector”).
8. Incidental open access sector vessels using a variety of gear types that catch groundfish incidentally, usually defined by catch composition rather than regulatory status.

In addition to the above-mentioned sectors, recreational, tribal, and research fisheries are regulated under the FMP and are considered part of this proposed action:

- Recreational groundfish fisheries, including charter vessels (commercial passenger fishing vessels (CPFVs)) and private recreational vessels (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 Permits (EFPs) allocate groundfish harvest to a vessel, which has the effect of allowing the vessel to engage in an activity that would otherwise be prohibited

by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) or other fishery regulations, for the purpose of collecting limited experimental data.

- Scientific Research Permits (SRPs) for scientific research activities to gain information on the species included in the Pacific Coast Groundfish Fishery Management Plan, and where the scientific research is being conducted with Federal funding. All of the scientific research activities are designed to conserve the affected species and would include a variety of research and monitoring activities such as: determining the abundance, distribution, and condition of adult and juvenile groundfish; and conducting investigations on groundfish behavior and survivability after interacting with fishing gear.

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 and salmon can be caught incidentally, either because they co-occur with Pacific whiting or because vessel operators mistakenly set the gear on the wrong species. The at-sea (mothership and catcher-processor) 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). The third whiting sector (shoreside), is managed with IFQs. 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 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 are reached. As a result, beginning with the 2009 to 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 and the non-whiting trawl sector are managed with IFQs. 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.

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 15 to 20 species. It is expected that fleet size will be reduced considerably under the new IFQ Program (see below).

Commercial Fixed Gear Sectors

Major sectors in the fixed gear groundfish fishery include the LE sablefish-endorsed sector, the LE non-sablefish-endorsed sector, and the Federal OA sector. 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 OA 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.

<u>Limited Entry Sablefish Primary Tier-Endorsed Fixed Gear</u>

Vessels participating in the LE sablefish-endorsed sector range in size from 33 to 95 feet and operate north of 36$^o$ N latitude. 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 percent of the primary-season sablefish allocation, with Tiers 2 and 3 receiving 0.64 percent and 0.36 percent, 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 any time 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 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.

<u>Limited Entry Non-Sablefish-Endorsed Fixed Gear</u>

The LE non-sablefish-endorsed fixed gear sector occurs coastwide but 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 operates 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 OA sector of the fixed gear groundfish fishery does not require Federal or state permits (state requirements for commercial fishing licenses notwithstanding), 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 coastal states and generally fish in waters shoreward of 30 fathoms or seaward of 100 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 OA fishery.

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 (CPFVs) and private recreational vessels (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

Indian tribes, specifically the coastal tribes, possess treaty rights to harvest federally-managed groundfish in their usual and accustomed fishing areas within the EEZ, as described in decisions in U.S. v. Washington and associated cases. The FMP and its implementing regulations provide for allocations or set-asides of specific amounts of some species for the tribal fisheries, to ensure implementation of treaty fishing rights. Those allocations and set-asides are developed annually or biennially (depending on the species) in consultation with the tribes. The individual tribes manage their fisheries, coordinating with NMFS and the Council. The tribes have formal allocations or set-asides for sablefish, black rockfish, and Pacific whiting, and harvest guidelines for Pacific cod and lingcod. Members of the four coastal treaty tribes participate in commercial, ceremonial, and subsistence fisheries for groundfish off the Washington coast. Participants in the tribal commercial fisheries use similar gear to non-tribal fishers. Groundfish caught in the tribal commercial fishery pass through the same markets as non-tribal commercial groundfish catch.

There are several groundfish species taken in tribal fisheries for which the tribes have no formal allocations and some species for which no specific allocation has been determined. Rather than try to reserve specific allocations of these species, the tribes recommend trip limits for these species to the PFMC, which then manages other sectors to accommodate these fisheries. Tribal trip limits for groundfish species without tribal allocations are usually intended to constrain direct catch as well as interactions with overfished species in the tribal groundfish fisheries.

Approximately one-third of the tribal sablefish allocation is taken during an open competition fishery, in which vessels from the sablefish tribes all have access to this portion of the overall tribal sablefish allocation. The remaining two-thirds of the tribal sablefish allocation is split among the tribes according to a mutually agreed-upon allocation scheme. Specific sablefish allocations are managed by the individual tribes, beginning in March and lasting into the autumn, depending on vessel participation and management measures used (Table 1).

In addition to these hook-and-line fisheries, the Makah tribe annually harvests a whiting allocation using mid-water trawl gear. Since 1996, a portion of the U.S. whiting OY has been allocated to the Pacific Coast treaty tribes (50 CFR 660.385(e)). The tribal allocation is subtracted from the whiting OY before allocation to the non-tribal sectors. From 1999 to 2009, the tribal allocation was based on a sliding scale related to the U.S. whiting OY. Since 2009, the tribal allocation has been based on estimated need by tribes anticipating participating in the fishery. To date, only the Makah tribe has conducted a whiting fishery; however, the Quileute and Quinault tribes have indicated their intent to participate in the future.

Makah non-whiting vessels fit with mid-water trawl gear have also been targeting yellowtail rockfish in recent years. Tribal regulations specify the monthly limit of yellowtail, based on the number of vessels participating, as well as limits for canary rockfish (300 pounds per trip); minor nearshore, shelf, and slope rockfish (300 pounds per trip combined); and interactions with widow rockfish (not to exceed 10 percent of yellowtail landings). This fishery is managed by both time and area to stay within projected impacts on overfished rockfish, primarily widow and canary, taken incidentally with yellowtail. Short test tows are taken in areas previously identified as having low bycatch rates before that area is open to fishing. If vessels in the fishery approach the limits established by tribal regulation, the area is closed to further fishing until there is a demonstrated reduction in bycatch rates. An observer program is in place to verify bycatch levels in the fishery, and assigned vessels must carry an observer in order to participate.

Table 1. Distribution of vessels engaged in tribal groundfish fisheries.

| Treaty Tribe | Number of Vessels in Groundfish Fishery | | | | Port |
|---|---|---|---|---|---|
| | Longline (length in ft) | Whiting (length in ft) | Trawl (length in ft) | Total | |
| Makah | 31 (33'-62') | 5 (95'-124') | 5 (49'-62') | 45 | Neah Bay |
| Hoh | - | - | - | 1 | N/A |
| Quileute | 8 (45’-68’) | - | - | 8 | La Push |
| Quinault | 15(38'-62') | - | - | 15 | West Port |

**Source: PFMC 2011**

Exempted Fishing Permits

An 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 Pacific Coast 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 evaluate current and proposed management measures. EFPs are adopted biennially with preliminary adoption by the PFMC at their November meeting and final approval in June. For additional information on EFP protocols, visit the PFMC website and review PFMC Operating Procedure 19 at www.pcouncil.org/operations/cops.html.

### 1.3.4 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 2. 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 2. Seasonality of non-whiting commercial groundfish landings—over 2005–2009 timeframe, average in metric tons per two-month season by sector.*

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

***Excerpted from PFMC 2011, p. F-14**

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.

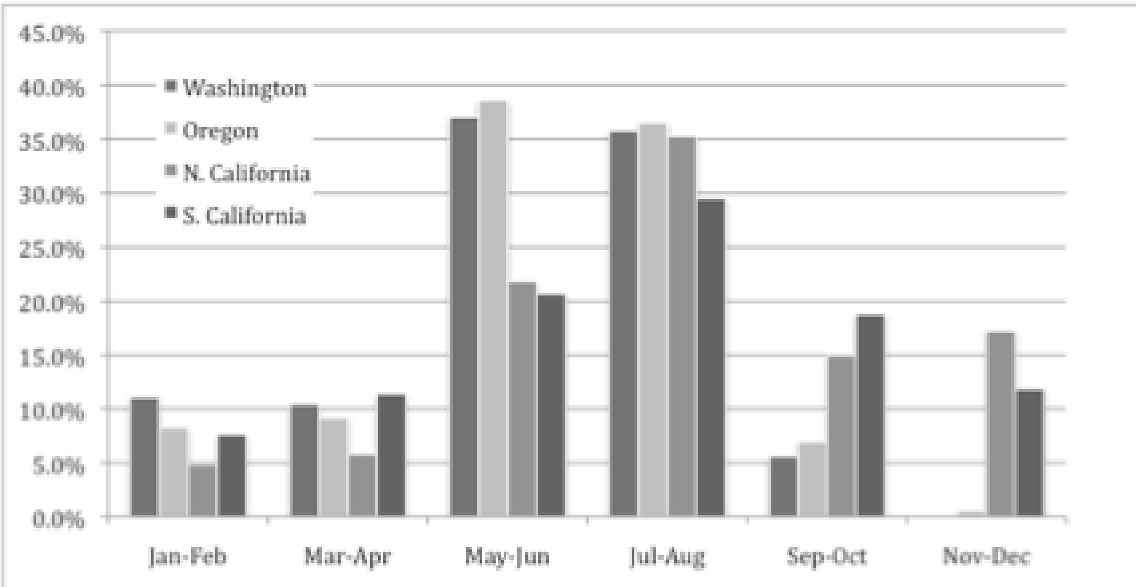


Figure 1. Seasonal distribution of marine angler trips in 2003 (Source: PFMC 2011).

### 1.3.5 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 EFH (PFMC 2005). In other cases, area closures are implemented through the harvest specification process to protect overfished species (PFMC 2011). Table 3 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 the PCGF.

Table 3. Commercial groundfish landings (mt) by sector and port group for 2009 (x=excluded for data confidentiality).*

| Port Group | Shoreside Whiting Trawl | Shoreside Non-whiting Trawl | Limited Entry Fixed Gear | Open Access Fixed Gear | Incidentally Caught Groundfish | Total |
|---|---|---|---|---|---|---|
| **Puget Sound** | | 1,295.5 | 257.4 | | x | x |
| **North Washington Coast** | | x | 220.2 | 23.1 | 1.7 | x |
| **South & Central Washington Coast** | 10,090.9 | 1,346.2 | 308.6 | 41.0 | 3.8 | 11,790.6 |
| **Astoria** | 14,085.8 | 8,406.4 | 148.3 | 16.5 | 5.1 | 22,662.2 |
| **Tillamook** | | x | | 34.5 | 0.2 | x |
| **Newport** | 12,993.0 | 3,774.6 | 525.1 | 42.4 | 11.8 | 17,347.0 |
| **Coos Bay** | x | 3,619.1 | 191.4 | 85.2 | 6.5 | x |
| **Brookings** | | 1,201.1 | 263.5 | 276.9 | 1.8 | 1,743.3 |
| **Crescent City** | 1,489.4 | 982.5 | 108.0 | 81.4 | 0.4 | 2,661.7 |
| **Eureka** | x | 2,678.7 | 101.8 | 73.0 | x | 3,162.0 |
| **Fort Bragg** | | 1,684.1 | 154.6 | 102.9 | 0.6 | 1,942.3 |
| **Bodega Bay** | | x | x | 17.2 | 3.8 | 81.4 |
| **San Francisco** | | 648.5 | 59.9 | 36.3 | 29.0 | 773.7 |
| **Monterey** | | x | 108.2 | 72.3 | 0.7 | x |
| **Morro Bay** | | x | 202.0 | 568.8 | 2.1 | x |
| **Santa Barbara** | | | 35.6 | 74.2 | 15.9 | 125.7 |
| **Los Angeles** | | | 117.7 | 12.9 | 12.7 | 143.2 |
| **San Diego** | | | 82.1 | 13.3 | 3.8 | 99.2 |
| **Total** | 40,580.1 | 26,164.7 | x | 1,571.1 | 104.7 | 71,314.5 |

***(Excerpted from PFMC 2011, p. F-24)**

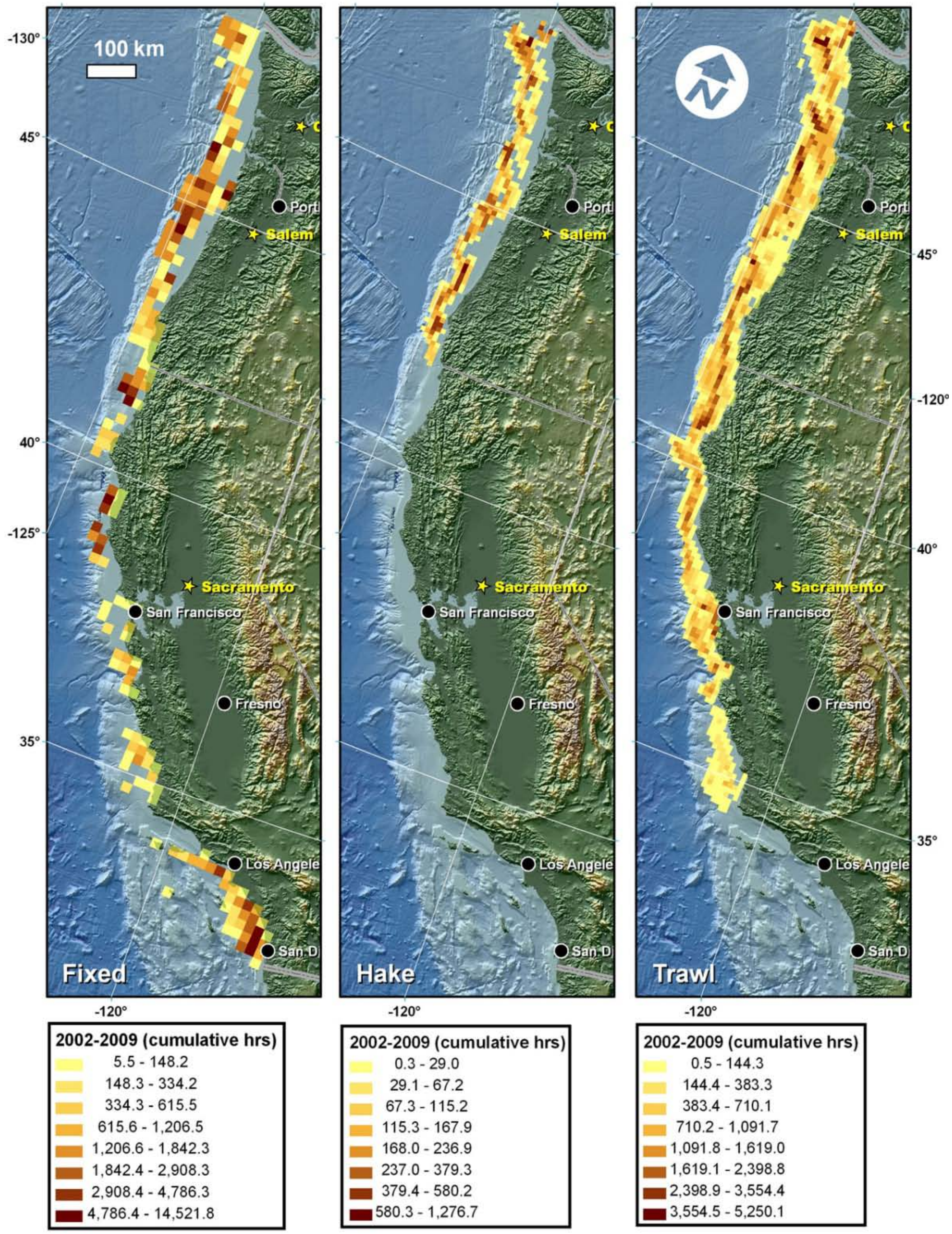


Figure 2. The figure demonstrates the general spatial distribution of fishing effort from 2002–2009 (as cumulative hours gear was deployed) in various sectors of the groundfish fishery for which spatial fishing effort information is available. Fixed represents the limited entry sablefish primary, limited 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.

### 1.3.6 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 2012) and are incorporated by reference. Table 4 summarizes the gear types used in the PCGF.

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 3 shows trawl gear as it is generally deployed on the West Coast.

The words “pot” and “trap” are used interchangeably to mean baited cages set on the ocean floor to catch fish and shellfish. They can be circular, rectangular, or conical in shape. The pots may be set out individually or as strings with multiple pots attached to a groundline. Larger vessels tend to set gear in strings of pots whereas smaller vessels often set traps individually. All pots contain entry ports and escape ports that allow undersized or unwanted species to escape. Additionally, all pots must have biodegradable escape panels or fasteners that prevent the pot from continuing to fish if lost. Strings of pots are marked at each end with a pole and flag, and sometimes a light or radar reflector. Individual pots are marked with surface buoys. NMFS has become aware that pot gear is sometimes stored at sea when not in use. When storing pot gear at sea, the escape panels are left open so fish are not caught.

Longline fisheries involve setting out 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 4 shows typical bottom longline gear deployed in the groundfish fishery.

To reduce take of seabirds, streamer lines (also called bird lines or tori lines) are sometimes deployed as longline 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. 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, pers. comm.; and, http://www.afsc.noaa.gov/Quarterly/amj2011/divrptsREFM4.htm). Seabird mitigation is not currently required in the PCGF, although Washington Sea Grant has recently initiated a NMFS-funded program to promote voluntary use of streamer lines (WA Sea Grant 2011).

Table 4. Gear types used in West Coast fisheries.

| | Nets | Longline, Pot, Hook-and-Line Gears | Other Gears |
|---|---|---|---|
| **Limited Entry** | Bottom trawl<br>Mid-water trawl<br>Scottish seine | Pot<br>Longline | |
| **Open Access – Directed** | Set gillnet<br>Sculpin trawl | Pot<br>Longline<br>Vertical hook/line<br>Rod and reel<br>Troll/dinglebar<br>Jig<br>Stick Gear | |
| **Open Access – Incidental (including non-groundfish fisheries)** | Exempted trawl (pink shrimp, spot and ridgeback prawn, Calif. halibut, sea cucumber)<br>Set net<br>Drift net<br>Purse seine | Pot (Dungeness crab, sheephead, spot prawn)<br>Longline<br>Rod and reel<br>Troll | Dive/spear<br>Dive/hook and line<br>Poke pole |
| **Tribal** | As above | As above | As above |
| **Recreational** | Dip net<br>Throw net | Hook-and-line<br>Pots | Dive/spear |

Source: PFMC 2005.

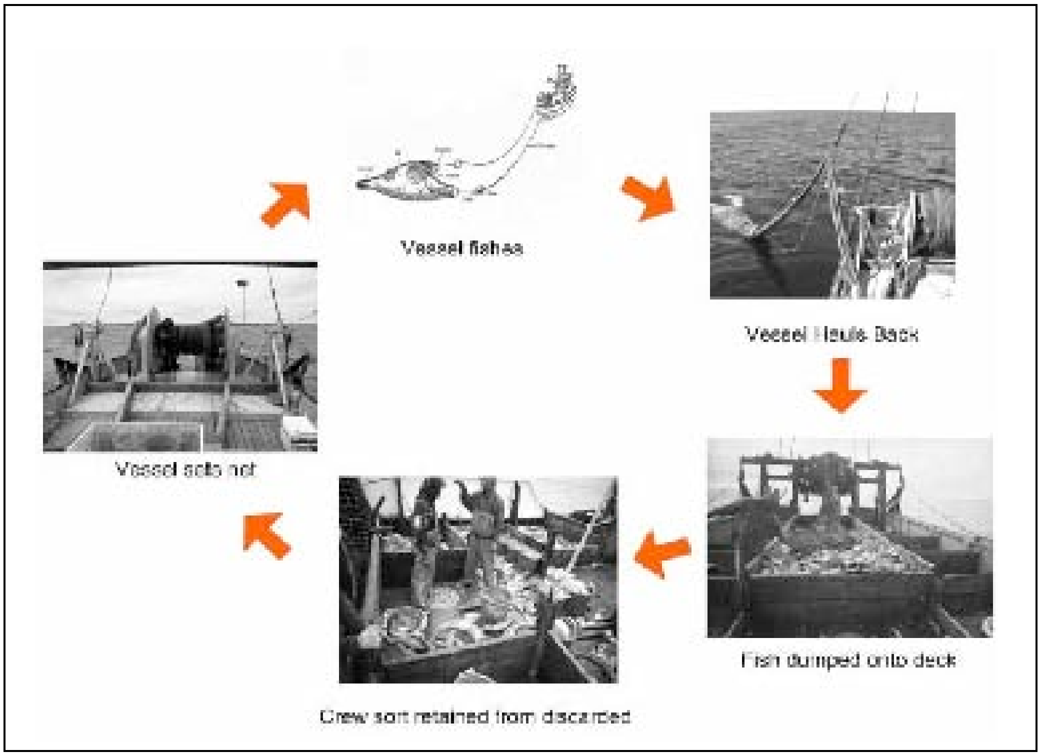


Figure 3. Typical activity on a groundfish trawl vessel (Source: NWFSC 2012).

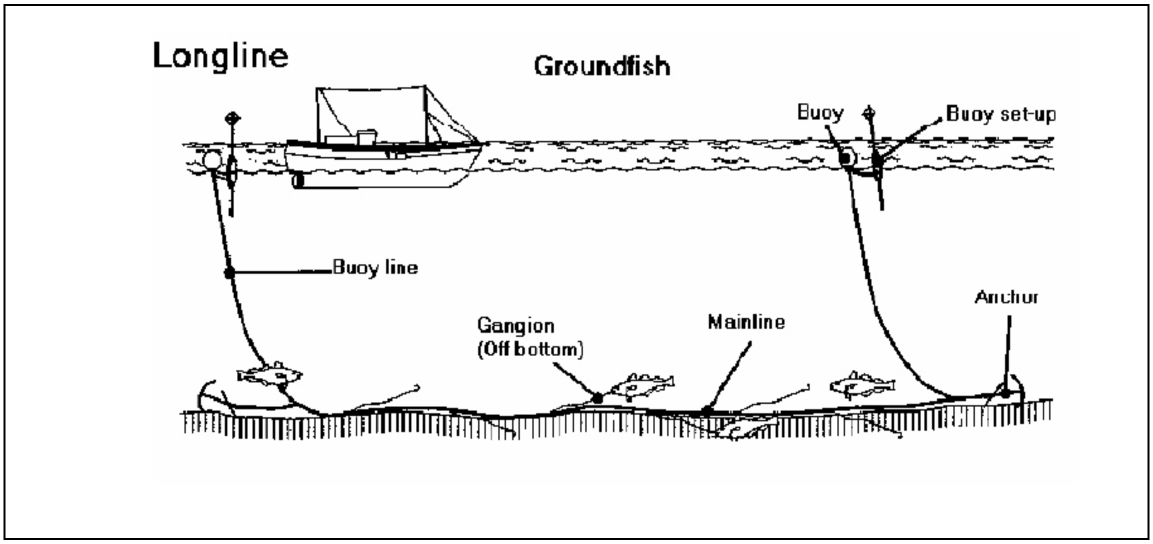


Figure 4. Schematic of groundfish longline gear (Source: NWFSC 2012).

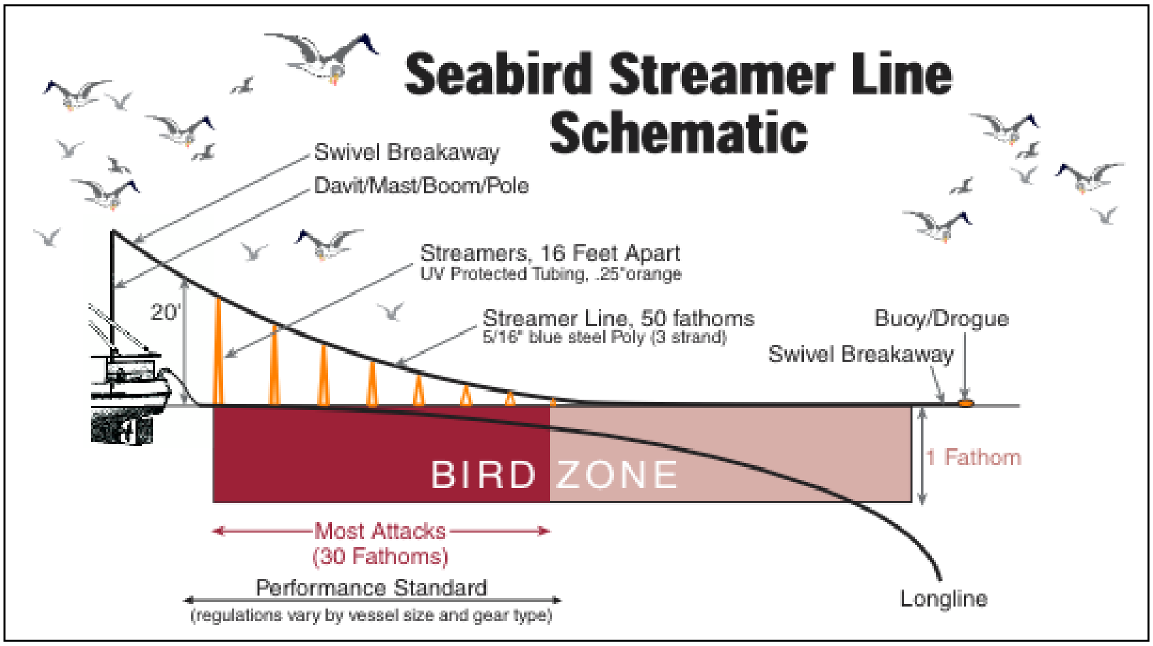


Figure 3. Schematic of streamer lines to reduce seabird bycatch (modified from Melvin 2000).

### 1.3.7 Catch Monitoring, Accounting, and Enforcement[2]

Establishing a standardized bycatch reporting methodology and limiting bycatch to the extent practicable are mandates of the MSA.[3] Effective bycatch accounting and control mechanisms are

[2] This Section Excerpted from Chapter 4 of PFMC 2008 with minor adaptations.
[3] For more information on bycatch, including NMFS' definition of bycatch, see http://www.nmfs.noaa.gov/by_catch/SPO_final_rev_12204.pdf

also critical for staying within 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 PFMC approved Amendment 18 to the Groundfish FMP. The PFMC 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 PFMC web page at http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-18/.

Various state, Federal, and tribal catch monitoring systems are used in West Coast 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**

For this biological opinion, estimates of bycatch are based on data from Federal observer programs that cover the following fishery sectors:

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

More information on each of these sectors is available in annual reports available at: www.nwfsc.noaa.gov/research/divisions/fram/observer/. Unobserved fisheries that impact groundfish include tribal groundfish (non-hake), shoreside hake, recreational, research, and non-groundfish fisheries that incidentally catch groundfish.

*Monitoring Commercial Landings*

Sorting requirements for monitoring programs are in place for all groundfish species and species groups with IFQs, trip limits, harvest guidelines, or ACLs, including all overfished species. This provides accounting for the weight of landed overfished 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, duration of trawl tows, and the total catch by species market category (i.e., those species and complexes with sorting requirements). Landings are recorded on state fish receiving tickets. Fish tickets are designed by the individual states, and the Pacific States Marine Fisheries Commission (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 fish tickets. Landings are also sampled in port by state personnel to collect species composition data, otoliths for ageing, lengths, and other biological data. Fish ticket landings, logbook data, and state port sampling data are reported as the season progresses to the regional commercial catch monitoring database and the Pacific Fisheries Information Network (PacFIN), managed by PSMFC (www.psmfc.org/pacfin/index.html).

The Groundfish Management Team (GMT—advisory body to the PFMC) and PSMFC manage the Quota Species Monitoring (QSM) dataset reported in PacFIN for the purpose of informing in-season management. All landings of groundfish stocks of concern (e.g., overfished stocks), 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 in-season management measures to the PFMC to attain, but not exceed, total ACLs of QSM species. Stock and complex landing limits are modified in-season 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*

There are two Federal observer programs that collect information aboard groundfish vessels on the U.S. 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, and the 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 the National Oceanic and Atmospheric Administration's (NOAA) Alaska Fishery Science Center. NMFS made observer coverage mandatory for at-sea processors in July 2004 (65 Fed. Reg. 31751). The At-Sea Hake Observer Program (A-SHOP), now at NOAA's NWFSC, places fishery observers on all vessels that process Pacific hake at sea. The at-sea hake sector consists of 8 to 14 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 must have 100 percent observer coverage as well. At-sea hake observers monitor and record catch data in accordance with protocols detailed in the A-SHOP manual available online at
http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observer_manuals.cfm.

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*

Non-hake groundfish sectors are observed by the West Coast Groundfish Observer Program (WCGOP), which was established in May 2001 by NMFS in accordance with the Pacific Fishery Management Plan (50 CFR Part 660) (50 Fed. Reg. 20609). The FMP and implementing regulations require that all vessels that catch groundfish in the U.S. EEZ from 3 to 200 miles offshore carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has required commercial fishing vessels in state waters to carry Federal fishery observers when asked, thus extending NMFS' ability to require that vessels which only fish in the 0 to 3 mile state territorial zone, also carry observers. WCGOP observers are stationed along the U.S. 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 U.S. West Coast (Table 5). Originally, the WCGOP focused observer effort in the LE bottom trawl and LE fixed gear sectors. In 2002, the WCGOP began deploying observers in OA 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 percent 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 percent under the catch share management structure with IFQs. An observer coverage plan from the WCGOP is available at
http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observer_manuals.cfm.

Additionally, the NWFSC 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 that describe the analysis of observer data for various fishery sectors and species collected under the program (Tables 5 to 8). These reports and background materials on the WCGOP are available on the Northwest Fisheries Science Center website at
http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observer_manuals.cfm.

Table 5. Total trips, tows, vessels and groundfish landings observed in the limited entry groundfish bottom trawl fishery. Coverage rates are computed as the observed proportion of total FMP groundfish landings (excluding Pacific hake), summarized from fish ticket landing receipts. See http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm#coverage-rates for more detailed information.

| **Coastwide Total** | | | | | | |
|---|---|---|---|---|---|---|
| **Year** | **Observed** | | | | **Fleet Total** | **Coverage Rate** |
| | # of trips | # of tows | # of vessels | Groundfish landings (mt) | Groundfish landings (mt) | % landings observed |
| 2002 | 559 | 3127 | 131 | 2583.7 | 20231.6 | 13% |
| 2003 | 461 | 2284 | 125 | 2592.0 | 18625.6 | 14% |
| 2004 | 613 | 3433 | 103 | 4300.7 | 17796.8 | 24% |
| 2005 | 522 | 3460 | 105 | 4243.2 | 19372.6 | 22% |
| 2006 | 476 | 2972 | 87 | 3438.4 | 17876.8 | 19% |
| 2007 | 371 | 2515 | 88 | 3442.1 | 20513.6 | 17% |
| 2008 | 438 | 3185 | 100 | 4889.6 | 24212.4 | 20% |
| 2009 | 588 | 4381 | 101 | 6044.9 | 26159.5 | 23% |
| 2010 | 348 | 2616 | 84 | 4100.3 | 22410.2 | 18% |

Table 6. Total trips, tows, vessels, and sablefish and groundfish landings observed in the limited entry sablefish-endorsed fixed gear groundfish fishery during the primary season. Coverage rates are computed as the observed proportion of total sablefish or groundfish landings, summarized from fish ticket landing receipts. See http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm#coverage-rates for more detailed information.

| Coastwide Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Observed** | | | | | **Fleet Total** | | **Coverage Rate** | |
| | # of trips | # of tows | # of vessels | Sablefish landings (mt) | Groundfish landings (mt) | Sablefish landings (mt) | Groundfish landings (mt) | % Sablefish landings observed | % Groundfish landings observed |
| 2002 | 91 | 638 | 31 | 273.3 | 298.6 | 1064.4 | 1287.0 | 26% | 23% |
| 2003 | 82 | 711 | 20 | 371.2 | 390.1 | 1504.7 | 1639.6 | 25% | 24% |
| 2004 | 58 | 459 | 19 | 261.8 | 272.0 | 1830.5 | 1919.6 | 14% | 14% |
| 2005 | 139 | 1154 | 32 | 762.6 | 813.9 | 1757.2 | 1889.2 | 43% | 43% |
| 2006 | 106 | 757 | 24 | 496.8 | 519.9 | 1855.9 | 1992.0 | 27% | 26% |
| 2007 | 105 | 671 | 26 | 388.6 | 461.4 | 1406.6 | 1563.5 | 28% | 30% |
| 2008 | 101 | 868 | 24 | 574.9 | 599.9 | 1343.9 | 1478.6 | 43% | 41% |
| 2009 | 73 | 354 | 12 | 164.7 | 177.2 | 1843.3 | 1986.6 | 9% | 9% |
| 2010 | 180 | 1068 | 27 | 511.2 | 541.6 | 1792.3 | 1929.9 | 29% | 28% |

Table 7. Total trips, tows, vessels, and sablefish and groundfish landings observed in the limited entry non-sablefish-endorsed fixed gear groundfish fishery. Coverage rates are computed as the observed proportion of total sablefish or groundfish landings, summarized from fish ticket landing receipts. See http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm#coverage-rates for more detailed information.

| **Coastwide Total** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Observed** | | | | | **Fleet Total** | | **Coverage Rate** | |
| | # of trips | # of tows | # of vessels | Sablefish landings (mt) | Groundfish landings (mt) | Sablefish landings (mt) | Groundfish landings (mt) | % Sablefish landings observed | % Groundfish landings observed |
| 2002 | 11 | 22 | 4 | 1.7 | 3.0 | 142.4 | 275.5 | 1% | 1% |
| 2003 | 130 | 219 | 17 | 14.3 | 32.1 | 135.7 | 309.2 | 11% | 10% |
| 2004 | 62 | 130 | 14 | 3.7 | 15.9 | 109.4 | 283.2 | 3% | 6% |
| 2005 | 35 | 60 | 11 | 2.4 | 9.3 | 134.3 | 306.7 | 2% | 3% |
| 2006 | 121 | 196 | 21 | 6.9 | 23.7 | 123.1 | 306.0 | 6% | 8% |
| 2007 | 158 | 303 | 36 | 16.5 | 37.5 | 113.1 | 260.2 | 15% | 14% |
| 2008 | 122 | 220 | 32 | 9.3 | 31.7 | 136.5 | 292.4 | 7% | 11% |
| 2009 | 138 | 271 | 34 | 12.0 | 30.3 | 279.9 | 444.8 | 4% | 7% |
| 2010 | 226 | 470 | 38 | 33.8 | 57.3 | 359.4 | 613.4 | 9% | 9% |

Table 8. Total trips, tows, vessels and sablefish and groundfish landings observed in the open access fixed gear groundfish fishery. Coverage rates are computed as the observed proportion of total sablefish or groundfish landings, summarized from fish ticket landing receipts. See http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm#coverage-rates for more detailed information.

| Coastwide Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Observed** | | | | | **Fleet Total** | | **Coverage Rate** | |
| | # of trips | # of tows | # of vessels | Sablefish landings (mt) | Groundfish landings (mt) | Sablefish landings (mt) | Groundfish landings (mt) | % Sablefish landings observed | % Groundfish landings observed |
| 2002 | | | | | | 358.5 | 433.0 | 0% | 0% |
| 2003 | 57 | 99 | 20 | 10.0 | 19.5 | 517.5 | 647.9 | 2% | 3% |
| 2004 | 136 | 235 | 30 | 24.3 | 33.2 | 419.7 | 562.1 | 6% | 6% |
| 2005 | 77 | 87 | 24 | 17.1 | 20.5 | 855.7 | 919.5 | 2% | 2% |
| 2006 | 48 | 50 | 22 | 10.6 | 12.4 | 736.9 | 825.4 | 1% | 2% |
| 2007 | 95 | 138 | 44 | 18.5 | 19.1 | 417.8 | 442.2 | 4% | 4% |
| 2008 | 111 | 141 | 51 | 23.0 | 26.6 | 517.1 | 570.3 | 4% | 5% |
| 2009 | 93 | 146 | 48 | 25.7 | 30.2 | 921.3 | 983.7 | 3% | 3% |
| 2010 | 105 | 173 | 60 | 30.0 | 33.7 | 990.3 | 1092.0 | 3% | 3% |

*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 Oregon Department of Fish and Wildlife (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 the SHOP 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 fish tickets were a good representation of what was actually landed. Focus shifted again because of 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. 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, and 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 2008, the PFMC and NMFS implemented a monitoring program to maximize 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 to ensure maximized retention of catch at sea. Since the inception of the IFQ Program in January 2011, 100 percent observer coverage has replaced electronic deck monitoring.

## 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 Recreational Fisheries Information Network (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 website at http://www.psmfc.org/Recreational_Fisheries_Information_Network_RecFIN.

*Central California Marine Sport Fish Project*

The California Department of Fish and Game (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, Catch Per Unit Effort (CPUE), mean length, and length frequency. In addition, total catch and effort estimates are based on adjustments of logbook data by sampling information. .

CPFV operators in California 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 to 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 rockfish 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 confidentiality reasons.

In May 1987, the Central California Marine Sport Fish Project began on-board sampling of the CPFV fleet. Angler catches on board central and northern California CPFVs were sampled from 14 ports, ranging from Crescent City in the north to Port San Luis (Avila Beach) in the south. Data collection continued until June 1990, when state budgetary constraints temporarily precluded further sampling; collection resumed in August 1991, and continued through 1994.

*Oregon Marine Recreational Observation Program*

In response to depleted species declarations and increasing concerns about fishery interactions with these species, ODFW started an observation 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 because of their infrequency in the catch. The sampler records locations of fishing sites by handheld GPS 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 Resources Program website at www.dfw.state.or.us/MRP/.

*WDFW Groundfish At-Sea Data Collection Program*

The Washington Department of Fish and Wildlife (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 overfished 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 PFMC 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 mid-water 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.

**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 PFMC 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 overfished 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). In order to avoid depleted species, fleet communication is practiced by all tribal fleets.

## Additional Relevant Data Collection Programs

### *Stranding Network*

Under the Marine Mammal Protection Act (MMPA) of 1972, NMFS' regional marine mammal stranding networks were established in the early 1980s and are composed of cooperating scientific investigators, academic institutions, volunteer individuals and non-government organizations, wildlife and fisheries agencies, and Federal, state, and local enforcement agencies. Network participants are trained in systematic data collection and are experienced in handling a variety of marine mammal stranding related tasks. The regional stranding networks are administered via authority delegated to the regional administrators in each of the six NMFS regions (Northeast, Southeast, Alaska, Northwest, Southwest, and Pacific Islands). The 1992 amendments to the MMPA established the Marine Mammal Health and Stranding Response Program (MMHSRP) and began the systematic compilation of regional stranding data and standardization of stranding response practices on a national level.

Two regional stranding networks operate on the Pacific coast of the continental U.S. The northwest network responds to marine mammal and sea turtle stranding events along the Washington and Oregon coasts, and the southwest network responds to events along the California coast. The stranding networks receive reports of stranding events from the public and respond to investigate and collect standardized data. Coordinators in each region verify and enter the data into a national database to establish baseline information on marine mammal populations and monitor their health. The reporting form containing prompts for standardized data collection is accessible online at http://www.nmfs.noaa.gov/pr/pdfs/health/levela.pdf. These standardized data include evidence of human interaction, such as signs of fishery interaction or boat collision. Where there are findings of human interaction, an additional report is generated that includes more details about the observations that support the determination of the specific interaction type.

For data quality control, specific reporting protocols have been developed for use by the networks and regional coordinators. The collection of stranding data in the field is strongly influenced by the condition of the remains when examined as well as environmental factors such as severe weather or tidal fluctuation at the exam location. These factors can obscure the detection of human interaction evidence, thus affecting the confidence in a human interaction determination. To assist with data interpretation, the MMHSRP protocols assign four confidence levels to the field data: 1) unconfirmed – low; 2) confirmed – minimum; 3) confirmed – medium; and 4) confirmed – high. Confirmed reports are used to inform the periodic updates to marine mammal stock assessment reports and annual modifications to the MMPA list of fisheries.

NMFS is completing policy development for analyzing and using marine mammal/human interaction data in stock assessment reports and list of fisheries decisions. Regional fisheries science centers compile information on marine mammal/human interactions from a variety of sources, including reports from regional stranding coordinators, fisher self reports, fisheries observer data, and other reports from the field. Although the publication of stock assessment reports and list of fisheries decisions are periodic (annual or semi-annual), the compilation of data from the various sources, including regional stranding data, may lag behind the current reporting cycle by up to two years.

**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 catch limits 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) enhance, rather than replace, 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, that includes satellite tracking of vessel positions and a declaration system for those vessels legally fishing within a rockfish conservation area (RCA). VMS were initially implemented on January 1, 2004, and is currently required on all vessels participating in the groundfish fishery with an LE permit. In November 2005, the PFMC 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 to Federal waters. Additionally, to enhance enforcement of closed areas for the protection of groundfish EFH, the PFMC 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.

Detailed descriptions of VMS and the analyses of VMS monitoring alternatives are contained in an Environmental Assessment under the National Environmental Policy Act (NEPA) prepared by NMFS and were presented to the PFMC in support of decisions to first implement and later expand the VMS monitoring program (NMFS 2007). Additional information on VMS, including links to the supporting NEPA documentation, can be found on the PFMC web site at www.pcouncil.org/groundfish/gfvms.html#info.

**Anticipated Fishing Effort Changes**

Most of our information on interactions between the PCGF and ESA-listed species has been obtained over the period from 2002–2010, corresponding to initiation of Federal observer programs (see above). Our assessment of likely fishing effort in 2012 is based on an analysis of fishing effort from 2002–2010 and a preliminary assessment of how that effort has changed in response to the new trawl catch shares program. These changes are analyzed in a March 2012 report titled *West Coast Groundfish IFQ Fishery Catch Summary for 2011: First Look* (Matson 2012). Early results from this monitoring effort are discussed below under Regulatory Induced Effort Shifts. NMFS and the PFMC will continue to monitor and report on fishing effort and we will use that information in future consultations on the continuation of the proposed management regime or any new proposed management regimes.

Regulatory Induced Effort Shifts

NMFS and the PFMC 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. Although this program was implemented in 2011 and the fishery monitored, we have just begun to analyze the first year of monitoring data to inform the present consultation. As more data are collected and analyzed, we will have a better ability to quantify change. During the first year of IFQ management, fishing effort in the IFQ sector was slightly different than past effort in the predecessor fisheries, with about 9 percent more pot/trap effort and about 14 percent less trawl effort than in previous years (estimated from Figure 14 of Matson 2012). These estimates were derived using counts of landing receipts as a proxy for trips.

The trawl rationalization program is a limited access privilege program designed to reduce capacity and improve the management, accountability, and 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 PFMC'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 and 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 percent to 66 percent; 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 to 2005. This time period is recent enough that we do not expect significant changes to the exposure of listed species. There are three exceptions: starry flounder, "other flatfish," and chilipepper rockfish south of 40º10'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. As described above, NMFS is actively monitoring changes in the fishery that result from the trawl rationalization program. NMFS has produced some early results that indicate slight changes (see Regulatory Induced Effort Shifts) and will continue to produce reports that will inform future consideration of the effects of operation of the PCGF on ESA-listed species and critical habitat.

*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 (PFMC and NMFS 2010); 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 40º10'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 future ESA consultations on the fishery.

*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 PFMC recommended the years 1994 to 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 LE 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 PFMC 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

PFMC to use control dates in the future. The recommended range of years from 1994 to 2003 would include fishing patterns 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 may consolidate effort in areas with high relative catch rates (Toft et al. 2011). The monitoring and data collection programs described above will document any changes.

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 the past. The magnitude of this deviation is not predictable; however, NMFS and the PFMC actively monitor fishing effort and produce periodic reports that will be available as the ESA consultation process unfolds.

## 1.4 Action Area

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the Pacific Coast Groundfish Fishery the action area includes the EEZ and state waters of the Pacific Ocean. As discussed in the description of the proposed action, the state-managed groundfish fisheries are not interrelated to, or interdependent with, the proposed action. However, vessels participating in federally-managed fisheries transit through state waters and land fish within the coastal states. Thus, some effects of the federally-managed groundfish fishery occur in state waters.

Figure 2 above shows the area where fishing has occurred from 2002 through 2010, and where we anticipate the direct effects to the ESA-listed species are most likely to occur (distribution for each species is identified in the respective status sections). It is reasonable to expect that future fishing will occur in the same areas because they are areas where the target fish are known to occur. The geographic range of many species evaluated extends beyond the spatial extent of fishing effort (i.e., the range of green sturgeon extends from Ensenada to the Bering Sea). Indirect effects may occur anywhere that trophic effects to prey availability may occur, which may slightly extend the action area beyond the EEZ; therefore, the action area extends slightly beyond the EEZ.

## 2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS), NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service(s) provide an opinion stating how the agencies' actions will affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

### 2.1 Approach to the Analysis

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[4]

We will use the following approach to determine whether the proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the effects of the environmental baseline in the action area.
- Analyze the effects of the proposed actions on both species and habitat.
- Describe any anticipated cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

[4] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

NMFS has determined that the proposed fishing is likely to adversely affect eulachon, green sturgeon, humpback whales, Steller sea lions, leatherback sea turtles, and critical habitat of green sturgeon and leatherback sea turtles. (As mentioned above, Pacific salmon and steelhead are the subject of separate consultations on the proposed fishery.) The jeopardy and adverse modification analyses for these species and critical habitats below include review of the status of the species and critical habitat, description of the environmental baseline in the action area, the effects of the action (direct, indirect, and cumulative), integration and synthesis of the effects considering the baseline, and conclusions. NMFS provides not likely to adversely affect determinations for the following species and designated critical habitat in Section 2.11: blue whales, fin whales, Northern Pacific right whales, Southern Resident killer whales and their designated critical habitat, sperm whales, sei whales, green sea turtles, olive ridley sea turtles, loggerhead sea turtles, and designated critical habitat of Steller sea lions.

## 2.2 Rangewide Status of the Species and Critical Habitat

This section describes the current status of each listed species and its critical habitat. One factor affecting the status of aquatic species and habitat is climate change. Physical changes associated with warming include increases in ocean temperature, increased stratification of the water column, and changes in the intensity and timing of coastal upwelling. These changes will alter primary and secondary productivity and the structure of marine communities (ISAB 2007).

### 2.2.1 Status of Listed Species

In evaluating the status of a listed species, we consider information relevant to the criteria in our regulations at 50 CFR 402.02, defining “jeopardize the continued existence of.” The regulation refers to actions that reduce “the reproduction, numbers, or distribution” of a species. We also consider information from status reviews and, where available, recovery plan documents. We describe the factors limiting recovery of the species to provide context for assessing the impacts of the proposed action.

#### 2.2.1.1 Status of Eulachon

On March 16, 2010, NMFS listed the Southern Distinct Population Segment (DPS) of eulachon (hereafter, “eulachon”) as a threatened species (75 Fed. Reg. 13012). This DPS encompasses all populations within the states of Washington, Oregon, and California and extends from the Skeena River in British Columbia south to the Mad River in Northern California (inclusive).

In May of 2011, the Committee on the Status for Endangered Wildlife in Canada (COSEWIC) released their assessment and status report for eulachon in Canada. COSEWIC divided the Canadian portion of the U.S.-designated Southern DPS into three designatable units (DUs): Nass/Skeena Rivers population, Central Pacific Coast population, and Fraser River population (COSEWIC 2011a). DUs are discrete evolutionarily significant units (ESU), where “significant” means that the unit is important to the evolutionary legacy of the species as a whole and if lost would likely not be replaced through natural dispersion (COSEWIC 2009). Thus, DUs are biologically similar to ESU and DPS designations under the ESA. The Fraser River population (the closest Canadian population to the conterminous U.S.) and was assessed as endangered by

COSEWIC, and the listing decision for the Species at Risk Act (SARA) registry is currently scheduled for 2014 or later (COSEWIC 2011b).

Eulachon are endemic to the northeastern Pacific Ocean; they range from northern California to southwest and south-central Alaska and into the southeastern Bering Sea. Puget Sound lies between two of the larger eulachon spawning rivers (the Columbia and Fraser Rivers) but lacks a regular eulachon run of its own (Gustafson et al. 2010). Within the conterminous U.S., most eulachon production originates in the Columbia River Basin and the major and most consistent spawning runs return to the Columbia River mainstem and Cowlitz River. Adult eulachon have been found at several Washington and Oregon coastal locations, and they were previously common in Oregon's Umpqua River and the Klamath River in northern California. Runs occasionally occur in many other rivers and streams but often erratically, appearing some years but not in others and only rarely in some river systems (Hay and McCarter 2000; Willson et al. 2006; Gustafson et al. 2010). Since 2005, eulachon in spawning condition have been observed nearly every year in the Elwha River by Lower Elwha Tribe fishery biologists (NMFS 2011e). The Elwha is the only river in the U.S. portion of Puget Sound and the Strait of Juan de Fuca that supports a consistent eulachon run.

Eulachon generally spawn in rivers fed by either glaciers or snowpack and that experience spring freshets. Because these freshets rapidly move eulachon eggs and larvae to estuaries, it is believed that eulachon imprint and home to an estuary into which several rivers drain rather than individual spawning rivers (Hay and McCarter 2000). From December to May, eulachon typically enter the Columbia River system with peak entry and spawning during February and March (Gustafson et al. 2010). They spawn in the lower Columbia River mainstem and multiple tributaries of the lower Columbia River.

Eulachon eggs, averaging 0.04 inch (1 mm) in size, are commonly found attached to sand or pea-sized gravel, though eggs have been found on a variety of substrates, including silt, gravel-to-cobble sized rock, and organic detritus (Smith and Saalfeld 1955; Langer et al. 1977; Lewis et al. 2002). Eggs found in areas of silt or organic debris reportedly suffer much higher mortality than those found in sand or gravel (Langer et al. 1977). Length of incubation ranges from about 28 days in 4 to 5°C waters to 21 to 25 days in 8°C waters. Upon hatching, stream currents rapidly carry the newly hatched larvae, 0.16 to 0.31 inch (4 to 8 mm) in length, to the sea. Young larvae are first found in the estuaries of known spawning rivers and then disperse along the coast. After yolk sac depletion, eulachon larvae acquire characteristics to survive in oceanic conditions and move off into open marine environments as juveniles. Eulachon return to their spawning river at ages ranging from 2 to 5 years as a single age class. Prior to entering their spawning rivers, eulachon hold in brackish waters while their bodies undergo physiological changes in preparation for fresh water and to synchronize their runs. Eulachon then enter the rivers, move upstream, spawn, and die to complete their semelparous life cycle (spawn once and die) (COSEWIC 2011a).

Adult eulachon weigh an average of 1.41 ounces (40 g) each and are 6 to 8 inches (15 to 20 cm) long with a maximum recorded length of 11.8 inches (30 cm). They are an important link in the food chain between zooplankton and larger organisms. Small salmon, lingcod, white sturgeon, and other fish feed on small larvae near river mouths. As eulachon mature, a wide variety of predators consume them (Gustafson et al. 2010).

No recovery plan for eulachon has been drafted.

Spatial Structure and Diversity

There are no distinct differences among eulachon throughout the range of the southern DPS. However, the eulachon Biological Review Team (BRT) did separate the DPS into four subpopulations in order to rank the threats they face. These are the Klamath River (including the Mad River and Redwood Creek), the Columbia River (including all of its tributaries), the Fraser River, and the British Columbia coastal rivers (north of the Fraser River up to, and including, the Skeena River). Eulachon population structure has not been analyzed below the DPS level. The COSEWIC assessed eulachon populations in Canada and designated them with the following statuses: Nass/Skeena Rivers population (threatened), Central Pacific population (endangered), and Fraser River population (endangered) (COSEWIC 2011a).

The southern DPS of eulachon are distinguished from eulachon occurring north of the DPS range by a number of factors including genetic characteristics. Significant microsatellite DNA variation in eulachon has been reported from the Columbia River to Cook Inlet, Alaska (Beacham et al. 2005). Within the range of the southern DPS, Beacham et al. (2005) found genetic affinities among the populations in the Fraser, Columbia, and Cowlitz rivers and also among the Kemano, Klinaklini, and Bella Coola rivers along the central British Columbia coast. In particular, there was evidence of a genetic discontinuity north of the Fraser River, with Fraser and Columbia/Cowlitz samples diverging three to six times more from samples further to the north than they did from each other. Similar to the study of McLean et al. (1999), Beacham et al. (2005) found that genetic differentiation among populations was correlated with geographic distances. The authors also suggested that the pattern of eulachon differentiation was similar to that typically found in studies of marine fish, but less than that observed in most salmon species.

The BRT was concerned about risks to eulachon diversity because of its semelparity and data suggesting that Columbia and Fraser River spawning stocks may be limited to a single age class. These characteristics likely increase their vulnerability to environmental catastrophes and perturbations and provide less of a buffer against year-class failure than species such as herring that spawn repeatedly and have variable ages at maturity (Gustafson et al. 2010).

Abundance and Productivity

Eulachon are a short-lived, high-fecundity, high-mortality forage fish; and such species typically have extremely large population sizes. Fecundity estimates range from 7,000 to 60,000 eggs per female with egg to larva survival likely less than 1 percent (Gustafson et al. 2010). Among such marine species, high fecundity and mortality conditions may lead to random “sweepstake recruitment” events where only a small minority of spawning individuals contribute to subsequent generations (Hedgecock 1994).

Few direct estimates of eulachon abundance exist. Escapement counts and spawning stock biomass estimates are only available for a small number of systems. Catch statistics from commercial and tribal fisheries are available for some systems in which no direct estimates of abundance are available. However, inferring population status or even trends from yearly catch statistic changes requires making certain assumptions that are difficult to corroborate (e.g., assuming that harvest effort and efficiency are similar from year to year, assuming a consistent relationship among the harvested and total stock portion, and certain statistical assumptions, such as random sampling). Unfortunately, these assumptions cannot be verified, few fishery-independent sources of eulachon abundance data exist, and in the United States, eulachon monitoring programs just started in 2011. However, the combination of catch records and anecdotal information indicates that there were large eulachon runs in the past and that eulachon populations have severely declined. As a result, eulachon numbers are at, or near, historically low levels throughout the range of the southern DPS.

Similar abundance declines have occurred in the Fraser and other coastal British Columbia rivers (Hay and McCarter 2000; Moody 2008). Over a three-generation span of 10 years (1999 to 2009), the overall Fraser River eulachon population biomass has declined by nearly 97 percent (Gustafson et al. 2010). In 1999, the biomass estimates were 418 metric tons[5], and by 2010 had dropped to just 4 metric tons (Table 9). Abundance information is lacking for many coastal British Columbia subpopulations, but Gustafson et al. (2010) found that eulachon runs were universally larger in the past. Furthermore, the BRT was concerned that four out of seven coastal British Columbia subpopulations may be at risk of extirpation as a result of small population concerns such as Allee[6] effects and random genetic and demographic effects (Gustafson et al. 2010).

Under SARA, Canada designated the Fraser River population as endangered in May 2011 because of a 98 percent decline in spawning stock biomass over the previous 10 years (COSEWIC 2011a). From 2008 through 2012, the Fraser River eulachon population is estimated at 458,750 adults (Table 9). However, this estimate does not include the larger Columbia River spawning run or any other spawning runs and is therefore likely to be several times smaller than the actual eulachon abundance for the DPS.

The Columbia River and its tributaries support the largest known eulachon run. Although direct estimates of adult spawning stock abundance are unavailable, commercial fishery landing records begin in 1888 and continue as a nearly uninterrupted data set to 2010 (Gustafson et al. 2010). From about 1915 to 1992, historic commercial catch levels were typically more than 500 metric tons, occasionally exceeding 1,000 metric tons. In 1993, eulachon catch levels began to decline and averaged less than 5 metric tons from 2005 to 2008 (Gustafson et al. 2010). Persistent low eulachon returns and landings in the Columbia River from 1993 to 2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan (WDFW and ODFW 2001). All recreational and commercial fisheries for eulachon were closed in Washington and Oregon in 2011. Beginning in 2011, ODFW and WDFW began eulachon biomass surveys similar to those conducted on the Fraser River (Table 10). Only one year's data has been collected and analyzed, so the estimated spawner population of 19.0 million eulachon should be viewed cautiously. Many of the calculations and assumptions are based upon what has been observed in the Fraser River, in which the eulachon population has different characteristics, such as a skewed sex ratio for the Columbia River (ODFW 2012). Further, the 2011 Fraser River eulachon run was the second largest since 2004, and the trends observed in the Fraser River have also been observed in the Columbia River (Gustafson et al. 2010). Therefore, it may be assumed

[5] The U.S. ton is equivalent to 2,000 pounds and the metric ton is equivalent to 2,204 pounds.
[6] The negative population growth observed at low population densities. Reproduction—finding a mate in particular—for migratory species can be increasingly difficult as the population density decreases.

that the 2011 Columbia River eulachon run was larger than the 5-year geometric mean would be if we had return data for those previous 4 years.

Table 9. Eulachon spawning estimates for the lower Fraser River, British Columbia.

| Year | Eulachon smelt plankton (eggs and larvae – billions) | Biomass estimate (metric tons) | Estimated spawner population[a] |
|---|---|---|---|
| 1995 | 105.90 | 302 | 7,550,000 |
| 1996 | 671.00 | 1,911 | 47,775,000 |
| 1997 | 25.74 | 74 | 1,850,000 |
| 1998 | 47.50 | 136 | 3,400,000 |
| 1999 | 146.96 | 418 | 10,450,000 |
| 2000 | 45.70 | 130 | 3,250,000 |
| 2001 | 213.30 | 609 | 15,225,000 |
| 2002 | 171.90 | 494 | 12,350,000 |
| 2003 | 93.00 | 266 | 6,650,000 |
| 2004 | 11.65 | 33 | 825,000 |
| 2005 | 5.55 | 16 | 400,000 |
| 2006 | 10.24 | 29 | 725,000 |
| 2007 | 14.27 | 41 | 1,025,000 |
| 2008 | 3.38 | 10 | 250,000 |
| 2009 | 4.94 | 14 | 350,000 |
| 2010 | 1.35 | 4 | 100,000 |
| 2011 | 10.98 | 31 | 775,000 |
| 2012 | 41.90 | 120 | 3,000,000 |
| **2008-2012[b]** | **6.36** | **18.35** | **458,750** |

[a] Estimated population numbers are calculated as 25,000 adults/metric ton (eulachon average 40g per adult).
[b] Five-year geometric mean of eulachon biomass estimates (2008-2012).
Source: http://www.pac.dfo-mpo.gc.ca/science/species-especes/pelagic-pelagique/herring-hareng/herspawn/pages/river1-eng.htm

In Northern California, no long-term eulachon monitoring programs exist. In the Klamath River, large eulachon spawning aggregations once regularly occurred, but eulachon abundance has declined substantially (Fry 1979; Moyle et al. 1995; Larson and Belchik 1998; Moyle 2002; Hamilton et al. 2005). Recent reports from Yurok tribal fisheries biologists mentioned only a few eulachon captured incidentally in other fisheries.

Table 10. Eulachon spawning estimates for the lower Columbia River (pers. comm. O. Langness, WDFW, Sept 20, 2012 ).

| Year | Eulachon smelt plankton (eggs and larvae – billions) | Estimated spawner population[a] |
|---|---|---|
| 2011 | 280.00 | 19,013,989 |

[a] Estimated spawner population numbers are calculated by estimating the number of eggs per female as 29,452 with a sex ratio of 1:1 M:F.

Limiting Factors

*Climate Change*

Scientific evidence strongly suggests that global climate change is already altering marine ecosystems from the tropics to polar seas. Physical changes associated with warming include increases in ocean temperature, increased stratification of the water column, and changes in the intensity and timing of coastal upwelling. These changes will alter primary and secondary productivity and the structure of marine communities (ISAB 2007).

Climate change impacts on ocean habitat are the most serious threat to persistence of the southern DPS of eulachon (Gustafson et al. 2010). Changing ocean conditions in the Pacific Northwest that are caused by global climate change present an unclear, yet potentially severe threat to eulachon survival and recovery. Increases in ocean temperatures have already occurred and will likely continue to impact eulachon and their habitats. In the marine environment, eulachon rely upon cool or cold ocean regions and the pelagic invertebrate communities therein (Willson et al. 2006). Warming ocean temperatures will likely alter these communities, making it more difficult for eulachon and their larvae to locate or capture prey (Roemmich and McGowan 1995; Zamon and Welch 2005). Warmer waters could also allow for the northward expansion of eulachon predator and competitor ranges, increasing the already high predation pressure on the species (Rexstad and Pikitch 1986; McFarlane et al. 2000; Phillips et al. 2007).

Climate change along the entire Pacific Coast is expected to affect fresh water as well. Changes in hydrologic patterns may pose challenges to eulachon spawning because of decreased snowpack, increased peak flows, decreased base flow, changes in the timing and intensity of stream flows, and increased water temperatures (Morrison et al. 2002). In most rivers, eulachon typically spawn well before the spring freshet, near the seasonal flow minimum. This strategy typically results in egg hatch coinciding with peak spring river discharge. The expected alteration in stream flow timing may cause eulachon to spawn earlier or be flushed out of spawning rivers at an earlier date. Early emigration may result in a mismatch between entry of larval eulachon into the ocean and coastal upwelling, which could have a negative impact on marine survival of eulachon during this critical transition period (Gustafson et al. 2010).

*Commercial and Recreational Harvest*

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In the past, commercial and recreational harvests likely contributed to eulachon decline. The best available information for catches comes from the Columbia River, where from 1938 to 1993 landings have averaged almost 2 million pounds per year (approximately 24.6 million fish), and have been as high as 5.7 million pounds in a single year (approximately 70 million fish) (Wydoski and Whitney 2003, Gustafson et al. 2010). Between 1994 and 2010, no catch exceeded one million pounds (approximately 12.3 million fish) annually and the median catch was approximately 43,000 pounds (approximately 529,000 fish), which amounts to a 97.7 percent reduction in catch (WDFW and ODFW 2001; JCRMS 2011). Catch from recreational eulachon fisheries was also high historically (Wydoski and Whitney 2003), and at its height in popularity, the fishery would draw thousands of participants annually. Currently, commercial and recreational harvest of eulachon is prohibited in both Washington and Oregon.

In British Columbia, the Fraser River supports the only commercial eulachon fishery that is within the range of the southern DPS. This fishery has been essentially closed since 1997, only opening briefly in 2002 and 2004 when only minor catches were landed (DFO 2008).

*Shrimp Fishery Bycatch*

Historically, bycatch of eulachon in the pink shrimp fishery along the U.S. and Canadian coasts has been very high (composing up to 28 percent of the total catch by weight) (Hay and McCarter 2000; DFO 2008). Prior to the mandated use of bycatch-reduction devices (BRDs) in the pink shrimp fishery, 32 to61 percent of the total catch in the pink shrimp fishery consisted of non-shrimp biomass, made up mostly of Pacific hake, various species of smelt including Pacific eulachon, yellowtail rockfish, sablefish, and lingcod (*Ophiodon elongatus*) (Hannah and Jones 2007). Reducing bycatch in this fishery has long been an active field of research (Hannah et al. 2003; Hannah and Jones 2007; Frimodig 2008) and great progress has been made in reducing bycatch. As of 2005, following required implementation of BRDs, the total bycatch by weight had been reduced to about 7.5 percent of the total catch, and osmerid smelt bycatch was reduced to an estimated average of 0.73 percent of the total catch across all BRD types (Hannah and Jones 2007). Despite this reduction, bycatch of eulachon in these fisheries is still significant. The total estimated bycatch of eulachon in the Oregon and California pink shrimp fisheries ranged from 217,841 fish in 2004 to 1,008,260 fish in 2010 (the most recent year that data is available) (Al-Humaidhi et al. 2012).

*Other Factors*

Hydroelectric dams block access to historical eulachon spawning grounds and affect the quality of spawning substrates through flow management, altered delivery of coarse sediments, and siltation. Dredging activities during the eulachon spawning run may entrain and kill adult and larval fish, and eggs. Eulachon carry high levels of pollutants – arsenic, lead, mercury, DDE, 9H-fluorene, and phenanthrene (EPA 2002), and although it has not been demonstrated that high contaminant loads in eulachon have increased mortality or reduced reproductive success, such effects have been shown in other fish species (Kime 1995). The negative effects of these factors on the species and its habitat contributed to the determination to list the southern DPS of Pacific eulachon under the ESA.

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#### 2.2.1.2 Status of Green Sturgeon

NMFS listed the Southern DPS of North American green sturgeon (Southern DPS green sturgeon) as threatened under the ESA in 2006 (71 Fed. Reg. 17757, April 7, 2006). In this section, we summarize information on the status of Southern DPS green sturgeon throughout its range. We present information taken from the NWFSC's (2012) risk assessment on the effects of the Pacific Coast Groundfish Fishery on threatened and endangered marine species and from recent regulatory documents and reports, including the green sturgeon ESA 4(d) rule and supporting documents (75 Fed. Reg. 30714, June 2, 2010; NMFS 2010a), the final biological report prepared for the critical habitat designation (NMFS 2009a), the most recent status review (Biological Review Team 2005), and the recovery plan outline (NMFS 2010b), as well as data that became available more recently. The best available information indicates that Southern DPS green sturgeon are at moderate to high risk of extinction because of low estimated adult abundance and restriction of spawning to one segment of the mainstem Sacramento River and lower Feather River (only a portion of the species' potential historical spawning habitat), which have likely also compromised the productivity and diversity of this species. The limited information available on the population's historical and current abundance, spatial structure, productivity, and diversity hinders our ability to accurately assess its viability.

<u>Description and Geographic Range</u>

The green sturgeon is an anadromous, long-lived, and bottom-oriented (demersal) fish species in the family Acipenseridae. Sturgeon have skeletons composed mostly of cartilage and lack scales, instead possessing five rows of characteristic bony plates on their body called "scutes." On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. The maximum age of adult green sturgeon is likely to range from 60 to 70 years, and adults may exceed 6.56 feet (2 m) in length and 198.42 pounds (90 kg) in weight.

Based on genetic analyses and spawning site fidelity (Adams et al. 2002; Israel et al. 2004), NMFS determined that green sturgeon comprises at least two DPSs: a northern DPS consisting of populations originating from coastal watersheds northward of and including the Eel River ("Northern DPS green sturgeon"), with spawning confirmed in the Klamath and Rogue River systems; and a southern DPS consisting of populations originating from coastal watersheds south of the Eel River ("Southern DPS green sturgeon"), with spawning confirmed in the Sacramento River system. In 2006, NMFS listed the Southern DPS green sturgeon as threatened under the ESA, but determined that ESA listing for Northern DPS green sturgeon was not warranted, maintaining the Northern DPS on the NMFS Species of Concern list instead. Because the ESA-listed entity (Southern DPS green sturgeon) and non-ESA listed entity (Northern DPS green sturgeon) co-occur throughout much of their range, most of the information presented here is general to green sturgeon. Where available, we provide information specific to Southern DPS green sturgeon.

Green sturgeon range from the Bering Sea, Alaska, to Ensenada, Mexico, and use a diversity of habitat types at different life stages. Adults spawn in the mainstem of large rivers during the spring (peaking May-June) every 2 to 4 years (Erickson and Webb 2007). They lay their eggs in turbulent areas of high velocity on the river bottom during the spring and the eggs settle into the interstitial spaces between cobble and gravel (Adams et al. 2007). Eggs hatch after 6 to 8 days, and larval feeding begins 10 to 15 days post-hatch; larval development is completed within 45 days at 2.36 to 3.15 inches (60 to 80 mm) total length (TL) (Beamesderfer et al. 2007). After rearing in fresh water or the estuary of their natal river for 1 to 4 years, juvenile green sturgeon transition to the subadult stage and move from estuarine waters into coastal waters.

Green sturgeon are one of the most marine-oriented and widely distributed of the sturgeons. Subadult green sturgeon (sexually immature fish that have entered coastal marine waters) spend several years at sea before reaching reproductive maturity and returning to fresh water to spawn for the first time (Nakamoto et al. 1995). After migrating out of their natal rivers, subadult green sturgeon move between coastal waters and various estuaries along the U.S. West Coast between San Francisco Bay, California, and Grays Harbor, Washington (Lindley et al. 2008; Lindley et al. 2011). Migration patterns differ among individuals within and among populations (Lindley et al. 2011). Green sturgeon form dense aggregations in multiple rivers and estuaries (e.g., lower Columbia River estuary, Willapa Bay, Grays Harbor) during summer months (Moser and Lindley 2007). Winter months are generally spent in the coastal ocean, with many green sturgeon migrating to northern waters in the fall. Areas north of Vancouver Island are favored overwintering areas, with Queen Charlotte Sound and Hecate Strait likely destinations based on observed depth and temperature preferences and detections of acoustically-tagged green sturgeon at the northern end of Vancouver Island (Lindley et al. 2008; Nelson et al. 2010). Peak migration rates exceeded 31 miles (50 km) per day during the spring southward migration (Lindley et al. 2008). Mature adults enter their natal river in the spring and typically leave the river during the subsequent autumn when water temperatures drop below 10°C and flows increase (Erickson and Webb 2007). Thereafter, they migrate among the coastal ocean and estuarine habitats before returning again to spawn 2 to 4 years later (Erickson and Webb 2007).

Relatively little is known about how green sturgeon use habitats in the coastal ocean and in estuaries, or the purpose of their episodic aggregations at certain times (Lindley et al. 2008; Lindley et al. 2011). Studies using pop-off archival tags (satellite tags) indicate that, while in the ocean, green sturgeon occur between 0- and 656-foot (0 and 200 m) depths, but spend most of their time between 65.62 to 262.47 feet (20 to 80 m) in water temperatures of 9.5 to 16.0°C (Erickson and Hightower 2007; Huff et al. 2011). They are generally demersal but make occasional forays to surface waters, perhaps to assist their migration (Kelly et al. 2007). Recent telemetry data in coastal ocean habitats suggest that green sturgeon spent a longer duration in areas with high seafloor complexity, especially where a greater proportion of the substrate consists of boulders (Huff et al. 2011). However, while in estuaries where green sturgeon feed over the bottom on benthic invertebrates (Dumbauld et al. 2008), they do not appear to use hard substrates. Preliminary data from feeding pit mapping surveys conducted in Willapa Bay, Washington, showed densities were highest over shallow intertidal mud flats, while harder substrates (e.g., gravel) had no pits (M. Moser, unpublished data). Telemetry data indicates that, in their natal rivers, mature green sturgeon prefer deep pools, presumably for spawning and conserving/restoring energy (Erickson and Webb 2007; Heublein et al. 2009). Similar tracking studies involving juvenile green sturgeon have not been conducted, and their behavior and habitat preferences in rivers and estuaries are largely unknown.

Genetic and acoustic tagging data indicate little migration between spawning areas of the Northern and Southern DPSs, although they co-occur in non-natal marine and estuarine habitats to varying degrees (Israel et al. 2009; Lindley et al. 2011). Southern DPS green sturgeon have been confirmed to occur throughout the coast from Monterey Bay, California, to as far north as Graves Harbor, Alaska (NMFS 2009a). Green sturgeon observed northwest of Graves Harbor, Alaska, and south of Monterey Bay, California, have not been identified as belonging to the Northern DPS or Southern DPS. Genetic analyses indicate that green sturgeon aggregations in the Columbia River estuary and Willapa Bay have a larger proportion of Southern DPS green sturgeon (0.69 to 0.88) than Northern DPS green sturgeon, whereas Grays Harbor has a slightly larger proportion of Northern DPS green sturgeon (0.54 to 0.59) (Israel et al. 2009).

Spatial Structure and Diversity

Although the geographic distribution of Southern DPS green sturgeon is broad, the available spawning habitat is limited. In the final rule to list Southern DPS green sturgeon as threatened under the ESA (71 Fed. Reg. 17757, 7 April 2006), NMFS identified the reduction of spawning habitat to a limited area of the Sacramento River as the principal factor for the species' decline. The final rule described a substantial loss of what was likely historical spawning habitat in the upper Sacramento and upper Feather Rivers (Figure 6), because of the construction of impassable barriers (i.e., Keswick Dam and Oroville Dam) which block access to green sturgeon (USFWS 1995, supported by Mora et al. 2009). The final rule also described how the remaining spawning habitat was impaired. Habitat alterations associated with the impassable barriers (e.g., increased water temperatures and altered flow regimes) and other threats (e.g., impaired water quality because of agricultural runoff) reduced the quality of the remaining spawning habitat within the mainstem Sacramento River and lower Feather River. In addition, seasonal migration barriers limited access to segments of the mainstem Sacramento River and lower Feather River during certain times of the year. For example, the closure of the Red Bluff Diversion Dam's (RBDD) gates for several months each year blocked access to a portion of the spawning habitat during the spawning season. For those green sturgeon that had already migrated upstream of the RBDD, closure of the gates prevented their downstream migration.

Since publication of the final ESA-listing rule, some management changes have occurred that are likely to improve the status of the Southern DPS green sturgeon. After several years of sampling, fertilized green sturgeon eggs were found in the lower Feather River in June 2011 (A. Seesholtz, pers. comm., California Department of Water Resources, June 16, 2011), confirming that Southern DPS green sturgeon spawn in that river. In addition, recent decisions have resulted in improvements to the quality of the habitat in the Sacramento River. In 2012, measures were implemented to keep the RBDD gates open all year, allowing green sturgeon to access spawning habitat in the mainstem Sacramento River upstream to Keswick Dam throughout the spawning season (NMFS 2011a; Bill Poytress pers. comm., U.S. Fish and Wildlife Service, July 20, 2012). Additional measures are being developed to improve fish passage at the Fremont Weir in the Yolo Bypass (where green sturgeon have been stranded in the past) and to manage the storage and release of cold water from the Shasta Reservoir to provide suitable water temperatures for green sturgeon in the Sacramento River (NMFS 2011a). Despite these improvements, however, spawning habitat remains restricted to a limited portion at the lower reaches of the Sacramento and Feather Rivers, much reduced from the species' likely historical spawning habitat. This exposes the Southern DPS green sturgeon to catastrophic events. A single event could affect a large portion or all of the spawning habitat and thus affect a whole year class. Because of spawning periodicity, only a portion of the adult spawning population would be in the river in any one year. However, a single event in one year could affect a large proportion (one-fourth to half) of the adult spawning population.

Recent studies have examined the genetic traits of Southern DPS green sturgeon to allow genetic differentiation from Northern DPS green sturgeon (Israel et al. 2004). However, little is known regarding how current levels of diversity (e.g., genetic, life history) compare with historical levels. The loss and alteration of available spawning habitat has potentially resulted in a reduction in the genetic diversity and diversity of life history traits of this species. This reduction would increase the risk of extinction to the species by limiting the population's ability to withstand short-term environmental changes and to adapt to long-term environmental changes. Based on this information, we conclude that Southern DPS green sturgeon are likely at moderate to high risk of extinction because of potentially reduced genetic and life history diversity.

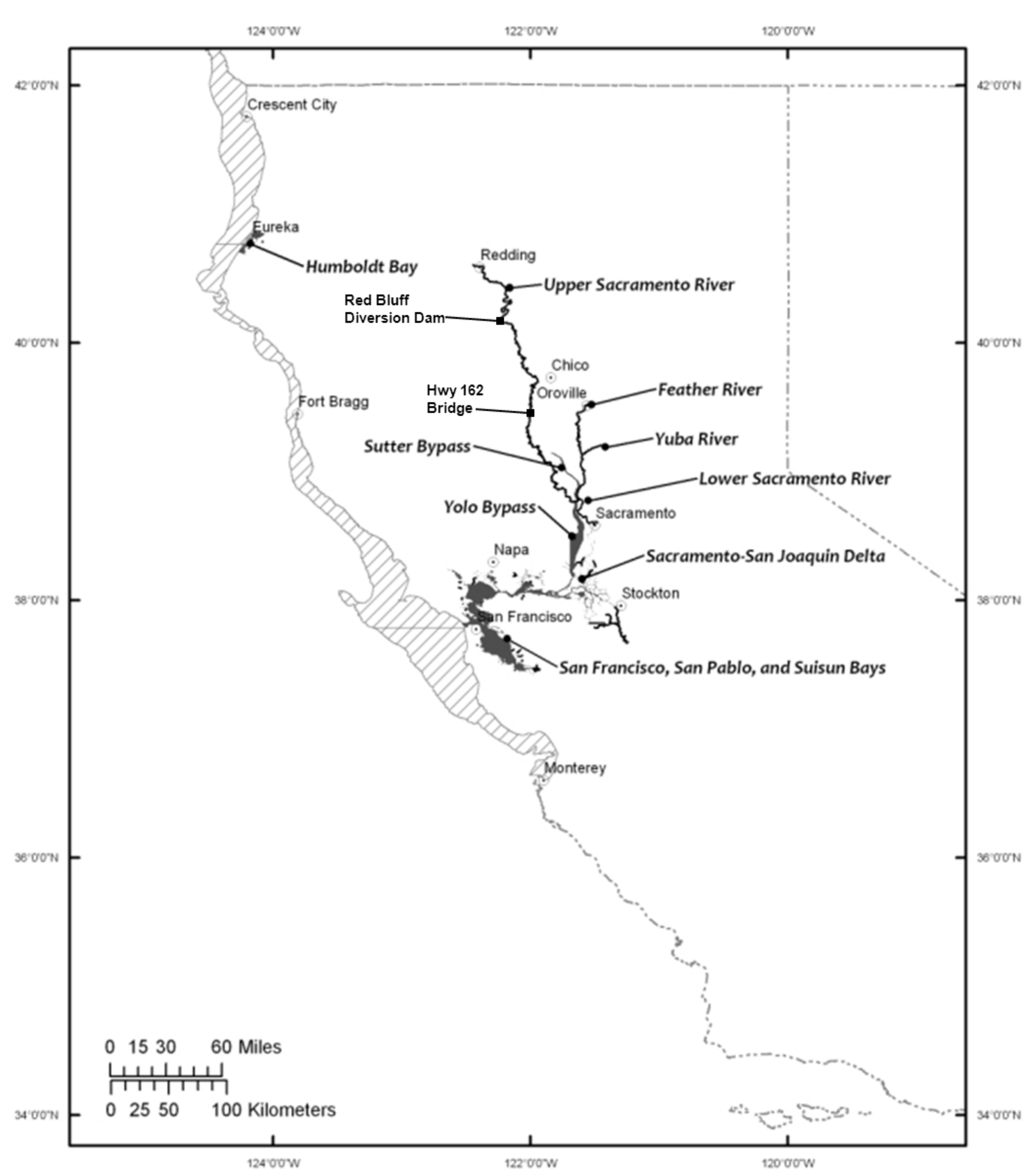


Figure 6. Map of Central Valley, California, depicting the extent of freshwater riverine habitat accessible to Southern DPS green sturgeon in the Sacramento River (upstream to Keswick Dam), the lower Feather River (upstream to Oroville Dam), and the lower Yuba River (upstream to Daguerre Dam).

Abundance and Productivity

To date, little population-level data have been collected for green sturgeon. In particular, there are no published abundance estimates for either Northern DPS or Southern DPS green sturgeon in any of the natal rivers based on survey data (Israel et al. in preparation). As a result, efforts to estimate green sturgeon population size have had to rely on sub-optimal data with known potential biases, including monitoring designed for white sturgeon (*Acipenser transmontanus*) populations, harvest time series, or entrainment from water diversion and export facilities (Adams et al. 2007). However, more recent genetic techniques and monitoring surveys are beginning to clarify questions about green sturgeon population size.

Prior to listing the species under the ESA, little was known about the population size and trends of Southern DPS green sturgeon. Of the available information, only the water diversion data indicated a possible trend, suggesting green sturgeon abundance or recruitment had declined since 1986 in the Sacramento River (Adams et al. 2007). Since the ESA-listing of the species, more studies have been conducted to estimate the population's abundance and trends. Genetic data collected from outmigrating juveniles suggest that the number of adult green sturgeon in the Sacramento River upstream of the RBDD remained roughly constant between 2002 and 2006, with a minimum of 10 to 28 adults successfully spawning in that upstream portion of the river each year (Israel and May 2010). Recently developed surveys using dual frequency identification sonar have estimated 175 to 250 sturgeon (±50) in the mainstem Sacramento River during the spawning season in 2010 and 2011 (Ethan Mora, pers. comm., University of California Davis, January 10, 2012). The estimate does not include the number of spawning adults in the lower Feather River, where green sturgeon spawning was recently confirmed (Alicia Seesholtz, pers. comm., California Department of Water Resources, June 16, 2011). There are many uncertainties regarding these estimates. Although most of the sturgeon observed in the surveys are likely to be green sturgeon, this must be verified by video data because some may be white sturgeon. Also, the movement of individual fish in and out of the area throughout the season remains to be characterized using telemetry data and could affect the estimated number of spawning adults present in the river during the spawning season each year (e.g., if sturgeon move into and out of the area throughout the season, the observed numbers represent minimum estimates of adult sturgeon abundance in the river). Given these uncertainties, caution must be taken in using these estimates to infer the spawning run size for the Sacramento River until further analyses are completed.

To generate a rough population estimate, we assumed that the observations of 175 to 250 sturgeon in the mainstem Sacramento River during the spawning seasons of 2010 and 2011 were observations of Southern DPS green sturgeon adults and are representative of the total spawning run size for those survey years, recognizing that there is great uncertainty associated with using these estimates and that they are incomplete because they do not include fish that are spawning in the lower Feather River. Although most spawning likely occurs in the mainstem Sacramento River, an unknown portion of the population spawns in the lower Feather River and potentially in the lower Yuba River. Data are not available at this time to estimate the number of spawning adults in the lower Feather or lower Yuba Rivers. The adult spawning run each year represents only a portion of the total adult population, because not all adults return to spawn each year. To estimate the size of the total adult and subadult populations, we made the following assumptions: (1) the adult spawning run size ranges from 175 to 250 Southern DPS green sturgeon per year;

(2) the spawning periodicity is 2 to 4 years (Erickson and Webb 2007); and (3) the proportion of juveniles, subadults, and adults in the population is similar to that expected in an equilibrium population (25 percent juveniles, 63 percent subadults, and 12 percent adults) (Beamesderfer et al. 2007). We estimated that the Southern DPS green sturgeon population comprises a total of 350 to 1,000 adults and 1,838 to 5,250 subadults. We also estimated that the total population of juveniles, subadults, and adults combined ranges from 2,917 to 8,333 individuals. Observations from recent years indicate that the total abundance of the adult population may be at the higher end of this estimated range of 350 to 1,000 adults; that is, there may be a total of around 800 to 1,000 adults in the Southern DPS population (Josh Israel, pers. comm., Bureau of Reclaimation, January 9, 2012; David Woodbury, pers. comm., NMFS, January 10, 2012). It follows that the total abundance of the subadult population may also be at the higher end of the estimated range of 1,838 to 5,250 subadults (i.e., a total of around 3,000 to 5,000 subadults in the Southern DPS population).

For Northern DPS green sturgeon, long term population trends from fishery data (note that effort data is absent) indicate that the adult population in the Klamath River is fairly constant, with a few hundred spawning adults typically being harvested annually by tribal fisheries (Adams et al. 2007). Recently, Erickson et al. (unpublished, cited in Israel et al. in preparation) estimated spawning run sizes for the Rogue River ranging from 426 to 734 adult green sturgeon (point estimates) using mark-recapture methods. These studies suggest the population in each Northern DPS river may be represented by around 1,000 to 2,000 adults, considering spawning periodicity is 2 to 4 years (Erickson and Webb 2007). These estimates appear to be inconsistent with harvest data indicating that 200 to 450 Northern DPS green sturgeon were harvested each year in the Klamath River tribal fishery from 1985 to 2003, with no evidence of declining catches (Adams et al. 2007) (refer to Section 2.3, Environmental Baseline below). The inconsistencies may be due to error in the population estimates and/or the fact that the data used to develop the recent population estimates were not collected during the same time period as the tribal harvest data.

Adams et al. (2007) concluded that the abundance of mature green sturgeon in the Southern DPS is smaller than in the Northern DPS. The available data (as summarized above) indicate that this is true, with the population of Southern DPS green sturgeon potentially consisting of 1,000 or fewer adults. However, the absolute and relative abundance of the two DPSs remains highly uncertain. In addition, we lack estimates of the historical abundance of green sturgeon for comparison to current estimates to assess the viability of the population based on abundance. Instead, we look to general principles in conservation biology relating population viability to population abundance. In general, an effective population size of 500 or more adults is needed for a population to be naturally self-sustaining, based on the general principle that genetic drift is significant when effective population sizes are less than 500 (Franklin 1980; Soulé 1980). Assuming that the ratio of the census to effective population size is about 0.2 for green sturgeon (based on the ratio for salmonids) (Waples et al. 2004), the census population size needed for a naturally self-sustaining population would be 2,500 adults. The ratio for the census to effective population size for salmon was used because similar information for green sturgeon is not available. This represents another source of uncertainty. Overall, the estimated current abundance of the adult Southern DPS green sturgeon population may be less than half the estimated census population size of 2,500 adults needed for a self-sustaining population. Carefully designed studies are needed to provide absolute estimates of abundance for the species.

Little is known about green sturgeon productivity. Green sturgeon do not mature until they are at least 15 to 17 years of age at a size of 4.59 to 7.22 feet (1.4 to 2.2 m) in length (Beamesderfer et al. 2007). The length at first maturity is estimated to be 59.84 inches (152 cm) TL (14 to 16 years) for males and 63.78 inches (162 cm) TL (16 to 20 years) for females in the Klamath River (Van Eenennaam et al. 2006), and 57 inches (145 cm) TL for males and 65.35 inches (166 cm) TL for females in the Rogue River (Erickson and Webb 2007). Adult green sturgeon are believed to spawn every 2 to 4 years (Cech et al. 2000; Moyle 2002; Erickson and Webb 2007). Although males are capable of spawning annually, female sturgeon typically require two years to complete vitellogenesis. Green sturgeon fecundity (50,000 to 80,000 eggs) (Van Eenennaam et al. 2001) is reportedly lower than other sturgeons, but the egg size is larger. Both fecundity and egg size increase with fish size (Van Eenennaam et al. 2006).

Recruitment data for Southern DPS green sturgeon are essentially nonexistent. Incidental catches of larval green sturgeon in the mainstem Sacramento River and of juvenile green sturgeon at the state and Federal pumping facilities in the South Delta suggest that green sturgeon are successful at spawning, but that annual year class strength may be highly variable (Beamesderfer et al. 2007; Adams et al. 2007). A decrease in the estimated number of juvenile green sturgeon entrained at the pumping facilities from 1986 to 2001 compared to years prior to 1986 indicate a decline in green sturgeon abundance or recruitment in the Sacramento River; however, there is an unknown level of expansion error because the estimates were based on catches from brief sampling periods (CDFG 2002). Successful recruitment into the population is unclear. Because green sturgeon are long-lived and spawn multiple times throughout their lifetime, spawning failure in one year can be made up for in another spawning year. In general, sturgeon year class strength appears to be episodic with overall abundance dependent on a few successful spawning events (NMFS 2010b). It is unclear if the population is able to consistently replace itself. Productivity is likely reduced because of restriction of spawning to one area in the mainstem Sacramento River and continuing impacts to the remaining spawning habitat.

<u>Limiting Factors</u>

*Climate Change*

Potential changes to freshwater and estuarine habitat conditions associated with climate change may affect the Southern DPS green sturgeon’s spawning and rearing habitats. Similar to other sturgeon species, water temperatures and flow rates are important factors influencing green sturgeon spawning and recruitment success. Optimum flow and temperature requirements for green sturgeon spawning and incubation are not known, but spawning in the Sacramento River typically occurs when temperatures are between 8°C and 14°C (Moyle 2002) and may be triggered by small increases in water flow (Schaffter 1997; Brown 2007). Laboratory studies show that the optimal thermal range for green sturgeon embryonic development is from 11°C to 18°C, with temperatures ≥ 23°C lethal to embryos (Van Eenennaam et al. 2005). Optimal water temperatures for larval and juvenile green sturgeon are around 15°C to 16°C, whereas temperatures greater than 19°C may be detrimental to growth and cause cellular stress and decreased swimming performance (Cech et al. 2000, cited in COSEWIC 2004; Mayfield and Cech 2004; Allen et al. 2006). Thus, the potential for climate change to increase water temperatures and reduce flow rates in freshwater and estuarine habitats may affect the spawning and recruitment success of Southern DPS green sturgeon. The Independent Scientific Advisory Board (ISAB) (2007) report discusses potential effects of climate change on white sturgeon habitat in the Columbia River, including: (a) increased egg mortality with increasing water temperatures in the river; (b) improved recruitment success if warmer water temperatures and reduced summer flows stimulate white sturgeon to spawn earlier than the typical May-June period; and/or (c) reduced recruitment success because of reduced summer flows if white sturgeon do not spawn earlier in the season. These potential effects may also apply to Southern DPS green sturgeon in the Central Valley.

Climate change also contributes to changing ocean conditions. Subadult and adult Southern DPS green sturgeon use ocean habitats for migration and potentially for feeding. Based on their use of coastal bay and estuarine habitats, subadults and adults can occupy habitats with a wide range of temperature, salinity, and dissolved oxygen levels (Kelly et al. 2007; Moser and Lindley 2007). Thus, it is not clear how changing ocean conditions because of climate change may affect Southern DPS green sturgeon and its habitat.

*Commercial and Recreational Harvest and Bycatch*

Historically, large numbers of green sturgeon were harvested in white sturgeon commercial and recreational fisheries, which often considered them as bycatch because of their inferior meat quality and lower relative market value (Emmett et al. 1991; Adams et al. 2007). A relatively smaller part of the harvest occurred as bycatch in the tribal gillnet salmon fisheries in the Columbia and Klamath Rivers. From 1985 to 2003, harvest of green sturgeon occurred predominately in the Columbia River (51 percent), coastal trawl fisheries (28 percent), the Oregon fishery (8 percent), and the California tribal fishery (8 percent) (Adams et al. 2007). Overall, the total average annual harvest of green sturgeon (both Southern DPS and Northern DPS fish) declined substantially from 6,494 fish in the period from 1985 to 1989 to 1,072 fish in the period from 2000 to 2003. Much of the reduction in harvest was because of increasingly restrictive Columbia River fishing regulations. Recently enacted fishing regulations have further reduced fishery impacts on green sturgeon throughout its range, including bans on the retention of green sturgeon throughout California, Oregon, Washington, and Canada and revised white sturgeon fishing regulations (75 Fed. Reg. 30714, June 2, 2010).

However, fisheries throughout the coast continue to incidentally catch green sturgeon, with sublethal and lethal effects. We summarize the impacts of several fisheries occurring outside of the action area (i.e., commercial and recreational fisheries in freshwater rivers, coastal estuaries, and coastal marine waters outside of the EEZ off California, Oregon, and Washington), focusing on those fisheries that encounter Southern DPS green sturgeon (note that Section 2.3, Environmental Baseline, of this opinion discusses the impacts of fisheries occurring within the action area). For each fishery, we present the available green sturgeon catch data (including both Southern DPS and Northern DPS fish) and estimate the proportion of that catch that belongs to the Southern DPS. We do not discuss the Klamath tribal fisheries because the green sturgeon harvested in that fishery belong to the Northern DPS.

One of the major existing sources of mortality for green sturgeon is bycatch-related mortality associated with coastal and estuarine fisheries, including coastal trawl fisheries and white sturgeon and salmon commercial and recreational fisheries (Adams et al. 2007). In California, the commercial sturgeon fishery has been closed since 1917 (Pycha 1956), but recreational sturgeon fisheries continue in the Central Valley (i.e., the Sacramento and lower Feather Rivers, the Delta, and the San Francisco, San Pablo, and Suisun Bays), with few green sturgeon catches recorded from 1985 to 2003 (Adams et al. 2007). Since the ESA-listing of Southern DPS green sturgeon, retention of green sturgeon has been prohibited throughout California, but incidental catch of green sturgeon in the white sturgeon recreational fishery continues to be a problem. From 2007 through 2009, sturgeon report card data indicated that 215 to 311 green sturgeon were caught and released per year within the Central Valley rivers, bays, and Sacramento-San Joaquin Delta (Delta) (Gleason et al. 2008; Dubois et al. 2009, 2010). We assume that all of the green sturgeon caught and released were Southern DPS green sturgeon, based on genetic and tagging data that indicate only Southern DPS green sturgeon use the Central Valley rivers, bays, and Delta (Lindley et al. 2008; Israel et al. 2009). To reduce the catch of green sturgeon, the California Fish and Game Commission prohibited sturgeon fishing on the Sacramento River from Keswick Dam to the Highway 162 Bridge (Figure 6), effective March 2010 (California Code of Regulations, Title 14, Section 5.81). This regulation appears to have reduced incidental catch of green sturgeon in the white sturgeon fishery, with sturgeon report card data indicating catch and release of 151 green sturgeon in 2010 (Dubois et al. 2011) and of 89 green sturgeon in 2011 (Dubois et al. 2012). We estimate that the Central Valley recreational sturgeon fisheries incidentally catch 89 to 151 Southern DPS green sturgeon per year, including subadults and adults. Using an estimated bycatch mortality rate of 2.6 percent for hook-and-line fisheries (Robichaud et al. 2006), we estimate that incidental catch in these fisheries kills 3 to 4 Southern DPS green sturgeon per year.

In Oregon, green sturgeon were historically harvested in the state-regulated commercial trawl fisheries and in recreational sturgeon fisheries conducted in coastal estuaries. From 1985 through 1998, the commercial trawl fisheries' harvest of green sturgeon (both Southern DPS and Northern DPS fish) ranged from 29 to 250 fish in most years, with a high catch of 400 fish in 1999 and 726 fish in 1985 (Adams et al. 2007). From 1999 through 2003, catch of green sturgeon decreased, ranging from 12 to 21 fish per year (Adams et al. 2007). Harvest of green sturgeon in the recreational fisheries has also been reduced compared to historical levels. From 1986 through 2007, harvest of green sturgeon in the recreational fisheries ranged from 25 to 366 fish per year, but was greater than 100 fish in most years (ODFW sturgeon sport catch data for coastal estuaries excluding the Columbia River (addressed separately below), available at: http://www.dfw.state.or.us/resources/fishing/sportcatch.asp). From 2008 to 2010, recreational catch of green sturgeon in coastal estuaries decreased, ranging from 24 to 39 fish per year (ODFW sturgeon sport catch data, http://www.dfw.state.or.us/resources/fishing/sportcatch.asp). Since 2010, retention of green sturgeon in commercial and recreational fisheries has been prohibited statewide. However, incidental catch and release of green sturgeon continues to occur in these fisheries. We estimated the present incidental catch of Southern DPS green sturgeon in the Oregon state fisheries using catch data from recent years and assuming that 16 percent to 55 percent of the green sturgeon caught in coastal estuaries or coastal waters off Oregon belong to the Southern DPS, based on genetic stock composition analysis (Israel et al. 2009). Based on catch data from 1999 through 2003, we estimate that the commercial fisheries incidentally catch 2 to 12 Southern DPS green sturgeon per year and kill 0 to 1 Southern DPS green sturgeon per year (based on an estimated bycatch mortality rate of 5.2 percent; see the Effects of the Action on Listed Species section). Based on catch data from 2008 through 2010, we estimate that the recreational fisheries incidentally catch 4 to 22 Southern DPS green sturgeon per year and kill 0 to 1 Southern DPS green sturgeon per year (based on an estimated bycatch mortality rate of 2.6 percent for hook-and-line fisheries) (Robichaud et al. 2006).

In the lower Columbia River estuary, green sturgeon may have been directly harvested and incidentally caught in recreational and commercial fisheries. More recently, harvest of green sturgeon has been the result of incidental capture in white sturgeon fisheries. From 1991 through 1993, harvest of green sturgeon (both Southern DPS and Northern DPS fish) in the recreational and commercial fisheries ranged from 2,236 to 3,208 fish per year. Since 1994, management actions implemented to control white sturgeon harvest have also reduced the harvest of green sturgeon. From 1994 through 2001, harvest of green sturgeon in the recreational and commercial fisheries ranged from 373 to 1,655 fish per year. From 2002 through 2006, harvest of green sturgeon was reduced further, ranging from 86 to 214 fish per year. Because of the ESA-listing of Southern DPS green sturgeon, retention of green sturgeon has been prohibited in commercial fisheries since 2006 and in recreational fisheries since 2007 (NMFS 2010a). However, incidental catch of green sturgeon still occurs. The recreational fisheries are estimated to incidentally catch up to 52 Southern DPS green sturgeon per year, with up to 7 to 10 fish estimated to be kept because of misidentification as white sturgeon and an estimated one fish killed because of catch and release (NMFS 2008a). The commercial fisheries are estimated to incidentally catch up to 271 Southern DPS green sturgeon per year, with an estimated 14 fish killed as a result of catch and release (NMFS 2008a).

In Washington State, harvest of green sturgeon primarily occurred in state-regulated commercial and recreational fisheries targeting white sturgeon or salmon in the large coastal estuaries. From 1985 through 2005, estimated incidental catch of green sturgeon (both Southern DPS and Northern DPS fish) in Grays Harbor ranged from 6 to 2,286 fish per year in commercial fisheries and from 8 to 146 fish per year in recreational fisheries, with an estimated total of 12 to 1,566 fish killed per year (WDFW 2011). Over the same period, estimated incidental catch of green sturgeon in Willapa Bay ranged from 12 to 2,179 fish per year in the commercial fisheries and from 5 to 37 fish per year in the recreational fisheries, with an estimated total of 15 to 1,627 fish killed pear year (WDFW 2011). Management measures have reduced harvest of green sturgeon from historic levels. For example, beginning in the late 1990s and into the early 2000s, WDFW reduced the summer season for commercial fisheries to protect salmon and sturgeon. Since the ESA-listing of green sturgeon, harvest of green sturgeon has been further reduced with the prohibition on retention of green sturgeon in commercial and recreational fisheries state-wide. However, incidental catch and release of green sturgeon continues to occur in state-regulated white sturgeon and salmon fisheries. WDFW biologists estimate that state commercial and recreational fisheries (excluding the Columbia River fisheries, which are addressed separately above) may incidentally catch up to 715 Southern DPS green sturgeon and kill up to 35 Southern DPS green sturgeon per year (Kirt Hughes, pers. comm., WDFW, October 18, 2011). This is a conservative estimate of the maximum number of Southern DPS green sturgeon that may be caught in a year, based on the maximum historical harvest levels (expanded to include green sturgeon smaller or larger than the legal fishing slot limit) during a period of time when the salmon and white sturgeon fishing seasons were structured similarly to what is expected in the future (WDFW 2011).

Bycatch of green sturgeon also occurs in marine waters in commercial fisheries off British Columbia and Alaska. Canada currently bans retention of green sturgeon in all fisheries, although they are frequently encountered in coastal bottom trawl fisheries off the west coast of Vancouver Island and may have been specifically targeted in past decades (COSEWIC 2004; Lindley et al. 2008). From 1996 through 2002, the domestic trawl fisheries incidentally caught and observed a total of 171 green sturgeon (COSEWIC 2004). Information is not available at this time to estimate the number of green sturgeon caught per year or the condition of the green sturgeon caught and released. Continued incidental catch of green sturgeon in Canada's coastal fisheries remains a concern. The North Pacific Groundfish Observer Program, which observes Federal groundfish fisheries off Alaska, has recorded rare encounters with green sturgeon in trawl fisheries in the Bering Sea. Two green sturgeon were encountered in 2006 (Colway and Stevenson 2007) and one in 2009 (B. Mason, pers. comm., NMFS, June 4, 2009). All of the green sturgeon encountered were observed dead. It is unknown whether the green sturgeon encountered belonged to the Northern DPS or the Southern DPS. Green sturgeon are rarely encountered in coastal waters off Baja California, Mexico, and fishery impacts in Mexican waters are likely negligible.

In summary, current levels of green sturgeon catch in commercial and recreational fisheries occurring outside of the action area have been considerably reduced compared to historical levels. The ban on retention of green sturgeon throughout California, Oregon, Washington, and Canada since the ESA listing has also reduced the mortality of green sturgeon in these fisheries. However, we estimate that the fisheries continue to encounter and incidentally catch up to 1,133 to 1,223 Southern DPS green sturgeon per year (including both subadults and adults), resulting in an estimated 61 to 66 Southern DPS green sturgeon killed per year (Table 11). Most of the estimated incidental catch and mortalities would occur in the Washington state commercial and recreational fisheries and lower Columbia River commercial fisheries. Given an estimated maximum of 1,000 adults and 5,250 subadults in the population, this indicates that fisheries outside of the action area encounter a large proportion of the adult and subadult populations each year. However, there are uncertainties regarding both our population estimates and our estimates of incidental catch and mortality in these fisheries. For example, we may have underestimated the population size because our estimates do not consider the number of spawning adults that may be in the lower Feather River each year. We may have overestimated the incidental catch of Southern DPS green sturgeon in the Washington State fisheries, because that estimate was based on historical harvest data from a period of high green sturgeon harvest. In addition, the same fish may be captured in multiple fisheries each year, which would also lead to overestimating the number of fish incidentally caught each year. In Section 2.6, Integration and Synthesis, of this opinion, we consider the potential impacts of this estimated incidental catch and mortality on the status of Southern DPS green sturgeon, as well as the uncertainties regarding these estimates. Note that these estimates do not include the number of Southern DPS green sturgeon that may be incidentally caught and killed in the bottom trawl fisheries off British Columbia and in tribal fisheries conducted in marine and estuarine waters where Southern DPS and Northern DPS green sturgeon co-occur, because we lack data to generate quantitative estimates.

Table 11. Summary of estimated incidental catch and mortality of Southern DPS (SDPS) green sturgeon (number of fish) in commercial and recreational fisheries occurring outside of the action area. The text describes these estimates in more detail.

| **Fishery** | **Estimated SDPS Incidental Catch** | | **Estimated SDPS Mortalities** | |
|---|---|---|---|---|
| | **Low estimate** | **High estimate** | **Low estimate** | **High estimate** |
| Central Valley, CA, recreational fisheries | 89 | 151 | 3 | 4 |
| Oregon recreational fisheries | 4 | 22 | 1 | 1 |
| Oregon commercial fisheries | 2 | 12 | 1 | 1 |
| Lower Columbia River recreational fisheries | 52 | 52 | 7 | 11 |
| Lower Columbia River commercial fisheries | 271 | 271 | 14 | 14 |
| Washington State fisheries | 715 | 715 | 35 | 35 |
| **TOTAL** | **1,133** | **1,223** | **61** | **66** |

*Other Factors*

Green sturgeon face several additional threats in the freshwater, estuarine, and marine environments within which they move throughout their life, including reduction/loss of spawning areas, insufficient freshwater flow rates in spawning areas, contaminants (e.g., pesticides), potential poaching, entrainment by water projects, vessel strikes, influence of exotic species, small population size, impassable barriers, and elevated water temperatures (Adams et al. 2007; NMFS 2010b). As discussed above, the principal factor in the ESA-listing of Southern DPS green sturgeon was the reduction of its spawning habitat to a single area in the Sacramento River because of migration barriers (e.g., dams), increasing the vulnerability of the spawning population to catastrophic events and of early life stages to variable environmental conditions within the system. Severe threats to the single remaining spawning population, coupled with the inability to alleviate those threats using current conservation measures, led to the decision to list the species as threatened.

#### 2.2.1.3 Status of Humpback Whales

Humpback whales were listed as endangered under the ESA in 1970. A Recovery Plan was finalized for this species in 1991 (NMFS 1991). Under the MMPA, humpback whales are classified as a strategic stock and considered depleted. On August 12, 2009, NMFS initiated an ESA status review of humpback whales (74 Fed. Reg. 40568). The status review is currently in progress. This section summarizes information taken from a draft NWFSC risk assessment of PCGF to threatened and endangered marine species (NWFSC 2012), which includes review of the recovery plan (NMFS 1991), stock assessment reports (reports for each stock are available online at http://www.nmfs.noaa.gov/pr/sars/species.htm#largewhales), the draft status review (Fleming and Jackson 2011), as well as data that became available more recently.

Humpback whales are a long-lived species, with late onset of sexual maturity (NMFS 1991). In the Pacific Ocean, females bear their first calves between 8 to 16 years of age, and the maximum life span is at least 50 years, with an average generation time of 21.5 years. Calving intervals are from 2 to 3 years following an 11-month gestation period. Humpback whales feed on krill and small schooling fish using solitary and group foraging strategies.

<u>Spatial Structure and Diversity</u>

Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the northern hemisphere and tropical to arctic waters in the southern hemisphere. All populations migrate seasonally between their winter calving and breeding grounds and summer feeding grounds. Humpback whales typically occur in the feeding grounds during the summer and fall months. For management under the MMPA, stocks of humpback whales are defined based on feeding areas, with the whales feeding off California, Oregon, and Washington currently considered one stock.

In the North Pacific, the primary breeding grounds are located in coastal areas of Central America, Mexico, Hawaii, the Philippines, the islands of Ogasaware and Okinawa, and an unidentified additional Western Pacific breeding ground (Calambokidis et al. 2008; Fleming and Jackson 2011). The breeding populations are genetically different (Baker et al. 1998; Baker and Steel 2010), and photo identification-based mark/recapture studies indicate a high, but not complete, degree of individual fidelity to one of the four general breeding areas (Mexico, Central America, Hawaii, Asia) (Calambokidis et al. 2008).

Feeding areas include coastal waters across the Pacific Rim from California to Japan. Humpback whales are commonly observed off the California, Oregon, and Washington coasts during the spring, summer, and fall months (Figure 7), and they have also been detected off California (Forney and Barlow 1998) and Washington (Oleson et al. 2009; NWFSC unpublished data) during the winter. The whales feeding off of California and Oregon are primarily from the Mexican breeding area, with smaller contributions from Central America. The whales feeding off of Washington and Southern British Columbia are also from the Mexican and Central American breeding areas, but also include a significant number of individuals from the Hawaiian breeding area (Calambokidis et al. 2008).

There is relatively high site fidelity of individuals to broad feeding grounds (Calambokidis et al. 2008), but movements likely occur between feeding areas. The migratory routes used by humpbacks from their West Coast feeding areas to breeding areas are not well known. Based on photo-identification data, their movements in Oregon and California are probably primarily coastal as they move to Mexico and Central America. Limited information is available on the routes of whales tagged on their Mexican breeding ground, but the movements of one whale to the British Columbia feeding ground was generally near or westward of the continental slope (Lagerquist et al. 2008). This coastal migration pattern may be similar for the portion of the northern Washington animals that also breed in these areas, but a substantial proportion of the animals observed in this area winter in Hawaii, and these animals obviously must have a less coastal migration pattern.

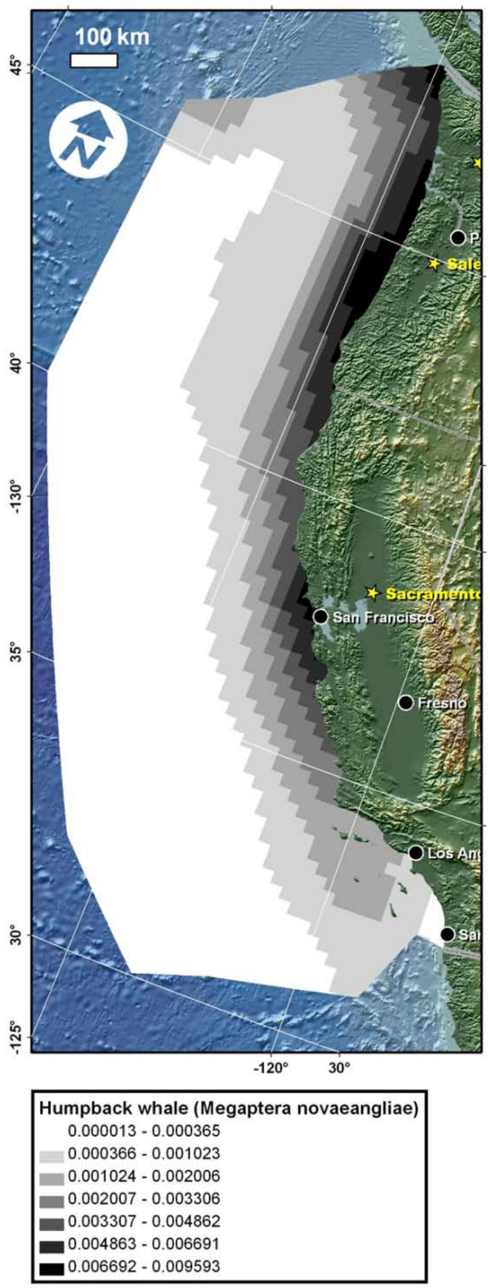


Figure 7. Mean predicted humpback whale density (number of animals/km$^2$), based on surveys conducted from June through November, from 1991–2005 (data from Barlow et al. 2009). Ship-based cetacean and ecosystem assessment surveys of humpback sighting locations were extrapolated to a regular grid (15.5 mile (25 km) resolution) for each year and were smoothed with geospatial methods to obtain a continuous grid of density estimates for the California Current Ecosystem (NWFSC 2012).

West Coast humpback whales migrate from breeding grounds in Mexico and Hawaii to the West Coast of the U.S. and British Columbia to feed in the summer. Thus, while whales do occur throughout the shelf waters of the U.S. West Coast, they aggregate off central California, Oregon, and the northwest coast of Washington State (Figure 7). In California, the whales use the Monterey Bay and Gulf of the Farallons (Barlow et al. 2009; Benson 2002; Benson et al. 2002; Forney 2007; Kieckhefer 1992). Off the northwest coast of Washington, whales are primarily observed east of the Barkley Canyon, between the La Perouse Bank and Nitnat Canyon, and on the shelf edge near the Juan de Fuca Canyon (Figure 7) (Calambokidis et al. 2004; Dalla Rosa 2010). In particular, the whales occur primarily on the periphery of the Juan de Fuca Eddy (Dalla Rosa 2010). In northern California and southern Oregon, humpback whale occurrence may be associated with the inside edge of the coastal upwelling front (Tynan et al. 2005).

<u>Abundance and Productivity</u>

The most recent population estimate of humpback whales in the North Pacific Ocean is 21,808 (CV=0.04) (2004-2006 estimate) (Barlow et al. 2011), which is higher than the estimated pre-exploitation abundance of ~15,000. There is, however, uncertainty about the latter estimate (Rice 1978). Estimates of the breeding population sizes are approximately 10,000 whales (Hawaii), 6,000 to 7,000 whales (Mexico, including Baja and the Revillagigedos Islands), 500 whales (Central America), and 1,000 whales (Western Pacific) (Calambokidis et al. 2008). For management under the MMPA, humpback whale stocks are defined based on feeding areas, with the whales feeding off of California, Oregon, and Washington currently considered one stock (Carretta et al. 2012). The estimated abundance of this feeding stock as of 2007/2008 was 2,043 whales (CV=0.10) (mark-recapture estimate) (Carretta et al. 2012), with a minimum population estimate of 1,878 whales (lower 20th percentile of the mark-recapture estimate) (Calambokidis 2009).

The maximum expected rate of annual increase for the species as a whole ranges from an estimated 7.3 to 8.6 percent (Zerbini et al. 2010), with a maximum plausible rate (upper 99 percent confidence interval of the expected maximum) of 11.8 percent annually. North Pacific populations as a whole grew by an estimated 6.8 percent annually over the period from 1966 to 2006 (based on an estimated post-exploitation abundance of 1,400 in 1966) (Calambokidis et al. 2008). The Hawaiian breeding population grew by an estimated 5.5 to 6.0 percent annually over the period from 1991–1993 to 2006. The annual growth rate for the California-Oregon-Washington (CA/OR/WA) feeding stock is estimated at 7.5 percent (Carretta et al. 2012). Most Southern Hemisphere populations have been increasing at annual rates of 7 to 9 percent since the early- to mid-1990s (Fleming and Jackson 2011). The Gulf of Maine feeding population has been estimated to be increasing at a lower rate of ~3 percent annually from 1979 to 1993 (Stevick et al. 2003).

<u>Limiting Factors</u>

Humpback whales face a variety of threats, depending on the region in which they occur. Threats listed in the Recovery Plan include entrapment and entanglement in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991). Climate change and ocean acidification are also global threats to marine ecosystems that could indirectly affect humpback whales via trophic dynamics and available prey. Globally, entrapment and entanglement in fishing gear and collisions with ships represent most of the reported and observed serious injuries and mortalities for the species (review in Carretta et al. 2012). Entanglement data are available for most stocks of humpback whales worldwide (Table 12). These entanglements result from humpback whale interactions with a variety of fisheries and gear types and generally result in some level of serious injury and mortality (Table 12). The absolute number of humpback whale entanglements is likely under-represented by these data, in part because observer programs and stranding networks do not exist in many parts of the world. For the CA/OR/WA stock, there may be unreported entanglements in fishing gear off Mexico, which could occur while these humpback whales are in their breeding grounds.

Table 12. Humpback whales reported seriously injured or killed from entanglement in fishing gear by stock.

| Stock | Reported Serious Injuries and Mortalities From Entanglement in Fishing Gear | Gear or Fishery that Resulted in Entanglement |
|---|---|---|
| American Samoa | 0 takes $yr^{-1}$ | n/a |
| CA/OR/WA | ≥ 3.2 takes $yr^{-1}$ | Pot or trap fisheries and unidentified fisheries |
| Central North Pacific | ≥ 3.6 takes $yr^{-1}$ | Longline, drift and set gillnet, pot or trap fisheries, purse seine, and unidentified fisheries |
| Gulf of Maine | ≥ 4.0 takes $yr^{-1}$ | Pot or trap fisheries, purse seine fisheries, and gillnet fisheries |
| Western North Pacific | ≥ 2.4 takes $yr^{-1}$ | Commercial fisheries in Japan and Korea |
| **Total Annual Average** | | **≥ 13.2 takes $yr^{-1}$** |

Source: Carretta et al. 2012; Allen and Angliss 2012.

### 2.2.1.4 Status of Steller Sea Lions

Steller sea lions were listed as threatened under the ESA on November 26, 1990 (55 Fed. Reg. 49204) across their entire range. Continued declines in the western portion of the population led to listing the western stock as endangered on May 5, 1997 (62 Fed. Reg. 24345); however, the eastern stock remained listed as threatened (the proposed fishing only has potential to affect eastern DPS Steller sea lions, as described further below). Under the MMPA, all Steller sea lions are classified as strategic stocks and are considered depleted. NMFS issued the final revised recovery plan for Steller sea lions in March 2008 (NMFS 2008b). The final Steller sea lion recovery plan identified the need to initiate a status review for the eastern DPS of Steller sea lions and consider removing it from the Federal List of Endangered Wildlife and Plants (NMFS 2008b). On December 13, 2010, NMFS announced a decision to review the status of the eastern DPS in response to two petitions to delist the eastern DPS (75 Fed. Reg. 77602). NMFS completed their draft status review and issued a proposed rule to delist the eastern DPS on April 18, 2012 (77 Fed. Reg. 23209). The proposed rule is subject to further consideration following a public comment period, which closed on June 18, 2012. This section summarizes information taken largely from a draft NWFSC risk assessment of the PCGF to threatened and endangered marine species (NWFSC 2012), which includes review of the recovery plan (NMFS 2008b) and the most recent stock assessment report (Allen and Angliss 2012).

Steller sea lions are a long-lived species, and reproduction is somewhat delayed (by age 10 years) (NMFS 2008b). Breeding occurs at rookeries where males compete for females by defending territories. Females bear at most a single pup each year between late May through early July, with peak numbers of births during the second or third week of June.

Steller sea lions are generalist predators, able to respond to changes in prey abundance. Their primary prey includes a variety of fishes and cephalopods. Some prey species are eaten seasonally when locally available or abundant, and other species are available and eaten year-round (NMFS 2008b). Pacific hake appears to be the primary prey item across the range of eastern Steller sea lions (NMFS 2008b). Other prey items include Pacific cod, walleye Pollock, salmon, and herring, among other species.

Spatial Structure and Diversity

The eastern DPS of Steller sea lions is a single population that ranges from southeast Alaska to southern California, including inland waters of Washington State and British Columbia. Occurrence in inland waters of Washington is limited to primarily male and subadult Steller sea lions in fall, winter, and spring months. They breed on rookeries in southeast Alaska, British Columbia, Oregon, and California. No rookeries occur in Washington. Haulouts are located throughout their range (NMFS 2008b).

Steller sea lions are not known to migrate. They disperse from rookeries outside of the breeding season (late May to early July), and adult males and juveniles are wider ranging than adult females (Allen and Angliss 2012). Exchange of breeding animals appears low between rookeries (Allen and Angliss 2012). The breeding distribution of the eastern DPS has shifted north, with range contraction in southern California and new rookeries established in southeast Alaska (Pitcher et al. 2007).

Abundance and Productivity

The total population estimate is a range between 58,334 and 72,223 animals based on extrapolation from pup counts, and the estimate of minimum abundance of non-pup and pup counts from all rookeries is 52,847 animals (Allen and Angliss 2012). The minimum estimate is not corrected for animals that were at sea. The population has increased at a rate of 3.1 percent per year from the 1970s until 2002 (Pitcher et al. 2007). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82 percent of pup production), but performance has remained poor in California at the southern extent of their range (Allen and Angliss 2012). In Southeast Alaska, British Columbia, and Oregon, the number of Steller sea lions has more than doubled since the 1970s. Historical abundance is not well known, because prior to 1970 count data were intermittently available and therefore not comparable with more recent count data (NMFS 2008b).

Limiting Factors

Given the long-term positive population growth, NMFS identified no threats to the continued recovery of the eastern DPS in the final revised recovery plan (NMFS 2008b). There are, however, factors that affect or have the potential to affect population dynamics of the eastern DPS. Those factors are predation (from killer whales and sharks), harvests, fishing bycatch and other human impacts, entanglement in debris, parasitism and disease, toxic substances, global climate change, reduced prey biomass and quality, and disturbance (NMFS 2008b). Most bycatch of eastern DPS Steller sea lions occurs with trawl fishing gear. Because most of the species' range occurs within the action area, we include greater detail related to bycatch and reduced prey, among other threats in Section 2.3, Environmental Baseline.

#### 2.2.1.5 Status of Leatherback Sea Turtles

Leatherback sea turtles were listed as endangered under the ESA throughout their range on June 2, 1970. NMFS and the USFWS issued a recovery plan for the U.S. Caribbean, Atlantic, and Gulf of Mexico populations on October 29, 1991 (NMFS and USFWS 1991) and issued another recovery plan for the U.S. Pacific populations on May 22, 1998 (NMFS and USFWS 1998). This section summarizes information taken from a NWFSC risk assessment of the PCGF to threatened and endangered marine species (NWFSC 2012), which includes review of the U.S. Pacific recovery plan (NMFS and USFWS 1998), the most recent status review (NMFS and USFWS 2007a), as well as information that became available more recently.

Leatherback sea turtles are a long-lived species, and likely have a late onset of sexual maturity (recent estimates suggest 13 to 14 years up to 29 years of age) (review in NMFS and USFWS 2007a). Female leatherbacks lay clutches of approximately 80 eggs in the sand on tropical beaches several times during a nesting season. Male leatherbacks are rarely seen near nesting aggregations, and it is speculated that breeding occurs on foraging grounds at sea (NMFS and USFWS 2007a). Leatherback hatchlings emerge from the nest after about two months.

Survival and mortality estimates for different life history stages are not well known, but available information indicates that early life-stage survival is low (review in NMFS and USFWS 2007a). Leatherbacks primarily forage on cnidarians (jellyfish and siphonophores) and, to a lesser extent, tunicates (pyrosomas and salps) (NMFS and USFWS 1998).

Spatial Structure and Diversity

Leatherback sea turtles are widely distributed across the oceans of the world, and are primarily found in four major regions: the Pacific, Atlantic, and Indian Oceans, and the Caribbean Sea. In the Pacific Ocean, nesting aggregations occur in the eastern Pacific (primarily in Mexico and Costa Rica) and in the western Pacific (primarily Indonesia, the Solomon Islands, and Papua New Guinea). In the Atlantic Ocean, nesting aggregations occur in Gabon, Sao Tome and Principe, French Guiana, Suriname, and Florida. In the Caribbean, nesting occurs in the U.S. Virgin Islands and Puerto Rico, and in the Indian Ocean, nesting occurs in India and Sri Lanka. Females display site fidelity to nesting aggregations, but within these areas may nest at more than one beach in a single season (Lutz et al. 2003).

Adult and subadult females migrate long distances between foraging areas (pelagic and coastal waters) and nesting grounds (tropical beaches) typically every two to four years (Garcia and Sarti

2000; Benson et al. 2007a). Although the exact location and timing of migration is still being documented, eastern Pacific female leatherbacks generally migrate south of the nesting beaches and forage off Central and South America, while western Pacific females may undergo transpacific migrations to waters off the Pacific Northwest and off central California (Benson et al. 2007a; Benson et al. 2011) (Figure 8). The migratory pattern of males and juveniles are not as well known but both have been recorded as bycatch or through stranding reports off the U.S. west coast. Based on stranding records, it appears that juveniles primarily occur in waters warmer than 26°C (Eckert 1999; Eckert 2002), and based on fisheries bycatch records and research capture efforts in the Pacific Ocean, subadults and males from the western Pacific population are also known to occur in the north Pacific and in waters off central California.

Foraging occurs in temperate waters where leatherbacks appear to use convergence zones, and upwelling areas in the open ocean along continental margins and in archipelagic waters (Morreale et al. 1994; Eckert 1998, 1999). Foraging is also likely aggregated in productive coastal areas where jellyfish prey is abundant (review in NWFSC 2012). There are few areas where the species is routinely encountered foraging, although we recently designated two areas identified as critical habitat for leatherbacks because of aggregations of their primary prey, brown sea nettles, including an area off the Pacific Northwest and an area off of central California (77 Fed. Reg. 4170, January 26, 2012). Also based on available information, use of the California Current by leatherbacks appears highly seasonal, with turtles arriving along the U.S. West Coast during summer and fall months when large aggregations of jellyfish form (Bowlby 1994; Starbird et al. 1993; Benson et al. 2007b; Graham 2009).

Abundance and Productivity

The abundance of leatherback sea turtles worldwide is currently unknown. The most recent global estimate for nesting females is 34,500 turtles (CV: 26,200 to 42,900), based on monitoring at nesting beaches (Spotila et al. 1996). Population trends are estimated by monitoring the number of nesting females from year to year, over time. Based on this information, some nesting sites in the Atlantic appear to be increasing; however, trends in the Pacific have been declining for the past three decades. Based on declines at eastern Pacific nest sites, some researchers suggest that eastern Pacific leatherbacks may be on the verge of extinction (Spotila et al. 1996; Spotila et al. 2000). By contrast, despite evidence of a long-term decline since the 1980s and given that annual nesting estimates are not available on a continuing basis, western Pacific leatherbacks show a slight increase in recent years, as suggested by a 2007 estimate of breeding females (2,700 to 4,500 turtles) (Dutton et al. 2007) compared to a 2000 estimate (1,775 to 1,900 turtles) (Spotila 2000). More recently, however, leatherback nesting in the western Pacific has shown a steady decline (C. Fahy, pers. comm., NOAA Fisheries SWR, July 18, 2012). Aside from coastal aerial surveys off central California and most recently off the Pacific Northwest (e.g., Benson et al. 2007b), there have been few attempts to assess abundance on foraging grounds.

To consider de-listing, each nesting stock of leatherbacks must average 5,000 females annually over six years (an estimated generation time) and nesting populations must be stable or increasing over a 25-year monitoring period (NMFS and USFWS 1998), among other criteria. In the recent status review, we identified that efforts to attain these goals are ongoing, but the goals have not been met (NMFS and USFWS 2007a).

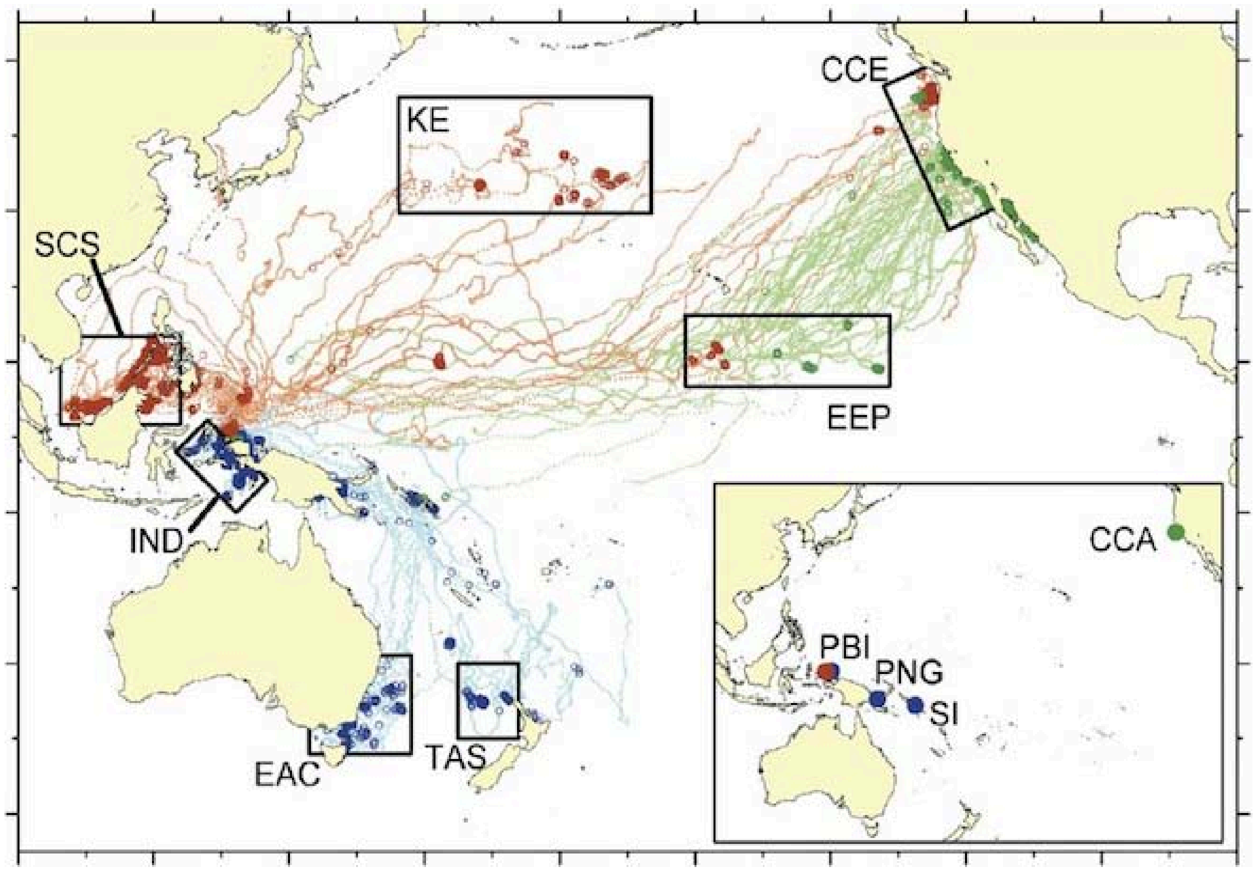


Figure 8. Between 2000 and 2007, Benson et al. (2011) attached GPS transmitters to 126 leatherbacks nesting in Indonesia, the Solomon Islands, and Papua New Guinea. The colored lines indicate transpacific migration from their nesting grounds to the waters adjacent to the West Coast of North America. (Source: NWFSC 2012, reproduced from Benson et al. 2011).

Limiting Factors

Leatherback sea turtles face a variety of threats depending on the region in which they occur; 22 threats are identified in the recovery plan for U.S. Pacific populations (NMFS and USFWS 1998). Many of the identified threats are specific to nesting beaches, and for the Pacific populations there are no leatherback nesting beaches in U.S. jurisdiction. Identified threats in the marine environment include direct harvest, natural disasters, disease and parasites, environmental contaminants, debris (entanglement and ingestion), fisheries bycatch, predation, boat collisions, marina and dock development, oil exploration and development, and power plant entrainment.

On the U.S. West Coast, one of the known threats to leatherbacks is bycatch in fisheries (NMFS and USFWS 1998). Bycatch poses a threat in pelagic foraging and transit areas, the coastal feeding grounds, and migratory routes along the U.S. West Coast and south into Mexico. While the level of leatherback bycatch in many fisheries is unknown, it has declined in U.S. fisheries such as the California drift gillnet fishery and the Hawaii longline fishery compared to historical levels, and fishing techniques that minimize bycatch (e.g., circle hooks) are now required in the Hawaii-based shallow set longline fishery. In addition, in 2001 NMFS implemented regulations to restrict the California/Oregon drift gillnet fishery off central, northern California and southern Oregon to reduce impacts to leatherbacks during times when they may likely be found off the coast (August 15 to November 15), which has significantly reduced interactions to nearly zero. Entanglement and ingestion of marine debris, including old, abandoned nets and plastic bags, and vessel strikes continue to pose a threat to leatherbacks. Appendix A summarizes the anticipated lethal and non-lethal take of leatherback sea turtles based on completed ESA consultations where authorized incidental take is still active.

### 2.2.2 Status of Critical Habitat

We review the status of designated critical habitat affected by the proposed action by examining the conditions and trends of essential physical and biological features throughout the designated area. These features are essential to the conservation of the listed species because they support habitat for one or more life stages of the species (e.g., sites with conditions that support reproduction, rearing, migration, and foraging). This section will evaluate the effects of critical habitat designated for green sturgeon and leatherback sea turtles. The action area for the proposed action does not overlap with designated eulachon critical habitat.

#### 2.2.2.1 Status of Green Sturgeon Critical Habitat

We designated critical habitat for Southern DPS green sturgeon within the following areas along the U.S. West Coast (74 Fed. Reg. 52300, October 9, 2009):

- Freshwater systems in the Central Valley, California (Sacramento River, lower Feather River, lower Yuba River, Yolo and Sutter Bypasses) and the Sacramento-San Joaquin Delta (note: spawning has been confirmed only in the mainstem Sacramento River and lower Feather River);
- Coastal estuaries in California (San Francisco Bay, San Pablo Bay, Suisun Bay, Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, Nehalem Bay), the lower Columbia River estuary, and Washington (Willapa Bay, Grays Harbor); and
- Coastal marine waters shallower than 60 fathoms (approximately 360.89 feet (110 m)) from Monterey Bay, California to the Canadian border, including Monterey Bay and the Strait of Juan de Fuca.

We identified the physical or biological habitat features or primary constituent elements (PCEs) of the habitat that are essential for conservation of the species. For freshwater rivers, the Sacramento-San Joaquin Delta, and coastal estuaries, these features or PCEs include abundant food resources, suitable substrates, suitable water flow, suitable water quality, a migratory corridor, deep holding pools, and suitable sediment quality. For coastal marine areas, the features or PCEs are a migratory pathway necessary for the safe and timely passage of Southern DPS green sturgeon within marine and between estuarine and marine habitats; suitable water quality (e.g., adequate dissolved oxygen levels and acceptably low levels of contaminants that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon); and food resources (likely to include benthic invertebrates and fish species similar to those fed upon by green sturgeon in bays and estuaries, including crangonid and callianasid shrimp, Dungeness crab, molluscs, amphipods, and small fish such as sand lances (*Ammodytes* spp.) and anchovies (*Engraulidae*) (Moyle 2002; Dumbauld et al. 2008)).

Overall, the status of green sturgeon critical habitat throughout the U.S. West Coast has likely improved in recent years, but remains limited by continuing threats and their impacts. As described above, conditions in the Sacramento River watershed have likely improved since 2009 because of implementation of measures to remove seasonal passage barriers (e.g., the RBDD), improve passage in the Yolo Bypass, and maintain water temperatures suitable for green sturgeon and salmonids, but otherwise remain substantially impaired. Coastal estuaries continue to be affected by industrial and agricultural runoff and discharges, the introduction and spread of invasive species, and activities that affect water quality, sediment quality, and food resources (e.g., dredging and dredge disposal activities, shellfish aquaculture). Less information is available on the status of and potential impacts of activities on critical habitat in coastal marine waters. Non-point source and point source discharges into coastal waters affect water quality, particularly close to shore. These discharges, along with other activities like fishing, may also affect prey resources in marine waters. Oil spills and low oxygen "dead zones" along the coast may constrict migratory corridors for green sturgeon, particularly between estuaries along the Oregon and Washington coasts. However, because little information is known about how green sturgeon use coastal marine habitats and how changes in water quality or levels of available prey resources affect their use of these habitats, it is difficult to assess the effects of these activities on the status of green sturgeon critical habitat.

#### 2.2.2.2 Status of Leatherback Sea Turtle Critical Habitat

We revised the critical habitat for leatherback sea turtles by designating areas within the Pacific Ocean on January 26, 2012. This designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour; and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The designated areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. Based on the natural history of leatherback sea turtles and their habitat needs, we identified the feature essential to conservation as the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (e.g., *Chrysaora*, *Aurelia*, *Phacellophora*, and *Cyanea*), of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

<u>Occurrence of Prey Species</u>

Although jellyfish blooms are seasonally and regionally predictable, their fine-scale local distribution is patchy and dependent upon oceanographic conditions. Little information exists on their populations in open coastal systems, including the California Current upwelling system. Based on available research in coastal waters, jellyfish are most abundant in coastal waters of California, Oregon, and Washington during late summer to early fall months (Shenker 1984; Suchman and Brodeur 2005; Graham 2009), which overlaps with the time when turtles are most frequently sighted near central California (Starbird 1993; Benson et al. 2007b) and in coastal waters off Oregon and Washington (Bowlby 1994). Any activities that adversely affect these prey species (e.g., through reduction in diversity, abundance, density, and condition) may affect the conservation value of critical habitat for leatherback sea turtles. Available scientific information does not indicate that jellyfish abundance or availability is currently limiting leatherback sea turtle recovery.

## 2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for the species affected by the proposed action includes the effects of many activities that occur across the broad expanse of the action area considered in this opinion. The status of the species described in the previous section of this biological opinion is a consequence of those effects.

We recognize the unique status of treaty Indian fisheries and their relation to the environmental baseline. The treaty fishing right itself exists and we account for it in the environmental baseline, although the precise quantification of treaty Indian fishing rights cannot be established. If, after completing this ESA consultation, circumstances change or unexpected consequences arise that necessitate additional Federal action to avoid jeopardy determinations for ESA-listed species, such action will be taken in accordance with standards, principles, and guidelines established under *United States v. Washington*, Secretarial Order 3206, and other applicable laws and policies.

We recognize that the proposed action is an ongoing fishery. Because of the ongoing nature of the action, past activities of the fishery are included in the environmental baseline; however, future effects are not part of the baseline, but are addressed in the effects section.

### 2.3.1 Eulachon

**Research Fisheries**

Although not identified as a factor for decline or a threat preventing recovery, scientific research and monitoring activities have the potential to affect the species' survival and recovery by killing eulachon. For the year 2012, we issued numerous section 10(a)(1)(A) scientific research permits allowing lethal and non-lethal take of listed species. Although eulachon take is not prohibited, the permit applicants are required to consult with NMFS on their take of the species. We estimate lethal and non-lethal take from the research being permitted will be 2,347 fish and 435 fish, respectively. We also authorized state scientific research programs under ESA section 4(d) for 2012. The estimated lethal and non-lethal take of eulachon by these programs is 35 fish and 595 fish, respectively, bringing the total estimated catch from research activities to 2,382 fish and 1,030 fish, respectively.

**Commercial and Recreational Harvest**

In the past, eulachon were harvested in both commercial and recreational fisheries. Currently, commercial and recreational harvest of eulachon is prohibited in Washington, Oregon, and British Columbia and is not presently a threat to the species (see limiting factors section).

## Shrimp Fisheries Bycatch

Eulachon are taken as bycatch in shrimp trawl fisheries off the coasts of Washington, Oregon, and California (NWFSC 2008, 2009a, 2010a). Offshore trawl fisheries for ocean shrimp (*Pandalus jordani*) extend from the west coast of Vancouver Island to the U.S. West Coast off Cape Mendocino, California (Hannah et al. 2003). *Pandalus jordani* is known as the ocean pink shrimp or smooth pink shrimp in Washington, simply pink shrimp in Oregon, and Pacific ocean shrimp in California. We use the common name "ocean shrimp" in reference to *P. jordani*, as suggested by the American Fisheries Society (see Gustafson et al. 2010).

Al-Humaidhi et al. (2012) provide estimates of the number of individual eulachon caught in the Oregon and California ocean shrimp trawl fishery as bycatch from 2004 to 2010 (except for 2006 when these fisheries were not observed). These estimates were derived from WCGOP data (Table 13). The WCGOP began coverage of Washington ocean shrimp licenses in 2010, with the same criteria used for Oregon and California State ocean shrimp coverage (Al-Humaidhi et al. 2012). The total estimated bycatch of eulachon in the Oregon and California ocean shrimp fisheries ranged from 217,841 fish in 2004 to a high of 1,008,259 fish in 2010 (Al-Humaidhi et al. 2012). For all years observed, fleet-wide eulachon bycatch estimates in the Oregon ocean shrimp fishery were much higher than in the California fishery. In 2010, estimated eulachon bycatch in the Washington ocean shrimp fishery was 66,820 fish; and the total 2010 estimated eulachon bycatch for all three states combined was 1,075,081 (Al-Humaidhi et al. 2012). Eulachon encountered as bycatch in these fisheries come from a wide range of age classes but are all assumed to be part of the southern DPS.

Table 13. Estimated bycatch of eulachon (number of individual fish) in all U.S. West Coast fisheries observed by the WCGOP and the A-SHOP from 2002-2010. Dashes (--) signify years when the sector was not observed.

| | | Eulachon Bycatch Estimates (number of fish) | | | | | | | | | Total Eulachon | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WCGOP | | | | | | A-SHOP | | | | |
| | | LE Trawl | | | Pink Shrimp | | | At-Sea Hake | | | | |
| Year | Season | WA | OR | CA | WA | OR | CA | Tribal Mothership | Non-Tribal Mothership | Catcher-Processor | Bycatch Estimate | 95% Confidence Interval |
| 2002 | Winter | 0 | 553 | 0 | -- | -- | -- | 0 | 0 | 0 | 821 | 147 |
| | Summer | 0 | 268 | 0 | | | | 0 | 0 | 0 | | 1,830 |
| 2003 | Winter | 0 | 52 | 0 | -- | -- | -- | 0 | 0 | 0 | 52 | 10 |
| | Summer | 0 | 0 | 0 | | | | 0 | 0 | 0 | | 136 |
| 2004 | Winter | 0 | 0 | 0 | -- | 146,560 | 71,281 | 0 | 0 | 0 | 217,846 | 115,359 |
| | Summer | 0 | 0 | 5 | | | | 0 | 0 | 0 | | 335,714 |
| 2005 | Winter | 0 | 0 | 0 | -- | 207,362 | 61,542 | 0 | 0 | 0 | 268,903 | 140,249 |
| | Summer | 0 | 0 | 0 | | | | 0 | 0 | 0 | | 410,833 |
| 2006 | Winter | 0 | 0 | 0 | -- | -- | -- | 0 | 0 | 0 | 145 | NA |
| | Summer | 0 | 0 | 0 | | | | 0 | 0 | 145 | | |
| 2007 | Winter | 0 | 0 | 0 | -- | 197,807 | 20,669 | 0 | 0 | 0 | 218,559 | 77,204 |
| | Summer | 0 | 72 | 0 | | | | 0 | 4 | 6 | | 364,387 |
| 2008 | Winter | 0 | 0 | 0 | -- | 389,604 | 67,610 | 0 | 2 | 37 | 457,256 | 294,773 |
| | Summer | 0 | 0 | 0 | | | | 0 | 4 | 0 | | 634,237 |
| 2009 | Winter | 0 | 0 | 0 | -- | 845,081 | 84,631 | 30 | 0 | 30 | 929,848 | 421,270 |
| | Summer | 0 | 67 | 0 | | | | 2 | 6 | 0 | | 1,456,610 |
| 2010 | Winter | 0 | 0 | 0 | 66,820 | 741,203 | 267,057 | 0 | 0 | 0 | 1,075,102 | 742,598 |
| | Summer | 0 | 0 | 21 | | | | 0 | 0 | 0 | | 1,407,618 |

The estimated bycatch of eulachon in the ocean shrimp fisheries increased considerably between 2007 (218,476 fish) and 2010 (1,075,081 fish). There are three reasons for this increase: (1)

increased reporting for the fisheries (i.e., the inclusion of bycatch data for Washington), (2) increased effort in the fisheries, and (3) increased bycatch rate in the fisheries. It is unknown whether the increasing bycatch rate of eulachon is a result of increasing eulachon abundance.

**Groundfish Fishery Bycatch**

Several recent reports (NWFSC 2008, 2009a, 2009b, 2010a, 2010b; Bellman et al. 2008, 2009, 2010, 2011; Al-Humaidhi et al. 2012) provide data on estimated bycatch of eulachon in U.S. West Coast commercial fisheries, which were derived from the WCGOP and the A-SHOP. Eulachon were observed as bycatch in the following fisheries: (1) LE bottom trawl fishery, (2) at-sea Pacific hake/whiting mothership fishery, (3) at-sea Pacific hake/whiting tribal mothership fishery, (4) at-sea Pacific hake/whiting catcher-processor fishery, and (5) Washington, Oregon, and California commercial shrimp trawl fishery (Al-Humaidhi et al. 2012). Al-Humaidhi et al. (2012) provided estimated bycatch of eulachon from 2002 to 2010 as number of individual fish in the LE groundfish trawl and at-sea Pacific hake fisheries (Table 13).

Observer data indicate that eulachon were not encountered in the Washington portion of the LE bottom trawl fishery from 2002 to 2010. The majority of eulachon encounters in the LE bottom trawl fishery from 2002 to 2010 occurred in the Oregon portion of the fishery, although eulachon were also encountered (in very low numbers) in the California portion of the fishery in 2004 and 2010 (Table 13). Total eulachon bycatch for the LE bottom trawl fishery from 2002 to 2010 was estimated at 1,030 total individual fish (Al-Humaidhi et al. 2012). Bycatch in this fishery was recorded in six of the nine observed years, with no bycatch reported in 2005, 2006, or 2008 (Al-Humaidhi et al. 2012). The highest observed yearly bycatch in the LE bottom trawl fishery (for all areas combined) was recorded in 2002 (819 eulachon).

The offshore fishery for Pacific hake occurs along the coasts of northern California, Oregon, and Washington from April through November. The total eulachon bycatch for the offshore Pacific hake fishery from 2002 to 2010 was estimated to be 256 individual fish (Table 13). Bycatch in this fishery was recorded in four of the nine observed years, and no bycatch was reported in 2002, 2003, 2004, 2005, or 2010 (Al-Humaidhi et al. 2012). The highest observed yearly bycatch in the offshore Pacific hake fishery (for all sectors combined) was recorded in 2006 (145 eulachon). Although bycatch of eulachon was observed in the tribal mothership, non-tribal mothership, and catcher-processor sectors of this fishery, Al-Humaidhi et al. (2012, p. 10) noted that eulachon appear "… to be encountered as bycatch in the catcher-processor sector of the fishery more than other sectors."

Not all observed smelt (family Osmeridae) bycatch in the LE bottom trawl and at-sea Pacific hake fisheries has always been identified at the species level. Because of sampling conditions and time constraints, it is likely that some portion of observed eulachon bycatch may have been recorded as "other non-groundfish," in the early years of the two observer programs. The proportion of eulachon bycatch recorded as "other non-groundfish" is unquantifiable, but likely was not very large given the current level of estimated bycatch.

### 2.3.2 Green Sturgeon

Green sturgeon that occur within the action area include both Southern DPS and Northern DPS green sturgeon. Therefore, the effects of the environmental baseline described below are not specific to the Southern DPS green sturgeon. Where information is available, we discuss the effects of the environmental baseline that are specific to the Southern DPS green sturgeon. In addition, some of the effects of the environmental baseline were discussed briefly in the "Rangewide Status of the Species and Critical Habitat" section of this opinion. Below, we focus on the activities and their effects on Southern DPS green sturgeon and designated green sturgeon critical habitat within the action area.

**Fisheries Bycatch**

The operation of the Federal groundfish fishery and the state-managed California halibut bottom trawl fishery has resulted in past and present impacts on green sturgeon incidentally caught in these fisheries (other fisheries that affect Southern DPS green sturgeon, but occur outside of the action area, are discussed in the Section 2.2, Rangewide Status of the Species and Critical Habitat, of this opinion). Although retention of green sturgeon is prohibited, some portion of the green sturgeon incidentally caught dies immediately or after being released back into the water. Because Southern DPS green sturgeon are not morphologically distinguishable from Northern DPS green sturgeon, the effects of these fisheries described below are not specific to Southern DPS green sturgeon. To estimate the effects of these fisheries on Southern DPS green sturgeon, we used stock composition information from genetic and tagging studies to estimate the proportion of the green sturgeon incidentally caught that may belong to the Southern DPS.

*Pacific Coast Groundfish Fishery*

Below is a brief summary of the past impacts of the PCGF on Southern DPS green sturgeon. Section 2.4, Effects of the Action on Listed Species and Designated Critical Habitat, provides a more thorough analysis of these effects as well as the expected effects of the fishery on the species under the proposed action. The LE groundfish bottom trawl sector and the at-sea Pacific hake/whiting sector (at-sea hake sector) of the PCGF have incidentally caught green sturgeon in the past (Al-Humaidhi et al. 2012). Incidental catch of green sturgeon in these fisheries has varied over the years. The LE groundfish bottom trawl sector encountered an estimated 0 to 43 green sturgeon per year from 2002 through 2010 (Al-Humaidhi et al. 2012). Based on the location of the encounters (WCGOP and NWFSC 2011) and data on green sturgeon stock composition in marine and coastal estuarine waters (Israel et al. 2009; Israel 2010) (for a detailed discussion, see Section 2.4, Effects of the Action on Listed Species and Designated Critical Habitat), we estimate that the majority of the green sturgeon encountered likely belonged to the Southern DPS, with a range of 0 to 39 Southern DPS green sturgeon encounters per year from 2002 through 2010. Almost all the fish were released alive. In the at-sea hake sector, only three green sturgeon were encountered and observed in the period from 1991 through 2011 and all had died because of the encounter (Al-Humaidhi et al. 2012; Vanessa Tuttle, pers. comm., A-SHOP, July 23, 2012). Data are not available to determine if the fish belonged to the Southern DPS or Northern DPS. A-SHOP data include two additional records of unidentified sturgeon encountered and observed during the 1990s (Vanessa Tuttle, pers. comm., A-SHOP, August 17, 2012).

*California Halibut Bottom Trawl Fishery*

In the 2012 interim biological opinion for the PCGF (NMFS 2012a), NMFS SFD included the California halibut bottom trawl fishery as part of the Federal fishery. For this consultation, however, NMFS SFD clarified that state-managed fisheries, such as the California halibut bottom trawl fishery, are not part of the Federal fishery, nor are they interrelated or interdependent with the Federal fishery. As a result, this opinion does not analyze the effects of the California halibut bottom trawl fishery as part of the effects of the Federal action on green sturgeon. Instead, we consider the effects of the California halibut bottom trawl fishery on green sturgeon as part of the environmental baseline, as described below. ESA coverage for the take of Southern DPS green sturgeon in the California halibut bottom trawl fishery is not provided by this opinion and must be obtained through a separate ESA process.

Green sturgeon are encountered in the state-regulated California halibut bottom trawl fishery conducted in coastal marine waters. From 2002 through 2010, an estimated 104 to 786 green sturgeon encounters occurred per year in the fishery (Al-Humaidhi et al. 2012). It is possible that individual green sturgeon are encountered by the fishery more than once per year, but recapture rates are not known. The majority of the green sturgeon encountered likely belonged to the Southern DPS, based on the location of the encounters (primarily in coastal marine waters adjacent to San Francisco Bay) (Al-Humaidhi et al. 2012) and data on green sturgeon stock composition in marine waters and coastal estuaries of California (Israel et al. 2009; Israel 2010; for a detailed discussion, see Section 2.4, Effects of the Action on Listed Species and Designated Critical Habitat). We estimate that from 2002 through 2010, the fishery had 86 to 786 encounters with Southern DPS green sturgeon per year. Changes in state fishing regulations were implemented in 2006 to reduce access to the California halibut fishery (California Fish and Game Code Section 8494) and appear to have decreased total California halibut landings and the number of encounters with green sturgeon per year. The estimated encounters with Southern DPS green sturgeon ranged from 86 to 289 per year from 2007 through 2010, compared to 152 to 786 per year from 2002 through 2006 (Al-Humaidhi et al. 2012). Thus, the level of encounters has been reduced compared to historical levels. Based on the 2007 through 2010 bycatch data, we estimate that the California halibut bottom trawl fishery encounters 86 to 289 Southern DPS green sturgeon per year. Applying a bycatch mortality rate of 5.2 percent (see Section 2.4, Effects of the Action on Listed Species and Designated Critical Habitat, for a discussion of this bycatch mortality rate estimate), we estimate that encounters in the California halibut bottom trawl fishery kills 5 to 15 Southern DPS green sturgeon per year.

**Other Human Sources of Injury**

Within the action area, disposal of dredged material at ocean disposal sites, introduction of contaminants through sediment disposal, and increased levels of underwater noise associated with in-water construction activities may cause injury to Southern DPS green sturgeon.

Several ocean dredged material disposal sites have been designated within the action area. NMFS consults with the EPA on the proposed designation of these sites, as well as on the issuance of permits by the EPA for disposal activities at these sites. For example, in recent years, NMFS has consulted with the EPA on the proposed designation of several sites off the Oregon coast (off the mouth of the Rogue River, Umpqua River, and Yaquina River) (NMFS 2009b, 2009c, and 2012b). In 2012, NMFS also consulted on the use of four ocean disposal sites off the Columbia River as part of the Columbia River Channel Operations and Maintenance Program (NMFS 2012c). NMFS concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of the Southern DPS green sturgeon. The disposal of dredged materials at these disposal sites has the potential to entrain and bury small (i.e., ≤ 2 feet in length) subadult green sturgeon that, unlike adults and larger subadults, may not be able to move quickly enough to avoid descending sediments. This may result in injury to small subadult green sturgeon, but the number affected was expected to be low given the location of the disposal sites and the migratory patterns of green sturgeon in marine waters (e.g., green sturgeon are likely to spend limited time in one area as they move from estuary to estuary).

The potential for exposure to contaminants in the dredged material was also a concern for green sturgeon. However, existing statutes and regulations require dredged material to be tested and deemed "clean" prior to disposal. Based on this, NMFS concluded that levels of compounds in the sediments will not exceed concentrations harmful to green sturgeon and other organisms occurring at the disposal sites. Measures to minimize effects include limiting the time and manner of dredging and disposal activities, as well as monitoring fish interactions with disposed dredged materials, to inform future analyses and development of appropriate minimization measures.

Underwater noise generated from in-water construction activities ha**s** the potential to cause injury to fish species such as green sturgeon; however, there is limited information available to assess these effects. In 2011, NMFS consulted on the proposed Columbia River Jetty System Rehabilitation Project at the mouth of the Columbia River (NMFS 2011b). NMFS concluded that the proposed action was likely to adversely affect but not likely to jeopardize the continued existence of the Southern DPS green sturgeon. Although pile driving and removal activities associated with the project could result in underwater noise effects on green sturgeon, the sound levels generated by the project were expected to be below estimated threshold levels that would result in injury to fish. NMFS expected that few, if any, green sturgeon would be in close proximity to the jetties and concluded that the activities were not likely to result in behavioral responses of green sturgeon that may be in the area. To minimize effects, NMFS recommended limiting activities to a few days or a single event annually.

**Disturbance of Normal Behavioral Patterns and Migration**

Increases in suspended sediment and turbidity levels associated with dredging and disposal activities have the potential to disrupt the normal behavioral patterns of green sturgeon in ocean habitats. In recent years, NMFS has consulted on the designation and use of several ocean disposal sites off the Oregon coast (identified in the section above). NMFS concluded that the potential effects on water quality were not likely to disrupt the normal behavioral patterns of green sturgeon, based on the expected short duration of increased suspended sediment and turbidity levels and green sturgeon's relatively high tolerance for increased levels. NMFS recommended monitoring to better understand fish interactions with disposed dredged materials.

Renewable ocean energy installations may also affect green sturgeon behavior and migration in marine waters because of potential impacts from anthropogenic noise and electromagnetic fields, as well as the addition of structures to the water column and seafloor. NMFS consulted on the effects of renewable ocean energy installations off the Oregon coast (off Reedsport and off Newport) and concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of the Southern DPS green sturgeon (NMFS 2012d and 2012e. Electromagnetic fields generated by the installations may either attract or deter green sturgeon in the area. In addition, the installation structures themselves could pose a migration barrier for green sturgeon. For both projects, the degree of exposure and responses of green sturgeon to the potential effects was uncertain, but expected to most likely be small. The proposed installations would cover a small area and would not create a continuous physical barrier to passage, based on plans allowing for a minimum spacing of 150 to 200 feet between structures. Additionally, NMFS estimated that one adult and one subadult green sturgeon may be captured during biological monitoring activities, but those fish would likely be released alive. The consultations included measures to implement study plans and adaptive management frameworks to identify unanticipated negative effects of the installations on green sturgeon and the development of appropriate actions to avoid and minimize those effects in the future. Proposed studies included studies to examine electromagnetic fields and their effects, project effects on fish and invertebrate habitat, and project effects on wave, current, and sediment transport.

**Prey Availability**

Several activities occur within the action area that may affect prey resources for Southern DPS green sturgeon. The feeding habits and diet of green sturgeon in the ocean is poorly known, but they may prey upon demersal fish (sand lance are a known diet item) captured in bottom trawl fisheries. Disturbance of benthic habitats by bottom trawl fisheries may also affect prey species and alter the abundance, distribution, and composition of benthic communities. How these changes may affect Southern DPS green sturgeon and designated critical habitat is unclear, however, because some of these benthic communities are in high energy environments characterized by frequent disturbance and rapid recolonization. In addition, it is unclear whether disturbance of benthic habitats by bottom trawls may reduce or enhance feeding opportunities for green sturgeon. Also, green sturgeon feeding while in marine waters and the prey resources they may feed on have not yet been confirmed or identified. Thus, effects of fishing activities on prey availability in designated green sturgeon critical habitat and feeding opportunities for green sturgeon are difficult to evaluate until more definitive information is known about the marine habitat use and diets of green sturgeon.

Dredging activities, disposal of dredged material at ocean disposal sites, and the management and operation of renewable ocean energy installations may also affect prey availability for green sturgeon in marine waters. In recent years, NMFS has conducted consultations on the designation and use of ocean disposal sites as well as proposed renewable ocean energy installations off the Oregon coast (identified in the sections above). In each consultation, NMFS concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of, or destroy or adversely modify designated critical habitat for, the Southern DPS green sturgeon. These actions may reduce the availability of prey resources for green sturgeon because of the disturbance of benthic habitats and the injury or burial of prey resources during the disposal of dredged materials. However, the reductions were expected to be highly localized and insignificant relative to the abundance of prey available to green sturgeon. The proposed actions were expected to affect a small area compared to the available surrounding habitat for prey species. In addition, prey abundance is determined by larger scale physical and biological factors beyond the scope of the proposed action.

Another concern is the potential introduction of contaminants into the environment through the disposal of dredged materials or through spills or leaks at the installations. NMFS concluded that effects on prey resources were expected to be small. As described above, levels of compounds in dredged materials for disposal were not expected to exceed concentrations harmful to organisms at the disposal sites, because dredged materials must be tested prior to disposal to ensure they meet current statutes and regulations for “clean” dredged material that is suitable for ocean disposal. In addition, the risk of spills and leaks at the installations was minimized with the adoption of spill prevention, management, and response plans.

Finally, climate change may alter conditions in coastal marine waters and result in shifts in the distribution of prey resources for green sturgeon in coastal marine areas. We are limited in our ability to assess the effects of climate change on green sturgeon critical habitat, however, because of the limited information available regarding green sturgeon habitat use in coastal marine waters. In addition, variation in the effects of climate change on the marine environment adds to the uncertainty. For example, the effects of climate change may cause some species to increase in abundance and expand in distribution, whereas other species may decline in abundance and become more restricted in distribution.

### 2.3.3 Humpback Whales

Humpback whales that occur within the action area are part of the CA/OR/WA stock (Carretta et al. 2012). Therefore, all effects of the environmental baseline described below are specific to this stock.

**Entrapment and Entanglement in Fishing Gear**

Humpback whales can become entrapped and entangled in fishing gear, which can result in serious injury and mortality. Observer programs record fisheries bycatch, including marine mammal bycatch. These programs have not observed entangled humpback whales, because the interactions are occurring when the fishing vessel is not present. Some fixed gear fisheries leave gear unattended. Large whales can swim considerable distances after becoming entangled in such gear, so mortality or injuries can go unobserved in these fisheries even if observers are on board. We have records of entangled whales, including humpback whales, from opportunistic sightings reported to stranding networks, not from observer programs. Because it is likely that many entangled whales are never seen or reported, the potential for unobserved injury or mortality from entanglement, particularly in fixed-gear, introduces uncertainty about the impacts of fisheries on humpback whales.

Between 2002 and 2011, NMFS NWR and Southwest Region (SWR) stranding networks reported 44 humpback whales entangled in fishing gear off the West Coast (Jim Carretta, pers. comm., NMFS Southwest Fisheries Science Center (SWFSC), August 9, 2012 and September 24, 2012) (Table 14). During this same time frame, observer programs did not observe any humpback whale entanglements. All of the reported entanglements were considered potential serious injuries or mortalities, with the exception of one sablefish trap/pot entanglement where the whale was successfully disentangled and did not appear to have sustained injury (Jim Carretta, pers. comm., NMFS SWFSC, August 9, 2012 and September 24, 2012).

In most cases, the final status of the entangled animal was unknown, and in only a few cases, entanglements were attributed to specific fisheries (Table 14). In two such instances, the entangling gear was identified as sablefish gear (a fishery of the proposed action). In a few other instances, the entangling gear was identified as spot prawn gear, Dungeness crab gear, lobster gear, and swordfish gear. In many cases, the specific fishery was unknown and the report did not specify gear type; however, type of gear was sometimes identified in more detail and reported as unidentified pot/trap gear or unidentified net gear.

Table 14. Number of humpback whale entanglements by gear type reported to NWR and SWR stranding networks from 2002-2011.

| Gear Type | Number of Entanglements |
|---|---|
| Unidentified Pot/Trap | 12 |
| Unidentified Net | 4 |
| Unidentified Fishery | 16 |
| Spot Prawn | 1 |
| Sablefish | 2 |
| Lobster | 1 |
| Crab | 7 |
| Swordfish | 1 |
| Total | 44 |

In addition, the stranding networks reported 26 unidentified whales entangled in fishing gear off the West Coast during the same timeframe (Jim Carretta, pers. comm., NMFS SWFSC, August 9, 2012 and September 24, 2012) (Table 15). All but two of these entanglements were potential serious injuries or mortalities. The final status of these unidentified whales and specific gear-type or fishery implicated was generally unknown. In a few cases, details about gear type were available (Table 15).

Table 15. Number of unidentified whale entanglements by gear type reported to NWR and SWR stranding networks from 2002-2011.

| Gear Type | Number of Entanglements |
|---|---|
| Unidentified Pot/Trap | 7 |
| Unidentified Net | 4 |
| Unidentified Fishery | 13 |
| Crab | 2 |
| Total | 26 |

Carretta et al. (2012) indicated that most of the unidentified whale entanglements were likely humpback whales. For the purposes of this biological opinion, we estimated the proportion of the unidentified whale entanglements that may have been humpback whales. We first evaluated all of the entanglements where the whale was identified to species and the entanglement resulted in a serious injury or mortality for a recent 5-year period. Allen and Angliss (2012) and Carretta et al. (2012) identified 16 entangled whales during this time period as either humpbacks (10 whales) or gray whales (6 whales). No entanglements were reported for other large whales during this time period. Thus, 62.5 percent of identified entangled whales were humpbacks (Table 16). We made the assumption that the humpback proportion of unidentified whale entanglements would be the same as the humpback proportion of whale entanglements identified to species. Therefore, we assumed 62.5 percent of the 26 unidentified whale entanglements from 2002 to 2011 were humpback whales.

Table 16. Proportion of unidentified whale entanglements that may be humpback whales, based on the humpback proportion of all whale entanglements identified to species that resulted in serious injury or mortality.

| Year | Humpback Whale Entanglements | Year | Gray Whale Entanglements |
|---|---|---|---|
| 2004 | 0 | 2005 | 2 |
| 2005 | 3 | 2006 | 2 |
| 2006 | 2 | 2007 | 2 |
| 2007 | 2 | 2008 | 0 |
| 2008 | 3 | 2009 | 0 |
| Totals | 10 | | 6 |
| Grand Total | | | 16 |
| Proportion Humpback | | | 0.625 |

There were 44 humpback whales entangled in fishing gear from 2002 to 2011 (Table 14), with two identified as entangled in sablefish gear, many others with some type of gear identified, or unknown. Because most entanglements were not identified to a specific fishery, there is uncertainty about how to allocate the entanglement impacts to either the PCGF or other ongoing fisheries (non-PCGF). We used two criteria to assign entanglements in unknown gear to either the PCGF or non-PCGF. First, we determined which humpback whale and unidentified whale entanglements could not possibly be gear from the PCGF, because the entangling gear was not used in the PCGF (swordfish, crab, lobster, spot prawn, and unidentified net gear). These 20 entanglements are from non-PCGF (Table 17). Second, we determined the number of entanglements with gear from unidentified fisheries (unidentified fisheries and unidentified pot/trap gear) that are likely non-PCGF entanglements by prorating the unknown entanglements based on proportion of humpback whale entanglements with known gear that are from the non-PCGF (Table 18 and 19). Using these methods, we quantified a variable number of entanglements from non-PCGF per year, ranging from 0 to approximately 12 entanglements per year with an average of approximately 5 entanglements per year (Table 19).

Table 17. Humpback whale and unidentified whale entanglements known to be from non-PCGF.

| Year | Known Non-PCGF Entanglements | | |
|---|---|---|---|
| | Identified Humpback Whales | Unidentified Whales | Total Annual |
| 2002 | 0 | 0 | 0 |
| 2003 | 0 | 0 | 0 |
| 2004 | 0 | 0 | 0 |
| 2005 | 1 | 0 | 1 |
| 2006 | 1 | 0 | 1 |
| 2007 | 2 | 0 | 2 |
| 2008 | 5 | 4 | 9 |
| 2009 | 2 | 1 | 3 |
| 2010 | 2 | 1 | 3 |
| 2011 | 1 | 0 | 1 |
| Total | 14 | 6 | 20 |

Table 18. Proportion of humpback whale entanglements with known gear that are non-PCGF and PCGF.

| Gear Type | Number of Entanglements |
|---|---|
| Prawn* | 1 |
| Sablefish** | 2 |
| Lobster* | 1 |
| Crab* | 7 |
| Swordfish* | 1 |
| Total Non PCGF* | 10 |
| Total PCGF** | 2 |
| Proportion non-PCGF | 0.833 |
| Proportion PCGF | 0.167 |

Table 19. Entanglements assigned to non-PCGF from 2002 to 2011 and the average annual number of entanglements.

| Year | Entanglements in Unknown Gear | | | | | Known Non-PCGF Entanglements* | Total Estimated Non-PCGF Entanglements |
|---|---|---|---|---|---|---|---|
| | Identified Humpback Whales | Non-PCGF | Unidentified Whales | Humpback | Non-PCGF | | |
| 2002 | 0 | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 |
| 2003 | 4 | 3.33 | 0 | 0.00 | 0.00 | 0 | 3.33 |
| 2004 | 1 | 0.83 | 0 | 0.00 | 0.00 | 0 | 0.83 |
| 2005 | 2 | 1.67 | 1 | 0.63 | 0.52 | 1 | 3.19 |
| 2006 | 4 | 3.33 | 4 | 2.50 | 2.08 | 1 | 6.41 |
| 2007 | 3 | 2.50 | 8 | 5.00 | 4.17 | 2 | 8.66 |
| 2008 | 2 | 1.67 | 2 | 1.25 | 1.04 | 9 | 11.71 |
| 2009 | 1 | 0.83 | 1 | 0.63 | 0.52 | 3 | 4.35 |
| 2010 | 6 | 5.00 | 3 | 1.88 | 1.56 | 3 | 9.56 |
| 2011 | 5 | 4.17 | 1 | 0.63 | 0.52 | 1 | 5.69 |
| Average Annual | | | | | | | 5.37 |

*Total annual entanglements with known non-PCGF gear from Table 17, above.

An additional method for evaluating fishery impacts to humpback whales is used on the east coast of the U.S. Observations of scarring are used to estimate the mortality rate of humpback whales associated with gear entanglement (e.g., as described in Robbins et al. 2009). This type of data is not currently available to estimate the mortality rate for the CA/OR/WA stock.

**Collisions with Ships**

Between 2002 and 2011, NMFS NWR and SWR stranding networks reported nine humpback whale collisions with ships, and all but three were considered potential serious injuries or mortalities (Jim Carretta, pers. comm., NMFS SWFSC, August 9, 2012). During the same time period, the stranding networks also reported 24 unidentified whale collisions with ships, and all but 8 were considered potential serious injuries or mortalities (Jim Carretta, pers. comm., NMFS SWFSC, August 9, 2012). Some of these may have been humpback whales. Other ship strikes likely happened but went unreported because the whales did not strand or did not have obvious signs of trauma. Several humpback whales were photographed in California with large gashes in their dorsal surface that may be from ship strikes (J. Calambokidis, pers. comm., in Carretta et al. 2012).

For the purposes of this biological opinion, we estimated the number of unidentified whale collisions with ships that may be humpback whales. We used records from the most recent marine mammal stock assessment reports to evaluate the annual number of ship strikes where the species was known and the strike resulted in serious injury or mortality. Based on this information, we estimated that 16.7 percent of known ship strikes involved humpback whales (Table 20). After applying this percentage to the unidentified whale collisions, we estimated the additional humpback collisions per year. We included known humpback collisions and 16.7 percent of unknowns to estimate the total number of humpback whale collisions with ships per year with an average of approximately 1 collision per year (Table 21).

Table 20. Proportion of humpback whale collisions with ships that result in serious injury and mortality.

| Species* | Average Annual Strikes Resulting in Serious Injury or Mortality | Source |
|---|---|---|
| CA/OR/WA Humpback Whales | 0.6 | Caretta et al. 2012 |
| Eastern North Pacific Gray Whales | 0.8 | Allen and Angliss 2012 |
| Eastern North Pacific Blue Whales | 1 | Caretta et al. 2012 |
| CA/OR/WA Fin Whales | 1 | Caretta et al. 2012 |
| CA/OR/WA Sperm Whales | 0.2 | Caretta et al. 2012 |
| Average Annual Total | 3.6 | |
| Proportion Humpback Whales | 0.17 | |

*There were no minke whale and sei whale collisions with ships reported in the most recent marine mammal stock assessment reports.

Table 21. Total estimated number of humpback whale collisions with ships from 2002 to 2011.

| Year | Identified Humpback Whales | Unidentified Whales | Humpback* | Total Estimated Humpback Collisions per Year |
|---|---|---|---|---|
| 2002 | 0 | 3 | 0.50 | 0.50 |
| 2003 | 0 | 1 | 0.17 | 0.17 |
| 2004 | 0 | 3 | 0.50 | 0.50 |
| 2005 | 1 | 0 | 0.00 | 1.00 |
| 2006 | 1 | 8 | 1.34 | 2.34 |
| 2007 | 2 | 0 | 0.00 | 2.00 |
| 2008 | 3 | 6 | 1.00 | 4.00 |
| 2009 | 0 | 0 | 0.00 | 0.00 |
| 2010 | 1 | 2 | 0.33 | 1.33 |
| 2011 | 1 | 1 | 0.17 | 1.17 |
| Average Annual | | | | 1.30 |

* Humpback = Unidentified Whales * 0.167, the humpback whale proportion identified in Table 20.

**Acoustic Disturbance**

Anthropogenic (human-generated) sound in the action area is generated by construction activities, vessels, and military operations. Natural sounds in the marine environment include wind, waves, surf noise, precipitation, thunder, and biological noise from other marine species. The intensity and persistence of certain sounds (both natural and anthropogenic) in the vicinity of humpback whales is expected to vary by time and location and have the potential to interfere with important biological functions (e.g., hearing and communication).

In-water construction activities are permitted by the Army Corps of Engineers under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899, and by the State of Washington under its Hydraulic Project Approval program. We consult on these permits and help project applicants incorporate conservation measures to minimize or eliminate potential effects of in-water activities, such as pile driving, to marine mammals.

We completed consultation on major rehabilitation of the jetty system at the mouth of the Columbia River, and concluded that the proposed action was likely to adversely affect but not likely to jeopardize the continued existence of humpback whales (NMFS 2011b). We anticipated that humpback whales exposed to sound from the proposed pile driving would respond by either a deviation in their course to deflect around the sound (in the case of whales otherwise passing through the area) or by avoiding the area (in the case of whales otherwise feeding in the area). The jetty rehabilitation includes maintenance pile driving that is expected to occur over a 20-year period from the time of project initiation; a time as yet to be determined. NMFS has not issued an incidental take statement for this anticipated behavioral disruption because the incidental take has not been authorized under section 101(a)(5) of the MMPA and/or its 1994 amendments. Following issuance of such regulations or authorizations, we may amend our opinion to include an incidental take statement for humpback whales, as appropriate.

Sound generated by large vessels is a source of low frequency (5 to 500 Hz), human-generated sound in the world's oceans (NRC 2003). Humpback whales have specialized hearing in the low-frequency range (estimated auditory bandwidth of 7 Hz to 22 kHz) (Southall et al. 2007), and therefore, sound from vessels is likely to disturb them. Sonar generated by military vessels also has the potential to disturb humpback whales. In 2010, NMFS completed consultation on the Navy training at the Northwest Training Range Complex and found that the proposed training activities were likely to adversely affect but not likely to jeopardize the continued existence of humpback whales. We issued an incidental take statement and MMPA permit for these activities that included some harassment of humpback whales (75 Fed. Reg. 69296). NMFS conducts consultations and issues MMPA permits for Navy training activities on an annual basis.

We have also completed consultations on renewable ocean energy installations off the Oregon Coast (off of Reedsport and Newport, OR), and concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of humpback whales (NMFS 2012d NMFS 2012e. For both of these projects, we anticipate potential adverse effects from exposure to sound associated with the proposed actions, and identify that it will be better able to evaluate the risk of collision with the proposed arrays as data are collected in proposed monitoring studies. In both instances, we worked with the action agencies and applicants to develop adaptive management plans that identify a process for minimizing or mitigating potential effects as more information is gained through monitoring.

**Prey Availability**

Many fisheries in the action area target relatively large, commercially valuable fish species, such as salmon, a variety of groundfish (some of which are targeted by the proposed action), and highly migratory species, which are not consumed by humpback whales. The Coastal Pelagic Species FMP does harvest anchovy, market squid, Pacific sardine, Pacific mackerel, and jack mackerel, some of which are also consumed by humpback whales. This FMP was recently amended to include all krill species and to prohibit their harvest (Amendment 12 – Measures to Prohibit Fishing for Krill; 74 Fed. Reg. 33372, July 13, 2009). This proactive PFMC recommendation was intended to protect krill's vital role in the marine ecosystem, and effectively limits the potential for competition over prey resources consumed by humpback whales.

### 2.3.4 Steller Sea Lions

Steller sea lions that occur within the action area are part of the eastern DPS. Therefore, all effects of the environmental baseline described below are specific to the eastern DPS.

**Subsistence Harvest**

On average, an estimated 12 Steller sea lions per year were harvested or struck but lost during subsistence hunting by Alaska Natives (from 2004 to 2008) (Allen and Angliss 2012). An unknown number of Steller sea lions are harvested by subsistence hunters in Canada; however, the magnitude of Canadian harvest is probably small (Allen and Angliss 2012).

## Fisheries Bycatch

Bycatch in fishing gear can result in serious injury and mortality to Steller sea lions. The number of serious injuries and mortalities is compiled annually, based on documented observations and stranding reports summarized in Allen and Angliss (2012). However, more information about bycatch specific to the PCGF is summarized in Jannot et al. (2011) and more information about stranding reports are summarized in NWFSC (2011).

Allen and Angliss (2012) reported a minimum estimated mortality of 33.5 Steller sea lions per year (2005 to 2009 average) incidental to commercial and recreational fisheries (both U.S. and Canadian), based on fisheries observer data (7.47), opportunistic observations (24.2), and stranding data (1.8). This bycatch includes interactions with the proposed fishery, which are isolated and discussed further in Section 2.4.1, Effects of the Action on Listed Species.

We relied on several types of data to estimate the annual average number of serious injuries and mortalities of Steller sea lions for fisheries bycatch other than PCGF. NWFSC (2011) used data from entanglement surveys, stranding networks, and an entanglement study by Raum-Suryan et al. (2009) to estimate a minimum, annual mortality attributable to entanglement in or ingestion of fishing gear of 5 to 40 Steller sea lions. In the stock assessment report, Allen and Angliss (2012) also included different types of data to estimate a minimum, annual mortality attributed to fisheries bycatch, and included opportunistic observations of ingested fishing gear (24.2 sea lions) and entanglements (1.8 sea lions) of the 33.5 sea lions. For purposes of this biological opinion, we rely on the upper-bound estimate of 40 Steller sea lions based on the summary of opportunistic observations in NWFSC (2011), rather than the 24.2 and 1.8 estimates from the stock assessment report.

To estimate the annual average number of serious injuries and mortalities of Steller sea lions from the WCGF we relied primarily on fishery observer data. Jannot et al. (2011) reported observed bycatch from two WCGF observer programs and estimated total bycatch by extrapolation from the proportions of each observed fishery in which bycatch is documented (the WCGOP and A-SHOP). Based on these methods, the estimated total was 44 Steller sea lions, with upper and lower 90 percent confidence intervals of 18 and 111 serious injuries or mortalities for the 2002 to 2009 period. This translates to an average annual estimate of 5.55 sea lions, with a lower bound of 2.25 and upper bound of 13.88 sea lions, annually (Table 22). This annual average estimate is also more conservative than the annual estimated mortality from WCGF as reported in the stock assessment report. Allen and Angliss (2012) estimated minimum mortality attributed to WCGF as 0.8 Steller sea lions, annually.

## Other Human-Caused Mortality

Between 2005 and 2009, other sources of human-caused mortality were minimal, but have been documented by stranding reports, including shooting, entanglement in marine debris, incidental trapping, and vessel collision (Allen and Angliss 2012). In addition, mortality can occur incidental to marine mammal research activities authorized under MMPA permits. Based on these reports, estimated mortality from these sources is 3.2 Steller sea lions per year.

Table 22. Estimated bycatch of Steller sea lions in the WCGF (from Table 7i, Jannot et al. 2011).

| Year | Bycatch Estimate | 90% CI lower | 90% CI upper |
|---|---|---|---|
| 2002 | 14 | 5 | 37 |
| 2003 | 1 | 0 | 2 |
| 2004 | 0 | 0 | 0 |
| 2005 | 2 | 1 | 5 |
| 2006 | 3 | 2 | 5 |
| 2007 | 4 | 2 | 6 |
| 2008 | 3 | 1 | 11 |
| 2009 | 17 | 7 | 45 |
| Total | 44 | 18 | 111 |
| Annual Average | **5.50** | **2.25** | **13.88** |

**Prey Availability**

Many fisheries in the action area target commercially valuable fish species, such as salmon and a variety of groundfish (some of which are targeted by the proposed action), some of which are also consumed by Steller sea lions. As mentioned in the Status section, Steller sea lions are generalist predators, able to respond to changes in prey abundance, and based on long-term population growth of the eastern DPS, prey availability does not appear to be limiting the population.

**Disturbance**

Anthropogenic sound in the action area is generated by construction activities, vessels, and military operations. Natural sounds in the marine environment include wind, waves, surf noise, precipitation, thunder, and biological noise from other marine species. The intensity and persistence of certain sounds (both natural and anthropogenic) in the vicinity of Steller sea lions is expected to vary by time and location and have the potential to interfere with important biological functions (e.g., hearing and communication).

In-water construction activities are permitted by the Army Corps of Engineers under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899, and by the State of Washington under its Hydraulic Project Approval program. We consult on these permits and help project applicants incorporate conservation measures to minimize or eliminate potential effects of in-water activities, such as pile driving, to marine mammals.

We completed consultations on Steller sea lions that make use of the action area, specifically for two upcoming construction projects: (1) major rehabilitation of the jetty system at the mouth of the Columbia River and (2) the Columbia River Crossing transportation project (a freeway bridge). In both cases, we concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of Steller sea lions (NMFS 2011b; NMFS 2011c). We anticipated that Steller sea lions exposed to sound from proposed pile driving for these projects would respond by spending less time at a proximate haulout or foraging in the immediate vicinity, or travel more quickly through the affected area. The jetty action includes maintenance pile driving that is expected to occur over a 20-year period from the time of project initiation; a time as yet to be determined. The Columbia River Crossing project includes pile driving with construction anticipated to begin September 2012 and end in December 2020. NMFS has not issued an incidental take statement for the anticipated behavioral disruption from either project because the incidental take has not been authorized under section 101(a)(5) of the MMPA and/or its 1994 amendments. Following issuance of such regulations or authorizations, we may amend our opinions to include an incidental take statement for Steller sea lions, as appropriate.

In 2010, we completed consultation on the Navy training at the Northwest Training Range Complex and found that the proposed training activities were likely to adversely affect but not likely to jeopardize the continued existence of Steller sea lions. We issued an incidental take statement and MMPA permit for these activities that included some harassment of Steller sea lions (75 Fed. Reg. 69296, November 10, 2010). We conduct consultations and issue MMPA permits for Navy training activities on an annual basis.

A few Steller sea lions that make use of the action area were also affected by a deterrence program from 2008 to 2010 to reduce pinniped impacts on ESA-listed Pacific salmon and steelhead below Bonneville Dam on the lower Columbia River. We previously consulted on the effects of this program, and concluded that the non-lethal deterrence activities that target Steller sea lions are likely to adversely affect but not likely to jeopardize Steller sea lions. Steller sea lions that are likely to be affected by this deterrence program have shown increasing habituation in recent years to the various hazing techniques used to deter the animals from foraging on sturgeon and salmon in the Bonneville tailrace area, including acoustic deterrent devices, boat chasing, and above-water pyrotechnics (Stansell et al. 2010; Brown et al. 2010). Additionally, many of the individuals that travel to the tailrace area return in subsequent years.

We have also completed consultations on renewable ocean energy installations off the Oregon Coast (off of Reedsport and Newport, OR), and concluded that the proposed actions were likely to adversely affect but not likely to jeopardize the continued existence of Steller sea lions (NMFS 2012d). For both of these projects, we anticipate potential adverse effects from exposure to sound associated with the proposed actions. In both instances, we worked with the action agencies and applicants to develop adaptive management plans that identify a process for minimizing or mitigating potential effects as more information is gained through monitoring.

### 2.3.5 Leatherback Sea Turtles

Leatherback sea turtles that occur within the action area are most likely turtles originating from nesting aggregations of the western Pacific (Benson et al. 2011; NWFSC 2012). Therefore, effects of the environmental baseline described below are specific to western Pacific leatherbacks.

**Fisheries Bycatch**

Only one interaction between a leatherback sea turtle and drift gillnet fishing gear in the action area has been observed or reported to NMFS since the leatherback conservation zone for the drift gillnet fishery was implemented in 2001; the turtle was released alive in good condition (in 2009) (NMFS 2011d; Appendix A). There have been a few stranding reports of leatherbacks entangled in pot-gear in the recent past (three entanglements in California reported from 2001 to 2008; SWR stranding network database).

We have completed a few consultations in the action area that authorized take of leatherback sea turtles incidental to fisheries and in all cases found that the fishing proposed was not likely to jeopardize the continued existence of leatherback sea turtles. These include consultations on shallow-set longline exempted fishing permits under the West Coast Highly Migratory Species FMP (e.g., NMFS 2008c). In these opinions, we issued an incidental take statement for a maximum of five captured turtles and one turtle mortality incidental to fishing effort in the year of authorization (2007 and 2008); however, these fishing activities never occurred. We also completed consultation on the CA/OR drift gillnet fishery managed under the West Coast Highly Migratory Species FMP (NMFS 2004). In this opinion, we authorized the annual capture of three leatherbacks in live condition and two leatherback mortalities (a subset of the captured turtles). To date, only one live interaction has occurred, and the turtle was released in good condition (in 2009, as referenced above). Currently, NMFS has reinitiated consultation on this fishery because the take of sperm whales was exceeded. NMFS also recently completed consultation on the deep-set tuna longline fishery also managed under the West Coast Highly Migratory Species FMP (NMFS 2011d). In this opinion, we issued an incidental take statement for a maximum of one leatherback mortality over 3 years. This fishery has been observed with 100 percent coverage since 2005, and in that time there has only been one observed turtle interaction, which was not a leatherback (mortality of an olive ridley sea turtle).

The proportion of fishing activity observed by programs that quantify bycatch is variable across fisheries in the action area. There remains uncertainty about the impacts of potential bycatch for fisheries with low observer coverage. We can, however, be confident that impacts on leatherback turtles are low for fisheries with relatively high observer coverage and no observed bycatch. Unlike large whales, sea turtles are not large enough to swim away with gear after becoming entangled. Therefore, there is little chance of a turtle entanglement going unobserved where observers are on board, with the exception of potential entanglement in ghost-gear (e.g., fixed gear that keeps fishing after being carried off its deployed location, such as can happen in storms).

**Collisions with Ships**

Between 2000 and 2005, there were three reported boat collisions with leatherbacks in the action area, and the fate of these turtles is unknown (SWR stranding database). Two of the reports documented damage to the carapace, head, or flippers. In 2008, there was another boat collision reported off Cayucos Point, California and the turtle was observed dead (SWR stranding database). Ship strikes likely go largely unreported, and may pose a threat to leatherbacks in foraging areas like the Gulf of the Farallones (Benson et al. 2007b).

**Entanglement and Ingestion of Marine Debris**

Marine debris may be a threat to leatherback sea turtles in the action area, and can cause mortality or illness (ingesting objects, e.g., plastic bags). There are no documented cases of leatherbacks entangled in debris that is not fishing-related; however, these types of events would be difficult to document and thus are likely to go unobserved or unreported.

**Other Human Activities**

NMFS has completed two consultations in the action area that authorize take of leatherback sea turtles incidental to the operation of nuclear generating systems, and in both cases found the activities were not likely to jeopardize the continued existence of leatherback sea turtles (Diablo Canyon, NMFS 2006b and San Onofre, NMFS 2006c; Appendix A). In these opinions, NMFS issued incidental take statements, both of which authorize a maximum of three turtle interactions that result in live release (with one serious injury) and one turtle mortality. These opinions and ITSs are currently active.

**Prey Availability**

Many fisheries in the action area target commercially valuable fish species, but can also capture leatherback prey (jellyfish) as bycatch. A reduction in prey availability could affect leatherbacks and the conservation value of their critical habitat. Jones (2009) estimated that adult leatherback turtles (551 to 992 pounds (250 to 450 kg)) consume approximately 180.78 pounds (82 kg) of jellyfish per day to meet their energetic demands. Unfortunately, the amount and distribution of jellyfish bycatch in various fisheries is not quantified, nor are they identified to species. Therefore, it is difficult to gauge potential impacts of the various fisheries considered in this opinion, particularly trawling, on leatherbacks or their critical habitat. Jellyfish blooms are reported increasing in oceans throughout the world, including East China and Yellow Seas, along the Mediterranean, and in the northern Benguela current, for example (summarized in Purcell et al. 2007). In addition, warming ocean conditions as well as eutrofication likely contribute to expanding jellyfish numbers. Lastly, lack of prey is not a presently identified threat to the species' recovery.

## 2.4 Effects of the Action on Species and Designated Critical Habitat

"Effects of the action" means the direct and indirect effects of an action on the species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

As discussed in the proposed action, a new trawl rationalization program may change fishing effort profiles by time, area, and gear type. The program has just begun to analyze the first year of data, and we will have a better sense of potential changes as more data are collected in the future. In the first year, a slight change in fishing effort was detected; however, the magnitude of change was small (approximately 9 percent more pot/trap effort and approximately 14 percent less trawl effort than in previous years) (Figure 14 of Matson 2012). Given the small magnitude of change detected and the short duration of data collection, these potential changes are not analyzed below.

Bycatch estimates of threatened and endangered species from the proposed action are based on data from Federal observer programs that cover the following fishery sectors:

- At-sea Pacific hake catcher-processor;
- At-sea Pacific hake mothership;
- At-sea Pacific hake tribal;
- Commercial LE non-mid-water trawl;
- Commercial fixed gear LE sablefish primary (tier endorsed);
- Commercial fixed gear LE non-primary sablefish (non-endorsed and daily trip limit sectors); and
- Commercial fixed gear OA daily trip limit.

Unobserved fisheries of the proposed action include tribal groundfish (non-hake), shoreside hake, and recreational sectors. Reference to fleet-wide bycatch estimates of the PCGF in the effects section do not include effort in these fisheries, and therefore effects may be an underestimate. Tribal (non-hake) and recreational fisheries are a small component of the overall effort in the PCGF; however, this remains a source of uncertainty for bycatch estimates.

### 2.4.1 Effects of the Action on Listed Species

#### 2.4.1.1 Eulachon

The proposed action's main effect is that the proposed fisheries would capture and kill juvenile and adult eulachon. An unknown number of eulachon may enter groundfish trawl nets during fishing operations. However, we have no way of determining what percentage of these fish are retained, nor how the survival of fish that are not retained would be affected. We expect that all of the eulachon retained as bycatch in these fisheries would be killed.

We do not anticipate fishing effort to increase in any of the proposed fisheries. Therefore, and to err on the side of caution, we analyzed the effects of the highest annual bycatch for which we have estimates (2002 to 2010) and projected that take into the future for each individual fishery (Table 23). Though these numbers represent the maximum reached for each fishery during 2002 to 2010, these maximum bycatch numbers were never reached during the same year. The highest total is from 2002 when 821 eulachon were captured as bycatch in the LE trawl.

Table 23. Anticipated annual bycatch of eulachon (number of individual fish) in all U.S. Pacific Coast groundfish fisheries covered by this biological opinion. These estimates are based on the highest estimated level of bycatch observed in these fisheries from 2002 to 2010.

| | Limited Entry Trawl | At-sea Hake | | | Total Annual Estimate |
|---|---|---|---|---|---|
| | | Tribal Mothership | Non-tribal Mothership | Catcher-Processor | |
| **Eulachon Bycatch Estimate (fish)** | 821 | 32 | 6 | 145 | 1,004 |

Any eulachon that may be captured during the proposed fisheries would probably come from a mix of various freshwater production areas. Beacham et al. (2005) reported that marine sampling by trawl showed that eulachon from different rivers mix during their 2 to 3 years of pre-spawning life in offshore marine waters, but not thoroughly. Their samples from southern British

Columbia comprised a mix of fish from multiple rivers, but were dominated by fish from the Columbia and Fraser River populations. Their results suggest that the eulachon that may be captured off the coasts of Oregon and Washington during the proposed fisheries are likely to come from the Columbia and Fraser Rivers (the major production areas for the DPS) as well as from several smaller streams along the Washington and Oregon coasts. This means that the projected decreases in abundance would be spread out over several populations. Additionally, the proposed action would take place in multiple marine locations, further decreasing the chance that the eulachon bycatch would disproportionately affect any particular population. The captured fish would also be members of several year classes, as eulachon spend 2 to 5 years at sea before returning to their spawning areas.

In addition, marine mortality is likely very high for eulachon. Based on our knowledge of survival of fishes with similar life histories, the marine mortality rate for eulachon could be potentially substantial. For example, the annual mortality rate of adult Pacific herring has been estimated at 50 percent (Hourston and Haegele 1980), and the annual mortality rate of 4- to 5-year-old capelin has been estimated as high as 93 percent (Dommansnes and Røttingen 1985). Thus, the death of 1,004 individuals of different age classes in the ocean, some years away from spawning, would be equivalent to a very small number of spawning adults. Thus, if we assume that all eulachon caught in the proposed action would have spawned in the following year (a conservative estimate given that multiple age classes will likely be caught) and we assume an annual mortality rate of 50 percent, then the 1,004 eulachon killed by the proposed action would represent approximately 502 adult spawners.

Even if all the captured fish would otherwise have survived to spawn, the total take still represents a very small loss from among the various populations and age classes. Although eulachon abundance is not well determined, a combined estimate from the two largest remaining eulachon runs (the Columbia and Fraser Rivers) yields 19.47 million eulachon annually. For the take and mortality of 1,004 eulachon out of a population of 19.47 million, the action may kill at most 0.0052 percent of eulachon annually (Table 24).

Table 24. Annual abundance and total requested take for eulachon for actions covered in this Biological Opinion.

| Species | Life Stage | Origin | Abundance | Total Take / Mortality | Percent of ESU killed |
|---|---|---|---|---|---|
| Eulachon | Adult | Natural | 19,472,739 | 1,004 | 0.0052% |

### 2.4.1.2 Green Sturgeon

We evaluated the potential direct and indirect effects of the proposed action on Southern DPS green sturgeon based on the best available data on past effects of the PCGF on the species and its habitat. The proposed action’s direct effects on Southern DPS green sturgeon would result from encounters during regular fishing activities (i.e., capture of green sturgeon in fishing gear and removal of those fish from the water when hauling the catch onto the vessel) and the handling of green sturgeon to release them back into marine waters. Although the majority of the green sturgeon captured would likely be released alive, some portion may die during capture and/or removal from the water, or after being released. The proposed action's indirect effects on Southern DPS green sturgeon would result from the effects of fishing activities on the species' habitat and prey resources. This analysis considers the extent to which the direct and indirect effects associated with the proposed action may reduce the reproduction, numbers, or distribution of Southern DPS green sturgeon, pursuant to the regulatory definition of jeopardy.

We analyzed direct effects in two steps. First, we estimated the number of Southern DPS green sturgeon likely to be encountered in the fisheries and considered both the sublethal and lethal effects on individuals. Second, we considered the consequences of those sublethal and lethal effects at the population level. We analyzed indirect effects by considering the potential effects of fishing activities on benthic habitats and the availability of prey resources for green sturgeon. Throughout, we identify uncertainties in light of data gaps and the assumptions made. As stated previously, this analysis focuses on the effects of the Federal groundfish fishery on Southern DPS green sturgeon and does not include the effects of the state-managed California halibut bottom trawl fishery (considered instead as part of the environmental baseline and integration and synthesis).

Effects from Bycatch in Fishing Gear

Green sturgeon occur throughout the U.S. West Coast from Mexico to Alaska, predominantly in coastal marine waters shallower than 360.89 feet (110 m) from Monterey Bay, California, to Vancouver Island, British Columbia. Because their distribution overlaps with the spatial extent of the fishery, green sturgeon are exposed to potential capture by fishing gear in the PCFG. WCGOP and A-SHOP data indicate that green sturgeon are vulnerable to capture by bottom trawl and mid-water trawl gear.

The fishery sectors that have encountered green sturgeon in the past and that are most likely to encounter green sturgeon during the continued operation of the PCGF are the:

- LE groundfish bottom trawl sector;
- At-sea Pacific hake/whiting mothership sector; and
- At-sea Pacific hake/whiting tribal mothership sector.

Most of the observed encounters occurred in the LE groundfish bottom trawl sector. The total number of green sturgeon observed in this sector was small (n = 22 observed green sturgeon in total from 2002 through 2010) (Table 25) (WCGOP 2011). Observed green sturgeon encounters in this sector occurred from San Francisco Bay, California, to Neah Bay, Washington, with the majority of observed encounters in marine waters adjacent to the Columbia River estuary and Willapa Bay, Washington (WCGOP 2011). Tows encountering green sturgeon from 2002 to 2010 in this sector ranged from 5 to 65 fathoms in average depth and from 0.5 to 4 hours in total haul duration (WCGOP 2011). No correlations between green sturgeon encounters and haul depth or duration were apparent from the data. Observed encounters primarily occurred during summer months from April through August, with a few observations in October and November (Al-Humaidhi 2011; WCGOP 2011).

Because the Southern DPS and Northern DPS co-occur throughout the action area and are morphologically indistinguishable from one another, the data on observed and estimated encounters with green sturgeon in the fishery do not specify the number of Southern DPS green sturgeon encountered. Therefore, we estimated the number of Southern DPS green sturgeon among the green sturgeon encountered based on the location of the encounters and available data on the likely proportion of Southern DPS to Northern DPS green sturgeon for those locations. Based on the estimated number of Southern DPS green sturgeon encountered in the fisheries from 2002 through 2010, we estimated the number of Southern DPS green sturgeon likely to be encountered under the proposed action. Uncertainties that may influence the bycatch estimates used in this analysis include the uncertainty in sampling of landings for species composition, logbook spatial information, observed retained catch weight, and green sturgeon recapture rates (Bellman et al. 2011; Al-Humaidhi et al. 2012). However, these estimates represent the best data available at this time to assess the effects of the proposed action on Southern DPS green sturgeon. The following paragraphs describe the analysis for each sector and the assumptions and uncertainties involved in more detail.

*Limited Entry Groundfish Bottom Trawl Sector*

To estimate the expected number of Southern DPS green sturgeon encountered in this sector under the proposed action, we analyzed the available WCGOP data on the number of green sturgeon encounters in this sector from 2002 through 2010. Observer coverage in this sector from 2002 through 2010 ranged from 13 percent to 26 percent (WCGOP Observer Coverage Rates available online at http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm). Although observer coverage of this sector increased to 100 percent in 2011, data from 2011 were not available for this analysis. The WCGOP data include the number of green sturgeon encountered in the observed portion of the sector each year as well as the estimated number of green sturgeon encountered fleet-wide each year (estimated by taking the observed bycatch rates for green sturgeon and directly expanding them to the fleet-wide level) (Table 25). Al-Humaidhi et al. (2012) also provided 95 percent confidence intervals around the estimated fleet-wide encounters.

To be conservative in our analysis, we used the upper bound of this 95 percent confidence interval to estimate the number of Southern DPS green sturgeon encountered in the past and used that estimate to project the number expected under the proposed action. From 2002 through 2010, estimated fleet-wide encounters with green sturgeon in the LE groundfish bottom trawl sector ranged from 0 to 100 encounters per year (for both Southern DPS and Northern DPS fish) (Table 25).

Because Southern DPS and Northern DPS green sturgeon co-mingle in coastal marine waters, we expect a portion of the green sturgeon encountered were Northern DPS fish. To estimate the number of encounters with Southern DPS green sturgeon, we used the best available data on the DPS composition of green sturgeon in marine waters and coastal estuaries. Only one study has directly examined the DPS composition of green sturgeon encountered in the LE groundfish bottom trawl fishery; the study used genetic analysis of tissue samples collected from observed green sturgeon encountered from 2007 through 2008. Eighteen of the 19 samples were collected from green sturgeon encountered in coastal waters adjacent to San Francisco Bay and one sample was collected from a green sturgeon encountered in coastal waters adjacent to the Columbia River estuary. Genetic results assigned 15 (or 83 percent) of the 18 green sturgeon encountered off the coast of San Francisco Bay to the Southern DPS, as well as the one green sturgeon encountered offshore of the Columbia River estuary (Israel 2010).

Table 25. Observed and estimated bycatch of green sturgeon (number of encounters) in the LE groundfish bottom trawl sector from 2002 through 2010.

| Year | Season | Observed bycatch | | | Estimated bycatch | | | Bycatch estimate | 95% CI |
|---|---|---|---|---|---|---|---|---|---|
| | | WA | OR | CA | WA | OR | CA | | |
| 2002 | Winter | 0 | 1 | 0 | 0 | 7 | 0 | 34 | 3 |
| | Summer | 1 | 1 | 0 | 20 | 7 | 0 | | 100 |
| 2003 | Winter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Summer | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 2004 | Winter | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 3 |
| | Summer | 0 | 2 | 1 | 0 | 11 | 5 | | 39 |
| 2005 | Winter | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 2 |
| | Summer | 1 | 1 | 0 | 5 | 5 | 0 | | 28 |
| 2006 | Winter | 0 | 1 | 0 | 0 | 5 | 0 | 5 | 1 |
| | Summer | 0 | 0 | 0 | 0 | 0 | 0 | | 15 |
| 2007 | Winter | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |
| | Summer | 0 | 1 | 0 | 0 | 6 | 0 | | 16 |
| 2008 | Winter | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Summer | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 2009 | Winter | 0 | 3 | 0 | 0 | 12 | 0 | 43 | 9 |
| | Summer | 0 | 6 | 1 | 0 | 25 | 6 | | 92 |
| 2010 | Winter | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 2 |
| | Summer | 0 | 2 | 0 | 0 | 8 | 0 | | 19 |

- Asterisks (*) indicate strata with fewer than three observed vessels.
- Italicized estimates result from bootstrapping due to fewer than three observed vessels in those strata.
- The 95% confidence interval (CI) for the fleet-wide bycatch estimate is provided; these are based on either the bycatch ratio standard errors, or the 95% quantiles of bootstrapped bycatch ratios, when there were fewer than three observed vessels within a stratum.
- Winter season is January–April and November–December; summer season is May–October (Table 1 from Al-Humaidhi et al. 2012).

Aside from this study, the best available information is limited to stock composition data for coastal estuaries based on tagging and genetic studies. Genetic studies indicate that almost all green sturgeon in the San Francisco Bay system belong to the Southern DPS (Israel et al. 2009). This is corroborated by tagging and tracking studies which found that no green sturgeon tagged in the Klamath or Rogue Rivers (i.e., Northern DPS spawning rivers) were detected in the San Francisco Bay system (Lindley et al. 2011). Genetic studies also indicate that the proportion of Southern DPS green sturgeon in Winchester Bay, Oregon, varied widely between years (0.16 to 0.55), whereas aggregations in the Columbia River estuary and Willapa Bay were primarily Southern DPS fish (proportions ranging from 0.69 to 0.88) and Grays Harbor had slightly greater proportions of Northern DPS fish (0.54 to 0.59) (Israel et al. 2009).

Table 26 provides a summary of the coastal areas where green sturgeon have been encountered and the estimated proportion of Southern DPS green sturgeon for each area. To estimate the number of Southern DPS green sturgeon encounters from 2002 through 2010, we multiplied the estimated number of green sturgeon encounters (expanded fleet-wide estimates) for each area by the proportion of Southern DPS green sturgeon for each area (Table 26). To be conservative in our estimates, we used the high estimated proportion of Southern DPS green sturgeon for each area. We also made the following assumptions. First, that green sturgeon stock composition in coastal estuaries is representative of the stock composition in adjacent coastal marine waters.

Second, that the 18 green sturgeon encountered, sampled, and genetically analyzed in 2007 and 2008 were a representative sample of the green sturgeon stock composition in waters adjacent to San Francisco Bay. Finally, that 50 percent of the green sturgeon encountered off Neah Bay, Washington, and Humboldt Bay, California, (where data on estuarine or marine stock composition are not available) belonged to the Southern DPS. Telemetry studies show that both Southern DPS and Northern DPS green sturgeon occur in these areas (Lindley et al. 2008, 2011). Although Humboldt Bay is closer in proximity to Northern DPS green sturgeon spawning rivers (Klamath River, California, and Rogue River, Oregon), Southern DPS green sturgeon migrating out of their natal waters migrate north the majority of the time. Thus, green sturgeon in waters off Humboldt Bay are just as likely to belong to the Southern DPS as they are the Northern DPS. Similarly, both Southern DPS and Northern DPS green sturgeon make northward migrations along the coast to Vancouver Island and further north. Thus, green sturgeon in waters off Neah Bay are just as likely to be Southern DPS green sturgeon as they are to be Northern DPS green sturgeon.

Applying the proportions listed in Table 26 to the estimated fleet-wide green sturgeon encounters (using the upper bound of the 95 percent confidence interval) (Table 25), we estimate that the LE groundfish bottom trawl sector encountered 0 to 84 Southern DPS green sturgeon fleet-wide per year from 2002 through 2010 (Table 27). In most years, the sector encountered 28 or fewer Southern DPS green sturgeon fleet-wide per year. The length frequency distribution of observed green sturgeon encountered in this sector from 2007 through 2010 indicates that subadult and adult green sturgeon are nearly equally vulnerable to incidental catch in the sector (WCGOP 2011). Using a minimum fork length (FL) of 55.12 inches (140 cm) for adults (corresponding to approximately 59 inches (150 cm) TL; David Woodbury, pers. comm., NMFS, January 10, 2012), 6 (or 46 percent) of the 13 green sturgeon observed and measured in this sector were adults (range in size of all measured green sturgeon was 34.25 to 83.86 inches (87 to 213 cm) FL). Assuming that the length frequency distribution of the observed green sturgeon encountered

Table 26. Estimated proportion of Southern DPS green sturgeon within areas along the U.S. West Coast where green sturgeon have been encountered.

| Coastal area | Estimated proportion of Southern DPS green sturgeon | Reference |
|---|---|---|
| Offshore of San Francisco Bay | 0.83 to 1.0 | Israel 2010; Israel et al. 2009 |
| Offshore of Humboldt Bay | 0.50 | Best professional judgment |
| Oregon Coast (excluding area off Columbia River estuary) | 0.16 to 0.55 | Israel et al. 2009 |
| Offshore of Columbia River estuary | 0.69 to 0.88 | Israel et al. 2009 |
| Offshore of Willapa Bay | 0.69 to 0.88 | Israel et al. 2009 |
| Offshore of Grays Harbor | 0.41 to 0.46 | Israel et al. 2009 |
| Offshore of Neah Bay | 0.50 | Best professional judgment |

from 2007 through 2010 is representative of those encountered from 2002 through 2010, we estimate the sector encountered 0 to 45 subadults and 0 to 39 adults fleet-wide each year from 2002 through 2010.

We expect the operation of the groundfish fishery under the proposed action to be similar to the operation of the fishery in the period from 2002 through 2010. Although fishing effort may shift because of implementation of the catch shares management program beginning in 2011, preliminary data from 2011 are not sufficient to predict what changes may occur in the foreseeable future. Thus, we assumed that the fishing effort and estimated encounters with Southern DPS green sturgeon in the LE groundfish bottom trawl sector from 2002 through 2010 is representative of the fishing effort and potential encounters with the species under the proposed action. In most years, the sector encountered an estimated 28 or fewer Southern DPS green sturgeon fleet-wide per year (Table 27). In only two years did the estimated number of encounters exceed 28 fish—2002 and 2009—when as many as 76 and 84 encounters with Southern DPS green sturgeon were estimated fleet-wide (Table 27). Therefore, we expect 28 or fewer Southern DPS green sturgeon encounters per year in the LE groundfish bottom trawl sector under the proposed action, with up to 15 subadults and 13 adults encountered per year. We also expect that the sector may exceed 28 encounters with Southern DPS green sturgeon in some years (but in no more than two out of nine years), with up to 84 encounters in a single year (Table 27).

*At-sea Pacific Hake/Whiting Fishery*

Bycatch of green sturgeon in the at-sea hake sector is rare (Vanessa Tuttle, pers. comm., A-SHOP, July 23, 2012). Only three confirmed green sturgeon have been observed as bycatch in this fishery, one in the summer of 2005 and two in the summer of 2006. One green sturgeon (a subadult at 52.76 inches (134 cm) TL) was caught in June 2006 in waters off the coast of Grays Harbor, Washington, during an observed tow at a depth of 45 fathoms (Duane Stevenson and Vanessa Tuttle, NMFS, unpublished data, September 2006). Biological and tow data were not available for the other two green sturgeon encountered in this sector. Given the lack of data, we assumed that the green sturgeon encountered in this sector may belong to either the Southern DPS or the Northern DPS and may be subadults or adults. Therefore, we expect this sector to encounter 0 to 2 Southern DPS green sturgeon per year under the proposed action (0 to 2 subadults and/or 0 to 2 adults). We expect that in most years, the at-sea hake fishery will not encounter any Southern DPS green sturgeon.

*Summary of Expected Bycatch of Southern DPS Green Sturgeon*

Based on the best available WCGOP and A-SHOP data, we expect the fishery under the proposed action to encounter Southern DPS green sturgeon in the LE groundfish bottom trawl and at-sea hake sector. In most years, we expect the LE groundfish bottom trawl sector to encounter 28 or fewer Southern DPS green sturgeon and the at-sea hake sector to encounter zero green sturgeon (based on the upper 95 percent confidence interval of prior bycatch estimates). We also expect that in some years, the fishery may exceed 28 encounters with Southern DPS green sturgeon (up to 86 encounters, including 84 encounters in the LE groundfish bottom trawl sector and 2 encounters in the at-sea hake sector) (Table 28). We do not expect this to occur in more than two years within a period of nine years, based on the level of past encounters. In the LE groundfish bottom trawl sector, we expect about 54 percent of the Southern DPS green sturgeon encountered to be subadults and about 46 percent to be adults. We also expect green sturgeon to be encountered throughout the coast from northern California to Washington,

Table 27 Estimated bycatch of Southern DPS green sturgeon from 2002 through 2010, and associated bycatch mortality using the high estimated proportion of Southern DPS green sturgeon (Table 26) and the upper bound of the 95 percent confidence interval (CI) of the estimated total green sturgeon bycatch (see 95 percent CI column under "Estimated total bycatch"). The estimated total green sturgeon bycatch represents the fleet-wide bycatch of green sturgeon (both Southern DPS and Northern DPS fish), as reported in Al-Humaidhi et al. 2012.

| **Year** | **Estimated Total Bycatch** | | **Estimated SDPS Bycatch** | | | **Estimated SDPS Bycatch Mortalities** | | |
|---|---|---|---|---|---|---|---|---|
| | **Total** | **95% CI** | **Total** | **Subadults** | **Adults** | **Total** | **Subadults** | **Adults** |
| 2002 | 34 | 3<br>100 | **76** | 41 | 35 | **4** | 2 | 2 |
| 2003 | 0 | 0<br>0 | **0** | 0 | 0 | **0** | 0 | 0 |
| 2004 | 16 | 3<br>39 | **28** | 15 | 13 | **2** | 1 | 1 |
| 2005 | 10 | 2<br>28 | **19** | 10 | 9 | **1** | 1 | 1 |
| 2006 | 5 | 1<br>15 | **9** | 5 | 4 | **1** | 1 | 1 |
| 2007 | 6 | 1<br>16 | **15** | 8 | 7 | **1** | 1 | 1 |
| 2008 | 0 | 0<br>0 | **0** | 0 | 0 | **0** | 0 | 0 |
| 2009 | 43 | 9<br>92 | **84** | 45 | 39 | **5** | 3 | 2 |
| 2010 | 8 | 2<br>19 | **17** | 9 | 8 | **1** | 1 | 1 |
| TOTAL | 122 | 21<br>299 | **245** | 132 | 113 | **13** | 7 | 6 |

Note: Estimated Southern DPS green sturgeon bycatch mortalities are discussed in the following section. Values are rounded up to whole numbers; as a result, values summed across rows or columns may not match the totals.

with the majority of the encounters expected in marine waters adjacent to the Columbia River estuary and Willapa Bay. In years when the at-sea hake sector encounters green sturgeon, the fish may be subadults or adults and may be encountered anywhere within the distribution of the sector.

*Sublethal and Lethal Effects from Bycatch*

Southern DPS green sturgeon are likely to experience sublethal and lethal effects as a result of capture in the fisheries. The majority of the Southern DPS green sturgeon encountered are released alive and expected to survive. Sublethal impacts on subadult Southern DPS green sturgeon caught and released in these fisheries could include stress, changes in migratory

Table 28. Summary of maximum expected Southern DPS green sturgeon encounters in the LE groundfish bottom trawl and at-sea hake sectors under the proposed action (in

numbers of encounters per year), in most years and in the worst case scenario (expected in no more than 2 years within a period of 9 years).

| Scenario | Impact Category | Life Stage | Fishery Sector | | |
|---|---|---|---|---|---|
| | | | LE groundfish | At-sea hake | TOTAL |
| **In most years** | Estimated encounters | Adults | 13 | 0 | 13 |
| | | Subadults | 15 | 0 | 15 |
| | | ALL | 28 | 0 | 28 |
| | Estimated mortalities | Adults | 1 | 0 | 1 |
| | | Subadults | 1 | 0 | 1 |
| | | ALL | 2 | 0 | 2 |
| **Worst-case** | Estimated encounters | Adults | 39 | 2 | 41 |
| | | Subadults | 45 | 2 | 47 |
| | | ALL | 84 | 2* | 86* |
| | Estimated mortalities | Adults | 2 | 2 | 4 |
| | | Subadults | 3 | 2 | 5 |
| | | ALL | 5 | 2* | 7* |

Note: Values are rounded up to whole numbers. Under the worst-case scenario, we expect up to 2 encounters and mortalities in the at-sea hake sector, consisting of up to 2 adults or subadults. Thus, for the worst-case scenario, the totals for all life stages (marked by an asterisk *) differ from the sum of the expected adult and subadult encounters. Bycatch mortality estimates are discussed in the next section.

behavior, and injury (which may affect migration, growth, development, future reproductive success, etc.). Sublethal impacts on adult Southern DPS green sturgeon would be the same, but may also include changes in spawning behavior and physiology, and the loss of spawning potential (e.g., disruption of spawning migration and atresia). We also expect some proportion of the fish to die, either immediately or after being released back into the water. We expect the proportion subject to lethal effects to differ by fishery sector, as discussed below.

In the at-sea hake sector, all three green sturgeon encountered were dead as a result of the encounter. Factors likely contributing to the death of green sturgeon encountered in this sector include the large volume of fish (50 tons or more) typically caught in a single tow and the length of time it takes to process the catch (Vanessa Tuttle, pers. comm., NWFSC, July 11, 2012). The weight of fish in each tow may injure, crush, or kill green sturgeon caught in the net. Also, because of the large volume caught, the catch is typically dumped into the vessel's holding tanks and processed over several hours. A green sturgeon may be kept in the holding tanks for 4 to 5 hours before it is found by the observers. Based on this information, we can expect that any green sturgeon encountered in the at-sea Pacific hake/whiting sector under the proposed action will die as a result of the encounter.

In the LE groundfish bottom trawl sector, most of the green sturgeon encountered were released alive. However, at least one green sturgeon was observed dead (WCGOP 2011) and it is unknown how many die after being released. A bycatch mortality rate estimate for green sturgeon encountered in commercial bottom trawl gear has not yet been generated. In the 2012 interim biological opinion for the PCGF (NMFS 2012a), we estimated a bycatch mortality rate of 5.2 percent for green sturgeon encountered in the LE groundfish bottom trawl sector. This estimate encompassed both immediate and delayed mortality, but was considered a qualitative estimate because of many uncertainties. Little additional information has become available since the 2012 interim opinion. For Atlantic sturgeon encountered as bycatch in commercial otter trawl fisheries, an estimated 5 percent of the sturgeon encountered were dead upon capture (Miller and Shepherd 2011). The number of fish that may have died after being released was not estimated. Because information to help refine our previous estimate remains limited, we continue to use the estimated bycatch mortality rate of 5.2 percent in this analysis as the best estimate. Below, we summarize the information used to develop this estimate.

As described in the 2012 interim opinion (NMFS 2012a), limited acipenserid bycatch mortality data is available from commercial trawl fisheries. Specific information on green sturgeon encountered in commercial bottom trawl fisheries is limited to biological data provided by the WCGOP (2011) on 88 green sturgeon encountered and observed from 2007 through 2010 in both the LE groundfish bottom trawl sector and the California halibut bottom trawl sector. The WCGOP (2011) recorded notes on the condition of 32 of these 88 green sturgeon. One of these 32 individuals was reported as dead (3.1 percent) (observed in the LE groundfish bottom trawl sector). Assuming only one mortality occurred, and parameters when biological data were collected for these 32 green sturgeon were somewhat representative of the entire LE groundfish bottom trawl sector, we can generate a qualitative immediate mortality rate estimate of 3.1 percent. We considered this a qualitative estimate of immediate mortality, recognizing that a sample size of 32 green sturgeon is small and an estimate based on this dataset may be associated with a large error rate. However, these are the best data available at this time upon which we can base an estimate of immediate mortality.

In addition to immediate mortality, mortality following capture and release, or “delayed mortality,” is anticipated in commercial fishing. The WCGOP (2011) reported that 3 of the 32 individuals for which fish condition data were recorded were in poor condition. Overall, four of the 32 individuals were reported as dead or in poor condition (12.5 percent). The fish in poor condition could be used to represent the number of fish likely to experience delayed mortality; however, these data are not representative of the entire sector because of inconsistencies in data collection and condition reporting. Therefore, rather than use these data to estimate the total bycatch mortality rate (immediate and delayed mortality), we used (1) mortality estimates for the Columbia River test gillnet fishery, and (2) qualitative mortality estimates from capture and tagging of green sturgeon (using gillnets) in San Pablo Bay.

We recognize that capture in gillnet gear may have different effects on green sturgeon than capture in commercial bottom trawl gear. However, there are similarities in the potential effects on green sturgeon and the characteristics of how the gear was fished between the gillnet studies and the LE groundfish bottom trawl sector. These similarities support the assumption that green sturgeon mortality rates are comparable for trawling and gillnetting. The primary direct effects of capture of green sturgeon with shallow gillnets are entanglement and associated abrasion, laceration, constriction, and restriction of ventilation and/or respiration. In addition to some entanglement, the primary direct effects of capture of green sturgeon with trawl nets involve rapid decompression (associated with hauling the trawl from depth), impingement, and crushing of green sturgeon by other fish or materials in the trawl. Both methods typically involve removal of green sturgeon from the water for varying durations prior to release. In the LE groundfish bottom trawl sector, most observed green sturgeon encounters occurred at depths less than 60 fathoms; tows ranged from 0.5 to 4 hours in duration, with a mean tow time of approximately 2 hours (WCGOP 2011). The green sturgeon gillnetting data from the two studies referenced above were associated with scientific collection and typically involved similar set times (<2 hours) to the average tow times in the LE groundfish bottom trawl sector. This is important because gear set or tow time with trawls or gillnets appear to have some direct relationship to bycatch mortality of acipenserids, with longer set times associated with higher immediate and, in some cases, delayed mortality (Stein et al. 2004; Robichaud et al. 2006).

Below is a summary of the estimated mortality rates associated with capture and release of green sturgeon in the two gillnet studies.

In the Columbia River test gillnet fishery, green sturgeon mortality estimates ranged from 2.7 to 5.2 percent. ODFW (2006) used condition upon capture and release of green sturgeon in the Columbia River test gillnet fishery during the month of July 1992 to estimate a green sturgeon bycatch mortality of 5.2 percent for the Fall 2006 Columbia River commercial gillnet fishery. Additional data from July 2004 increased the total number of green sturgeon captured in July to 258 fish with no additional observed mortalities, thus reducing the mortality estimate from 5.2 to 3.1 percent (Olaf Langness, pers. comm., WDFW, December 29, 2011, ODFW unpublished data). "Mortality" was presumably defined as sturgeon floating upon capture or displaying a loss in equilibrium (Olaf Langness, pers. comm., WDFW, December 29, 2011), although gillnetting during summer months has resulted in direct green sturgeon mortality (likely because of increases in physiological stress, such as hypoxia, associated with warmer water temperatures) (Dan Erickson, pers. comm., ODFW, January 3, 2012). Thus, this estimate is potentially conservative or high. Subsequent records from the Columbia River test gillnet fishery indicate lower mortality (Olaf Langness, pers. comm., WDFW, December 29, 2011, ODFW unpublished data). During the month of June from 1986 to 1993, the test gillnet fishery caught a total of 295 green sturgeon with 8 observed mortalities, or 2.7 percent mortality (Olaf Langness, pers. comm., WDFW, December 29, 2011, ODFW unpublished data).

In green sturgeon tagging studies in San Pablo Bay, no short-term or long-term delayed mortality was observed. Between April 2004 and March 2006, Heublein et al. (2009) captured and released 212 green sturgeon with gillnets in waters of less than 32.81 feet (10 m) in depth in San Pablo Bay, California. No mortality was observed in green sturgeon caught and released immediately from gillnets (Heublein et al. 2009, unpublished data; Joe Heublein, pers. comm., NMFS, January 6, 2012). No short term (approximately 24-hour) delayed mortality could be measured in 96 green sturgeon surgically implanted with acoustic tags and released following recovery (held in onboard holding tanks for approximately 24 hours following gillnet capture) (Heublein et al. 2009). All but two fish vigorously swam following release; the post-release lethargy observed in two fish was attributed to a new anesthetic technique and not the capture or tag implantation methodologies (Heublein et al. 2009, unpublished data; Joe Heublein, pers. comm., NMFS, January 6, 2012). Furthermore, no long-term (>24-hour) delayed mortality has been attributed to tagged green sturgeon initially captured by either gillnet or hook-and-line in San Pablo Bay or the Sacramento River (i.e., lack of detections was attributed to poor tag performance or lack of receiver coverage) (Heublein et al. 2009, unpublished data; Matt Manuel, pers. comm., GCID, December 22, 2011; Joe Heublein, pers. comm., NMFS, January 6, 2012).

In summary, some delayed mortality is expected in commercial bycatch; a green sturgeon bycatch mortality estimate based solely on immediate mortality is likely to be low. Without specific data available on bycatch mortality in trawl gear, we relied on estimated and observed mortality rates from capture and release studies using gillnet gear. Bycatch in gillnet and trawl gear have different effects on green sturgeon, likely resulting in some disparity in bycatch mortality between the two different fishing methods. However, similar fishing parameters (tow and set duration, depth, etc.) and low numbers of immediate green sturgeon mortality in these two methods could result in similar total bycatch mortality. Based on the mortality estimate for gillnetting of green sturgeon in the lower Columbia River and data from tracking of green sturgeon captured with gillnets in San Pablo Bay, it is unlikely that mortality associated with gillnetting of green sturgeon under similar conditions would exceed 5.2 percent (ODFW 2006). Therefore, we used the mortality estimate of 5.2 percent as a qualitative measure of total green sturgeon mortality in the LE groundfish bottom trawl sector.

Applying this qualitative mortality estimate of 5.2 percent, the total estimated mortality of Southern DPS green sturgeon in the LE groundfish bottom trawl sector from 2002 through 2010 ranged from 0 to 5 fish per year, with up to 3 subadults and 2 adults killed in a year (Table 27). In most years, however, we estimate that the sector encountered and killed 0 to 2 Southern DPS green sturgeon per year, with up to one subadult and/or one adult killed per year (Table 27). Based on this information, we expect the LE groundfish bottom trawl sector to kill 0 to 2 Southern DPS green sturgeon per year in most years under the proposed action (Table 28). In some years, up to 5 fish may be killed in a year (including up to 3 subadults and 2 adults), but we do not expect this to occur in more than 2 years within a period of 9 years (Table 28).

*Summary of Sublethal and Lethal Effects on Individual Southern DPS Green Sturgeon*

We expect that the majority of the Southern DPS green sturgeon encountered in the LE groundfish bottom trawl sector will be released alive and are likely to survive. These fish may experience sublethal effects, including stress and injury that may result in altered migratory behavior or altered growth and development. Capture in the fishery may disrupt the migration of adults on their spawning migration, resulting in a loss of spawning potential. A portion of the Southern DPS green sturgeon encountered in this sector, and all of the Southern DPS green sturgeon encountered in the at-sea hake sector, are expected to die as a result of the encounter. Uncertainties in this analysis include uncertainties regarding the recapture rate and bycatch mortality estimate for green sturgeon in the LE groundfish bottom trawl sector.

Effects from Handling by NMFS Observer Programs

NMFS observers handle green sturgeon that are encountered in the PCGF. Beginning in 2007, the NMFS Observer Program implemented sampling protocols to gather information about green sturgeon observed in the fishery to inform analyses of the effects of the fishery on the species. The protocols include taking measurements (e.g., fork length, weight), notes on fish condition and the presence of tags, and photographs of each individual green sturgeon encountered. The protocol also includes collecting a tissue sample for genetic analysis. For green sturgeon released alive, observers collect a fin clip (i.e., a 0.2 in. by 0.2 in. (5mm by 5mm) piece of the anal or caudal fin). For green sturgeon that are dead upon capture, observers collect the whole first pectoral fin ray and examine the gonads to determine the individual’s sex. The observer may also retain the whole fish for further analysis.

In the reasonable and prudent measures to be implemented under this opinion (see Section 2.8.3, Reasonable and Prudent Measures and Terms and Conditions), the NMFS Observer Program may also tag green sturgeon encountered and observed throughout the program with external spaghetti tags and/or internal passive integrated transponder (PIT) tags, to monitor the recapture rate of individual green sturgeon in the fishery. Double tagging with both external spaghetti tags and internal PIT tags may be necessary because external tags provide an easily identified visual indication that the fish was previously captured, whereas internal PIT tags provide another method for detecting previously caught fish, should external tags fall off over time. In addition, most green sturgeon researchers throughout the U.S. West Coast are now tagging green sturgeon with PIT tags and scanning captured fish for tag information. The spaghetti tags would be inserted into the base of the dorsal fin. Tags would be printed with unique information to identify individuals, including a tag number and relevant contact information for NMFS. PIT tags would be inserted in the recommended standardized location for sturgeon (Kahn and Mohead 2010), to the left of the spine, immediately anterior to the dorsal fin and posterior to the dorsal scutes.

To estimate the number of Southern DPS green sturgeon that may be sampled and/or tagged by the NMFS Observer Programs under the proposed action, we considered the number of Southern DPS green sturgeon expected to be encountered in each observed sector. Based on A-SHOP data from 1991 through 2011 (with 100 percent observer coverage), the at-sea hake sector encountered one green sturgeon in 2005 and two in 2006, but did not encounter any green sturgeon in all other years (Al-Humaidhi et al. 2012; pers. comm. with Vanessa Tuttle, A-SHOP, on July 23, 2012). All of the green sturgeon encountered were dead upon capture. Based on this information, we expect the A-SHOP to sample up to two green sturgeon per year under the proposed action. The fish are likely to be dead because of effects of capture in the fishing gear and removal from the water, not from handling and sampling by the observers.

The WCGOP observes several sectors of the PCGF, including the Federal LE groundfish bottom trawl sector and the state-managed California halibut bottom trawl sector. Although the California halibut bottom trawl sector is not part of the Federal action, the operation of the NMFS Observer Program is part of the Federal action. Therefore, this analysis considers the NMFS Observer Program's handling, sampling, and/or tagging of Southern DPS green sturgeon encountered in both the LE groundfish bottom trawl sector and California halibut bottom trawl sector. We expect the LE groundfish bottom trawl sector to encounter up to 84 Southern DPS green sturgeon per year. Because the WCGOP provides 100 percent observer coverage for this sector (beginning in 2011), observers may sample and/or tag up to 84 Southern DPS green sturgeon per year. We expect the California halibut bottom trawl sector to encounter up to 289 Southern DPS green sturgeon per year (see Section 2.3, Environmental Baseline, of this opinion). Although observer coverage rates for this sector have been less than 100 percent, observer coverage rates may change in the future. To allow for these changes, we considered the effects of handling, sampling, and/or tagging all Southern DPS green sturgeon encountered in this sector.

In total, the NMFS Observer Program may handle, sample, and/or tag up to 375 Southern DPS green sturgeon per year. Although the sampling and/or tagging of green sturgeon captured in the fishery would constitute additional handling of the fish, we expect the effects on individual fish to be minimal, whereas the information gathered would be highly beneficial to understanding the impacts of the fishery on the species. First, the green sturgeon handled would be those captured in the fishery during regular fishing activities. No additional sampling would be conducted to target green sturgeon. Handling time would be limited to a few minutes. Observers are advised to minimize the time the fish is out of the water by collecting samples quickly and releasing the fish as soon as possible. Collection of fin clips from live green sturgeon has been conducted in research studies and is expected to have minimal effects on individual fish, given the small size of the sample. NMFS has also evaluated PIT tagging and external tagging methods and developed best practices to minimize adverse effects on the species (Kahn and Mohead 2010). NMFS would provide training to observers on tagging methods and general practices for minimizing adverse effects when handling green sturgeon. We do not expect the sampling and tagging of green sturgeon captured and released in the fishery to result in additional injury or death to green sturgeon. Any green sturgeon injuries or deaths would be attributed to the effects of capture in the fishing gear and removal of the fish from the water, not from sampling and/or tagging by the observers. Therefore, we do not expect the handling of green sturgeon by the NMFS Observer Program to reduce the fitness of individual fish.

Effects on Prey Availability

The proposed action may result in indirect effects on green sturgeon because of the disturbance of benthic habitat by bottom trawl gear. Little is known about green sturgeon habitat use in marine waters, but green sturgeon potentially feed while making migrations along the coast. Green sturgeon are likely to feed on demersal fish and benthic invertebrates similar to those they feed on in coastal estuaries (Dumbauld et al. 2008). Fishing with bottom trawl gear may disturb benthic habitats where these prey species are found or may remove certain prey species (e.g., captured as targeted or non-targeted species in the fisheries). The potential effects on prey availability for green sturgeon, however, are unclear. First, green sturgeon are known to be generalist feeders and may feed opportunistically on a variety of benthic species encountered. Thus, the removal of certain prey species in the fisheries may not affect the ability of green sturgeon to feed. Second, bottom trawl fisheries may actually help to expose more prey resources for green sturgeon by disturbing the bottom in soft-sediment habitats. Third, feeding by green sturgeon in marine waters has not yet been confirmed. Additional information is needed, but at this time the indirect effects of the proposed action on green sturgeon prey resources are expected to be minor.

Species-Level Analysis

To consider the effects of the proposed action on Southern DPS green sturgeon at the species level, we generated a rough estimate of the population’s abundance based on the following assumptions. As described in the Section 2.2, Rangewide Status of the Species and Critical Habitat, we estimate that the Southern DPS green sturgeon population comprise a total of 350 to 1,000 adults and 1,838 to 5,250 subadults, with a total population of juveniles, subadults, and adults combined ranging from 2,917 to 8,333 individuals. The total abundance of the adult population may be at the higher end of this estimated range (i.e., around 800 to 1,000 adults), based on observations of green sturgeon over recent years (Josh Israel, pers. comm., USBR, January 9, 2012; David Woodbury, pers. comm., NMFS, January 10, 2012). If that is the case, then the total abundance of the subadult population may also be at the higher end of the estimated range (i.e., around 3,000 to 5,000 subadults). The broad range reflects the high degree of uncertainty in these estimates. The following paragraphs summarize our analysis of the species-level effects of bycatch in the fishery under the proposed action on Southern DPS green sturgeon, within the context of the estimated population size.

The lethal and sublethal take of adults can have the greatest effect on the overall population because of immediate loss of spawning potential and changes in spawning behavior and physiology. However, the loss of a portion of the subadult population can also have a substantial effect on the future adult population size and reproductive potential (Beamesderfer et al. 2007). In most years under the proposed action, we expect the fishery to encounter up to 28 Southern DPS green sturgeon, including up to 13 adults and 15 subadults, per year (Table 28). This corresponds to bycatch of up to 1 to 4 percent of the adult population and 0.3 to 0.8 percent of the subadult population per year, depending on whether we use the highest estimated population sizes (i.e., 1,000 adults and 5,250 subadults) or the lowest estimated population sizes (i.e., 350 adults and 1,838 subadults). We also expect the fishery to kill up to 2 Southern DPS green sturgeon, including up to 1 adult and 1 subadult, per year. This corresponds to additional mortality of 0.1 to 0.3 percent of the adult population and 0.02 to 0.05 percent of the subadult population per year because of bycatch in the fishery.

Based on historical bycatch data, we also expect the fishery may encounter greater numbers of green sturgeon in some years. In the worst case, we expect the fishery to encounter up to 86 Southern DPS green sturgeon, including up to 41 adults (4 to 12 percent of the adult population) and 47 subadults (0.9 to 3 percent of the subadult population) in a year, with up to 4 adults and 5 subadults killed in a single year (Table 28). This corresponds to additional mortality of 0.4 to 1 percent of the adult population and 0.1 percent to 0.3 percent of the subadult population per year because of bycatch in the fishery. We do not expect this to occur in more than 2 years within a period of 9 years. The likelihood of killing up to 4 adults and/or up to 5 subadults in 1 year is low, because this includes the killing of 2 adults and/or subadults in the at-sea hake sector in which green sturgeon are rarely encountered (Table 28).

To evaluate the potential effects of the estimated lethal take on the viability of Southern DPS green sturgeon, we used information from a simple life table model developed by Beamesderfer et al. (2007). The Beamesderfer et al. (2007) model makes several assumptions that are rarely met (i.e., constant recruitment, population equilibrium, stable size and age structure, and lack of density dependence), but provides a tool for evaluating the sensitivity of the population to changes in demographic rates, including how fish numbers and reproductive potential may be affected by varying rates of mortality operating over different size ranges of green sturgeon. Beamesderfer et al. (2007) estimated the additional mortality rates (i.e., mortality in addition to natural mortality) that would reduce the species' reproductive potential to 20 to 50 percent of the maximum potential (i.e., the reproductive potential expected with no additional mortality imposed on the species). These values represent the estimated minimum reproductive potential needed to maintain the population (20 percent of the maximum potential; Goodyear 1993) and rebuild the population (50 percent of the maximum potential; Boreman et al. 1984). The life table model indicated that the species' reproductive potential would be reduced to 20 to 50 percent of the maximum potential if additional mortality rates of 7 to 25 percent were imposed on adult green sturgeon (> 65.96 inches (165 cm) in total length) or additional mortality rates of 5 to 10 percent were imposed on subadult and adult green sturgeon (from 46 to 72 inches (117 to 183 cm) TL). In comparison, the estimated additional mortality imposed by the groundfish fishery on the adult population (0.1 to 0.3 percent in most years and up to 0.4 to 1 percent in some years) and subadult population (0.02 to 0.05 percent in most years and up to 0.1 to 0.3 percent in some years) is low. If we expect that the size of the adult and subadult population may be at the higher end of the estimated range (i.e., around 800 to 1,000 adults and 3,000 to 5,000 subadults), then the additional mortality imposed by the groundfish fishery would likely be at the lower end of the estimated ranges (i.e., 0.1 to 0.4 percent of the adult population and 0.02 to 0.1 percent of the subadult population).

Sublethal impacts of the fishery on adults may have an immediate effect on the species' reproductive potential, whereas sublethal impacts on subadults may have delayed effects on reproductive potential. Little information is available on the sublethal effects of bycatch on green sturgeon, but handling and/or injuries as a result of incidental capture may alter the spawning behavior and physiology of adults (e.g., aborted or delayed spawning migrations) and the growth and reproductive development of subadults. Observed green sturgeon encounters occurred throughout the West Coast, primarily off the Columbia River estuary and Willapa Bay, and from April through June (WCGOP 2011). Thus, the green sturgeon encountered may include adults migrating south to spawn in the Sacramento River, adults and subadults migrating north to Washington estuaries, and adults and subadults migrating between the Columbia River estuary and other coastal Washington and Oregon estuaries.

Green sturgeon captured and tagged for research purposes during their upstream spawning migrations have been shown to continue migrating upstream, presumably to spawn (McCovey et al. 2011). Although the gear used and handling of green sturgeon for research differs from that involved in bottom trawl fisheries, these observations suggest that adult green sturgeon encountered in the fishery and released alive may continue on their spawning migrations. The morphology of green sturgeon, including their tough exoskeleton, indicates that green sturgeon are hardy fish that are able to withstand longer periods out of the water than other more delicate fish. The available information from the WCGOP, research studies, and test gillnet fisheries indicate that green sturgeon are generally released in good condition. The best available information at this time supports the assumption made that green sturgeon caught and released in this fishery have high post-release survival and experience short-term or low sublethal effects.

#### 2.4.1.3 Humpback Whales

The proposed fishing may affect listed humpback whales directly by entrapment and entanglement in fishing gear as well as indirectly by affecting prey availability. Even though the proposed fishing targets species at higher trophic levels than are consumed by humpback whales, removal of this biomass could still indirectly affect prey availability at lower trophic levels that are consumed by humpback whales (e.g., by disrupting food-web dynamics of the ecosystem). Humpback whales that occur within the action area are part of the CA/OR/WA stock (Carretta et al. 2012). Therefore, effects of proposed fishing are specific to this stock.

Effects from Entrapment and Entanglement in Fishing Gear

Proposed fishing may increase the number of injuries and mortalities of humpback whales from entanglement in fishing gear. This analysis considers whether effects of increased injuries and mortalities may reduce the reproduction, numbers, or distribution of humpback whales, pursuant to the regulatory definition of jeopardy. We evaluated the potential effects of proposed fishing on humpback whales based on the best scientific information about past human interactions with humpback whales including past entanglement in fishing gear.

We analyzed effects in three steps. First, we examined the overlap between the fishery and whale occurrence. Next, we estimated the number of humpback injuries and mortalities expected annually from the proposed fishing. Finally, we considered the consequences of that level of injury and mortality at the population level. We considered population-level consequences by evaluating the recent rate of increase of the species and comparing this to the rate expected in the absence of entanglement from proposed fishing on the CA/OR/WA stock. This analysis highlights our level of confidence in the available data, identifies where there is uncertainty in light of data gaps, and identifies how we based assumptions in our analysis on the best available science.

*Degree of Spatial Overlap*

Humpback whales occur at highest densities near the coast, and therefore generally have a relatively high degree of spatial overlap with the PCGF (Figure 9). Among the three fisheries categories, the highest overlap index was with the fixed-gear fishery, followed by the mid-water trawl hake fishery and the bottom trawl fishery (see Appendix B in NWFSC 2012). For the fixed-gear portion of the fishery, peak areas of overlap (>17 animal hours/km$^2$) occur north of Cape Mendocino, off the central Oregon coast, and off the Columbia River mouth (Figure 9). For the trawl fishery, the highest overlap indices occur along the north portion of the coast from Cape Mendocino to Cape Flattery, and areas of overlap are > 3 animals hours/km$^2$ (Figure 9). The highest overlap indices for the hake fishery occur near Cape Flattery, and are < 2 animal hours/km$^2$ (Figure 9). The degree of overlap indicates there are substantial opportunities for humpback whales to interact with proposed fishing.

*Serious Injury and Mortality*

We used the number of past entanglements of CA/OR/WA humpback whales from 2002 to 2011 to estimate the number of future entanglements from the proposed action that could result in serious injuries and mortalities as average and maximum metrics, annually (data details available in Section 2.3, Environmental Baseline). All CA/OR/WA humpback whales that were reported entangled in fishing gear within the action area were used to inform these estimates. We also included a portion of the past entanglements of unidentified whales from 2002 to 2011 that we estimated were likely humpback whales (see Section 2.3, Environmental Baseline) (Tables 16 and 21).

We included past entanglements regardless of the animals’ fate, because of uncertainty about factors that influence fate, the opportunistic nature of disentanglement events, and the opportunistic nature of entanglement reporting. We assigned all entanglements to either the PCGF or other non-PCGF activities using criteria and methods described in the Environmental Baseline (Section 2.3) (Table 18). Using the above criteria and methods, we estimated that proposed fishing would cause an annual average of 0.88 humpback whale injury or mortality and an annual maximum of approximately 3.09 humpback whale injuries or mortalities (Table 29).

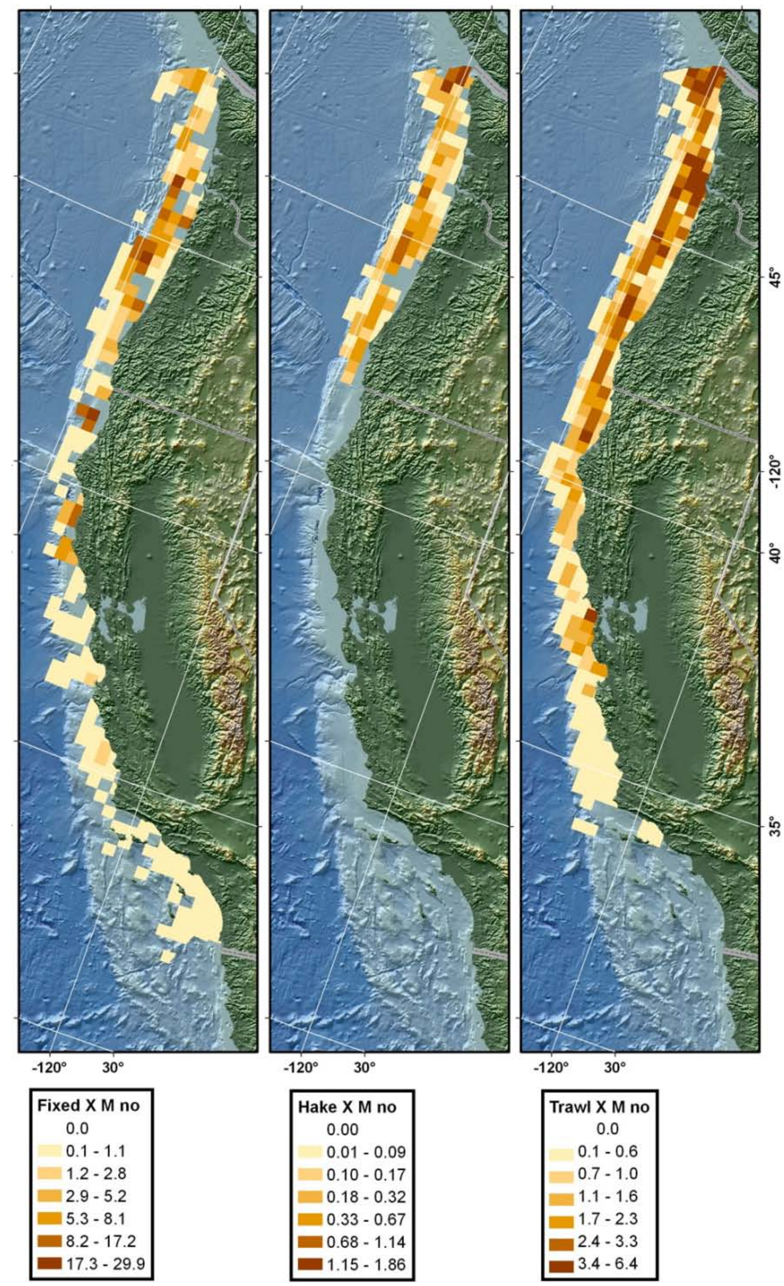


Figure 9. Overlap indices of humpback whales with three fishery sectors: fixed gear, hake trawl (mid-water trawl), and bottom trawl. Indices are in units of animal hours/km$^2$ (Appendix B in NWFSC 2012 for details).

Table 29. Estimated number of human-caused serious injuries and mortalities of humpback whales likely to occur annually in the PCGF.

| Year | Known PCGF entanglements | | Entanglements in unknown gear | | | | | Total PCGF entanglements |
|---|---|---|---|---|---|---|---|---|
| | Humpback Whales | Unidentified Whales | Humpback Whales | PCGF | Unidentified Whales | Humpbacks | PCGF | |
| 2002 | 0 | 0 | 0 | 0.00 | 0 | 0.00 | 0.00 | 0.00 |
| 2003 | 0 | 0 | 4 | 0.67 | 0 | 0.00 | 0.00 | 0.67 |
| 2004 | 0 | 0 | 1 | 0.17 | 0 | 0.00 | 0.00 | 0.17 |
| 2005 | 0 | 0 | 2 | 0.33 | 1 | 0.63 | 0.10 | 0.44 |
| 2006 | 2 | 0 | 4 | 0.67 | 4 | 2.50 | 0.42 | 3.09 |
| 2007 | 0 | 0 | 3 | 0.50 | 8 | 5.00 | 0.84 | 1.34 |
| 2008 | 0 | 0 | 2 | 0.33 | 2 | 1.25 | 0.21 | 0.54 |
| 2009 | 0 | 0 | 1 | 0.17 | 1 | 0.63 | 0.10 | 0.27 |
| 2010 | 0 | 0 | 6 | 1.00 | 3 | 1.88 | 0.31 | 1.32 |
| 2011 | 0 | 0 | 5 | 0.84 | 1 | 0.00 | 0.10 | 0.94 |
| Average Annual | | | | | | | | 0.88 |

Our estimate of the annual average is based only on entanglements in trap/pot gear. We do not consider fishing gear of the proposed fishery other than trap/pot gear to be an entanglement risk for humpback whales, because other gear types of the proposed fishery are not left unattended or are actively fished. Thus, observer programs are able to document entanglement or entrapment from direct observation and estimate fleet-wide mortality based on those observations (Jannot et al. 2011). Since the PCGF observer programs have not observed any interactions of humpback whales with fisheries that are actively fished and have high observer coverage (i.e., 100 percent coverage of trawl fisheries), we do not anticipate other gear types of the proposed fishery (e.g., bottom and mid-water trawl) to constitute an entanglement risk for humpbacks (Jannot et al. 2011). Similarly, collisions with ships are observable by fishers and observer programs, and there are no reported collisions of humpback whales with boats of the proposed fishery. Thus, we do not consider fishing boats of the proposed fishery to be a collision risk for humpbacks.

*Reduction in Population Growth Rate*

At the current estimated growth rate (7.5 percent) and abundance (2,043) of CA/OR/WA stock humpback whales, the population is growing at approximately 153 whales annually. Based on this information, the effect of the action (a reduction of an average 0.88 whales per year), would reduce the population growth rate by approximately 0.04 percent.

<u>Effects on Prey Availability</u>

The PCGF targets relatively large, commercially valuable fish species, including rockfish, hake, and various mid-water and bottom fish (see Section 1.3.1, Overview to the Groundfish Fishery). Humpback whales feed on krill and small schooling fishes, such as anchovies and sardines, which are not impacted by the PCGF to any significant extent (NWFSC 2010b). Indirect trophic effects of the PCGF on humpback whale prey are expected to be minor and in fact may positively affect the abundance of krill through removal of predators (see Appendix A of NWFSC 2012).

#### 2.4.1.4 Steller Sea Lions

The proposed fishing may affect Steller sea lions directly by entanglement in fishing gear and could potentially cause indirect effects by reducing the availability of their prey. Steller sea lions that occur within the action area are part of the eastern DPS. Therefore, effects of the proposed fishing are specific to this listed entity.

<u>Effects from Bycatch in Fishing Gear</u>

Proposed fishing may increase the number of injuries and mortalities of Steller sea lions from bycatch in fishing gear. This analysis considered whether effects of increased injuries and mortalities may reduce the reproduction, numbers, or distribution of Steller sea lions, pursuant to the regulatory definition of jeopardy. We evaluated the potential effects of proposed fishing on Steller sea lions based on the best scientific information about past human interactions with sea lions including past entanglement in fishing gear. We estimated the number of Steller sea lion injuries and mortalities caused by the proposed fishing annually.

We analyzed effects in two steps. First, we estimated the number of Steller sea lion serious injuries and mortalities caused by the proposed fishing, annually. Second, we considered the consequences of that level of injury and mortality at the population level. This analysis highlights our level of confidence in the available data, identifies where there is uncertainty in light of data gaps, and identifies how we based assumptions in our analysis on the best available science.

*Serious Injury and Mortality*

We used the number of Steller sea lions caught in fishing gear of the PCGF from the recent past (as compiled in Allen and Angliss 2012 and Jannot et al. 2011) to estimate the number of serious injuries and mortalities anticipated to occur from proposed fishing in the future as an annual average.

The number of serious injuries and mortalities in the WCGF has varied across years and has been increasing the last five years (Table 26) (Jannot et al. 2011; NWFSC 2012). Given this increasing trend, the upper-bound estimate is a more conservative estimate of potential future effects than the average- or lower-bound estimates. In this biological opinion, we rely on the upper-bound estimate of 13.88 sea lions based on Jannot (2011). While on average 13.88 sea lions may be injured or killed annually, a maximum of 45 could be injured or killed in a single year from proposed fishing (upper-bound 90 percent CIs represent conservative annual estimates given the increasing trend in Steller sea lion bycatch).

Estimated serious injuries or mortalities may be underestimates. For this reason, we have incorporated upper-bound estimates from Jannot et al. (2011) and NWFSC (2011) into our predictions. These predictions are still based in part on opportunistic stranding reports, and there remains uncertainty about the number of strandings that may go unobserved or unreported. Our predictions are, however, more conservative than predictions based solely on minimum estimates.

*Population Growth Rate Comparison*

At the current estimated growth rate (3.1 percent) and abundance (52,847) of eastern DPS Steller sea lions, the population is growing at approximately1,636 sea lions, annually. Based on this information, the effect of the action (a reduction of an average of 13.88 sea lions per year), would reduce the population growth rate by approximately0.03 percent.

<u>Effects on Prey Availability</u>

The PCGF targets a variety of groundfish, some of which are also consumed by Steller sea lions. Food web modeling conducted by the NFWSC (2011) indicates that marine mammals, including pinnipeds, which frequently prey upon fish species affected either directly or indirectly by proposed fishing, are unlikely to be strongly impacted by food web interactions caused by proposed fishing. The forage species evaluated in this modeling effort were found to be resilient to direct fishing mortality (i.e., high productivity of the stocks compensated for the range of fishing harvest evaluated, such that only small prey reductions were anticipated), as would be expected from the life history of many small pelagic fishes. Because of their resiliency, the forage species were likewise not impacted through indirect effects of predation or competition (NWFSC 2012).

Food web modeling conducted by NWFSC was based on species assemblages where pinnipeds are represented by a number of seal and sea lion species, of which the Steller sea lion is one of the largest, and their dominant prey is skewed toward relatively larger fish than represented for the assemblage as a whole. Therefore, the food web modeling results may underestimate the potential for effects on Steller sea lions. Nonetheless, eastern Steller sea lions have been increasing by 3 percent per year for approximately 20 years (Allen and Angliss 2012). This suggests that any effects of fishing on their prey availability, at least over the last 20 years, have not prevented steady population increases.

#### 2.4.1.5 Leatherback Sea Turtles

The proposed fishing may affect leatherback sea turtles directly by entanglement in fishing gear and could potentially cause indirect effects by reducing the availability of their jellyfish prey. Leatherback sea turtles that occur within the action area are most likely to originate from nesting aggregations of the western Pacific. Therefore, we analyze effects of the proposed action on leatherbacks from the western Pacific.

<u>Effects from Entanglement in Fishing Gear</u>

Proposed fishing may cause injuries and mortalities of leatherbacks from entanglement in fishing gear. This analysis considers whether effects of injuries and mortalities from the proposed fishing may reduce the reproduction, numbers, or distribution of leatherback sea turtles, pursuant to the regulatory definition of jeopardy. We evaluated the potential effects of proposed fishing on leatherback sea turtles based on the best scientific information about past human interactions with leatherbacks including past entanglement in fishing gear. We estimated the number of leatherback sea turtle injuries and mortalities caused by the proposed fishing, annually. This analysis highlights our level of confidence in the available data, identifies where there is uncertainty in light of data gaps, and identifies how we based assumptions in our analysis on the best available science.

There is uncertainty about the number of past entanglements attributed to fisheries of the proposed action, because most of the fishing effort identified as an entanglement risk was not observed. Additionally, entanglements reported through stranding networks could not be attributed to specific fisheries. The entanglements were characterized as pot/trap gear from unidentified fisheries. Some of these may therefore have involved pot/trap gear from proposed fishing. Given the present uncertainties of the available data, we made precautionary assumptions in our analysis to ensure the proposed fishing is not likely to jeopardize the continued existence of leatherbacks. We included in our analysis (1) any entanglements that had been observed in the proposed fishery between 2002 and 2010 (one, observed in sablefish pot gear; Jannot et al. 2011) and (2) any entangling gear of a type used in the proposed fisheries that could not be identified to a specific fishery (two). Therefore, the serious injuries and mortalities of leatherback sea turtles potentially caused by the proposed fishing are anticipated to be 0.38 turtles per year on average, and no more than 1 turtle in a single year.

Although our approach is a reasonable method to estimate the number of injuries and mortalities likely to occur in the proposed fisheries based on the available data, uncertainty remains because of the very low observer coverage in the sablefish pot/trap fishery. The very low observer coverage of the sablefish pot/trap fishery does not allow for accurate estimation of the fleet-wide mortality rate (non-nearshore open access fixed gear had 1 to 9 percent coverage from 2002 to 2009; Jannot et al. 2011).

<u>Effects on Prey Availability</u>

The PCGF fishery targets a variety of groundfish, but also capture leatherback prey (jellyfish) as bycatch. Food web modeling conducted by the NWFSC (2011) indicates that the protected species evaluated are unlikely to be strongly impacted by food web interactions caused by proposed fishing (i.e., because of the resiliency of the forage species evaluated, as described in the Steller sea lion section above). The effort did not specifically model interactions between the fisheries and leatherback prey, but based on the general predicted pattern of resiliency, it is unlikely that leatherback prey would be strongly affected by the proposed fishing, and therefore unlikely that leatherback turtles would be impacted by food web interactions caused by proposed fishing.

### 2.4.2 Effects of the Action on Critical Habitat

#### 2.4.2.1 Green Sturgeon Designated Critical Habitat

Designated critical habitat for Southern DPS green sturgeon includes coastal marine waters within 60 fathoms in depth from Monterey Bay, California, to the U.S./Canada border, including the Strait of Juan de Fuca. The operation of bottom trawl fisheries under the proposed action overlaps with and may impact designated critical habitat for Southern DPS green sturgeon. Fishing with bottom trawl gear may alter or disturb benthic habitats as well as prey resources for green sturgeon in coastal marine waters.

Bottom trawl fisheries conducted under the proposed action may affect the prey resources in designated green sturgeon critical habitat. Little is known about green sturgeon feeding and prey resources in marine waters, but prey resources likely include demersal fish (e.g., sand lance) and benthic invertebrates similar to those that green sturgeon feed on in coastal estuaries (Dumbauld et al. 2008). The groundfish bottom trawl fisheries may disturb benthic habitats where these prey species are found or may remove prey resources (e.g., captured as targeted or non-targeted species in the fisheries). However, the effects on benthic habitats and prey resources are unclear because of several factors. First, green sturgeon are known to be generalist feeders and may feed opportunistically on a variety of benthic species encountered. Thus, the removal of certain prey species in the fisheries may not affect the availability of prey resources for green sturgeon. Second, although green sturgeon are believed to feed in marine habitats, marine feeding has not been confirmed. Finally, very little is known about the marine habitat preferences of green sturgeon to identify where they feed and how those habitats are affected by bottom trawling activities. Thus, the potential effects of bottom trawl fisheries on green sturgeon critical habitat are difficult to evaluate until more definitive information is known about marine habitat use and feeding habitats of the species.

We expect the effects of the proposed fishing on green sturgeon critical habitat to be low, based on the following. First, existing footrope size restrictions likely provide a measure of protection. Throughout most of the marine waters designated as green sturgeon critical habitat, regulations prohibit the use of large footrope (> 8 inches) bottom trawl gear (Becky Renko, pers. comm., NMFS, August 14, 2012). This restriction helps to reduce disturbance of benthic habitats by bottom trawling activities. Second, because green sturgeon are generalist feeders that feed opportunistically on available prey, the disturbance of benthic habitats and removal of some benthic species by the proposed fishing would not be likely to result in a substantive reduction in prey resources available to green sturgeon. Finally, some of the areas within green sturgeon critical habitat are dynamic, high energy areas characterized by frequent disturbance and rapid recolonization by benthic communities. To the extent that green sturgeon feeding and the proposed fishing overlap with these areas, the proposed fishing would not be expected to substantively affect benthic prey resources within green sturgeon critical habitat. Additional studies are needed to further evaluate the effects of the proposed fishing on green sturgeon critical habitat. However, based on the best available information, we conclude that the fishery under the proposed action is not likely to reduce the quality of the PCEs for green sturgeon critical habitat within the action area.

#### 2.4.2.2 Leatherback Sea Turtle Critical Habitat

In addition to the direct and indirect effects to the species discussed above, the proposed fishing may affect critical habitat for leatherback sea turtles. Based on the natural history of the species and their habitat needs, NMFS designated critical habitat based on the following physical or biological feature essential to conservation: occurrence of prey species of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development.

The proposed fishing is likely to result in some bycatch of jellyfish, which will reduce prey availability in critical habitat. As described previously, food web modeling conducted by the NWFSC (2011) indicated that the protected species evaluated are unlikely to be strongly impacted by food web interactions caused by proposed fishing (i.e., because of the resiliency of the forage species evaluated, as previously described). The effort did not specifically model interactions between fisheries and jellyfish, but based on the general predicted pattern it is unlikely that the conservation value of critical habitat will be substantially impacted by food web interactions caused by proposed fishing.

## 2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. For purposes of this analysis, the action area includes all marine waters of the U.S. west coast EEZ.

Although state, tribal, and local governments have developed plans and initiatives to benefit marine fish and mammal species, including those under consultation, we cannot consider them reasonably certain to occur in our analysis of cumulative effects until concrete steps are taken to implement them. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area, which encompasses several government entities exercising various authorities, and the changing economies of the region, make analysis of beneficial cumulative effects difficult. There are some impacts that we predict are reasonably certain to occur into the future, such as private activities associated with other commercial and sport fisheries, construction and other habitat altering activities, vessel traffic and sound, and marine pollution, discussed in more detail below.

We find it likely that the past and present impacts of state and private actions identified above in the Environmental Baseline (Section 2.3) will continue into the future. We find it reasonably certain that the impacts of entanglement and bycatch in fishing gear and other sources of human-caused injury and mortality to the species under consultation identified above are likely to continue into the future at comparable levels to those seen in the present and recent past (unless changes result from implementing the reasonable and prudent measures and conservation recommendations in this biological opinion).

Some types of human activities that contribute to cumulative effects are expected to have adverse impacts on the listed populations and their designated critical habitat. Many of these are activities that have occurred in the recent past and had an effect on the environmental baseline. These can be considered reasonably certain to occur in the future because they occurred frequently in the recent past, especially if authorizations or permits have not yet expired. Although it is not possible to quantify these effects, we find it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities.

For eulachon, the most likely non-Federal action affecting their viability is bycatch in offshore trawl fisheries for ocean shrimp (Gustafson et al. 2010). These fisheries are operated by the states of Washington, Oregon, and California and are not subject to section 7 consultation under the ESA. Estimated bycatch of eulachon in these fisheries (Table 11) has ranged from 217,841 fish in 2004 (Oregon and California only) to 1,075,081 fish in 2010 (all three states). Green sturgeon, humpback whales, and leatherback turtles are also likely to be incidentally caught in state-managed fisheries. The past impacts of these fisheries are described in Section 2.3, Environmental Baseline. In our analysis for these three species, we have assumed that levels of bycatch will continue into the future similar to what they have been in the past, at levels described in Section 2.4, Effects of the Action on Species and Designated Critical Habitat.

## 2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency’s biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2). The term of this consultation is the foreseeable future.

### 2.6.1 Eulachon

Because the proposed action is unlikely to differentially affect eulachon from different spawning populations and year classes, we do not expect it to have a measureable effect on the species’ structure or diversity. Our analysis of effects, therefore, focuses primarily on abundance. Productivity may also be affected by the actions, but those effects would be the result of effects on abundance (see Section 2.4, Effects of the Action on Species and Designated Critical Habitat). As the effects section describes, the action may kill a yearly maximum of 1,004 individuals from different age classes. Given the high natural mortality rates for this species, this conservatively equates to a loss of, at most, 502 spawning adults. That loss comes in the context of the fact that eulachon spawner abundance has declined greatly in the last 20 years, and the species has been extirpated (or nearly so) from several historic spawning areas (Gustafson et al. 2010). The reasons for this are manifold: climate change poses a threat to eulachon throughout their range, freshwater habitat alteration has greatly affected their spawning areas, and bycatch in commercial and recreational fisheries has directly decreased their abundance. The impacts on eulachon from climate change and habitat alteration are difficult to quantify, but the impact of bycatch in commercial fisheries has been documented (Al-Humaidhi et al. 2012).

Because we lack a reliable estimate of eulachon abundance or information on the geographic and year-class composition of this catch, we based our analysis on a conservative abundance estimate from the two largest eulachon spawning runs—the Columbia and Fraser Rivers. This estimate is also conservative because we used spawner abundance as opposed to the whole at-sea population (eulachon live 2 to 5 years at-sea with an expected 50 percent annual mortality rate). The proposed action would only take 0.0052 percent of the estimated eulachon population and overall less than 0.1 percent of the total bycatch from U.S. fisheries (Table 30). The level of take expected for the proposed action is therefore so small that we do not anticipate it would have any notably deleterious effect on the species, nor would it add materially to the ongoing effects already occurring in the action area, described in the Environmental Baseline section and reflected in Table 11.

Table 30. Total requested and observed take for eulachon for already approved research and fishery actions plus actions covered in this Biological Opinion.

| Species | Activity | Total Take | Percent of Abundance | Lethal Take | Percent of ESU Killed |
|---|---|---|---|---|---|
| Eulachon | Commercial / Recreational Fisheries | 0 | - | 0 | - |
| | Research | 3,412 | 0.0175% | 2,382 | 0.0122% |
| | Shrimp Fishery Bycatch | 1,075,081 | 5.5210% | 1,075,081 | 5.5210% |
| | Groundfish Fishery Bycatch | 1,004 | 0.0052% | 1,004 | 0.0052% |
| | **TOTAL** | **1,079,497** | **5.5436%** | **1,078,467** | **5.5383%** |

### 2.6.2 Green Sturgeon

To assess the effects of the proposed action on the survival and recovery of Southern DPS green sturgeon, we consider the effects on abundance, productivity, spatial structure, and diversity. The proposed action is not likely to further restrict the spatial structure of the species (e.g., extent of spawning habitat in freshwater rivers, geographic distribution along the coast), but may affect productivity by altering or disrupting the spawning migration of adults that are caught incidentally in the fishery and released. The primary effect of the proposed action is on the abundance of Southern DPS green sturgeon, which likely results in additional effects on productivity and, to some extent, diversity (though this is difficult to assess given the limited information available). We considered these effects within the context of the status of the species and environmental baseline.

As described above in Section 2.2, Rangewide Status of the Species and Critical Habitat, we conclude that Southern DPS green sturgeon are at moderate to high risk of extinction because of the low estimated abundance of adults (the estimated total adult abundance ranges from 350 to 1,000 adults, compared with the estimated abundance needed for a naturally self-sustaining population of an effective population size of 500 or more adults and a census population size of 2,500 or more adults), restriction of spawning to one segment of the mainstem Sacramento River (and more recently confirmed in the lower Feather River), and potentially reduced productivity and genetic diversity because of the low adult abundance and restriction of spawning to a portion of the purported historical spawning habitat. The lack of information regarding productivity and abundance hinders an accurate assessment of the species' risk of extinction.

Capture in fisheries has been a significant source of mortality for the species. Fisheries catch of green sturgeon in recent years has been much reduced compared to historical levels. Prohibitions on retention of green sturgeon in fisheries throughout most of the West Coast have likely reduced fisheries-related mortality. However, incidental catch in fisheries continues to impose additional mortality on the species. In the fisheries for which data are available (excluding the Federal groundfish fishery), we estimate that 1,219 to 1,512 Southern DPS green sturgeon (adults and subadults) are incidentally captured each year (Table 31). This represents 20 to 69 percent of the total subadult and adult population, depending on if we use the high estimates of abundance (i.e., 6,250 subadults and adults, combined) or the low estimates of abundance (i.e., 2,188 subadults and adults, combined). We also estimate that 66 to 81 Southern DPS green sturgeon (adults and subadults) will be killed each year because of incidental capture in the fisheries. This represents additional mortality of 1 to 4 percent on the combined subadult and adult population. Beamesderfer et al. (2007) estimated that additional mortality of 5 to 10 percent on fish 46 to 72 inches (117 to 183 cm) in length (i.e., subadults and small adults) or additional mortality of 7 to 25 percent on fish greater than 65 inches (165 cm) in length (i.e., adults) would reduce the species' reproductive potential below the minimum needed to maintain (20 percent of maximum potential) (Goodyear 1993) or rebuild (50 percent of maximum potential) (Boreman et al. 1984) sturgeon populations. Based on this, the estimated additional mortality imposed by incidental catch in these fisheries (excluding the Federal groundfish fishery) may be affecting the continued survival and recovery of Southern DPS green sturgeon.

However, there is a high degree of uncertainty regarding these estimates. First, the level of incidental catch in these fisheries may be overestimated, particularly for the Washington State fisheries. We estimated that up to 715 Southern DPS green sturgeon may be incidentally caught in the Washington State fisheries each year (Table 31). This is a conservatively high estimate, based on the maximum number of encounters with green sturgeon in the Washington State fisheries from 1994 through 2005 (WDFW 2011; Kirt Hughes, pers. comm., WDFW, October 18, 2011). Second, the estimated abundance of adults and subadults is uncertain. The abundances may be greater than estimated, because we did not consider the number of spawning adults that may be in the lower Feather River or potentially in the lower Yuba River each year. We consider the population estimates to be rough estimates based on preliminary data and in need of further refinement. Third, individual fish may be recaptured in the same or different fisheries within a year, reducing the number of individual fish encountered. A comparison of the estimates of abundance (up to 6,250 subadults and adults combined) and the incidental catch of Southern DPS sturgeon in coast-wide fisheries (1,219 to 1,512) emphasizes the uncertainty in both estimates. It is possible that the fisheries are encountering a large portion of the adult and subadult population. Green sturgeon have a wide distribution, but aggregate in coastal estuaries, particularly in the Columbia River estuary, Willapa Bay, and Grays Harbor during summer months. All Southern DPS green sturgeon use the San Francisco Bay Delta and Sacramento River system, as well as coastal waters adjacent to San Francisco Bay. The overlap of Southern DPS green sturgeon and fisheries activities within these areas could result in high rates of encounters. However, these fisheries are all much reduced and regulated to minimize impacts to green sturgeon. Given these uncertainties, additional information is needed to more accurately assess the effects of the status, environmental baseline, and cumulative effects on the species for future analyses.

Adding the effects of the proposed action to the status, environmental baseline, and cumulative effects would result in a comparatively small increase in the mortality imposed on the subadult and adult population. This is because we expect the majority of the green sturgeon incidentally caught in the fishery to be released alive and to survive. In most years, we expect encounters with Southern DPS green sturgeon in the Pacific Coast groundfish fishery to be low (up to 28 encounters, including 15 subadults and 13 adults per year), with up to 2 mortalities per year (0.03 to 0.09 percent of the total subadult and adult population). In the worst case (not expected to occur more than 2 years within a period of 9 years), we would expect up to 86 encounters with Southern DPS green sturgeon and 7 mortalities (0.1 to 0.3 percent of the total subadult and adult population). Again, this would result in a relatively small increase in the mortality imposed on the species, compared to the levels estimated by Beamesderfer et al. (2007) to substantially reduce reproductive potential.

Sublethal effects resulting from incidental capture and release in the fishery may also reduce the species’ reproductive potential by disrupting the spawning migrations of adults and the growth and reproductive development of subadults. However, the best available information indicates that these effects would likely be low because green sturgeon are typically released alive and in good condition. We expect that only a portion of the adults encountered in the fishery would be on their spawning migration, because most of the green sturgeon are expected to be encountered off Washington and Oregon, rather than adjacent to San Francisco Bay. Also, tagging studies show that green sturgeon caught and tagged for research purposes may continue on their upstream migration after being released (McCovey et al. 2011). The same may be true for adult green sturgeon caught and released in this fishery.

Table 31. Summary of estimated incidental catch and mortality of Southern DPS (SDPS) green sturgeon (number of fish) in commercial and recreational fisheries occurring within and outside of the action area, excluding the Federal Pacific Coast Groundfish Fishery.

| Fishery | Estimated SDPS Incidental Catch | | Estimated SDPS Mortalities | |
|---|---|---|---|---|
| | **Low estimate** | **High estimate** | **Low estimate** | **High estimate** |
| California halibut bottom trawl fishery | 86 | 289 | 5 | 15 |
| Central Valley, California, recreational fisheries | 89 | 151 | 3 | 4 |
| Oregon recreational fisheries | 4 | 22 | 1 | 1 |
| Oregon commercial fisheries | 2 | 12 | 1 | 1 |
| Lower Columbia River recreational fisheries | 52 | 52 | 7 | 11 |
| Lower Columbia River commercial fisheries | 271 | 271 | 14 | 14 |
| Washington State fisheries | 715 | 715 | 35 | 35 |
| **TOTAL** | **1,219** | **1,512** | **66** | **81** |

In summary, the lack of substantial impacts on the Southern DPS green sturgeon based on the low expected sublethal and lethal impacts of the fishery supports the conclusion that the proposed fishing will not appreciably reduce the likelihood of survival and recovery of the species.

We also assessed the effects of the action on green sturgeon critical habitat in the context of the status of critical habitat, the environmental baseline, and cumulative effects, to evaluate whether the effects of the proposed fishing are likely to reduce the value of designated critical habitat for the conservation of Southern DPS green sturgeon. The proposed fishing may affect the prey resources in designated green sturgeon critical habitat within coastal marine waters. As discussed in Section 2.2, Rangewide Status of the Species and Critical Habitat and Section 2.3, Environmental Baseline of this opinion, prey resources within the action area may be affected by non-point source and point source discharges, oil spills, dredged material disposal activities, renewable ocean energy installations, low oxygen “dead zones,” bottom trawl fishing activities, and climate change. These activities and factors may also affect water quality and migratory corridors for green sturgeon. Given the limited information available on green sturgeon habitat use in marine waters, the effects of these activities and factors on green sturgeon critical habitat are uncertain. Adding the potential effects of the proposed fishing on green sturgeon critical habitat would likely result in low levels of effects on prey resources for green sturgeon. Although use of bottom trawl gear may disturb benthic habitats and remove prey resources, existing gear restrictions provide a measure of protection for green sturgeon critical habitat. In addition, the expected effects of the proposed fishing on the prey resources are likely to be low given the opportunistic feeding behavior of green sturgeon and the likely dynamic nature of benthic prey communities. The low expected impacts to green sturgeon prey resources supports the conclusion that the proposed fishing is not likely to reduce the value of designated critical habitat for the conservation of Southern DPS green sturgeon.

### 2.6.3 Humpback Whales

This section discusses the effects of the action in the context of the status of the species, the environmental baseline, and cumulative effects, and offers our opinion as to whether the effects of the proposed fishing are likely to jeopardize the continued existence of humpback whales.

Humpback whales face a variety of threats including entrapment and entanglement in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans. Humpback whales are found in all oceans of the world. For management under the MMPA, stocks of humpback whales are defined based on feeding areas, with the whales feeding off California, Oregon, and Washington currently considered one stock. The most recent population estimate of humpback whales in the North Pacific Ocean is 21,808 (CV=0.04). The most recent estimated abundance of the CA/OR/WA feeding stock is 2,043 whales (CV=0.10), with a minimum population estimate of 1,878 whales. The maximum expected rate of annual increase for the species as a whole ranges from an estimated 7.3 to 8.6 percent, with a maximum plausible rate of 11.8 percent annually. North Pacific populations as a whole grew by an estimated 6.8 percent annually over the period from 1966 to 2006. The annual growth rate for the CA/OR/WA feeding stock is estimated at 7.5 percent.

Effects of the proposed fishing are specific to the CA/OR/WA feeding stock, and in this section we put effects specific to this stock in the context of effects to the globally-listed species. We estimated the number of serious injuries and mortalities, annually, and the reduction in population growth rate caused by the proposed fishing. In this section, we also consider information to help put effects of the action in context, including comparison of the stock's potential biological removal (PBR) to the estimated number of human-caused serious injuries and mortalities for the stock likely to occur in the future, and comparison of the recent rate of increase for the species to this rate absent human-caused mortality on the CA/OR/WA stock (including entanglements from fishing). This pertinent information includes not only effects of the proposed fishing, but also environmental baseline and cumulative effects. We consider whether effects of serious injuries and mortalities caused by the proposed fishing, together with baseline and cumulative effects, and in light of the status of the species, may reduce the reproduction, numbers, or distribution of humpback whales to such an extent as to appreciably reduce the likelihood of the survival and recovery of the species in the wild, pursuant to the regulatory definition of jeopardy.

There is a high degree of spatial overlap with the PCGF, and the greatest overlap is with the fixed-gear fishery. There is uncertainty about the number of past entanglements attributed to the proposed fishing, but based on precautionary assumptions we estimated that an average of 0.89 humpback whales may be injured or killed by proposed fishing, annually. In order to put these effects in context, we compare the most recent estimate of the stock's PBR with the estimated number of human-caused serious injuries and mortalities of CA/OR/WA humpback whales likely to occur in the future, annually (from baseline, cumulative effects, and proposed fishing activities).

*PBR Comparison*

We use the PBR concept in assessing effects of incidental mortality under the MMPA. PBR represents the maximum level of human-caused mortality a stock can sustain and still have a high likelihood of achieving its optimum sustainable population level. PBR is calculated as $N_{min}$* 0.5 $R_{max}$ * F, where $N_{min}$ is the minimum current population size, $R_{max}$ is the maximum annual rate of increase for the species or stock, and F is a recovery factor that ranges from 0.1 to 1 depending on the conservation status of the stock (Barlow et al. 1995). PBR is reported in stock assessment reports and the most recent estimate of PBR can be found in Carretta et al. (2012).

For the CA/OR/WA stock of humpback whales, PBR is estimated by computing the minimum population size (1,878 whales) times one-half the estimated population growth rate for the stock (1/2 of 8 percent) times a recovery factor of 0.3 (for an endangered species, with $N_{min} > 1{,}500$ and CV ($N_{min}$) < 0.50), resulting in a PBR of 22.5 whales (Carretta et al. 2012). This stock only spends about half of its time inside the U.S. EEZ, and therefore the PBR allocation for U.S. waters is 11.3 whales (1/2 of 22.5 whales). On average, we estimated that 7.19 human-caused serious injuries or mortalities of CA/OR/WA humpback whales are likely to occur annually (from baseline, cumulative effects, and proposed fishing). This annual average is below the current PBR. Based on past annual variability, we anticipate that the average estimate will be exceeded in some years, up to a maximum of 16.25 injuries or mortalities in a single year (Table 32). In stock assessment reports, PBR is often compared to a recent 5-year average of human caused mortality and serious injury. For this analysis, we estimated an average based on the last 10 years of data, including more recent data than what is currently included in the stock assessment report. Although PBR may be exceeded in an individual year, on average and for the majority of years, we anticipate the total number of human caused humpback injuries and mortalities will be below PBR. Therefore, the population should continue to grow toward its optimum sustainable population level.

Further, we estimate that the total serious injuries and mortalities likely to occur in the future (including serious injury and mortality from the proposed fishing) is less than the U.S. allocation of the stock's PBR (7.55 whales compared to 11.3 whales or 67 percent of the U.S. allocation of PBR) (Table 32).

The NMFS SWR recently drafted a similar analysis comparing the total human-caused serious injury and mortality for CA/OR/WA to the stock's PBR. Their analysis was conducted for the purpose of making a negligible impact determination under the MMPA. Their analysis anticipated that the total human-caused serious injury and mortality for CA/OR/WA humpback whales would not cause more than a 10 percent delay in time to recovery. Based on this result, the SWR concludes that West Coast fisheries have a negligible impact on CA/OR/WA humpback whales (NMFS in review).

*Reduction in Population Growth Rate*

Using these same serious injury and mortality estimates—an annual average of 0.88 whales and annual maximum of 3.09 whales from proposed fishing and an annual average of 7.55 whales from all human sources including proposed fishing—we anticipated that the population growth rate will decrease by approximately 0.04 percent from proposed fishing and by approximately 0.37 percent from all human sources, including proposed fishing. Based on food web modeling, we also expect that trophic effects of the PCGF will be minor and in fact may positively affect the abundance of krill (prey of humpback whales) through removal of predators.

Table 32. Estimated total human-caused serious injury and mortality for CA/OR/WA humpback whales.

| Year | Total Entanglements | | Total Collisions | Grand Total |
|---|---|---|---|---|
| | PCGF | Non-PCGF | Non-PCGF | |
| 2002 | 0.00 | 0.00 | 0.50 | 0.50 |
| 2003 | 0.73 | 3.27 | 0.17 | 4.17 |
| 2004 | 0.18 | 0.82 | 0.50 | 1.50 |
| 2005 | 0.48 | 3.15 | 1.00 | 4.63 |
| 2006 | 3.18 | 6.32 | 2.34 | 11.84 |
| 2007 | 1.46 | 8.54 | 2.00 | 12.00 |
| 2008 | 0.59 | 11.66 | 4.00 | 16.25 |
| 2009 | 0.30 | 4.33 | 0.00 | 4.63 |
| 2010 | 1.43 | 9.44 | 1.33 | 12.21 |
| 2011 | 0.55 | 2.45 | 1.17 | 4.17 |
| Annual Average | | | | **7.19** |

Estimated serious injury and mortality of CA/OR/WA humpback whales from all fisheries, including the proposed fishing, may be underestimates because of the difficulty of observing entanglement events and identifying entangling gear to specific fisheries. Therefore, these estimated reductions in population growth rate may also be underestimates. For these reasons, the NWFSC developed two different approaches for estimating the maximum mortality rate potentially imposed by all West Coast fisheries, including the PCGF (NWFSC 2012). Those approaches are summarized below.

The first approach evaluated the difference between the estimated 7.5 percent growth rate of the stock and maximum plausible growth rate of 11.8 percent (described further below), for a difference of 4.3 percent. Under the highly improbable assumption that fishing is the only source of non-natural mortality on the stock and that the stock is sufficiently below carrying capacity that it is increasing at its maximum rate, this value would be an upper bound on the maximum possible impact from fishing and would imply that in recent years approximately 88 whales/year are killed because of fishing activities. The second approach was to assume that the estimated 3 percent mortality from entanglement for the Gulf of Maine stock (Robbins et al. 2009) is also representative of the CA/OR/WA stock. This would imply that in recent years approximately 61 whales are killed annually because of fishing. Although there are currently no estimates of the annual rate of new scarring from entanglement for the CA/OR/WA stock, the proportion of all whales with scars is similar between the two stocks (Robbins and Matilla 2004; Robbins et al. 2009), which might imply that the rate of scarring from entanglement is similar between the two areas. Both of the upper bound estimates are well above PBR and, if true, would suggest that total mortality from fishing is having a substantial impact on the population’s growth rate.

The true level of impact is almost certainly well below these upper estimates for the following reasons. The maximum plausible growth rate of 11.8 percent is based on the 99th percentile of a distribution around a mean estimate (Zerbini et al. 2010). The authors of that estimate emphasize that "…such a high figure can be observed only with extreme and very optimistic life-history parameters" (Zerbini et al. 2010 p. 1,233). The point estimates of the maximum plausible growth rate (7.3 to 8.6 percent) are in fact very close to the observed growth rate of the CA/OR/WA stock (7.5 percent), suggesting that this population is likely to be growing at close to its maximum rate and that mortality from fishing is therefore not substantially impacting its growth rate. The Gulf of Maine estimate of 3 percent mortality/year is also considered to be a "…crude, preliminary…" estimate by its authors (Robbins et al. 2009 p. 3), and becomes even more so when applied to an entirely different population.

From this, we conclude that impacts of proposed fishing in addition to other human sources are not likely to substantially reduce the population abundance or trend. The lack of substantial impacts on the CA/OR/WA humpback whales combined with the increasing population trend for this listed entity supports the conclusion that the proposed fishing will not reduce appreciably the likelihood of both survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution.

### 2.6.4 Steller Sea Lions

This section discusses the effects of the action in the context of the status of the species, the environmental baseline, and cumulative effects, and offers our opinion as to whether the effects of the proposed action are likely to jeopardize the continued existence of Steller sea lions.

No threats to the continued recovery of the eastern DPS were identified in the final revised recovery plan for Steller sea lions (NMFS 2008b), but there are factors that affect or have the potential to affect population dynamics of the eastern DPS, including subsistence harvest, fisheries bycatch, other sources of human-caused mortality, prey availability, and disturbance. The eastern DPS of Steller sea lions is a single population that ranges from southeast Alaska to southern California, including inland waters of Washington State and British Columbia. The total population estimate is a range between 58,334 and 72,223 sea lions, with a minimum population estimate of 52,847 sea lions. The population has increased at a rate of approximately 3.1 percent in recent decades.

We estimated the number of serious injuries and mortalities, annually, and the reduction in population growth rate caused by the proposed fishing. In this section, we also consider information to help put effects of the action in context, including comparison of the stock's PBR to the estimated number of human-caused serious injuries and mortalities for the stock likely to occur in the future, and comparison of the recent rate of increase for the population to this rate absent human-caused mortality on the eastern DPS of Steller sea lions (including bycatch from fishing). This pertinent information includes not only effects of the proposed fishing, but also environmental baseline and cumulative effects. With this information, we consider whether effects of increased human-caused serious injuries and mortalities may reduce the reproduction, numbers, or distribution of Steller sea lions, pursuant to the regulatory definition of jeopardy.

We estimated that on average 13.88 Steller sea lions would be seriously injured or killed incidental to the proposed fishing, annually. When added together, we estimate a total of 60.55

sea lions seriously injured or killed annually from fisheries bycatch, including the proposed fishing (6.67 sea lions from fishery observer programs other than PCGF (from Allen and Angliss 2012) + 13.88 sea lions from PCGF observer programs (from Jannot et al. 2011) + 40 opportunistic observations (from NWFSC 2012)). Further, we estimate the total human-related serious injury and mortality from all sources by combining our estimate of 60.55 sea lions injured or killed annually from fisheries bycatch with the estimate from Allen and Angliss (2012) for other sources of injury or mortality of 15.2, for a total of 75.75 sea lions per year. In order to put these effects in context, we compare the most recent estimate of the stock's PBR with the estimated number of human-caused serious injuries and mortalities of eastern DPS Steller sea lions likely to occur in the future, annually (from baseline, cumulative effects, and proposed fishing activities).

*PBR Comparison*

We reviewed the most recent estimate of PBR (Allen and Angliss 2012) for comparison with the estimated number of human-caused serious injuries and mortalities of Steller sea lions likely to occur in the future (from baseline, cumulative effects, and proposed fishing). For eastern stock Steller sea lions, PBR is estimated by computing the minimum population size (52,847 sea lions) times one-half the estimated population growth rate for the stock (1/2 of 12 percent) times a recovery factor of 0.75 (as recommended by the Alaska Scientific Review Group) (Allen and Angliss 2012), resulting in a PBR of 2,378 sea lions. By comparison, the estimated number of all human-caused serious injuries and mortalities anticipated to occur in future years, including the proposed fishing, is 75.75 sea lions, which is approximately 3.19 percent of the PBR. Based on food web modeling, we also expect that trophic effects of the PCGF will be minor.

The NMFS Alaska Region (AKR) recently completed a similar analysis comparing the total human-caused serious injury and mortality for eastern Steller sea lions to the stock's PBR. Their analysis was conducted for the purpose of making a negligible impact determination under the MMPA. Their analysis resulted in the same conclusion, that the anticipated total human-caused serious injury and mortality for eastern Steller sea lions is less than 10 percent of the stock's PBR. Based on this result, the AKR found that Alaska groundfish fisheries have a negligible impact on eastern Steller sea lions (NMFS 2010c).

*Reduction in Population Growth Rate*

Using these same serious injury and mortality estimates—an annual average of 13.88 sea lions and annual maximum of 45 sea lions from proposed fishing and an annual average of 75.75 sea lions from all human sources including proposed fishing—we anticipated that the population growth rate will decrease by approximately 0.03 percent from proposed fishing and by approximately 0.14 percent from all human sources including proposed fishing.

From this, we conclude that impacts of proposed fishing, in addition to other human sources, are not likely to substantially reduce the population abundance or trend. The lack of substantial impacts on the eastern DPS combined with the increasing population trend for this listed entity supports the conclusion that the proposed fishing will not reduce appreciably the likelihood of both survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution.

### 2.6.5 Leatherback Sea Turtles

This section discusses the effects of the action in the context of the status of the species and designated critical habitat, the environmental baseline, and cumulative effects, and offers our opinion as to whether the effects of the proposed action are likely to jeopardize the continued existence of leatherback sea turtles or adversely modify their critical habitat.

Leatherback sea turtles face a variety of threats depending on the region in which they occur; they are widely distributed across the oceans of the world. Identified threats in the marine environment include direct harvest, debris entanglement and ingestion, fisheries bycatch, and boat collisions, among other threats. In the Pacific Ocean, nesting aggregations occur in the eastern Pacific (primarily in Mexico and Costa Rica) and in the western Pacific (primarily Indonesia, the Solomon Islands, and Papua New Guinea). Leatherbacks that occur within the action area are most likely to originate from nesting aggregations of the western Pacific. The abundance of leatherback sea turtles is currently unknown; however, the most recent global estimate for nesting females is 34,500 turtles. The trend for the western Pacific subpopulation has been declining over the past four decades; however, estimates of breeding females slightly increased from 2000 to 2007 (2,700 to 4,500 turtles in 2007 compared to 1,775 to 1,900 turtles in 2000), although this is likely due to additional nesting sites that were not previously factored into the estimate (Dutton et al. 2007). Given recent monitoring over the last few years, however, the trend continues to decline (C. Fahy, pers. comm., NOAA Fisheries SWR, July 18, 2012).

Effects of the proposed fishing are specific to western Pacific leatherbacks, and we put effects specific to this population in the context of effects to the globally-listed species. We estimated the leatherback mortalities caused by the proposed fishing, annually, and also qualitatively considered available information on western Pacific leatherbacks to help put the mortalities in context. This pertinent information includes not only effects of the proposed fishing, but also environmental baseline and cumulative effects. With this information, we consider whether the mortality from the proposed action may reduce the reproduction, numbers, or distribution of leatherback sea turtles, pursuant to the regulatory definition of jeopardy. We estimate that on average 0.38 leatherbacks per year may be killed incidental to the proposed fishing and no more than 1 turtle in a single year; however, we note that this estimate is uncertain because of very low observer coverage in the sablefish pot/trap fishery.

In this section, we also estimate the total serious injury and mortality from all human sources, including the proposed fishing. We used the number of past entanglements and ship strikes of leatherback sea turtles in the recent past (2001 to 2008 for entanglements and 2000 to 2008 for ship strikes), as well as incidental mortalities we have authorized in the action area for future years, to estimate the number of entanglements, ship strikes, and other human sources of mortality anticipated to occur annually. We computed the average annual estimates from these sources and added the estimates together to compute a total annual estimate. All reports from stranding networks and observer programs were used to inform these estimates.

We consider it appropriate to include all past human interactions from these sources to estimate the number of potential serious injuries and mortalities that could occur in the future because it is the only information we have to support a projection, and successful disentanglement cannot be relied upon with certainty in the future. Additionally, some of the observed injuries and mortalities are based on opportunistic stranding reports, and there is potential for entanglement or strike events to go unobserved or unreported.

The minimum number of potential injuries and mortalities from entanglements is 3 turtles over 8 years (including entanglement with proposed fishing gear) and from ship strikes is 4 turtles over 9 years (data are summarized in Section 2.3, Environmental Baseline). Additionally, the number of leatherback mortalities already authorized in the action area that could occur annually is 5 turtles (also summarized in Section 2.3, Environmental Baseline). Therefore, we estimate a total of 5.82 turtles (with proposed fishing) of the western Pacific killed incidental to all human sources in the action area. This represents 0.22 to 0.13 percent of the 2,700 to 4,500 breeding female turtles in the population.

We also identify that mortality of western Pacific leatherbacks is authorized outside of the action area; for example, in the Pacific Islands region (summarized in Appendix A). We highlight that the anticipated mortality attributed to the proposed fishing is less than one turtle per year on average and no more than one turtle in a single year, which is a very small increase to the level of mortality already authorized for the species both inside and outside of the action area. Based on food web modeling, we also expect that trophic effects of the PCGF on leatherbacks and the conservation value of their critical habitat will be minor.

In addition to the direct and indirect effects to the species, the proposed fishing is likely to result in some bycatch of jellyfish, which will reduce prey availability in critical habitat. However, based on the general predicted pattern of food web modeling, it is unlikely that the conservation value of critical habitat will be substantially impacted by food web interactions caused by the proposed fishing.

From this, we conclude that the proposed fishing contributes a very small additional impact to those of other human sources and the conservation value of critical habitat will not be substantially impacted, such that effects of the action, when combined with effects of other human sources in the action area, are not anticipated to result in an appreciable change to the population abundance or trend. A lack of an appreciable change in population abundance or trend supports the conclusion that the proposed fishing will not reduce appreciably the likelihood of both survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution. Likewise, a lack of substantial impact on the conservation value of critical habitat supports the conclusion that the proposed fishing will not adversely modify critical habitat.

## 2.7 Conclusion

### 2.7.1 Eulachon

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the southern DPS of eulachon. Critical habitat has been designated for this species outside of the action area, and would therefore not be affected by the action.

### 2.7.2 Green Sturgeon and Their Critical Habitat

After reviewing the current status of the Southern DPS green sturgeon, the environmental baseline within the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of threatened Southern DPS green sturgeon.

After reviewing the current status of critical habitat designated for Southern DPS green sturgeon, the environmental baseline within the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to adversely modify the Southern DPS green sturgeon's designated critical habitat.

### 2.7.3 Humpback Whales

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of humpback whales. No critical habitat has been designated or proposed for this species, therefore none will be affected.

### 2.7.4 Steller Sea Lions

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of eastern DPS Steller sea lions. We address critical habitat for Steller sea lions in Section 2.11, "Not Likely to Adversely Affect" Determinations, with our not likely to adversely affect findings.

### 2.7.5 Leatherback Sea Turtles and Their Critical Habitat

After reviewing the current status of the listed species and designated critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of leatherback sea turtles or to destroy or adversely modify its designated critical habitat.

## 2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered[7]. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

We issue a provisional take statement for humpback whales. This take statement will go into effect when the provisions of MMPA 101(a)(5) have been met, as described below. For Steller sea lions, the provisions of MMPA 101(a)(5) have been met, and therefore, the take statement for Steller sea lions is valid.

A marine mammal species or population stock that is listed as threatened or endangered under the ESA is, by definition, also considered depleted under the MMPA. The ESA allows taking of threatened and endangered marine mammals only if authorized by section 101(a)(5) of the MMPA. Before incidental take of listed marine mammals may be exempted from the taking prohibition of ESA section 9(a), incidental taking must be authorized under section 101(a)(5)(E) of the MMPA. The decision of whether incidental taking is authorized under section 101(a)(5)(E) of the MMPA is based on the negligible impact determination (NID) and publication in the Federal Register of a list of those fisheries for which such a determination was made. If the fishery is identified as Category I or II per the provisions of section 118, issuance of an MMPA permit is also required. Consistent with the provisions of section 101(a)(5)(E)(ii), issuance of an MMPA permit is not required for Category III fisheries. Per the first tier of fishery classification criteria under section 118[8], all U.S. fisheries are Category III with respect to eastern stock Steller sea lions, because the total annual mortality and serious injury of eastern stock Steller sea lions, across all fisheries, is less than or equal to 10 percent of the PBR level of the stock (as summarized in Section 2.4, Effects of the Action on Species and Designated Critical Habitat). Therefore, for the purposes of issuing an incidental take statement for eastern Steller sea lions, a permit is not required; however, an NID and a publication in the Federal Register identifying that the determination applies to the PCGF fishery is required.

NMFS recently made an NID finding for eastern stock Steller sea lions, and concluded that the minimum estimated serious injury and mortality rate for the stock because of all commercial fisheries, combined with total human-related mortality, is less than 10 percent of the stock's PBR and will therefore have a negligible impact on the stock (NMFS 2010c). This NID finding is also applicable to the PCGF, and NMFS published a list of authorized fisheries in the Federal Register (77 Fed. Reg. 11493, February 27, 2012).

[7] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the Service's interpretation of the term.

[8] The fishery classification criteria is a two-tiered stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock, and then addresses the impact of individual fisheries on each stock. Per the first tier, if the total annual mortality and serious injury of a marine mammal stock, across all fisheries, is less than or equal to 10 percent of the PBR level of the stock, all fisheries interacting with the stock would be placed in Category III, at least as related to that particular marine mammal stock. If this tier is not met, fisheries are subject to the next tier to determine classification.

Per the second tier of fishery classification criteria under section 118[9], the WA/OR/CA sablefish pot fishery is Category II with respect to the CA/OR/WA stock of humpback whales, because the total annual mortality and serious injury of this stock, across all fisheries, is more than 10 percent of the PBR level of the stock (and therefore does not qualify for Category III) and annual mortality and serious injury of the stock in this specific fishery—WA/OR/CA sablefish pot—is less than 50 percent of the PBR level of the stock. Therefore, for the purposes of issuing an incidental take statement for humpback whales, a permit is required in addition to an NID and a publication in the Federal Register identifying that the determination applies to this specific fishery. After which time, the below incidental take statement for humpback whales will be valid.

NMFS' draft NID finding for CA/OR/WA humpback whales concluded that the minimum estimated serious injury and mortality rate for the stock because of all commercial fisheries, combined with total human-related mortality, would not cause more than a 10 percent delay in time to recovery and will therefore have a negligible impact on the stock (NMFS in review). This draft NID finding is applicable for all West Coast fisheries, including the PCGF, and following issuance, NMFS will publish a list of authorized fisheries in the Federal Register including those of the WCGF. NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened eulachon. The Court of Appeals for the Ninth Circuit recently ruled that the ESA requires an incidental take statement even when take is not prohibited (Center for Biological Diversity, et al. v. Salazar, et al., 2012 WL 3570667 (9th Cir. 2012)). We have therefore included an incidental take statement for eulachon. In the event we subsequently adopt a rule prohibiting take of eulachon, the elements of this ITS that relate to eulachon would take effect on the effective date of that rule.

### 2.8.1 Amount or Extent of Take

#### 2.8.1.1 Eulachon

We anticipate that the take of threatened southern DPS eulachon will occur as a result of the proposed continued operation of the PCGF. Incidental take of southern DPS eulachon occurs as a result of bycatch and handling in the fisheries, or mortalities resulting from encounter with fishing gear, as a consequence of fishing activity. Take of eulachon in the proposed action is expected to not exceed 1,004 fish per year. This take is expected to occur in the LE groundfish bottom trawl and at-sea hake fisheries.

#### 2.8.1.2 Green Sturgeon

We anticipate that the take of threatened Southern DPS green sturgeon will occur as a result of the continued operation of the Pacific Coast groundfish fishery. Incidental take of Southern DPS green sturgeon is expected to occur as a result of incidental capture and handling in the fishery,

[9] Tier 2, Category I: Annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50 percent of the PBR level (i.e., frequent incidental mortality and serious injuries of marine mammals).
Tier 2, Category II: Annual mortality and serious injury of a stock in a given fishery is greater than 1 percent and less than 50 percent of the PBR level (i.e., occasional incidental mortality and serious injuries of marine mammals).
Tier 2, Category III: Annual mortality and serious injury of a stock in a given fishery is less than or equal to 1 percent of the PBR level (i.e., a remote likelihood or no known incidental mortality and serious injuries of marine mammals).

mortalities resulting from encounter with fishing gear and/or removal of captured fish from the water, and handling by the NMFS observer program. We expect incidental take of both adult and subadult Southern DPS green sturgeon. Under the proposed action, incidental take of Southern DPS green sturgeon because of bycatch and handling in the fishery is not expected to exceed 28 fish per year; however, we recognize the potential for incidental take of greater numbers of Southern DPS green sturgeon in some years. Therefore, this take statement allows for incidental take of up to 86 Southern DPS green sturgeon per year in no more than 2 years within a period of 9 consecutive years. Lethal take of Southern DPS green sturgeon because of bycatch and handling in the fishery is not expected to exceed 2 fish per year. However, recognizing the potential for lethal take of greater numbers of Southern DPS green sturgeon in some years, this take statement allows for lethal take of up to 7 Southern DPS green sturgeon per year in no more than 2 years within a period of 9 consecutive years. Lethal takes are expected to be immediate mortalities or delayed mortalities after release of the fish back into the water.

Under the proposed action, incidental take of Southern DPS green sturgeon by the NMFS Observer Program when observing and handling fish encountered in the fishery is not to exceed 375 Southern DPS green sturgeon per year. We do not expect handling of fish by the observer programs to result in lethal take of Southern DPS green sturgeon. Although green sturgeon handled by the observers may be dead when observed or may die after being released, we attribute the cause of death to the effects of bycatch and handling in the fishery rather than to handling by the observers.

#### 2.8.1.3 Humpback Whales

We anticipate that take of humpback whales will occur as a result of the proposed continued operation of the PCGF. Incidental take of humpback whales occurs as a result of entanglement with fishing gear, as a consequence of fishing activity. This take is expected to occur in the sablefish pot/trap fishery. In the effects section, we estimated an average of 1 humpback whale per year entangled by proposed fishing, with a maximum of 3 humpback whales entangled in a single year. Therefore, the incidental take limit for humpback whales is a 5-year average of 1 humpback whale injury or mortality per year, and up to 3 humpback whale injuries or mortalities in any single year. Available data on takes will be reviewed periodically by a Pacific Coast Groundfish and Endangered Species Workgroup as described under Reasonable and Prudent Measures and Terms and Conditions below. In addition to these take limits, we will evaluate total human-caused serious injury and mortality of humpback whales annually, and if PBR is exceeded, we will determine whether the MMPA 101(a)(5)(E) permit and humpback whale ITS are still valid. Consistent with the analysis in this biological opinion, a portion of unidentified whale and gear entanglements would be counted against these take limits and for this PBR evaluation in addition to known humpback whale entanglements in gear of the proposed fishery (pro-rating criteria and methods described in Section 2.3.3 or as adjusted by the Workgroup). Data used to pro-rate unidentified whale and gear entanglements will be updated each year. These criteria and methods are conservative in light of uncertainty about proposed fishery impacts on humpback whales, because of the opportunistic nature of entanglement observation and reporting, potential for unobserved injury or mortality because of entanglements, and difficulty identifying entangled whales to species and entangling gear to specific fisheries.

#### 2.8.1.4 Steller Sea Lions

We anticipate that the take of Steller sea lions will occur as a result of the proposed continued operation of the PCGF. Incidental take of Steller sea lions occurs as a result of entanglement with fishing gear as a consequence of fishing activity. This take is expected to occur in LE trawl and at-sea hake fisheries. In the effects section, we estimated an average of 14 Steller sea lions per year bycaught in proposed fishing, with a maximum of 45 Steller sea lions bycaught in a single year. Therefore, the incidental take limit for Steller sea lions is a 5-year average of 14 Steller sea lion injuries or mortalities per year, and up to 45 Steller sea lion injuries or mortalities in a single year. In addition to these take limits, we will evaluate total human-caused serious injury and mortality of Steller sea lions annually, and if PBR is exceeded, we will determine whether the MMPA 101(a)(5)(E) permit and Steller sea lion ITS are still valid.

#### 2.8.1.5 Leatherback Sea Turtles

We anticipate that the take of leatherback sea turtles will occur as a result of the proposed continued operation of the PCGF. Incidental take of leatherback sea turtles occurs as a result of entanglement with fishing gear as a consequence of fishing activity. This take is expected to occur in the sablefish pot/trap fishery. In the effects section, we estimated an average of 0.38 leatherback sea turtles per year entangled by proposed fishing, with a maximum of 1 leatherback sea turtle entangled in a single year. Therefore, the incidental take limit for leatherback sea turtles is a 5-year average of 0.38 leatherback sea turtle injury or mortality per year, and up to 1 leatherback sea turtle injury or mortality in a single year. Consistent with the analysis in this biological opinion, unidentified gear entanglements reported to stranding networks would be counted against these take limits in addition to known leatherback sea turtle entanglements in gear of the proposed fishery (until minimum coverage levels are achieved; see Take Monitoring Measures and Terms below). These criteria are conservative in light of uncertainty about proposed fishery impacts on leatherback sea turtles because of low observer coverage for this fishery.

### 2.8.2 Effect of the Take

In the accompanying biological opinion, we determined that the level of anticipated incidental take of the above identified listed species by the proposed action is not likely to result in jeopardy to the species or destruction of critical habitat.

### 2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

**Management Planning and Take Reporting Measures**

We include reasonable and prudent measures in this incidental take statement for management planning and take reporting that is applicable to all species considered in this opinion (green sturgeon, eulachon, humpback whales, Steller sea lions, and leatherback sea turtles). These measures will require NMFS to periodically analyze, report, and review new information, and evaluate whether reinitiation is warranted.

(1) NMFS shall develop a Pacific Coast Groundfish and Endangered Species Workgroup[10].
(2) NMFS shall characterize changes in fishing effort.
(3) NMFS shall update reporting of take considered in this opinion.
(4) NMFS shall update the NWFSC risk assessment, as needed.

**Take Monitoring Measure**

We include a reasonable and prudent measure in this incidental take statement to monitor the extent of incidental take of species considered in this opinion associated with the operation of the PCGF. The extent of take monitored will be compared with take limits specified for the fishery (Section 2.8.1, Amount or Extent of Take). To this end, monitoring is specific to observer coverage for all species considered in the opinion, with the exception of humpback whales. We do not anticipate that observer programs will be able to provide accurate bycatch estimates for humpback whales entangled in sablefish pot/trap gear, because the gear is left untended (and therefore unobserved) and humpback whales are mobile once entangled in the gear.

(1) NMFS shall identify goals for minimum coverage levels to achieve fleet-wide take estimates for green sturgeon, eulachon, Steller sea lions, and leatherback sea turtles, and a plan for implementation.
(2) NMFS shall consider methods of accounting for take of listed species in unobserved fisheries of the proposed action.

**Species-Specific Measures**

We also include reasonable and prudent measures in this incidental take statement specific to individual species considered in this opinion. Included are measures to minimize the amount or extent of incidental take associated with NMFS observer program sampling and handling of protected species where these effects are not otherwise authorized or exempted.[11] For this action and species contemplated in the opinion, green sturgeon are the only species not otherwise authorized or exempted.

*Eulachon*

We include the following reasonable and prudent measures in this incidental take statement to monitor and limit impact from the incidental take of eulachon associated with operation of the PCGF.

(1) NMFS shall regularly develop and modify protocols and implement biological sampling to assess the impacts of the Groundfish FMP actions upon eulachon.

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[10] If the workgroup becomes a Council committee, the name of this group may change. We are flexible as to who houses the group and the group name.

[11] Samples collected for turtles are authorized under 50 CFR 222.310 and 223.206 of the ESA. For Category I and II fisheries, observers are authorized to take samples of marine mammals under MMPA, Section 118, 50 CFR 229.7(b) and (c), and for Category III fisheries, observers are authorized via 229.7(d). Disentanglement, dehooking, and other handling considered aiding a stranded marine mammal are authorized under MMPA Section 109(h). Samples collected for eulachon do not cause additional effects, because mortality is assumed from trawl bycatch.

(2) Any changes in groundfish trawling regulations that are anticipated to increase eulachon bycatch (i.e., trawl net requirements such as chafing gear, mesh size, codend specifications) will result in a reinitiation of this biological opinion.
(3) Promulgation of 4(d) take prohibitions for eulachon shall result in a reinitiation of this biological opinion if operation of the WCGF fishery results in take that is prohibited by the 4(d) rule but not covered by the incidental take statement.

*Green Sturgeon*

We include the following reasonable and prudent measures in this incidental take statement to monitor the incidental take of Southern DPS green sturgeon associated with operation of the PCGF.

Although the expected incidental capture and associated mortality of Southern DPS green sturgeon per year in the fishery is relatively low, the bycatch data from 2002 through 2010 indicate that incidental capture and mortality can be greater in some years. Given the uncertainties in this analysis, measures should be taken to identify factors contributing to greater incidental take of green sturgeon, to improve our ability to predict when greater levels of incidental take may occur, and to address those factors in the future. The measures and the associated terms and conditions (identified in the following section) also specify monitoring needed to track the fleet-wide incidental take and to estimate the lethal take of Southern DPS green sturgeon in the fishery to demonstrate that the impacts of the fishery are consistent with this opinion. To do that, the measures and associated terms and conditions address the uncertainties regarding the effects on Southern DPS green sturgeon from capture in the fishery.

The primary uncertainties include those regarding the expanded estimate of encounters, the recapture rate of fish that are captured and released alive, and the sublethal and lethal impacts on green sturgeon of capture with trawl gear[12]. These uncertainties need to be addressed to more accurately assess the effects of the fishery on Southern DPS green sturgeon. The information generated from implementation of these measures is relevant to and necessary for implementation of the measures described in this take statement under Management Planning and Take Reporting.

(1) NMFS shall analyze years with a high number of green sturgeon encounters (i.e., years with greater than 28 estimated green sturgeon encounters, representing the number of encounters expected in the fishery in most years) to identify factors associated with greater incidental take of green sturgeon in the PCGF.
(2) NMFS shall collect biological samples and data on incidental take of Southern DPS green sturgeon associated with the operation of the PCGF.

[12] Our conclusions regarding the effects of the fishery on the viability of Southern DPS green sturgeon were based on the best available information from the observer programs and assumptions that green sturgeon encountered in the fishery are not recaptured within the same year, and green sturgeon caught in the fishery and released alive have high survival rates and do not experience significantly adverse sublethal effects. The impacts of the fishery on the species may become of more concern if information indicates that the fishery recaptures the same green sturgeon more than once and/or that green sturgeon encountered and released alive experience higher post-release mortality rates and more severe sublethal impacts than estimated here.

*Humpback Whales*

We include the following reasonable and prudent measure to improve our knowledge of incidental take of humpback whales in the PCGF.

(1) NMFS shall provide all west coast observers with the Fixed Gear Guide (http://swr.nmfs.noaa.gov/psd/Fixed%20Gear%20Guide-FINAL_12.14.11.pdf) and the entangled whale hotline (877-SOS-WHALe) during observer training. The guide will help observers that may opportunistically sight an entangled whale identify the entangling gear to a specific fishery. The hotline provides a resource for reporting and response.

*Leatherback Sea Turtles*

We include the following reasonable and prudent measures to limit impact from the incidental take of leatherback sea turtles associated with operation of the PCGF.

(1) NMFS shall educate observers on handling methods that will reduce sea turtle injury or mortality.

### 2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and NMFS must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). NMFS has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

**Management Planning and Take Reporting Terms and Conditions**

Terms and conditions (a,b,c…) specific to each of the above identified reasonable and prudent measures (1,2,3…) for management planning and take reporting are identified below (1.a, etc.).

1.a. NMFS shall identify preliminary membership[13] for a Pacific Coast Groundfish and Endangered Species Workgroup (PCGW) within eight months of opinion issuance.
1.b. Within three months of opinion issuance, NMFS shall invite PFMC and USFWS to provide points of contact, participate in the PCGW, and help develop terms of reference for the workgroup (see e. below). NMFS shall request response regarding participation within six months of opinion issuance.
1.c. The PCGW shall at a minimum convene on a biennial basis to consider all new information, described in the below measures.
1.d. Based on review of new information, the PCGW will make recommendations, for example, to develop new analyses or reports, changes to sampling protocols, implement conservation measures, and identify whether reinitiation is warranted.
1.e. The PCGW members shall recommend and NMFS shall adopt the final terms of reference for the PCGW, ideally within 12 months of opinion issuance. These terms

[13] Membership is subject to change based on technical needs, constituent interest, Council direction, etc.

shall document the purpose and structure of the group, the basis for key recommendations, staff points of contact and their roles and responsibilities, resources needed to accomplish the workgroup purpose, and a breakdown of anticipated work schedules (e.g., for biennial reporting and completing a future consultation following a PCGW recommendation to reinitiate).

2.a. NMFS shall analyze the available data on fishing effort to evaluate changes in fishing effort by gear type that may result from implementing the IFQ management program, and develop a report to characterize changes on a biennial basis. Roles for this analysis will be defined as part of 1(e), above.

   i. For example, NMFS shall report any significant increases or changes in the spatial and temporal characteristics of fisheries, where possible.

3.a. Fleet-wide take reporting: NMFS shall analyze the available data on observed take of protected species to provide fleet-wide take estimates on a biennial basis. Roles for this reporting will be defined as part of 1(e), above.

3.b. Annual tracking of observed take: NMFS Groundfish Observer Programs shall provide annual summaries of observed takes based on final data. NMFS NWR and SWR stranding networks shall provide annual summaries of observed marine mammal and sea turtle human interactions.

3.c. Immediate notification: NMFS Groundfish Observer Programs shall provide immediate notification[14] of observed sea turtle takes as well as any opportunistically observed whale or sea turtle entanglements, regardless of whether the entangled species or gear is known.

4.a. The need for an updated risk assessment shall be determined by recommendation of the PCGW. Roles for this assessment will be defined as part of 1.e, above.

**Take Monitoring Terms and Conditions**

Terms and conditions specific to the above identified reasonable and prudent measures for take monitoring are identified below.

a. Roles of workgroup participants to identify minimum coverage levels for monitoring and an implementation plan will be defined as part of the Management Planning and Take Reporting Term and Condition 1.e, above.
b. The minimum goals for monitoring will be defined for fisheries with anticipated observable take of ESA-listed species identified in Table 33, below.

Table 33. Anticipated observable take in the PCGF fishery by species and fisheries.

| Species* | Fisheries | Source |
|---|---|---|
| Green sturgeon | LE groundfish bottom trawl and at-sea hake fisheries | Al-Humaidhi et al. 2012 |
| Eulachon | LE groundfish bottom trawl and at-sea hake fisheries | Al-Humaidhi et al. 2012 |
| Steller sea lions | LE groundfish bottom trawl and at-sea hake fisheries | Jannot et al. 2011 |

[14] By immediate, NMFS means as soon as practicably feasible. For sea turtles, contact the Southwest Fisheries Science Center, attention Scott Benson. For marine mammals, use the 1-800-SOS-WHALe hotline for reporting.

| | | |
|---|---|---|
| Leatherback sea turtles** | Sablefish pot/trap fisheries | Jannot et al. 2011 and stranding records |

*Although humpback whale take is anticipated in sablefish pot/trap fisheries, observer programs as described in the analysis above do not observe this take because humpback whales are mobile once entangled.
**Leatherback sea turtles are not mobile once entangled, and therefore, entanglements are readily observable upon gear retrieval.

c. The implementation plan will identify a near-term timeframe to implement goals for minimum monitoring coverage.
d. Once implemented, NMFS shall meet or exceed the minimum monitoring each year, unless take is no longer observed for a minimum number of years.

**Species-specific Terms and Conditions**

*Eulachon*

Terms and conditions specific to each of the above identified reasonable and prudent measures for fishery modification are identified below.

1.a. By late summer/early fall of each year, the Groundfish Observer Program will analyze the current year's eulachon bycatch data and will discuss and modify, if necessary, protocols and sampling procedures with NMFS PRD and NWFSC for the following year.

2.a. Any proposed changes in groundfish regulations that are anticipated to increase eulachon bycatch (i.e., fishing effort, trawl net requirements such as chafing gear, mesh size, codend specifications) will be evaluated by the PCGW to determine whether reinitiation is warranted.

*Green Sturgeon*

Terms and conditions specific to each of the above identified reasonable and prudent measures for fishery modification are identified below.

1.a. In coordination with the PCGW, NMFS shall evaluate years of high green sturgeon encounters (i.e., years with greater than 28 estimated green sturgeon encounters, representing the number of encounters expected on average based on the WCGOP and A-SHOP data and estimates from 2002 through 2010) to investigate factors that may have contributed to the higher number of encounters compared to other years. Factors to investigate include characteristics of the fishery (e.g., the level and distribution of fishing effort in the LE groundfish bottom trawl sector, by area, season, depth, haul duration, etc.), characteristics of the observer program (e.g., overall observer coverage rates, the distribution of observer coverage by sector, area, and season), characteristics of green sturgeon populations and movements (e.g., distribution of green sturgeon along the coast, transition of a strong year class of juveniles to subadults), and oceanographic conditions (e.g., water temperature, productivity).
2.a. NMFS shall continue to collect biological data on observed green sturgeon throughout the Groundfish Observer Programs, according to the green sturgeon sampling protocol in the observer manuals. These data will be provided to NMFS PRD in the take reports

as described in this section of the opinion under Management Planning and Take Reporting.

2.b. NMFS shall ensure that green sturgeon tissue samples collected are appropriately stored and transported for genetic analysis.

2.c. In coordination with the PCGW, NMFS shall develop and implement methods to monitor the extent to which individual green sturgeon incidentally captured in the PCGF are recaptured each year. These methods may involve applying external tags (e.g., spaghetti tags) or internal tags (e.g., PIT tags) to green sturgeon encountered and observed in the fishery.

2.d. In coordination with the PCGW, NMFS shall develop and implement methods to monitor the impacts on green sturgeon of capture and release in the fishery. The methods should address the lethal and sublethal impacts on green sturgeon post-release. Methods may include the application of external or internal tags to green sturgeon encountered and observed in the fishery and/or development and implementation of a fish condition key to more consistently assess the condition of fish caught and released in the fishery. ESA coverage must be obtained for any additional take of Southern DPS green sturgeon as a result of implementing this term and condition, if not already considered in this opinion.

**Humpback Whales**

1.a. Reporting shall be directed from observers through the observer program.

1.b. Reporting shall be similar to or modeled after the attached form (Appendix B).

**Leatherback Sea Turtles**

1.a. NMFS shall provide information to observers regarding regulations requiring fishermen to properly handle, release, and resuscitate sea turtles, per 50 CFR 223.206(d)(1).

1.b. NMFS shall provide information on sea turtle biology during groundfish observer training.

## 2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

### 2.9.1 Eulachon

The following conservation recommendations for eulachon would provide information for future consultations involving the operation of the PCGF:

(1) NMFS should continue operations for the NMFS Observer Program and an adequate level of observation for the WA/OR/CA pink shrimp fishery.

(2) NMFS should retain eulachon bycatch for archiving: whole body eulachon specimens should be retained for further understanding of the species. Eulachon marine life history

is poorly understood; therefore, the impact of the Groundfish FMP upon eulachon is not well understood. Whole body specimens can allow for stock identification (genetic samples), diet (stomach analysis), sex ratios (examination of gonads), age (Ba:Ca ratios in otoliths), presence (locations of captures), and general morphology measurements. Eulachon sampling procedures for sample size, collection location and frequency, and archiving details should be determined by NMFS PRD, NWFSC, and Groundfish Observer Programs.

### 2.9.2 Green Sturgeon

The following conservation recommendations for green sturgeon and green sturgeon critical habitat would provide information for future consultations involving the operation of the PCGF:

(1) NMFS should develop a rangewide abundance estimate for the Southern DPS green sturgeon. The lack of data to generate reliable rangewide abundance estimates of adult and subadult Southern DPS green sturgeon was a source of uncertainty in the analysis in this opinion of the impacts of the fishery to the species. This source of uncertainty can be reduced or eliminated by developing an abundance estimate. One of the main concerns with existing abundance estimates is that the data used were generally from studies not specifically designed to sample green sturgeon. Reliable methods need to be developed for estimating the abundance of adults, subadults, and juveniles. In particular, methods for monitoring the annual spawning run size and for monitoring the abundance of juveniles are needed. These methods would need to be applied over a sufficiently long period of time (e.g., at least 10 years) to collect the data required to generate reliable rangewide abundance estimates.

(2) NMFS should assess the effects of bottom trawl gear on bottom habitat within designated green sturgeon critical habitat. Repeated disturbance of bottom habitats could be a concern for green sturgeon critical habitat because of effects on prey resources. Information needed to evaluate the effects of this fishery on green sturgeon critical habitat include characterization of the bottom types where bottom trawl fishing occurs, quantification of the area affected by bottom trawl gear, and quantification of the distribution, frequency, and level of bottom trawling effort throughout green sturgeon critical habitat to assess the level of repeated impacts.

(3) NMFS should continue to monitor state-managed fishery sectors that encounter green sturgeon (i.e., the California halibut bottom trawl sector) and, if funding is available, increase coverage rates. Develop minimum coverage levels necessary to extrapolate fleet-wide take estimates from monitoring data. Rationale: The observer program provides valuable data to estimate the effects of these fisheries on Southern DPS green sturgeon and inform the assessment of the environmental baseline, which is an integral part of the opinion analysis. Determining the minimum coverage levels necessary to extrapolate fleet-wide take estimates from monitoring data would help to set target coverage levels.

### 2.9.3 Humpback Whales and Leatherback Sea Turtles

The following conservation recommendations for humpback whales and leatherback sea turtles provide general guidance for unique, visual marking of sablefish pot/trap gear as identifiable to a specific fishery, as well as guidance to report, track, and retrieve pot/trap gear that becomes lost, and guidance to minimize the loss of pot/trap gear. Implementing these recommendations would improve our knowledge of incidental take of humpback whales and leatherback sea turtles in the PCGF and minimize that take. Washington and Oregon commercial Dungeness crab fisheries are example models where regulations for unique, visual marking of gear and programs to report, track, and retrieve lost gear are established. Citations regarding these regulations and programs are provided below. Dan Ayres, WDFW's Coastal Shellfish Lead Biologist, is a point of contact for questions about the Washington fishery: Daniel.Ayres@dfw.wa.gov or 360-249-4628 ext. 209. Kelly Corbett, ODFW's Commercial Crab Project Leader, is a point of contact for questions about the Oregon fishery: Kelly.C.Corbett@state.or.us or 541-867-0300 ext. 244. These measures shall be further discussed and developed by the PCGW, who may recommend adoption as conservation measures.

(1) NMFS and the PCGW should work with the PFMC to require or recommend visual marking that can be used to uniquely identify sablefish pot/trap gear (e.g., OAR 635-005-0480 and WAC 220-52-040 for Dungeness Crab Buoy Tag and Gear Marking Requirements). Visual marking can help identify gear entangled on a whale or turtle to a specific fishery, while absence of visual markings can also help rule out a fishery that uses unique, visual markers (e.g., Figure 10).

Figure 10. In this photograph, unique, visual markers (blue tag and buoy identification number) confirm that the entangled gear is from the Washington commercial crab fishery.

(2) NMFS and the PCGW should work with the PFMC to create electronic monitoring and logbook reporting requirements for the sablefish pot/trap fishery that require or recommend fishers to document effort and lost gear (see Appendix C for example logbook regulations, instructions, and entry forms that include lost gear reporting).
(3) NMFS and the PCGW should work with the PFMC to develop a database to track sablefish pot/trap fishing effort, locations, and lost fixed-gear (see Appendix D for an example database).

(4) NMFS and the PCGW should work with the PFMC to summarize data on lost gear from the sablefish pot/trap fishery to evaluate the magnitude of gear loss and factors that may influence loss (specific areas, times of year, etc.). Also, summarize fixed-gear fishing effort and locations to support overlap analysis with humpback whale (or other large whale) migrations or aggregation. Data summary should follow the reporting cycle developed for the PCGW above.
(5) NMFS and the PCGW should work with the PFMC to promote retrieval of lost gear (see Appendix E and Appendix F for information about example programs for gear recovery).
(6) NMFS and the PCGW should work with the PFMC to assess available technology to minimize loss of sablefish pot/trap gear (i.e., Gearfinder technology) and promote use of appropriate technology.
(7) NMFS and the PCGW should work with the PFMC to investigate the practice of storing sablefish pot/trap gear in the ocean to evaluate the potential for conservation issues and any need for additional regulation.

#### 2.9.4 Leatherback Sea Turtles

(1) NMFS and the PCGW should assess the feasibility of collecting data to assess bycatch of jellyfish in the groundfish trawl fisheries.
    (a) NMFS and the PCGW should consider the practicality of identifying jellyfish to species that could be encountered in the groundfish trawl fisheries.
    (b) NMFS and the PCGW should evaluate methods that observers could use to estimate the proportion of jellyfish in a trawl set and, if applicable, the proportion of brown sea nettles in that estimate.

### 2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

### 2.11 "Not Likely to Adversely Affect" Determinations

<u>Marine Mammals and Sea Turtles (Sei Whales, Northern Pacific Right Whales, Blue Whales, Fin Whales, Sperm Whales, Southern Resident Killer Whales and their Critical Habitat, Guadalupe Fur Seals, Green Sea Turtles, Olive Ridley Sea Turtles, and Loggerhead Sea Turtles)</u>

The above ESA-listed marine mammal and sea turtle species may occur in the action area and may be directly affected by interaction with vessels or gear or indirectly affected by reduced prey availability or trophic effects of the proposed fishing. Sightings of the large whales along the west coast of the U.S. range from year-round (fin and sperm whales) to seasonal (blue whales) to rare (sei, North Pacific right whales). Potential exposure of the above whales to the proposed fishing effort is low relative to other ESA-listed species for which there are past documented interactions (e.g., relative to humpback whales; NWFSC 2012 and overlap indices in Appendix B of NWFSC 2012). The above identified sea turtle species rarely occur in the action area (NMFS and USFWS 2007b, 2007c, 2007d). Occurrence of Guadalupe fur seals in U.S. waters is also rare (Carretta et al. 2011). Any effects on species rarely sighted in the action area are extremely unlikely to occur.

Vessel traffic and fishing effort associated with proposed fishing are anticipated to be similar to past levels over the broad expanse of the West Coast, and fishing vessels and gear would have a short-term presence in any specific location. There are no documented interactions of the above identified species with PCGF vessels or gear from observer programs or the stranding network, with the exception of one documented collision of a fishing vessel with a sperm whale (Jannot et al. 2011). Although sperm whales and killer whales are known to remove fish caught on longline hooks, potentially making them more susceptible to entanglement or other types of human-interaction (summarized in NWFSC 2012), this kind of depredation behavior is not known or observed to be a widespread problem off the U.S. West Coast. Nonetheless, we plan to continue monitoring effort in the PCGF with observer programs, which will allow us to identify a problem early on if depredation starts. Based on the low potential for exposure and the occurrence of only one past interaction of a sperm whale with PCGF vessels and gear observed, it is extremely unlikely that the proposed fishing effort will result in interactions with any of the above marine mammal or sea turtle species and the potential effects are, therefore, discountable.

The PCGF targets relatively large, commercially valuable fish species, including rockfish, hake, and various mid-water and bottom fish. Sei whales, Northern Pacific right whales, blue whales, and fin whales feed on krill and small schooling fishes, such as anchovies and sardines, which are not impacted by the PCGF to any significant extent. Based on food-web modeling conducted by the NWFSC, trophic effects of the PCGF are expected to be minor and in fact may positively affect the abundance of krill through removal of predators, and therefore positively affect prey available to sei whales, Northern Pacific right whales, blue whales, and fin whales (Appendix A of NWFSC 2012). The above identified sea turtle species feed on a variety of species, including kelp and invertebrates such as jellyfish, sponges, and sea pens as well as pelagic prey. Food web modeling indicates that trophic effects of the PCGF are expected to be minor because of the resiliency of the forage species evaluated (described further below). Guadalupe fur seals and sperm whales consume a variety of pelagic prey that may be either directly or indirectly affected by the PCGF. However, the above referenced modeling indicates that marine mammals are unlikely to be significantly impacted by food web interactions caused by the proposed fishing. The forage species evaluated in the modeling effort were found to be resilient to direct fishing mortality (i.e., high productivity of the stocks compensated for the range of fishing harvest evaluated, such that only small prey reductions were anticipated), as would be expected from the life history of small pelagic fishes. Because of their resiliency, the forage species were likewise not impacted through indirect effects of predation or competition (NWFSC 2012).

Southern Resident killer whales consume a variety of fish and one species of squid, but salmon, and Chinook salmon in particular, are their primary prey (review in NMFS 2008d). Ongoing and past diet studies of Southern Residents conduct sampling during spring, summer, and fall months in inland waters of Washington State and British Columbia (i.e., Ford and Ellis 2006; Hanson et al. 2010; ongoing research by NWFSC). Therefore, our knowledge of diet is specific to inland waters. Less is known about the diet of Southern Residents off the Pacific Coast. However, chemical analyses support the importance of salmon in the year-round diet of Southern Residents (Krahn et al. 2002; Krahn et al. 2007). Additionally, Southern Residents were found to consume Chinook salmon in two documented predation events off the coast. The predominance of Chinook salmon in the Southern Residents' diet when in inland waters, even when other species are more abundant, combined with information indicating that the killer whales consume salmon year round, makes it reasonable to expect that Southern Residents consume Chinook salmon when available in coastal waters.

As described above, no direct interactions with fisheries have been observed or reported for Southern Resident killer whales. The PCGF may, however, affect Southern Residents indirectly by reducing availability of their primary prey, Chinook salmon. Chinook salmon bycatch occurs in both the hake and non-hake sectors of the PCGF, ranging in the recent past from approximately 2,000 to 12,000 Chinook salmon annually (summarized in Table 11 of NWFSC 2012). Chinook salmon bycatch has decreased in both sectors of the fishery, but the hake sector represents the largest fraction of bycatch (over 90 percent of bycatch from 2007 to 2009). Of the non-hake sector, most of the bycatch occurs in the LE groundfish bottom trawl (review in NWFSC 2012).

Much of the Chinook salmon bycatch is represented by individuals smaller than 23.62 inches (60 cm) (younger than 2 years old). In 2007, an estimated 45 percent of the Chinook caught coast-wide in the groundfish fishery were less than 23.62 inches (60 cm), and in 2008, the fraction was closer to 85 percent (review in NWFSC 2012). By contrast, Southern Residents predominantly consume older and larger Chinook salmon (Ford and Ellis 2006; Hanson et al. 2010), particularly 4- to 5-year-olds that are returning to natal streams to spawn. The Chinook salmon bycatch is represented primarily by southern stocks, originating south of the Columbia River. Stocks originating from Puget Sound, British Columbia, and Alaska represent less than 10 percent of total bycatch (review in NWFSC 2012). These same northern stocks represent the largest contribution to Southern Resident diet, based on feeding events in inland waters (Hanson et al. 2010).

Given the total quantity of prey available to Southern Residents throughout their range, the anticipated reduction in prey is extremely small, and although measurable is anticipated to be less than a 1 percent reduction under a range of Chinook salmon bycatch and abundance scenarios (from -0.02 to -0.32 percent) (summarized in Table 12 of NWFSC 2012). Previous work has demonstrated links between Chinook salmon abundance and killer whale fecundity and survival (Ward et al. 2009; Ford et al. 2010). Based on a linear relationship between Chinook salmon abundance and the probability of calving, the prey reduction anticipated here would at most reduce the probability of a female calving by 0.06 percent (NWFSC 2012). Given that births occur infrequently and the population is subject to both demographic and environmental stochasticity, such a change would be undetectable. Therefore, NMFS anticipates that the reduction in Chinook salmon associated with the proposed fishing would result in an insignificant reduction in adult equivalent prey resources for Southern Residents. Over the long term, we are not currently able to evaluate if recovery levels identified for salmon ESUs are consistent with the prey needs and recovery objectives for Southern Resident killer whales. However, we have no information that suggests recovery levels for the affected Chinook salmon would be insufficient for Southern Resident survival and recovery.

Future loss of Chinook salmon could also affect the prey PCE of designated critical habitat for Southern Resident killer whales. However, of the small reduction in prey along the coast evaluated above, only a small number of those fish would have potentially entered inland waters of Washington that are designated critical habitat for Southern Residents, and that reduction is not anticipated to affect the conservation value of the critical habitat. In addition, NMFS determined that the PCGF is not likely to jeopardize the continued existence of ESA-listed Chinook salmon (NMFS 2006a).

Therefore, we find that the potential adverse effects of proposed fishing on the above identified marine mammal and sea turtle species would be either discountable or insignificant and determine that the proposed fishing may affect, but is not likely to adversely affect sei whales, Northern Pacific right whales, blue whales, fin whales, sperm whales, Southern Resident killer whales or their critical habitat, Guadalupe fur seals, green sea turtles, olive ridley sea turtles, and loggerhead sea turtles.

<u>Critical Habitat of Steller Sea Lions</u>

We designated critical habitat for Steller sea lions in certain areas and waters of Alaska, Oregon, and California, August 27, 1993 (NMFS 1993). Certain rookeries, haulouts, and associated areas, as well as three special foraging areas were designated as critical habitat. Critical habitat east of 144 W includes air zones extending 3,000 feet above the terrestrial and aquatic zones, and aquatic zones extending 3,000 feet seaward from the major rookeries and haulouts. All three special foraging areas are west of 144 W, and therefore outside the action area. There is no indication that the proposed fishing causes disturbance to rookeries or haul outs, and we do not anticipate any effects to either. Further, food web modeling indicates that food web interactions and prey reductions in critical habitat (i.e., aquatic zone) are unlikely to strongly impact marine mammals, including pinnipeds (NWFSC 2012) because of the resilience of the forage species evaluated as described above. Although food web modeling conducted by NWFSC may underestimate potential for effects on Steller sea lions, their long-term population growth suggests that any effects on their prey availability have not prevented steady population increases. Therefore, we anticipate that fishing-induced reduction in prey would have an insignificant effect on the conservation value of their critical habitat.

Therefore, we find that the potential adverse effects of proposed fishing on critical habitat of Steller sea lions are insignificant and determine that the proposed fishing may affect, but is not likely to adversely affect, designated critical habitat of Steller sea lions.

# 3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

## 3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the National Marine Fisheries Service. Other interested users could include the PFMC and others interested in the conservation of the affected ESUs/DPSs. Individual copies of this opinion were provided to the SFD of NMFS NWR and the PFMC. This opinion will be posted on the NMFS NWR web site (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

### 3.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, Security of Automated Information Resources, Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

### 3.3 Objectivity

Information Product Category: Natural Resource Plan

***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq.*, and the MSA implementing regulations regarding EFH, 50 CFR 600.

***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion contain more background on information sources and quality.

***Referencing:*** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

***Review Process:*** This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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# 5. APPENDICES

## Appendix A. Anticipated lethal and non-lethal take of leatherback sea turtles, based on active incidental take statements.

### Fisheries Actions

| Consultation Activity | Date Signed | Action Area | Incidental Take Authorized |
|---|---|---|---|
| Northeast Region | | | |
| NMFS NEFSC Research Vessel Activities | 8/20/2007 | U.S. EEZ from Gulf of Maine to Cape Hatteras, NC | **Dredge or trawl gear**<br>1 mortality annually |
| Atlantic Sea Scallop FMP | 3/14/2008 - ITS ammended Feb 5, 2009 | U.S. EEZ from ME to the VA/NC border | **Dredge gear - 2 year estimate**<br>1 - non-lethal<br>**Trawl gear - 1 year estimate**<br>1 - lethal or non-lethal |
| Skate FMP | 7/24/2003 | U.S. EEZ from ME to Cape Hatteras, NC | **1-yr Estimate**<br>1 leatherback |
| Monkfish FMP | 4/14/2003 | U.S. EEZ from ME to the NC/SC border | **1-yr Estimate**<br>**Gillnet Gear**<br>1 leatherback<br>**Trawl Gear**<br>1 leatherback |
| American Lobster - Federal Lobster Management | 10/31/2002 | U.S. EEZ waters from ME to Cape Hatteras, NC & adjoining state waters | **2-yr Estimate**<br>9 - lethal or non lethal |
| Deep-Sea Red Crab FMP | 2/6/2002 | U.S. EEZ from ME to Cape Hatteras, NC | **1-yr Estimate**<br>1 - lethal or non lethal |
| Spiny Dogfish FMP | 6/14/2001 | U.S. EEZ from ME thru FL | **1-yr Estimate**<br>1 - lethal or non lethal |
| Multispecies FMP | 6/14/2001 | U.S. EEZ waters from ME thru the range of the species covered by the FMP (~Cape Hatteras, NC) | **1-yr Estimate**<br>1 lethal or non lethal |
| Conservation Measures for the VA Pound Net Fishery | 4/16/2004 | VA waters as described in the BO (no Federal waters) | **1-yr Estimate**<br>1 lethal |
| Tilefish FMP | 3/13/2001 | All waters under U.S. jurisdiction in the Atlantic | **1-yr Estimate** |

| | | | |
|---|---|---|---|
| | | Ocean north of the VA/NC border | 1 lethal or non lethal |
| Herring FMP | 9/17/1999 | All 3 management areas as described in the FMP; roughly waters from ME through NC | **1-yr Estimate**<br>1 lethal or non lethal |
| Atlantic Mackerel, Squid, Butterfish FMP | 4/28/1999 | U.S. EEZ from ME to the NC/SC border | **1-yr Estimate**<br>1 lethal or non lethal |
| Southeast Region | | | |
| South Atlantic and Gulf of Mexico Stone Crab FMP | 9/28/2009 | U.S. EEZ South Atlantic and Gulf of Mexico | **3-yr Estimate**<br>1 lethal or non lethal |
| South Atlantic and Gulf of Mexico Spiny Lobster FMP | 8/27/2009 | U.S. EEZ South Atlantic and Gulf of Mexico | **3-yr Estimate**<br>1 lethal or non lethal |
| South Atlantic and Gulf of Mexico Coastal Migratory Pelagics Fishery | 8/13/2007 | U.S. EEZ from the Mid- and South Atlantic (NY/NJ border to E. Coast FL) and Gulf of Mexico (W. FL to TX) | **3-yr Estimate**<br>2 - lethal or non-lethal |
| South Atlantic Snapper-Grouper Fishery | 6/7/2006 | U.S. EEZ in South Atlantic (VA/NC to E. Coast FL) | **3-yr Estimate**<br>25 total (15 lethal) |
| Caribbean SFA Amendment | 8/19/2005 | U.S. EEZ Caribbean Sea | **1-yr Estimate**<br>1 non-lethal and 6 lethal |
| Gulf of Mexico Reef Fish Fishery FMP | 10/13/2009 | U.S. EEZ in Gulf of Mexico (W. Coast FL to TX) | **3-yr Estimate 2009-2011**<br>11 lethal<br>**3-yr Estimate - After 2011**<br>11 lethal |
| Atlantic Pelagic Longline Fishery for HMS | 6/1/2004 | U.S. EEZ in Atlantic, Gulf of Mexico, and Caribbean Sea | **3-yr Estimates**<br>1764 total (594 lethal) |
| Atlantic shark fisheries (commercial shark bottom longline, drift gillnet, recreational shark fisheries) | 5/20/2008 | U.S. EEZ in Atlantic, Gulf of Mexico, and Caribbean Sea | **3-yr Estimate**<br>74 total (47 lethal) |
| FMP for Dolphin-Wahoo | 8/27/2003 | U.S. Atlantic EEZ | **1-yr Estimate**<br>11 non-lethal and 1 lethal |
| Shrimp Trawling in the | 12/2/2002 | U.S. EEZ in South Atlantic (VA/NC to E. Coast FL) | **1-yr Estimate** |

| | | | |
|---|---|---|---|
| Southeast United States - Sea Turtle Cons. Regs and Shrimp FMP | | and Gulf of Mexico (W. Coast FL to TX) | 3,090 total (80 lethal) |
| Southwest Region | | | |
| Highly Migratory Species Fishery Management Plan (CA/OR drift gillnet fishery) | 2/4/2004 | West coast EEZ | 3 alive and 2 dead, annually |
| ETP purse seine fishery (large vessels only) | 12/8/1999, ITS amended 1/8/01 and then 7/7/04 | Eastern Tropical Pacific Ocean | 20 alive and 1 dead, every 10 years |
| Pacific Islands Region | | | |
| Hawaii Based Shallow-Set (Swordfish) Longline Fishery | 10/15/2008 | Central, Western, and Northern Pacific Ocean, including inside the EEZ around U.S. Islands in the Pacific | **1-yr Estimate**<br>16 alive and 4 dead |
| U.S. WCPO Purse Seine Fishery | 11/1/2006 | EEZs of 16 Pacific Island Countries party to the South Pacific Tuna Treaty and High Seas | **1-yr Estimate**<br>11 alive |
| Hawaii Based Deep-Set (Tuna) Longline Fishery | 10/4/2005 | Central, Western, and Northern Pacific Ocean, including inside the EEZ around U.S. Islands in the Pacific | **3-yr Estimate**<br>39 alive and 18 dead |
| Hawaii Based Shallow-Set (Swordfish) Longline Fishery | 2/23/2004 | Central, Western, and Northern Pacific Ocean, including inside the EEZ around U.S. Islands in the Pacific | **1-yr Estimate**<br>16 alive and 2 dead |
| Western Pacific Pelagics FMP handline, troll, pole and line and America Samoa Longline | 2/23/2004 | Central, Western, and Northern Pacific Ocean, including inside the EEZ around U.S. Islands in the Pacific | **1-yr Estimate**<br>1 alive |

## Non-fisheries Actions

| Consultation Activity | Date Signed | Action Area | Incidental Take Authorized |
|---|---|---|---|
| Northeast Region | | | |
| Long Island NY to Manasquan NJ Beach Nourishment | 12/15/1995 | South shore of Long Island, Sandy Hook to Manasquan, NJ and New York Bight area for borrow sites | **1-yr Estimate**<br>4 lethal |
| Sandy Hook Channel Dredging | 6/10/1996 | Sandy Hook Channel (in NY Bight) as described and identified in the BO | **1-yr Estimate**<br>1 lethal |
| Ambrose Channel, NJ Sand Mining | 10/11/2002 | 4.63 km section of Ambrose Channel located outside of the entrance to Lower NY Bay between Rockaway Pt, NY and Sandy Hook, NJ and the area between the Channel and the processing facility at South Amboy | **Total Anticipated Take for the entire 10-yr project**<br>1 lethal |
| Cape Henry, York Spit, York River Entrance, and Rappahannock Shoal Channels - Maintenance Dredging | 7/24/2003 | Cape Henry Channel, York Spit Channel, York River Entrance Channel and the Rappahannock Shoal Channel, the Wolf Trap Alternative Placement Area and the Dam Neck Ocean Management Area, and the waters between and immediately adjacent to these areas. | **Based on cubic yards of material dredged as noted below**<br>120 non-lethal for any combination of the four turtle species |
| VA Beach Hurricane Protection | 12/2/2005 | The borrow area surrounding Thimble Shoals Channel and the Atlantic Ocean Offshore borrow site (off Cape Henry, VA), Virginia Beach, and the waters between and immediately adjacent to these areas where project vessels will travel and sand will be transported. | **Anticipated Take for each dredge cycle (once every 3 years)**<br>Up to 45 takes for any combination of the four turtle species during relocation trawling |
| Cape Wind | 11/13/2008 | Nantucket Sound, | **1-yr Estimate** |

| | | | |
|---|---|---|---|
| | | Massachusetts | 3-7 sea turtles exposed to harassing noise levels during each pile driving event and 13-28 sea turtles exposed to harassing levels of noise during the geophysical survey will be a combination of these species. |
| Southeast Region | | | |
| DOT - Port Pelican LLC Deepwater Port | 4/14/2004 | Gulf of Mexico | **40-year Estimate**<br>2 dead (all species combined) |
| USCOE - Sabine-Neches Waterway Channel Improvement Project | 8/13/2007 | Jefferson and Orange County, TX and Cameron Parish, LA | **4.75-yr Estimate**<br>1 alive |
| NRC - Operation of the Cooling Water Intake System at the Brunswick Steam Electric Plant - NC | 1/20/2000 | Intake/Discharge canals associated with plant | **1-yr Estimate**<br>50 alive |
| NRC - Continued Operation of the St. Lucie Power Plant | 5/4/2001 | St. Lucie Power Plant, Unit 1 & 2 and the piping canals, making up the circulating seawater cooling system. | **1-yr Estimate**<br>1000 alive, 1 dead |
| NRC - Cooling water intake system at the Crystal River Energy Complex | 8/8/2002 | Crystal River Energy Complex, Unit 1,2, & 3 and discharge canal, and the intake canal and intake structures, which includes the bar racks, traveling screens, and sea water pump components | **1-yr Estimate**<br>75 alive, 3 dead |
| MMS - Gulf of Mexico Outer Continental Shelf Oil and Gas Lease Sales of Areas 169, 172, 175, 178, 182, 171, 174, 177 & 180 | 1/6/1998 | Gulf of Mexico Central Planning Area (Waters off AL, MS, and LA) & Gulf of Mexico Western Planning Area (Waters off LA, TX) | **1-yr Estimate**<br>25 |
| MMS - Eastern Gulf of Mexico Oil and Gas Lease Sale 181 | 6/15/2001 | Eastern Gulf of Mexico | **30-yr Estimate**<br>1 (all turtle species combined) |
| MMS - Gulf of Mexico Outer Continental Shelf Lease Sale 184 | 7/11/2002 | Western Gulf of Mexico | **30-year Estimate**<br>1 (all turtle species combined) |
| MMS - Gulf of Mexico Outer | 11/29/2002 | U.S. EEZ in the Gulf of Mexico | **1-yr Estimate** |

| | | | |
|---|---|---|---|
| Continental Shelf Multi-Lease Sale (185, 187, 190, 192, 194, 196, 198, 200, 201) | | | 1 (all turtle species combined) |
| MMS - Freeport McMoran Injection Well of E&P Waste into Salt Caverns and Caprock at Main Pass, Block 229 | 4/1/2004 | Gulf of Mexico | **26-year Estimate**<br>206 |
| MMS - OCS Oil and Gas Leasing Program 2007-2012 | 6/29/2007 | Gulf of Mexico | **40-yr Estimate**<br>21 alive, 10 dead |
| USN - Navy Activities off the Southeastern U.S. along the Atlantic Coast | 5/15/1997 | Charleston, SC to approximately, Sebastian Inlet, FL; from the coast out to approx. 80 nm | **1-yr Estimate**<br>12 |
| USAF - Air-to-Surface Gunnery Testing - Detonation of High Explosive Gunnery Munitions in EGTR | 12/17/1998 | 123,00 sq. miles in NE Gulf of Mexico @ Eglin Gulf Test Range | **1-yr Estimate**<br>2 |
| USN - Establishment of the Mine Warfare Center of Excellence (MWCE) at the Navy's existing complex at Ingleside/Corpus Christi, Texas | 10/26/1999 | Naval Air Station Corpus Christi and Naval Station Ingleside, and areas within MMS Lease Blocks 732, 733, 734, 793, 799, and 816 | **1-yr Estimate**<br>2 |
| USAF - Search and Rescue Training in the GOM | 12/22/1999 | 175 sq. nm area of GOM off N. Florida | **1-yr Estimate**<br>2 |
| USMC - Marine Corps Air Station | 9/27/2002 | 2 target bombings, target ranges, BT-9 and BT-11, Located of off the Neuse River and Pamlico Sound in NC | **10-year Estimate**<br>21 alive, 7 dead |
| USN - Mine Warfare Exercises (MINEX) and Explosive Ordnance Disposal (EOD) Unit Level Training at Several Locations Along the East Coast of the U.S. | 10/9/2002 | Onslow Bay, NC (an irregular shaped area extending from [the shoreline] approximately 6-48 km offshore); Charleston, SC (an boxed area extending approximately 5-30 km offshore) | **5-yr Estimate**<br>1 |
| USAF - Eglin Air Force Base and Training Range Mission Activities | 10/20/2004 | Warning Areas (W-151, W-168, and W-470) as well as Eglin Water Test Areas(EWTA-1 Through EWTA-6) | **1-yr Estimate**<br>1 |

| | | | |
|---|---|---|---|
| USAF - Eglin Gulf Test and Training Range, Precision Strike Weapons (PSW) Test | 3/14/2005 | Gulf of Mexico, Eglin Air Force Base; The two test locations located within W-151 at a distance of approximately 15-24 NM from shore in 45.7 m of water. | **5-yr Estimate**<br>1 |
| USCG - Hurricane Katrina Coastal Debris Removal Trawling | 1/23/2006 | Mississippi Sound | **1.25-yr Estimate**<br>1 alive |
| NASA - Evaluation of EFH for Sharks and Selected Sportfishes in an MPA off Cape Canaveral | 2/21/2006 | Atlantic Ocean between Lat. 28°15'N & 28°45'N; 16-24 km from shore | **1-yr Estimate**<br>6 alive, 2 dead |
| NMFS - NER Funding for the grant proposal to use longlines to sample for Red Drum off NC, SC, and GA | 10/11/2006 | Sampling areas off NC, SC, GA, FL (maps of areas available upon request) | **3-yr Estimate**<br>3 alive, 1 dead |
| DOI - New Management Plan for Dry Tortugas National Park (continued authorization of recreational fishing) | 7/7/2006 | Dry Tortugas National Park | **1-yr Estimate**<br>1 |
| NMFS Funding - Cooperative State-Fed Program - Longline Study of Adult Red Drum in NC, SC, GA | 8/18/2008 | Sampling areas off NC, SC, GA | **1-yr Estimate**<br>1 lethal or non-lethal |
| Rudloe, Gulf Specimen Marine Laboratories - Incidental Take Permit (Aquarium collections) | 5/15/2003 | Florida Panhandle | **1-yr Estimate**<br>3 alive (for collection) |
| Removal of Offshore Structures in the Gulf of Mexico Outer Continental Shelf | 8/28/2006 | Gulf of Mexico | **1-yr Estimate**<br>3 non-lethal or lethal |
| Southwest Region | | | |
| Nuclear Regulatory Commission - Diablo Canyon | 9/18/2006 | Diablo Cove, San Luis Obispo County, CA | **1-yr Estimate**<br>3 alive (1 with serious injury), 1 dead |
| Nuclear Regulatory Commission - San Onofre Nuclear Generating Station | 9/18/2006 | Near San Clemente, CA | **1-yr Estimate**<br>3 alive (1 with serious injury), 1 dead |

| Pacific Islands Region | | | |
|---|---|---|---|
| Scripps Institution of Oceanography for a marine seismic survery in the ETP | 3/8/2006 | Eastern Tropical Pacific | 2 alive |

## Appendix B: Whale Entanglement Form

Whale Entanglement Form

Date:

Time of Sighting:

Observer Name:

Vessel Name:

Type of Fishery:

Phone Number:

General Location (Landmarks):

Specific Location:

Species (If known, use guide):

Approximate Size and Age Class:

Nature of Distress (Describe in detail what you see, colors, numbers, type of gear, type of line, etc. Use Fixed Gear Guide: California, Oregon, and Washington Commercial Fisheries to help determine type of gear):

General Condition of the Whale:

Is the animal moving?

Photos?

Video? Unknown

## Appendix C. Example logbook regulations, instructions, and entry forms for the Washington commercial Dungeness crab fishery.

**Logbook regulations:**

*WAC 220-52-041*

Coastal Dungeness crab logbook requirements.

(1) It is unlawful for any vessel operator engaged in fishing for Dungeness crab in the coastal commercial fishery to fail to complete a department-issued logbook for all fishing activity occurring in Grays Harbor, Willapa Bay, the Columbia River, or the Pacific Ocean waters adjacent to the state of Washington.

(2) It is unlawful for any vessel operator engaged in fishing to fail to comply with the following method and time frame related to harvest logbook submittal and record keeping:

(a) The department must receive a copy of the completed logbook sheets within ten days following any calendar month in which fishing occurred. Completed Dungeness crab harvest logs must be sent to the following address: Washington Department of Fish and Wildlife, Attention: Coastal Dungeness Crab Manager, 48 Devonshire Rd., Montesano, WA 98563.

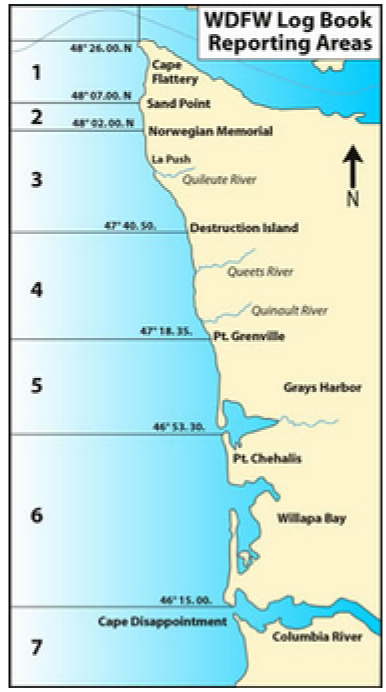
(b) Vessel operators engaged in fishing for Dungeness crab in the coastal commercial fishery must complete a logbook entry for each day fished prior to offloading. Vessel operators responsible for submitting logs to the department must maintain a copy of all submitted logs for no less than three years after the fishing activity ended.

(c) Vessel operators can obtain logbooks by contacting the department's coastal Dungeness crab manager at 360-249-4628.

(3) Violation of this section is a misdemeanor, punishable under RCW 77.15.280.

[Statutory Authority: RCW 77.12.047. 07-23-090 (Order 07-285), § 220-52-041, filed 11/20/07, effective 12/21/07.]

**Logbook Instructions (**http://wdfw.wa.gov/fishing/commercial/crab/coastal/logbook.html**):**




| Logbook Catch Areas | Location |
|---|---|
| 1 | U.S. Border - 48°07.00 (Sand Point) |
| 2 | 48°07.00 - 48°02.00 (Norwegian Memorial) |
| 3 | 48°02.00 - 47°40.50 (Destruction Island) |
| 4 | 47°40.50 - 47°18.35 (Point Grenville) |
| 5 | 47°18.35 - 46°53.30 (Point Chehalis) |
| 6 | 46°53.30 - 46°15.00 (WA/OR border) |
| 7 | South of 46°15.00 (Oregon) |

### Washington Coastal Commercial Dungeness Crab Logbook Instructions

Notice: *The skipper of each vessel landing Dungeness crab in Washington is responsible for maintaining a logbook provided by the Washington Department of Fish and Wildlife in accordance with these instructions* (WAC 220-52-040).

> Logbooks are due by the 10th of each month for the previous month
> Send completed logbooks to:
>
> WDFW Attn: Coastal Crab Manager
> 48 Devonshire Rd.
> Montesano, WA 98563

Vessel: Registered name of vessel

Crab License #: Coastal Dungeness crab license number

Port: Port of landing

Federal #: Vessel's Federal document number

Landing date: Date of landing (on fish ticket)

Fish Ticket #: Fish ticket number

LOGBOOK INFORMATION INSTRUCTIONS

Date: Date the pot or string is picked

String #: A random numeric identifier for strings (example: 1, 2, 3, etc...)

Depth (fm): Average depth of the string

Pots Fished: Number of pots currently being fished in string

Pots Lost: Number of pots that are unlikely to be retrieved due to weather or disappearance of pot

Soak Time (days): Number of days a pot has been fishing (example: 2.5 days)

Latitude Begin/End: Latitude of the beginning and end of the string

Longitude Begin/End: Longitude of the beginning and end of the string

Number of Crab Retained: Number of individual crab retained in each string of pots

Logbook Catch Area: Catch area of string using catch areas on front cover of Coastal Dungeness Crab Fishery Logbook

Bait: List bait used to lure crab into pots of current string

Lost Gear Recovered: Number of pots recovered that were previously considered lost and recorded in Pots Lost column of logbook

## Logbook Entry Form:

# Washington Coastal Dungeness Crab Fishery Logbook

Washington Department of FISH and WILDLIFE

Vessel________________________ Crab License #____________ Port________________

Federal #______________________ Landing Date____________________

Fish Ticket #___________________ Fish Ticket #____________________

| Date | String # | Depth (fm) | Pots Fished | Pots Lost | Soak Time (days) | | Latitude | Longitude | Number of Crab Retained | Logbook Catch Area | Bait |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |
| | | | | | | Begin | | | | | |
| | | | | | | End | | | | | |

NOTES:

SIGNED:____________________________ Date___________

*Under penalty of perjury, I certify that the information contained herein is true and complete.*

**Lost Gear Recovered:**_____________________

## Appendix D. A spreadsheet from WDFW's logbook database with example data, including information about lost gear. The example data does not reflect actual fishing activities.

| Logbook Header.ID | Vessel | License | Port | Federal ID | Landing Date | Fish Ticket 1 | Fish Ticket 2 | Logbook Header.Primary Logbook Page | Secondary Pages | Logbook Sets.ID | Set Date | String | Depth (ftm) | Pots Fished | Pots Lost | Soak Time (days) | Latitude Begin Degrees | Latitude Begin Minutes | Longitude Begin Degrees | Longitude Begin Minutes | Latitude End Degrees | Latitude End Minutes | Longitude End Degrees | Longitude End Minutes | Crab Retained (count) | Crab Retained (lbs) | Logbook Catch Area | Lost Gear Recovered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2712 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/18/10 | Z123456 | | 15301 | 15302, 153 | 13926 | 12/15/10 | 15 | 19 | 25 | 1 | 2 | 47 | 21.58 | 124 | 11.86 | 47 | 18.24 | 124 | 11.78 | 190 | | 6 | |
| 2712 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/18/10 | Z123456 | | 15301 | 15302, 153 | 13930 | 12/16/10 | 19 | 6 | 42 | 3 | 1 | 47 | 24.92 | 124 | 5.38 | 47 | 22.12 | 124 | 5.24 | 440 | | 6 | |
| 2712 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/18/10 | Z123456 | | 15301 | 15302, 153 | 13932 | 12/16/10 | 21 | 21 | 41 | 1 | 3 | 47 | 19.12 | 124 | 12.10 | 47 | 15.99 | 124 | 11.84 | 121 | | 6 | |
| 2712 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/18/10 | Z123456 | | 15301 | 15302, 153 | 13933 | 12/16/10 | 22 | 25 | 39 | 2 | 1 | 47 | 19.99 | 124 | 13.49 | 47 | 24.09 | 124 | 13.79 | 397 | | 6 | |
| 2712 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/18/10 | Z123456 | | 15301 | 15302, 153 | 13938 | 12/17/10 | 27 | 20 | 47 | 1 | 1 | 47 | 21.58 | 124 | 11.86 | 47 | 18.24 | 124 | 11.78 | 180 | | 6 | |
| 2713 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/21/10 | Z123456 | | 15306 | | 13940 | 12/19/10 | 1 | 6 | 42 | 2 | 2 | 47 | 24.92 | 124 | 5.24 | 47 | 22.12 | 124 | 5.38 | 550 | | 6 | |
| 2714 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/29/10 | Z123456 | | 15308 | | 13946 | 12/28/10 | 2 | 7 | 62 | 1 | 8 | 47 | 25.94 | 124 | 6.01 | 47 | 22.27 | 124 | 6.21 | 550 | | 6 | |
| 2714 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/29/10 | Z123456 | | 15308 | | 13949 | 12/28/10 | 5 | 22 | 31 | 1 | 18 | 47 | 19.96 | 124 | 14.60 | 47 | 15.76 | 124 | 12.07 | 300 | | 6 | |
| 2602 | VESSEL NAM | 99999 | WESTPORT | 123456 | 1/10/11 | Z123456 | | 42822 | | 13541 | 1/9/11 | 7 | 17 | 100 | 8 | 1 | 47 | 28.00 | 124 | 10.00 | 47 | 18.00 | 124 | 9.00 | 550 | | 6 | |
| 2602 | VESSEL NAM | 99999 | WESTPORT | 123456 | 1/10/11 | Z123456 | | 42822 | | 13542 | 1/9/11 | 8 | 19 | 100 | 7 | 1 | 47 | 28.00 | 124 | 11.50 | 47 | 18.00 | 124 | 10.50 | 350 | | 6 | |
| 2603 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/13/10 | Z123456 | | 37164-1 | | 13543 | 12/13/10 | 1 | 18 | 100 | 2 | 3 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 1000 | | 6 | |
| 2603 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/13/10 | Z123456 | | 37164-1 | | 13544 | 12/13/10 | 2 | 23 | 55 | 1 | 3 | 47 | 18.31 | 124 | 12.39 | 47 | 16.25 | 124 | 11.83 | 800 | | 6 | |
| 2604 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/16/10 | Z123456 | | 37164-2 | | 13547 | 12/16/10 | 1 | 18 | 100 | 2 | 3 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 900 | | 6 | |
| 2604 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/16/10 | Z123456 | | 37164-2 | | 13548 | 12/16/10 | 2 | 23 | 55 | 1 | 3 | 47 | 18.31 | 124 | 12.39 | 47 | 16.25 | 124 | 11.83 | 600 | | 6 | |
| 2604 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/16/10 | Z123456 | | 37164-2 | | 13549 | 12/16/10 | 3 | 26 | 50 | 2 | 3 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 700 | | 6 | |
| 2604 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/16/10 | Z123456 | | 37164-2 | | 13550 | 12/16/10 | 4 | 35 | 65 | 1 | 3 | 47 | 18.31 | 124 | 12.39 | 47 | 16.25 | 124 | 11.83 | 1000 | | 7 | |
| 2605 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/17/10 | Z123456 | | 37165-1 | | 13552 | 12/17/10 | 2 | 18 | 100 | 3 | 1 | 47 | 16.42 | 124 | 11.13 | 47 | 22.58 | 124 | 11.06 | 300 | | 6 | |
| 2606 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/21/10 | Z123456 | | 37165-2 | | 13553 | 12/21/10 | 1 | 16 | 45 | 4 | 2 | 47 | 19.15 | 124 | 10.11 | 47 | 21.32 | 124 | 10.06 | 350 | | 7 | |
| 2608 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/28/10 | Z123456 | | 37165-3 | | 13554 | 12/28/10 | 1 | 16 | 44 | 1 | 6 | 47 | 19.15 | 124 | 10.11 | 47 | 21.32 | 124 | 10.11 | 403 | | 6 | |
| 2608 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/28/10 | Z123456 | | 37165-3 | | 13555 | 12/28/10 | 2 | 18 | 60 | 4 | 6 | 47 | 16.42 | 124 | 11.06 | 47 | 22.58 | 124 | 11.13 | 1000 | | 6 | |
| 2609 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/30/10 | Z123456 | | 37165-4 | | 13556 | 12/30/10 | 1 | 16 | 40 | 5 | 6 | 47 | 19.15 | 124 | 10.11 | 47 | 21.32 | 124 | 10.06 | 150 | | 6 | |
| 2609 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/30/10 | Z123456 | | 37165-4 | | 13557 | 12/30/10 | 2 | 18 | 60 | 5 | 6 | 47 | 16.42 | 124 | 11.06 | 47 | 22.58 | 124 | 11.13 | 300 | | 6 | |
| 2610 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/31/10 | Z123456 | | 37166-1 | | 13558 | 12/31/10 | 1 | 16 | 44 | 1 | 2 | 47 | 12.06 | 124 | 9.10 | 47 | 14.75 | 124 | 10.17 | 100 | | 6 | |
| 2610 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/31/10 | Z123456 | | 37166-1 | | 13559 | 12/31/10 | 2 | 18 | 100 | 4 | 2 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 50 | | 6 | |
| 2610 | VESSEL NAM | 99999 | CHINOOK | 123456 | 12/31/10 | Z123456 | | 37166-1 | | 13560 | 12/31/10 | 3 | 26 | 50 | 2 | 2 | 47 | 15.00 | 124 | 12.01 | 47 | 18.18 | 124 | 12.72 | 100 | | 6 | |
| 2612 | VESSEL NAM | 99999 | CHINOOK | 123456 | 1/3/11 | Z123456 | | 37166-2 | | 13562 | 1/3/11 | 2 | 26 | 50 | 3 | 1 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 130 | | 6 | |
| 2614 | VESSEL NAM | 99999 | CHINOOK | 123456 | 1/9/11 | Z123456 | | 37167-2 | | 13567 | 1/9/11 | 2 | 35 | 65 | 1 | 3 | 47 | 12.00 | 124 | 11.30 | 47 | 10.00 | 124 | 11.89 | 140 | | 7 | |
| 2615 | VESSEL NAM | 99999 | CHINOOK | 123456 | 1/10/11 | Z123456 | | 37167-3 | | 13568 | 1/10/11 | 1 | 16 | 45 | 1 | 2 | 47 | 19.15 | 124 | 10.11 | 47 | 21.32 | 124 | 10.06 | 40 | | 6 | |
| 2615 | VESSEL NAM | 99999 | CHINOOK | 123456 | 1/10/11 | Z123456 | | 37167-3 | | 13569 | 1/10/11 | 2 | 18 | 99 | 1 | 2 | 47 | 16.46 | 124 | 11.06 | 47 | 22.40 | 124 | 11.13 | 75 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13570 | 12/12/10 | 1 | 10 | 55 | 1 | 2 | 47 | 22.70 | 124 | 6.40 | 47 | 25.40 | 124 | 6.20 | 1130 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13571 | 12/12/10 | 2 | 10 | 54 | | 2 | 47 | 27.90 | 124 | 6.20 | 47 | 25.40 | 124 | 6.70 | 932 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13572 | 12/12/10 | 3 | 11 | 98 | | 2 | 47 | 27.70 | 124 | 7.00 | 47 | 22.40 | 124 | 7.40 | 2067 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13573 | 12/12/10 | 4 | 19 | 43 | | 2 | 47 | 27.30 | 124 | 10.50 | 47 | 23.80 | 124 | 10.80 | 575 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13574 | 12/13/10 | 5 | 10 | 55 | | 1 | 47 | 22.70 | 124 | 6.40 | 47 | 25.10 | 124 | 5.20 | 720 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13575 | 12/13/10 | 6 | 10 | 54 | | 1 | 47 | 27.90 | 124 | 6.20 | 47 | 25.40 | 124 | 6.70 | 452 | | 6 | |
| 2616 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/13/10 | Z123456 | | 5821 | | 13576 | 12/13/10 | 7 | 11 | 98 | | 1 | 47 | 27.70 | 124 | 6.70 | 47 | 22.40 | 124 | 7.00 | 1125 | | 6 | |
| 2617 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/16/10 | Z123456 | | 5823 | | 13577 | 12/16/10 | 1 | 10 | 55 | | 2 | 47 | 22.70 | 124 | 6.40 | 47 | 25.40 | 124 | 6.20 | 560 | | 6 | |
| 2617 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/16/10 | Z123456 | | 5823 | | 13578 | 12/16/10 | 2 | 10 | 54 | 1 | 2 | 47 | 27.90 | 124 | 6.70 | 47 | 25.40 | 124 | 6.70 | 586 | | 6 | |
| 2617 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/16/10 | Z123456 | | 5823 | | 13579 | 12/16/10 | 3 | 11 | 98 | | 2 | 47 | 27.70 | 124 | 7.00 | 47 | 22.40 | 124 | 7.40 | 565 | | 6 | |
| 2617 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/16/10 | Z123456 | | 5823 | | 13580 | 12/16/10 | 4 | 19 | 43 | | 2 | 47 | 27.30 | 124 | 10.50 | 47 | 23.80 | 124 | 10.80 | 286 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13585 | 12/28/10 | 1 | 11 | 96 | 2 | 6 | 47 | 27.70 | 124 | 7.00 | 47 | 22.40 | 124 | 7.40 | 667 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13586 | 12/28/10 | 2 | 10 | 53 | 1 | 6 | 47 | 22.70 | 124 | 6.40 | 47 | 25.40 | 124 | 6.20 | 364 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13587 | 12/28/10 | 3 | 10 | 52 | 1 | 6 | 47 | 24.90 | 124 | 6.70 | 47 | 25.40 | 124 | 6.70 | 484 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13588 | 12/30/10 | 4 | 19 | 43 | | 7 | 47 | 27.30 | 124 | 10.50 | 47 | 23.80 | 124 | 10.80 | 373 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13589 | 12/30/10 | 5 | 11 | 96 | | 7 | 47 | 27.70 | 124 | 7.00 | 47 | 22.40 | 124 | 7.40 | 598 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13590 | 12/30/10 | 6 | 10 | 52 | | 7 | 47 | 27.70 | 124 | 6.70 | 47 | 25.40 | 124 | 6.70 | 299 | | 6 | |
| 2619 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/30/10 | Z123456 | | 5825 | | 13591 | 12/30/10 | 7 | 19 | 43 | | 7 | 47 | 22.70 | 124 | 7.40 | 47 | 25.40 | 124 | 6.40 | 265 | | 6 | |
| 2627 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/14/10 | Z123456 | | 7851-2 | | 13606 | 12/14/10 | 1 | 15 | 140 | 1 | 2 | 47 | 24.35 | 124 | 9.81 | 47 | 16.06 | 124 | 9.99 | | 2500 | 6 | |
| 2629 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/18/10 | Z123456 | | 7852-1 | | 13612 | 12/17/10 | 1 | 30 | 190 | 1 | 2 | 47 | 26.05 | 124 | 14.78 | 47 | 16.03 | 124 | 13.32 | | 4000 | 6 | |
| 2653 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/17/10 | Z123456 | | 34822 | | 13658 | 12/12/10 | 1 | 15 | 160 | 2 | 2 | 47 | 28.00 | 124 | 8.98 | 47 | 16.77 | 124 | 10.21 | 2833 | | 6 | |
| 2653 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/17/10 | Z123456 | | 34822 | | 13662 | 12/13/10 | 5 | 32 | 65 | 3 | 3 | 47 | 23.51 | 124 | 15.52 | 47 | 20.02 | 124 | 16.74 | 855 | | 6 | |
| 2653 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/17/10 | Z123456 | | 34822 | | 13665 | 12/15/10 | 8 | 15 | 160 | 4 | 1 | 47 | 27.99 | 124 | 8.90 | 47 | 15.67 | 124 | 10.20 | 2552 | | 6 | |
| 2654 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/23/10 | Z123456 | | 34823 | | 13666 | 12/19/10 | 1 | 21 | 60 | 1 | 5 | 47 | 28.01 | 124 | 10.73 | 47 | 24.14 | 124 | 10.90 | 299 | | 6 | |
| 2654 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/23/10 | Z123456 | | 34823 | | 13668 | 12/20/10 | 3 | 15 | 120 | 1 | 5 | 47 | 24.14 | 124 | 9.94 | 47 | 16.71 | 124 | 10.22 | 1301 | | 6 | |
| 2654 | VESSEL NAM | 99999 | WESTPORT | 123456 | 12/23/10 | Z123456 | | 34823 | | 13669 | 12/20/10 | 4 | 17 | 35 | 3 | 5 | 47 | 27.02 | 124 | 9.29 | 47 | 24.25 | 124 | 11.97 | 196 | | 6 | |
| 2655 | VESSEL NAM | 99999 | WESTPORT | 123456 | 1/3/11 | Z123456 | | 15309 | 15310, 1531 | 13676 | 12/31/10 | 7 | 30 | 48 | 2 | 14 | 47 | 27.83 | 124 | 15.94 | 47 | 22.60 | 124 | 14.70 | 376 | | 6 | |
| 2655 | VESSEL NAM | 99999 | WESTPORT | 123456 | 1/3/11 | Z123456 | | 15309 | 15310, 1531 | 13683 | 1/1/11 | 14 | 21 | 40 | 1 | 4 | 47 | 18.96 | 124 | 12.28 | 47 | 15.46 | 124 | 11.70 | 129 | | 6 | |
| 2663 | VESSEL NAM | 99999 | ILWACO | 123456 | 12/22/10 | Z123456 | | 1054 | | 13749 | 12/22/10 | 1 | 12 | 59 | 1 | 6 | 47 | 12.66 | 124 | 5.62 | 47 | 9.74 | 124 | 3.04 | 457 | | 7 | |
| 2700 | VESSEL NAM | 99999 | ASTORIA | 123456 | 12/31/10 | Q999999 | | 31724 | | 13838 | 12/30/10 | 1 | 8 | 130 | 4 | 2 | 47 | 22.80 | 124 | 6.00 | 47 | 28.00 | 124 | 5.90 | | | 6 | |
| 2700 | VESSEL NAM | 99999 | ASTORIA | 123456 | 12/31/10 | Q999999 | | 31724 | | 13839 | 12/30/10 | 2 | 11 | 80 | 2 | 2 | 47 | 22.53 | 124 | 7.61 | 47 | 18.56 | 124 | 8.28 | | | 6 | |
| 2700 | VESSEL NAM | 99999 | ASTORIA | 123456 | 12/31/10 | Q999999 | | 31724 | | 13840 | 12/30/10 | 3 | 11 | 40 | 1 | 2 | 47 | 15.14 | 124 | 9.77 | 47 | 16.47 | 124 | 9.95 | | | 6 | |
| 2700 | VESSEL NAM | 99999 | ASTORIA | 123456 | 12/31/10 | Q999999 | | 31724 | | 13841 | 12/30/10 | 4 | 12 | 50 | 3 | 2 | 47 | 16.57 | 124 | 9.63 | 47 | 18.64 | 124 | 8.78 | | | 6 | |

**Appendix E. Information about Washington programs for recovery of lost Dungeness crab gear and public hotline for reporting lost gear sightings.**

**Permit Program for Gear Recovery:**

<u>Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program, Final Report:</u>

**NOAA Restoration Center** OMB Approval No. 0648-0472

**Community-based Restoration Program (CRP)** Expires 12/31/2011

Progress Report Narrative Format

**I. Project Title:** **Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program**

**II. Reporting Period** (01/01/09 - 12/31/11)

**III. Project Narrative (this section is required for the final comprehensive report only)**

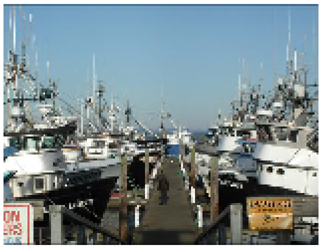
## Background

The states of Washington, Oregon and California are authorized to manage the coastal Dungeness crab fisheries adjacent to each state in state (0-3 miles) and federal waters (3-200 miles) through the Magnuson Stevens Fishery Conservation and Management Act. The Washington Department of Fish and Wildlife (WDFW) manages the fishery off the coast of Washington.

The coastal commercial Dungeness crab fishery has occurred in Washington's coastal waters for many years and is one of the most important commercial fisheries in Washington State. Since 1950, the Washington coastal crab fishery has produced between 2.6 and 25 million pounds per season. Coastal crab landings over the last 20 years average about 14.7 million pounds per season; the 2004-2005 season produced record high landings of 25 million pounds.

*Dungeness crab fishing*

The commercial fishery in Washington occurs in coastal waters extending approximately 140 miles from the U.S. Canadian Border to the Washington Oregon border and west from the shore to approximately 80 fathoms and at times deeper.



*A small portion of the Washington Dungeness crab fleet*

There are 223 coastal Dungeness crab licenses under a limited license program; approximately 190-200 of those have been actively fished during the most recent seasons. Under a two tiered pot limit of 300 or 500 pots per vessel, approximately 90,000 crab pots are deployed at the start of each commercial season, which typically starts in December or January. The majority of the crabs are harvested in the first four to five months of the nine-month season.

A healthy Dungeness crab resource sustains a commercial fishery that has a strong socioeconomic impact on the small remote coastal communities of Westport, Ilwaco, Chinook, Neah Bay and LaPush. The majority of the crabs harvested in the coastal fishery are delivered to buying facilities and processing plants located in these ports, which provides additional jobs and resources to these communities. Most of the fishers that participate in this fishery also make their homes and raise their families in these communities. A healthy Dungeness crab resource has provided these communities long term stability during years when salmon and groundfish resources could not support large commercial fisheries.

One long term issue for most fisheries is that fishing gear is occasionally lost. Consistent gear loss is a problem for the Dungeness crab fishery. Weather is a major mechanism for crab gear loss, poor weather during the season can create rough seas where pots can drift off with strong currents and become lost. Crab pots can also get buried by sand because of strong currents and become what is known as a "stuck pot". Marine vessel propellers may cut off buoys as they pass through heavily fished areas creating what are called "cut-offs". Dungeness crab pots can also become lost if they are moved from their organized strings by becoming snagged on the tow bridles of barges that frequently transit crab-fishing grounds. If fishers cannot find lost pots or do not have the means to recover stuck pots or pots with cut off buoys they become abandoned or derelict gear.

The coastal crab fishery is underway during some of the most severe weather of the year. In the past, post-season surveys have estimated gear loss to be approximately 10% of the pots fished during the season. Gear loss may be higher in some areas.

For the Dungeness crab fishery these stray and abandoned crab pots present a problem to those that are dependent on a healthy Dungeness crab resource to make a living, they also have a detrimental effect on NOAA trust resources. State-enforced regulations governing crab pot design and construction serve to minimize the potential for long term 'ghost fishing' by pots that remain on the sea floor. 'Escape rings' and panels held together with biodegradable cotton help to insure that crabs trapped in lost pots can escape in a reasonable amount of time. These measures will protect the Dungeness crab resource to some extent but even with these provisions, it is certain that lost crab pots are responsible for unnecessary crab mortality and degradation of the marine environment.

**Project Overview**

WDFW is taking a stepwise approach to the development and implementation of a stray and abandoned crab pot removal program in coastal waters. The portion of this WDFW project that comprises the majority of the funding focuses on stray and abandoned crab pot removal efforts on the southern Washington coast. The rationale behind this smaller scale focus is twofold: 1) to provide the WDFW team an opportunity to develop the skills and methods required for effective gear removal on the open ocean; 2) to target the gear removal to specific high priority areas (one on the northern Washington coast, one near Grays

Harbor and one near the mouth of the Columbia River). The northern high priority area is located in an area that is co-managed by the WDFW and the Quinault Indian Nation (QIN). WDFW and QIN will work together to coordinate gear removal effort in this area.

In addition to this project, with the support of the coastal commercial crab industry and the Washington State Legislature, WDFW implemented the state supported Permitted Stray and Abandoned Gear Recovery Program. Separate from this NOAA funded project, this program provides fishers who hold a Washington State commercial crab fishing license the opportunity to request a permit from WDFW that allows them to recover and retain any pots remaining in the ocean following the close of the commercial fishing season. This permitted program required action by the state legislature to modify long-standing lost property statutes in Washington State law and provides some incentive for fishers to recover abandoned pots by allowing them to keep the gear recovered.

## IV. Methodology

Active crab fishing by both tribal and state fishers is in progress during the majority of the year (December 1 through September 15). No gear recovery work on this project occurred during the period when the fishery was open. This was due to the fact that it is difficult to identify lost and abandoned pots during periods of active fishing and not mistakenly recover pots that are still in use. In addition, the project's recovery work waited one-week after the close of the season to provide WDFW Enforcement Officers an opportunity to seize any gear that was not lost, but had simply (and illegally) not been removed by September 15. In short, the project's recovery work did not begin until late September all three years.

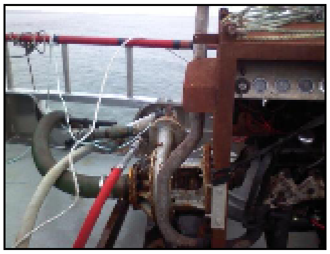
The gear recovery portion of the project was divided into two parts: the Stray and Abandoned Pot Recovery work and the Cut-Off Pot Recovery work. In addition, WDFW also implemented a monitoring component that was designed to use the data collected during gear recovery to provide a measure of the numbers of lost pots per square mile and an estimate of ghost fishing mortality per pot for each area monitored. Finally, an education component was also implemented.

### Stray and Abandoned Pot Recovery

This portion of the project focused on the removal of stray and abandoned crab pots that are visible from the surface using contracted commercial crab vessels. A total of seventeen vessel days (included two donated days) were dedicated to removing stray and abandoned pots visible from the surface (exceeding the goal of twelve days). During the course of this work a total of 20.20 MT of gear was recovered.

*Hydraulic crab block*

During the course of this portion of the project, WDFW signed contracts with the owners of a total of five commercial crab fishing vessels. The captains of each of these vessels and their crews were all experienced crab fisherman and all had extensive



*Gas powered pot pump*

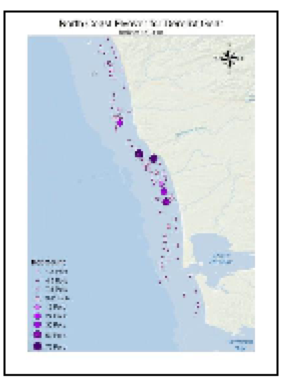
experience in the recovery of stray and abandoned pots with buoys still visible from the surface. Pots were recovered using the vessel's hydraulic crab block, attaching the crab pot line to the block and pulling the pot to the surface. However, many of the pots were stuck or "sanded-in" on the ocean floor. In these cases, a water hose was attached to the crab line and run down the line to the ocean floor. A high pressure pump attached to the opposite end of the hose was used to "jet" the sand and mud from around the stuck pot – eventually freeing it. We found this to be a time consuming process requiring as much as one hour of pumping per pot.

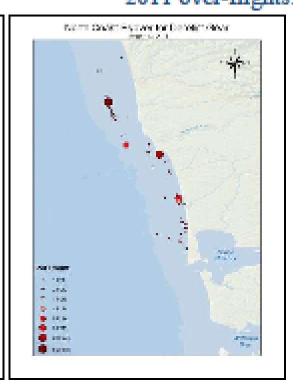
In every case when the pot came to the boat deck, WDFW staff was always onboard to inspect the pot, record the general condition of the pot, the status of the biodegradable cotton, the number of crab (dead or alive) in each pot, determine (when possible) the pot owner and record anything else that was notable.

Late fall weather and ocean conditions played a role in restricting recovery operations to a certain degree. Our contract vessels were less likely to want to operate too far from their home port when conditions were predicted to deteriorate. Final decisions on what conditions were suitable for safe work were always left to the judgment of the experienced vessel captains. Despite these issues, WDFW was able to successfully execute a total of seventeen vessel days of recovery work on this portion of the project.

*WDFW Partenavia P68 used for flyovers*

WDFW also conducted two low level ocean over-flights using an agency owned aircraft with project personnel onboard to locate and document the GPS locations of as many pots as possible, paying close attention to areas of pot accumulations. The over flights were conducted in 2010 and 2011 just prior to commencing pot recovery work funded by this project (following the Sept. 15 end of the commercial crab season). There is a noticeable difference in the density of pots between the 2010 and 2011 over-flights. WDFW staff observed 486 pots during the 2010 flight and 209 pots during the 2011 flight. This data appears in the two graphics presented here.





During the course of the project, WDFW observed that fishers were doing a better job of cleaning up their own gear. The reasons for this are not certain; however among those reasons is certainly an increased awareness within the crab industry of the problems lost crab gear creates, the additional attention WDFW was placing on the issue and the potential negative image lost gear can give their fishery among groups outside the industry. In addition, more fishers are using the separate WDFW Permitted Pot Recovery Program (described earlier) to actively clean up remaining gear.

**Cut-off Crab Pot Recovery**

This portion of WDFW's project focused on the removal of up to 100% of the crab pots that have had buoys separated and become un-retrievable in two one square mile areas. The removal was focused in the high priority areas near the mouth of the Columbia River and the entrance to Grays Harbor. The goal was to quantify the amount of gear on the ocean floor in each of these areas and to attempt to restore marine habitat and protect living marine resources by removing derelict gear from these two specific areas.

A total of three vessel days were dedicated to using a large commercial trawl vessel sweeping an area near the mouth of Grays Harbor for cut off pots. During the course of this work a total of 1.5 MT of gear was recovered.

A total of five vessel days were dedicated to using a smaller commercial crab vessel to sweep an area near the mouth of the Columbia River for cut-off pots. During these five days a total of 0.6 MT of gear was recovered.

WDFW began this portion of the project by convening a group of experienced coastal crab fishers in September 2009 to study the nautical charts of the Washington coast and agree on two areas, one near the mouth of the Columbia River and one near the mouth of Grays Harbor where likely accumulations of cut off gear would be found. After some discussion, these fishers were successful in identifying two areas where this portion of the project could be executed.

Initially, to conduct this portion of the project, WDFW choose to seek a contract with a large trawl vessel that met the bid specifications to: have a crab block; have a forward net reel; and have a vessel length at a minimum of seventy-five feet. The successful bidder provided a vessel that not only met the specifications, but was also operated by a captain with extensive experience using trawl gear.

Because pots in this area had their buoys cut-off and were not visible from the surface, it was planned to use grappling gear to sweep the area. It is important to note that the bottom depths in this area are 45 to 80 fathoms, depths not easily accessed by divers. Bathometry charts indicate that while these areas have a soft (sandy) substrate, these depths would not support eelgrass. There were no hard rocky sensitive habitats in either of these areas.

WDFW staff worked with the skipper of the contracted trawl vessel to design grappling equipment intended to decrease the bottom impacts resulting from towing grapples on the sea floor. The new grappling set up included buoys that were designed to "roll" the tow line and grapples off the bottom but still allow the grapples to catch the pots and/or the line attached to the pots. WDFW also consulted with Oregon Department of Fish and Wildlife staff and a captain of a vessel they used for similar gear recovery work in Oregon, to closely model the design of the grapples used there.

Difficult weather and ocean conditions combined with conflicts with fishing schedules of the contract vessel resulted in the delay of the execution of the first phase of this work.

However, in late October 2010 everything came together and WDFW staff and the contract vessel spent three days in an area near the mouth of Grays Harbor.

*Grappling array ready for deployment*

The initial plan was to pull the grappling array to cover the bottom in the previously identified one square mile areas. During the grappling recovery near Grays Harbor it was discovered when using a trawl vessel to deploy the array the original plan to cover the one-square mile area became impractical, primarily because the time to "turn-around" the gear set up was much longer than expected. Instead an at-sea decision was made to run longer tracks with the grappling gear with the intent to cover an area equivalent to one-square mile. In the end, over the course of three full days of work the contract vessel, crew and WDFW staff executed numerous tracks that covered a total of 0.87 square miles of area near the mouth Grays Harbor (calculated using the width of the area covered by the gear and the length of each track). These tracks occurred within the same general area of the original "box" – an area expected to have a high volume of lost or abandoned gear. This operation recovered a total of twenty-one pots and seventeen sections of line (that had connected the buoys to the pots) for a total of 3,330 pounds (1.5 MT) of stray or abandoned fishing gear removed from this 0.87-mile square area. The vast majority of the pots recovered were in a badly deteriorated and unfishable condition, similar to the pot pictured above.

*Badly deteriorated pot recovered with grappling array.*

On two occasions WDFW also used the contracted trawl vessel to attempt to recover large concentrations of crab pots commonly referred to by crab fishers as "flower pots". These are best described as pots and line that have been moved together by heavy ocean swell and currents resulting from storm conditions. This gear is "twisted" in to large concentrations and can act to easily "trap" even more gear as they are "swept" into the area by ocean conditions. Even though the trawl vessel was a large, powerful vessel – in both cases it was unable to bring these large accumulations of gear on-board, or even break them free from the ocean floor.

The plan was to move directly from the Grays Harbor area to work the area near the Columbia River with the same contract vessel. However, the on-set of a major winter storm with resulting difficult ocean conditions that persisted for an extended period of time side-tracked those plans essentially ending the 2010 work window.

In our initial overall project planning, we had set aside a total of four-days in our schedule and budget to sweep two one-square mile areas with this vessel using a "grappling array". This plan proved to be more ambitious than we expected. In practice, we found that sweeping just one area required three days (rather than the anticipated two days) and one third more staff time and funds than were initially expected.

While we were confident that the grappling array as towed by the contract trawl vessel was making bottom contact (based on observed "scouring" of the iron grapples) we remain puzzled by the lack of gear recovered. One possibility was that we may not have been operating in an area of concentration of lost pots.

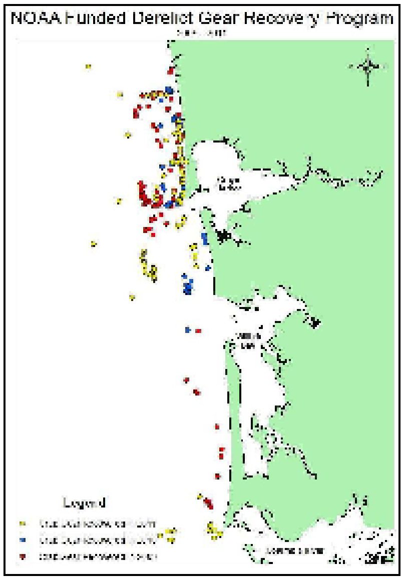
Before beginning phase two of this portion of the project, we discussed a plan of action with some of our industry advisors. After much consideration, we made the decision to conduct the sweep of the one-square mile area near the mouth of the Columbia River with a smaller more maneuverable and less expensive crab vessel.

*Grapple coming to surface with crab line it "caught".*

Our crew worked aboard a contract commercial crab fishing vessel, for five days at the end of September and into the first of October 2011 sweeping through the previously determined designated area. Rough weather made it impossible to conduct this work in five consecutive days. However the entire area was successfully swept with grappling gear and we were able to stay true to the one-square mile box we had initially designated.

Because this area was indentified to be a location with a high concentration of lost pots, we were surprised to recover only a total of eight crab pots. These eight pots, when combined with the nylon crab line also recovered resulted in a total of 0.57 MT of cut-off gear recovered. Each of these pots were very deteriorated and broken up. No crabs (either dead or alive) were found and the biodegradable cotton in each was "long-gone" and the escape panels open. While it is difficult to determine with certainty if our grappling gear was working correctly, we are confident that bottom contact was being made as evidenced again by scouring of the iron grapples. During each of the days we worked, we made minor adjustments to assure to gear was working correctly. One assumption is that the one-square mile pre-selected for this work did not have the accumulation of gear that was expected.

## V. Results/Progress to Date




At the onset of this project, WDFW proposed to conduct a total of sixteen vessel days with the goal of collecting a total of 27 MT of stray and abandoned crab gear.

During the three years in which WDFW conducted field work associated with this project, a total of 25 vessel days were dedicated to the recovery of stray and abandoned crab gear. That work was conducted aboard a total of nine commercial crab vessels and one contracted trawl vessel.

During all of these trips a total of 330 crab pots and a large volume of heavy nylon line associated with these pots were recovered. In addition, more heavy nylon line was recovered when in some occasions, pot recovery efforts resulted in the line breaking off.

The total amount of gear (pots and line) recovered was 23.4 MT. This value is primarily based on the actual weight of the gear recovered. However, in some cases fishable gear was returned to the legal owners just after the recovery boat returned to the dock and before that gear could be weighed. In these cases an estimate of the weight was used, based on the actual weights of other gear that had been recovered.

### Stray and Abandoned Pot Recovery

**Goal:** This portion of the proposal focused on the removal of stray and abandoned crab gear that are visible from the surface using contracted commercial vessels.

**Results:** As we stated earlier, a total of seventeen vessel days (included two donated days) were dedicated to this portion of the project (exceeding the goal of twelve vessel days). A total of 21.3 MT of gear was recovered. In 2010 and 2011 we preceded this work with an ocean over-flight aboard a WDFW aircraft to locate concentrations of gear visible from the surface.

| | 2009 | 2010 | 2011 | *TOTAL* |
|---|---|---|---|---|
| **VESSEL DAYS** | 4 | 5 | 8 | *17* |
| **NO. POTS** | 103 | 77 | 121 | *301* |
| **POTS LBS** | 15,900 | 11,550 | 18,150 | *45,600* |
| **NO. CUT LINES** | 30 | 39 | 14 | *83* |
| **CUT LINE LBS** | 350 | 600 | 280 | *1,230* |
| **TOTAL LBS** | 16,250 | 12,150 | 18,430 | *46,830* |
| **TOTAL MT** | 7.4 | 5.5 | 8.4 | *21.3* |

**Table 1. Results from the stray and abandoned pot recovery portion of the project.**

**Discussion:** During the course of this project we learned much about recovering crab gear visible from the surface. Among those lessons was the realization of the role good weather conditions plays in successful gear recovery. We also learned the importance of aerial surveys. In 2009 we did not do an ocean over flight and found we spent more time looking for gear than we had expected. In 2010 and 2011 we tried to time our aerial survey to the beginning of a period of good weather so that at-sea work could begin immediately following. This of course was complicated by aircraft and contract vessel availability – and the reliability of weather and ocean forecasts in the late fall. In 2010 the at-sea work started ten days after the over-flight (due to the above reasons and a big storm that moved into the area) and much of the gear we saw from the air had been moved by the heavy swell that accompanied the storm. We also learned that having to pump stuck pots is very time consuming and can greatly slow down the overall gear recovery work. Gear that was not stuck or "sanded in" was recovered at a rate of fifteen or more pots/hour – the only limiting factor was finding the buoys. While stuck gear (that required pumping) had a recovery rate closer to four pots per hour. We also found that the later in the season the recovery work occurred, the more time for storms to move and cause pots to become stuck – resulting in less successful the recovery work.

### Cut-off Crab Pot Recovery

**Goal:** This portion of the program focused on the removal of up to 100% of the crab pots that have had buoys separated and become un-retrievable in two one square mile areas.

| | 2009 | 2010 | 2011 | *TOTAL* |
|---|---|---|---|---|
| **VESSEL DAYS** | 0 | 3 | 5 | *8* |
| **NO. POTS** | 0 | 21 | 8 | *29* |
| **POTS LBS** | 0 | 3,150 | 1,200 | *4,350* |
| **NO. CUT LINES** | 0 | 17 | 3 | *20* |
| **CUT LINE LBS** | 0 | 180 | 50 | *230* |
| **TOTAL LBS** | 0 | 3,330 | 1,250 | *4,580* |
| **TOTAL MT** | 0.0 | 1.5 | 0.6 | *2.1* |

Table 2. Results from the cut-off pot recovery portion of the project.

**Results:** A total of three vessel days were dedicated to using a large commercial trawl vessel sweeping an area near the mouth of Grays Harbor for cut off pots and a total of
1.5 MT of gear was recovered. A total of five vessel days were dedicated to using a smaller commercial crab vessel to sweep an area near the mouth of the Columbia River for cut-off pots and here a total of 0.6 MT of gear was recovered.

Results: It is possible to use the data collected by this portion of the project to make an estimate of the number of crab pots are within a one-square mile area. As we stated in the methods section where we described this work, we were able to sweep a total of 1.87 square miles of ocean floor using two different sized vessels to pull grapple gear. That resulted in the recovery of 29 crab pots. Using those results we calculate a total of 15.5 pots per square mile.

Discussion: With the help of our industry advisors we purposely tried to choose two areas where there would be a high density of crab pots. We do not know if the resulting estimate of 15.5 crab pots per square mile is an accurate representation of the lost pots on the ocean floor in these areas. Future projects would benefit from securing additional funding to use sonar and/or remotely operated vehicles (ROV) with lights and cameras to confirm areas of high density of lost gear and the effectiveness of grapples to remove that gear.  An approach of this type could also be designed to gather data on the impacts of grappling equipment to recover lost crab gear.

Monitoring

Goal: to provide a specific measure of the numbers of derelict pots per square mile and an estimate of ghost fishing mortality per pot and per square mile for each area monitored.

| Total | 2009 | 2010 | 2011 | *TOTAL* |
|---|---|---|---|---|
| VESSEL DAYS | 4 | 8 | 13 | ***25*** |
| POTS RECOVERED | 103 | 98 | 129 | ***330*** |
| % BIO.LINE BROKEN | 73.8% | 83.7% | 93.0% | ***76.7%*** |
| AVER. LIVE CRAB/POT | 6.47 | 0.29 | 2.81 | ***3.22*** |
| AVER. DEAD CRAB/POT | 0.03 | 0.13 | 0.08 | ***0.08*** |

Table 3. Results from the monitoring portion of the project.

Results: As described in the previous section, we were able to calculate an estimate of 15.5 lost or abandoned crab pots per square mile; however for the reasons in the previous section, we are not sure if this represents an area of high concentration of lost gear.

*Biodegradable line holding closed an escape panel*

WDFW staff did collect data on the number of pots with "broken" biodegradable line – required to be used to tie closed the also required escape panels in each pot. Table 3 shows that a total of 76.7% of the pots recovered had the biodegradable cotton broken. On average, a total of 3.2 live crab and .08 dead crab were found per pot.

Discussion: The results of our observations of the usefulness of biodegradable line to open escape panels is conclusive. Very few dead crabs were found with an average of less than 1/10 dead crab per pot. The vast majority of the live crabs found were found in pots where the escape panel had opened and the crab were free to come and go. In fact, our crews observed that the majority of these were smaller females or sub-legal sized males who may have been using these pots for shelter – moving in and out as needed.

**VI. Monitoring and Maintenance Activities**

Through-out the project WDFW monitored the stray and abandoned gear reporting hot line. However, by far most of the information on locations of lost gear came directly from some coastal crab fishers. This came both in direct contacts in phone calls or in-person meetings and from notations in their required log books. We also found the locations of gear recovered during our ocean over flights were very helpful.

**VII. Community Involvement**

WDFW worked closely with members of the coastal crab industry. An estimated total of forty-five crab fishers volunteered time and energy to provide WDFW advice and guidance on the recovery of stray and abandoned crab gear. These fishers also were a great assistance to us in returning fishable crab gear to the legal owners. Because of their efforts, we were not required to rent any storage space allowing us to re-direct $3,000 set-aside for that purpose to additional vessel time. In addition, a local owner of a refuse business agreed to take all of the recovered gear that was broken and un-repairable, free of charge. This allowed WDFW to re-direct $3,500 of our project funds originally designated for disposal to more gear recovery vessel time and to cover the costs aircraft time associated with two aerial surveys.

During the course of this project WDFW also began a buoy tag recycling program in cooperation with a local recycling firm. Many thousands of buoy tags must be replaced annually and we are told that many are dumped at sea or thrown in the garbage. By placing labeled recycling containers in coastal ports (Westport, Ilwaco and Chinook) we successfully delivered over 250 pounds (0.11 MT) of tags for recycling. This total is not included in our total of recovered gear.

*Buoy tags recovered for recycling.*

**VIII. Outreach Activities**

An educational brochure was produced describing the problems associated with lost crab pots; how to avoid pot loss; and pot recovery efforts. The brochures have been distributed to all licensed commercial crab fishers have been made available to the general public through local visitor centers, museums and chambers of commerce. This brochure has also been posted on the WDFW web site. A full copy of the brochure is included with this report.

*WDFW brochure*

**IX. Supporting Materials**

Please include any supporting materials relating to the project, such as articles/news clippings, project photographs (before, during, and after--high resolution images on CD ROM are appreciated), project maps, related web sites, and evidence of NOAA Community-based Restoration Program support (e.g. photographs of signs at project sites, funding credit on outreach materials, press releases with complete program name, etc.)

**X. Funding Information (Cash and In-kind)**

Itemized Budget table (similar to example below) showing expenses incurred during the reporting period, for both NOAA funds and matching contributions, as follows. Budget categories should correspond to those described in the approved proposal.

| Budget Category (e.g. personnel, supplies, contractual, etc.) | NOAA Funds | Matching Contributions | Total Expense | Nature (cash or in-kind) and Source of Match |
|---|---|---|---|---|
| Salaries | | $66,390 | $66,390 | In-kind / WDFW and Quinault Indian Nation |
| Contractual (vessel charters) | $48,700 | $5,000 | $53,750 | In-kind / Vessel Owners |
| Aircraft | $944 | | | |
| Travel | $1,546 | | | |
| Supplies (grapples, line, buoys) | $4,751 | | | |
| Educational Material | $1,172 | | | |
| Agency Approved Indirect | $13,179 | | | |
| | | | | |
| | | | | |

1. Budget Narrative: Briefly describe expenditures by category and explain any differences between actual and scheduled expenditures. Include documentation of volunteer hours and in-kind donations.

Contractual: vessel charters. In October, 2010 with approval from our NOAA project Officer we moved $13,960 to this category from previously budgeted categories (salary, benefits, travel) to increase the funds available for vessel charter.

Aircraft: use of WDFW aircraft for two ocean over-flights.

Travel: lodging and per diem costs for WDFW staff working on the project, per Washington State Travel Regulations.

Supplies: grappling gear, nylon crab line and weights to support grappling gear used to recover crab pots.

Educational Material: brochure developed by WDFW and printed by state printer (3,600 total copies).

Volunteer hours: commercial crab fishers provided volunteer assistance to this project by: attending planning meetings; locating stray and abandoned crab gear and providing that location information to WDFW; returning recovered crab pots to the legal owners.

In-kind donations were made in the form of two vessel days provided by the Westport Crab Fisherman's Association and the Columbia River Crab Fisherman's Association (one each). In addition, one month of biologist time was provided as an in-kind donation by the Quinault Indian Nation in consulting, analyzing and direct participation in the project.

## NOAA Restoration Center
## Community-based Restoration Program (CRP)
**Project Data Form**

OMB Approval No. 0648-0472
Expires 12/31/2011

### CONTACT INFORMATION

Contact Name: **Dan L. Ayres**
Contact Title: Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program
Organization (Grantee): **Washington Department of Fish and Wildlife**
Street Address: **48 Devonshire Road**
City: **Montesano** State: **WA** Zip: **98563**
Phone: **360-249-4628 (ext. 209)** Fax: **360-664-0689**
E-mail: **Daniel.Ayres@dfw.wa.gov**
Organization website (if applicable): **www.wdfw.wa.gov**

### PROJECT INFORMATION

Project Title: Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program
Project Award Number: **NA09NMF4630063** Project Reporting Period: **1/1/09 – 12/31/11**
**Project Location: Washington Coast**
City:
County: **Grays Harbor and Pacific** State: **WA** Zip Code:
Congressional District(s): **WA-006**
Landmark (e.g. road intersection, beach):
Land Ownership (check one): Public: X Private: Both:
Geographic Coordinates (in decimal degrees, if readily available)
Longitude (X-coord):
Latitude (Y-coord):
Are there multiple project sites for this award?* Yes No
River Basin:
Geographic Identifier (e.g. Chesapeake Bay):
Pacific Ocean Coast of Washington
Project Start Date: **7/1/09** Project End Date: **12/31/11**
Project Volunteers
Number of Volunteers: **45** Volunteer Hours: **200**

Page 13 of 16

***Brief Project Description (1-2 sentences) describing project and what it hopes to accomplish:***

- Implement a program utilizing chartered vessels operating both during and after the commercial crab season to remove crab pots that have been lost or abandoned.
- Implement data collection protocols that will quantify the amount of gear removed and the species affected by derelict gear in the chartered vessel removal and the high priority area gear removal effort.
- Develop educational materials on the effect of derelict gear, ways to reduce gear loss, and report on the extent of derelict gear on the Washington coast.

***List of Project Partners and their contributions (e.g. cash, in-kind, goods and services, etc.)***

**Westport Crab Fisherman's Association : in-kind services / vessel days**
**Columbia River Crab Fisherman's Association: in-kind service / vessel days**
**Quinault Indian Nation: in-kind services / staff time.**

***If permits are required, please list the permits pending and those acquired to date:***

**NEPA Permit (acquired on Sept. 15, 2009)**
**WDFW Gear Recovery Permit (acquired Sept. 16, 2009)**

**RESTORATION INFORMATION- Please complete this section to the best of your ability. Information below will be confirmed via site visit or phone call by NOAA staff before the close-out of an award.**

List the habitat type(s) and acres restored/enhanced/protected or created to date (cumulative) and remainder to be restored/enhanced/protected or created (projected) with CRP funds by the end date of the award. If the project restores fish passage, list the stream miles opened upstream and downstream for fish access. Actual and Projected columns should add up to the total(s) for acreage to be restored with CRP funds indicated in the approved proposal.

| **Habitat Type** (e.g. tidal wetland, oyster reef, mangrove) | **Actual Acres Restored** (To date-cumulative) | **Projected Acres** (i.e. Remainder to be restored with CRP funds by award end date) | **Actual Stream Miles Opened for Fish Access** | **Projected Stream Miles Opened for Fish Access** (i.e. Remainder to be restored with CRP funds by award end date) |
|---|---|---|---|---|
| | | | | |
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***What indirect benefits resulted from this project? (e.g. improved water quality, increased awareness/stewardship)***:
The removal of these abandoned pots will eliminate the chance that they will become entangled with pots fished at the beginning of the upcoming crab season. The removal of these abandoned

pots creates more open space for vessels to transit coastal waters and reduces potential entanglements with marine mammals. The removal of derelict gear protects marine resources and restores habitat. WDFW and industry members that are involved in the removal of derelict gear benefit from a cooperative effort to recover stray and abandoned crab gear.

***List of species (fish, shellfish, invertebrates) benefiting from project (common name and/or genus and species):***

| | |
|---|---|
| **1. Dungeness crab** | **6.** |
| **2.** | **7.** |
| **3.** | **8.** |
| **4.** | **9.** |
| **5.** | **10.** |

***MONITORING ACTIVITIES***

***List of monitoring techniques used (e.g. salinity, fish counts, vegetation presence/absence):***

| | |
|---|---|
| **1. Sampling of crab caught in recovered pots.** | **6.** |
| **2. Specific locations of recovered pots.** | **7.** |
| **3. Depth of recovered pots.** | **8.** |
| **4. Presence of biodegradable cotton.** | **9.** |
| **5. Biodegradable cotton broken/unbroken.** | **10.** |

**Report Prepared By:** ______________________ **March 27, 2012**
Signature Dan L. Ayres Date

**Please send semi-annual and final progress reports and supporting materials to:**

NOAA Restoration Center F/HC3
1315 East-West Highway
Silver Spring, MD 20910
ATTN: NOAA Community-based Restoration Program Progress Reports

**The Progress Report Narrative Format and Project Data Form are available on the NOAA Restoration Center website at:**
http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/index.html. **Electronic submissions are encouraged. Please submit electronic progress reports on PC compatible floppy disk or CD ROM in Microsoft Word, WordPerfect or PDF formats.**

**Be sure to save a copy of each report for your records; subsequent submissions of the Project Data Form need only add outstanding information, so that the form is completed in its entirety as part of the final comprehensive progress report.**

Questions? Please call 301-713-0174 and ask to speak with NOAA Community-based Restoration Program staff

## NOTICE

Responses to this collection are required of grant recipients to support the NOAA Community-based Restoration Program. The information provided will be used to evaluate the progress of the work proposed under the grant/cooperative agreement and determine whether the project conducted under the grant/cooperative agreement was successfully completed. Public reporting burden for completing the progress report narrative and project data form is estimated to average fifteen hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the information needed and completing and reviewing the collection of information. Responses to this information collection are required to retain funding provided by the NOAA Community-based Restoration Program. Confidentiality will not be maintained – the information will be available to the public. Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing this burden, to the NOAA Fisheries Office of Habitat Conservation, Restoration Division, F/HC3, 1315 East West Highway, Silver Spring, MD 20910.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

The information collected will be reviewed for compliance with the NOAA Section 515 Guidelines established in response to the Treasury and General Government Appropriations Act, and certified before dissemination.

Example Permit:

## COASTAL DUNGENESS CRAB GEAR REMOVAL PERMIT

This permit, when issued by the WDFW to a coastal commercial Dungeness crab license owner, allows for the recovery and retention of commercial Dungeness crab gear owned by Washington state licensed fishermen in the specified areas and at times outlined below. Failure of the license owner or alternate operator to abide by the terms of this permit will result in termination of the provisions authorized.

- Recovery operations are restricted to the waters between 46° 15 North Latitude and the Washington-Canada border.
- This permit must be on board the vessel at any time crab pot recovery work is being conducted or anytime crab pots that do not belong to the license owner are on board.
- WDFW staff must be notified 24-hours prior to the vessel leaving the dock and at least 2-hours prior to returning to the dock following a gear recovery operation even if no gear was recovered during the trip. Notification can be made by calling 360-581-3337.
- All pots recovered during permitted gear recovery must remain on the vessel and remain in the condition it was recovered until the gear is registered and tagged by WDFW. Tampering with recovered gear, including removing pot tags, buoys or other markings prior to registering the gear will result in termination of this permit.
- No fishing gear belonging to tribal fishers can be recovered.
- Accurate and complete data records must be collected and provided to the Department upon returning with recovered gear.
- It is unlawful to retain crab during the closed season, WAC 220-52-040, all crab caught must be immediately returned to the ocean.
- A one square mile area off the Columbia River is off limits to WDFW permitted gear recovery to allow WDFW to conduct cut-off gear recovery work as part of our project which is funded through NOAA's Community-based Marine Debris Prevention and Removal Program. Coordinates for the closed area is as follows:

  Columbia Closure (1 $nm^2$)

  46° 15.0' N 124° 13.5' W
  46° 15.0' N 124° 14.9' W
  46° 16.0' N 124° 14.9' W
  46° 16.0' N 124° 13.5' W

**COASTAL DUNGENESS CRAB GEAR REMOVAL PERMIT**

| | |
|---|---|
| Permit Valid Dates | |
| License Owner | |
| Vessel Operator | |
| Alternate Operator | |
| Vessel Name | |
| Geographic Restrictions | |
| Permit Authorized by | Sgt. Dan Chadwick |

*I understand and agree to abide by the terms of this permit and acknowledge that failure to do so will result in immediate termination of the provisions of this permit.*

Signature (license owner) ____________________________________________

Date____________________________________________________________

Signature (alternate operator) __________________________________________

Date____________________________________________________________

Example Gear Recovery Log:

## WASHINGTON STRAY & ABANDONED GEAR RECOVERY LOGBOOK

Washington Department of FISH and WILDLIFE

Vessel______________________________ Crab License #____________________ Port____________________

Federal #____________________________ Leave Date______________________ Return Date________________

| | | | Rotten Cotton | | | | SPECIES RELEASED (COUNT) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Others (List Live/Dead) | |
| Date | Gear Description/Buoy # | Depth (fm) | Present yes/no | Broken yes/no | Latitude | Longitude | Live Crab | Dead Crab | Species: | Species: |
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NOTES:

SIGNED:________________________________

**Public Reporting for Lost Gear Sightings (**http://wdfw.wa.gov/fishing/derelict/**):**

## Derelict Fishing Gear Removal Project

Buy Your License Online!

### What's the Problem?

Derelict fishing gear includes nets, lines, crab and shrimp traps/pots, and other recreational or commercial harvest equipment that has been lost or abandoned in the marine environment. Modern nets and fishing line made of synthetic materials have been in use since the 1940s and take decades, even hundreds of years, to decompose in water. Derelict fishing gear is long-lasting marine debris that poses many problems to people and to marine animals, including:

- Entangling divers and swimmers;
- Trapping and wounding or killing fish, shellfish, birds and marine mammals;
- Degrading marine ecosystems and sensitive habitats;
- Damaging propellers and rudders of recreational boats, commercial and military vessels;
- Endangering boat crews and passengers with vessel capsizing.

Unfortunately, Puget Sound is littered with derelict fishing gear. It is estimated that hundreds of tons of derelict gear have collected over time in Puget Sound and the Northwest Straits region, especially the Strait of Juan de Fuca and northern Puget Sound from Everett to the Canadian border.

#### What's Being Done?

In 2002, the Northwest Straits Initiative, a program authorized by Congress to protect and restore marine resources in the Northwest Straits, began a comprehensive program to locate and remove harmful derelict fishing gear from Puget Sound. In cooperation with the Department of Fish and Wildlife and other federal and state agencies, it developed removal guidelines, created a database of known derelict gear, established a phone and web-based reporting system and began removing derelict fishing gear, primarily gillnets and crab pots. By mid 2009 the Initiative had removed over 1,200 gillnets and 2,000 crab pots. Trained commercial divers and vessels locate derelict gear with side-scan sonar and camera surveys and then physically remove and dispose of the gear from the waters of Puget Sound and the Northwest Straits.

**Report Derelict Gear Sightings**

Report Online

Reporting Hotline: 1-855-542-3935

For more information on the status of derelict fishing gear removal from Puget Sound, please visit the Northwest Straits Foundation website at http://www.derelictgear.org

*Download*
Derelict Fishing Gear Removal Guidelines

In July 2009, the Northwest Straits Initiative received $4.6 million federal stimulus grant through the American Recovery and Reinvestment Act (ARRA) and the National Oceanic and Atmospheric Administration to work full-time to essentially rid Puget Sound of most of the derelict commercial fishing nets that had been accumulating for decades. By the time the project ends in December 2010, over 3,000 additional partial gillnets (average size: 7,000 square feet) will have been removed, restoring many hundreds of acres of habitat and preventing thousands of fish, marine birds, marine mammals and invertebrates from being captured.

A map of cleaned areas, summary of activities and a species list with links to web sites with photos and descriptions of the species encountered in this project can be found on the Northwest Straits website at www.derelictgear.org.

### What You Can Do

Report derelict fishing gear:

Use the no-fault reporting system to report any derelict gear you encounter:

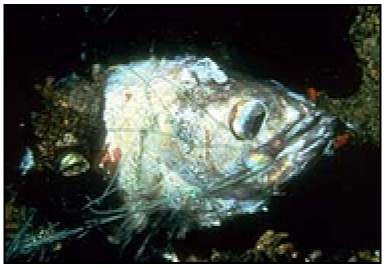
- Report online
- Call 1-855-542-3935 (WA Dept of Fish and Wildlife) or 360-428-1084 (Northwest Straits)

There are no penalties associated with reporting lost fishing gear.

When you encounter derelict fishing gear:

Stay safely away from it! Do not attempt removal. Recreational divers are strongly cautioned to avoid the gear because of the inherent dangers – divers have died from entanglement in the past.

Record as much information as you can while you're on-site including:



- Location - GPS coordinates/chart location (latitude/longitude), water depth, distance from nearby landmarks and/or common names for the area;
- Type of Gear - Nets (monofilament gillnet or twine-like purse seine, trawl or fish farm pens), Pots/Traps (round or square for crab or shrimp, singular or multiple), Ropes/Lines, Floats, Trawl Doors or others;
- Details - Date and time of sighting, your activity during sighting (fishing, beach walk, swimming, diving, boating), type of seabed, size of the gear, number and type of invertebrates, fish, birds or marine mammals entangled or dead in the gear, perceived level of threat to humans or passing vessels;
- Contact Name - Your name, phone number, address, and/or email address will be very helpful should more information be needed. However, anonymous reports will be accepted;
- Report what you see - even if you're not sure the gear is lost or abandoned.

Prevent your own gear from becoming lost:

Fish and boat only in approved areas; know what's below you when fishing to avoid snagging. Properly dispose of all broken lines/gear on shore. Over 12,000 crab pots are lost in Puget Sound each year. Use escape cord on crab pots (go to www.escapecord.org website for more information). Always report lost gear within 48 hours to aid removal efforts.

### Project Partners

Agencies and organizations providing assistance and/or funding to the Derelict Fishing Gear Program include: Northwest Straits Marine Conservation Initiative; Marine Resources Committees of Whatcom, Skagit, San Juan, Snohomish, Clallam, Jefferson, and Island counties; National Oceanic and Atmospheric Administration; U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency; U.S. Navy; Washington Department of Fish and Wildlife; Washington Department of Natural Resources, Washington Department of Ecology; Puget Sound Partnership; Tulalip Tribes; Stillaguamish Tribe; King County; National Fish and Wildlife Foundation; commercial fishing and diving companies, local ports, and private foundations. *Additional support and participation are welcome!*

### The "No-Fault" Approach

The focus of the Derelict Fishing Gear Removal Project is not on assessing blame. The goals are to remove lost and abandoned gear, to help restore Puget Sound and the Northwest Straits, to improve public safety, and to assist species recovery. The success of the project will rely on the collective efforts of citizens, government organizations and private businesses that all have an interest in healthy marine life.

### What is the Northwest Straits Commission?

The Northwest Straits Marine Conservation Initiative, authorized by Congress, is nationally recognized as an innovative approach to bring sound science and an ecosystem perspective together with citizen energy and entrepreneurship. The Northwest Straits Foundation is a non-profit organization established to support the scientific, restoration, and education projects and programs of the Northwest Straits Marine Conservation Initiative.

NORTHWEST STRAITS
marine conservation initiative

**Appendix F. Information about Oregon programs and regulations to recover lost Dungeness crab gear.**

Program Information:

Beginning in 2009, a federally-funded and ODFW-managed project was initiated to recover lost crab pots, lines and buoys. The two-year project, called the Oregon Fishing Industry Partnership to Restore Marine Habitat, employed members of crab fishing industry to retrieve lost crabbing gear and develop efficient and resourceful retrieval methods. The below is a summary of this program's results (http://marinedebris.noaa.gov/about/pdfs/regionwc.pdf):

**Oregon Fishing Industry Partnership**

NOAA continues to support the Oregon Fishing Industry Partnership to Restore Marine Habitat project. With all field operations now completed, the project removed nearly 3,000 derelict crab pots, as well as other debris such as lines and nets. None of the recovered gear went to a landfill. All usable crab pots were returned to their owners, and thanks to the Fishing for Energy partnership, bins were placed in Astoria, Garibaldi, and Newport, enabling fishermen to recycle the gear. All the mangled and unusable pots were recycled for metal and nets and lines were used for energy. Side scan sonar was conducted to assess crab pot density and removal efficacy both offshore near the entrance to the Columbia River and off Newport, OR. Collaborating with the U.S. Coast Guard, project personnel flew in Coast Guard helicopters over the entire Oregon coast to spot lost crab pots, and provide relay this information to removal vessels. Collaborating with the fishing industry, the project supported the removal of over 440 lost pots by volunteer fishers, and conducted outreach and education to the crabbing industry and the general public.

To continue the industry's involvement, the Oregon Dungeness Crab Commission (ODCC) partnered with NOAA and ODFW in 2011 to create the gear recovery reimbursement program. This program offers monetary rewards for pots recovered. So far this year, ODCC has chartered vessels out of the major crabbing ports to retrieve derelict gear that has been reported to them through the season.

Oregon regulations about retrieval of derelict Dungeness crab gear:

Vessels that have a valid crab permit are allowed to retain and sell the legal crab harvested from the derelict gear they recovery if recovered during the season. This incentive to retrieve gear is new. The ODCC just took action this year to allow the legal crab from any derelict gear recovered during the crab season to be retained by Dungeness crab permitted vessels. The retrieving vessel can be any commercial fishing vessel that holds a valid boat license and the crew/captain have valid commercial fishing licenses. The retrieving vessel has to have a crab permit if they retain the legal crab for sale.

***OAR 635-005-0490*:**

Derelict Dungeness Crab Gear

Derelict Dungeness crab gear may be retrieved from the ocean, including the Columbia River, and transported to shore provided that:

(1) The retrieving vessel holds a valid boat license, issued pursuant to ORS 508.260, and the captain and crew of that vessel hold valid commercial fishing license(s), issued pursuant to ORS 508.235.

(2) The number of derelict Dungeness crab gear which may be retrieved per trip are as follows:

(a) From the opening of the ocean Dungeness crab fishery in the area where retrieval takes place until the second Monday in June of the same ocean Dungeness crab season: 25 derelict pots and rings in aggregate;

(b) From the second Monday in June through August 28: 50 derelict pots and rings in aggregate;

(c) August 29 through October 31: an unlimited number of derelict pots and rings may be retrieved.

(3) Upon retrieval from the ocean or Columbia River, the Dungeness crab gear must be un-baited.

(4) Crab from the retrieved Dungeness crab gear shall not be retained, except crab of legal size and sex may be retained by vessels holding a valid Dungeness crab permit, at such times and in such areas that Dungeness crab may otherwise be legally taken for commercial purposes.

(5) Immediately upon retrieval of Dungeness crab gear, the retrieving vessel operator must document in the retrieving vessel's logbook the date and time of pot or ring retrieval, number of retrieved crab pots or rings in aggregate, location of retrieval, and retrieved Dungeness crab gear owner identification information.

(6) Any retrieved Dungeness crab gear must be transported to shore during the same fishing trip that retrieval took place.