

# CONSERVATION PLAN FOR ESA LISTED SPECIES OF ROCKFISH IN PUGET SOUND

REDUCING THE IMPACT OF FISHERIES AND RESEARCH ACTIVITIES ON  
YELLOWEYE, CANARY AND BOCACCIO ROCKFISH

Prepared for the

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by

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## Executive Summary

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) listed the Puget Sound/Georgia Basin Distinct Population Segments (DPSs) of yelloweye rockfish (*Sebastes ruberrimus*) and canary rockfish (*S. pinniger*) as threatened, and bocaccio (*S. paucispinis*) as endangered under the Endangered Species Act (ESA) (75 FR 22276) on April 28, 2010. This conservation plan assesses Washington State Department of Fish and Wildlife (WDFW) authorized recreational and commercial fisheries and research activities that may encounter these listed rockfishes and offers collateral information on the potential take of eulachon and other ESA-listed fish in the U.S. Puget Sound/Georgia Basin DPS. The recreational bottomfish and commercial shrimp trawl fisheries are proposed for coverage under section 10(a)(1)(B) of the ESA for incidental take of several species of ESA-listed fish. The WDFW research activities that may take ESA-listed fish are proposed for coverage under Section 10 (a)(1)(A) of the ESA. NMFS is authorized to provide incidental take coverage (ITP) under section 10 of the ESA for non-federal activities when deemed appropriate. Section 10(a)(1)(A) allows for a scientific take and Section 10(a)(1)(B) allows incidental take of listed fish in otherwise lawful activities.

The DPSs for ESA-listed rockfishes approximately correspond to WDFW Recreational Marine Catch Areas 6-13 (though a portion of area 6 occurs outside the DPSs), and Marine Fish-Shellfish Management and Catch Reporting Areas 23C-28D. WDFW does not manage tribal fisheries, and tribally managed fisheries within the DPSs are not assessed in this plan. This plan also does not address recreational or commercial fisheries for salmon and halibut that occur within the DPS, which are addressed under section 7(a)(2) of the ESA because they each have a federal nexus.

During the development of this conservation plan WDFW and NMFS jointly assessed all state-authorized recreational and commercial fisheries that occur within the DPSs for their relative risk of incidentally catching ESA-listed rockfish. Several fisheries have been closed due to inactivity in recent years, or due to unacceptably high risks of bycatch for ESA-listed rockfish. All but two of the remaining fisheries were judged to have little or no risk for encountering listed rockfish. For these fisheries that have a likelihood of ESA rockfish bycatch and are proposed for coverage under a take permit the specific gears, the locations and relative risks of rockfish bycatch and other listed species are described in this plan, as well as any management measures that have been taken to reduce this risk. WDFW will continue to monitor fisheries with little or no risk for encounters of listed rockfish and coordinate with NOAA to complete a separate ITP for those fisheries as necessary. In the WDFW Marine Fish Research Activities section we describe ongoing research and monitoring activities that assess the assemblage and status of marine biota in Puget Sound, as well as expected catch of listed rockfish and other listed species associated

with them. Finally, in the Annual Reporting and Adaptive Management Plan section we describe the synthesis of this information as well as coordination with NOAA.

In summary, to implement the provisions of the conservation plan for listed rockfishes, WDFW will on an annual basis:

- Monitor bycatch of all rockfish, including ESA-listed rockfish and other listed species, in commercial shrimp-trawl fisheries and recreational fisheries for bottomfish that occur within the Puget Sound DPSs.
- Conduct research and monitoring of Puget Sound marine biota, and track catch of ESA-listed rockfish and other listed species within WDFW-lead research and monitoring efforts (which are specifically described in the management plan).
- Submit an annual report that provides; 1) bycatch estimates for each ESA-listed rockfish and other listed species within the Puget Sound DPSs for both recreational and commercial fisheries covered under the proposed ITP; 2) take of ESA-listed fish from research and monitoring efforts; 3) any new research results for ESA-listed rockfish species and other listed species; and 4) an assessment of the potential need for modifications or additions to existing fishery regulations or reporting methodologies, or any other management measures that may be deemed necessary to protect ESA-listed rockfish and other listed species.

We propose five-year take permits to cover incidental take of ESA-listed rockfishes resulting from recreational bottomfishing and commercial shrimp trawl fisheries, and for research activities anticipating that any potential long term recovery efforts for each ESA-listed rockfish species will be identified in future recovery plans and implementation of elements of the state Puget Sound Rockfish Conservation Plan (PSRCP, WDFW 2011b), as appropriate. Future Federal ESA recovery Plans and the PSRCP will be informed by, and periodically revised with, additional information on stock status, abundance, demographics and spatial structure, among other parameters provided by the implementation of this conservation plan. The structure of this plan will enable WDFW, in cooperation with NMFS, to comprehensively manage covered species to ensure their survival while allowing socio-economically important fisheries to continue. The plan will enable fisheries management and conservation efforts to respond to new information and research on an annual basis as warranted. The following table summarizes the section 10(a)(1)(B) covered species, activities and conservation measures (Table 1).

**Table 1.** Summary of the Section 10(a)(1)(B) covered species, activities and conservation measures.

Puget Sound/Georgia Basin (PS/GB) bocaccio ( <i>Sebastes paucispinis</i> )	Endangered	Yes	Yes	1. Continue the permanent closure by permanent regulation of the set net, set line, bottom fish trawl, bottom fish pot, and scallop trawl fisheries; 2. Continue to prohibit fishing for rockfish in Marine Catch Areas 5 through 13; 3. Continue to prohibit retention of rockfish caught in any fishery in Marine Catch Areas 5 through 13; 4. Continue to prohibit bottom fishing in waters deeper than 120 feet throughout the DPSs; 5. Require permit holders in the shrimp trawl fishery to have on-board observers on 10 percent of all trips who would identify and track bycatch; and 6. Continue to allow only beam trawls in the shrimp trawl fishery (no rockhopper gear). 7. Adaptive Management to respond to take levels and new information, as necessary.
PS/GB canary rockfish ( <i>S. pinniger</i> )	Threatened	Yes	Yes	
PS/GB yelloweye rockfish ( <i>S. ruberrimus</i> )	Threatened	Yes	Yes	
Puget Sound (PS) Chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	Threatened	Yes	Yes	
Southern green sturgeon ( <i>Acipenser medirostris</i> )	Threatened	No <sup>b</sup>	Yes	
Southern (S) eulachon ( <i>Thaleichthys pacificus</i> )	Threatened	No <sup>b</sup>	Yes	

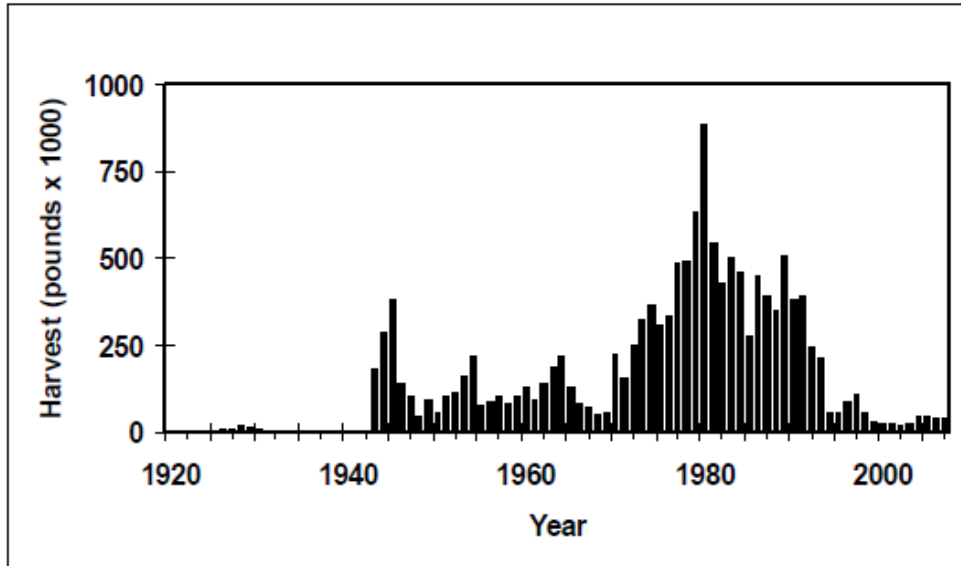
<sup>a</sup>The geographic area of coverage includes the U.S. portion of the Puget Sound/Georgia Basin ESA-listed rockfish DPSs. <sup>b</sup>These species are not incidentally caught in this fishery

## Introduction

Human use of rockfish in Puget Sound has occurred for centuries. Beginning in the early 1970s and through the early 1990s a substantial increase in rockfish landings by both commercial and recreational fishers occurred (Figure 1). Subsequent to the increase in landings, the populations of some rockfish species declined and WDFW enacted a series of increasingly restrictive regulations (Table 2). The restrictions included the prohibition of certain types of commercial fishing gear, regulations designed to keep fishing gear away from rockfish habitat, and the establishment of trip limits for rockfish. As a result of the impact to abundance from past fisheries and more restrictive regulations, the current level of rockfish catch in both commercial and recreational fisheries is very low; less than ten percent of the peak levels (Palsson et al. 2009).

In 2010, NOAA's National Marine Fisheries Service (NMFS) found that the abundance of several species of rockfish had declined so much that protection under the Endangered Species Act was warranted (Federal Register 2010), subsequently listing bocaccio (*Sebastes paucispinis*) as endangered, and canary rockfish (*S. pinniger*) and yelloweye rockfish (*S. ruberrimus*) as threatened. NMFS further defined the Distinct Population Segments (DPSs) of all three species to be east of the sill between Port Angeles, Washington and Victoria, British Columbia (Federal Register 2009, Figure 2).

The information contained in this Fishery Conservation Plan supports the application for an Incidental Take Permit (ITP) for the three ESA-listed rockfishes in the Puget Sound DPS under coverage for section 10 (a)(1)(B) for those state-managed fisheries targeting anything but salmon and that have a moderate potential for encountering the listed rockfish species. Information is also presented in context of the fishery and population management regime that supports individual applications for research under section 10 (a)(1)(A), thus both approaches identify the potential takes of listed rockfishes by the Washington Department of Fish and Wildlife by non-salmonid commercial and recreational fisheries and research for bottomfishes. Potential takes in these fisheries and research activities are also identified for ESA-listed salmonids, green sturgeon, and eulachon by continuing fisheries for shrimp and the recreational fishery for bottomfish and other fishes besides salmon and halibut. Coverage for the take of listed rockfishes and other ESA-listed species by salmon fisheries is separately covered by the Puget Sound Chinook Harvest Management Plan. WDFW is not seeking coverage for fisheries listed as having a very low encounter potential for ESA-listed rockfishes (Appendix 2). Any encounters of listed rockfishes by these low potential fisheries would be addressed through separate section 10(a)(1)(B) permitting, as necessary.



**Figure 1.** Annual combined commercial and recreational rockfish landings from Puget Sound.

**Table 2.** Conservation Measures Taken by WDFW to Protect Rockfish in Puget Sound since 1983.

<b>YEAR</b>	<b>RECREATIONAL</b>	<b>COMMERCIAL</b>
1983	10 fish bag limit for rockfish in North Sound, 5 in South Sound	
1984		Closure of San Juans to bottomfish jig and troll gears
1989		Bottom trawl fishing south of Admiralty Inlet prohibited
1991		Roller gear prohibited for bottom trawling east of the Sekiu River
1992		Prohibition of bottomfish jig and troll gears in all of Puget Sound east of the Sekiu River
1994	Rockfish daily limit reduced to 5 rockfish in North Sound and three in South Sound	Bottom trawl fishing for food fish prohibited in Admiralty Inlet, eastern Strait of Juan
1998	Adoption of the Puget Sound Groundfish Management Plan and the Marine Protected Area Policy.	
1999		Live fish fishery for rockfish and other species prohibited
2000	One rockfish bag limit for all of Puget Sound east of the Sekiu River	
2002	Temporary prohibition of harvest of yelloweye and canary	
2003	Permanent rule prohibiting harvest of yelloweye and canary rockfish	
2004	Daily rockfish limit to first rockfish caught. Rockfish seasons instituted. Closed to spearfishing for rockfish	
2010	Prohibition of all rockfish retention within the DPS. No fishing for any species of bottomfish (including rockfish) in waters deeper than 120 feet throughout all of the DPS.	Temporary closure of the bottom trawl, bottomfish pot, set line, and set net fisheries within the DPS.
2011		Permanent closure of bottom trawl, set net, set line, bottomfish pot, pelagic trawl, and scallop trawl throughout all of the DPS.

In 2010, the Fish and Wildlife Commission (FWC) formally adopted regulations which ended the retention of rockfish by recreational fishers in any part of the Puget Sound DPSs. WDFW enacted the following package of regulations by emergency rule in the latter portion of 2010 and permanently in February 2011 for the following commercial fisheries in Puget Sound:

1. Closure of the set net fishery
2. Closure of the set line fishery
3. Closure of the pelagic trawl fishery
4. Closure of the bottomfish<sup>1</sup> pot fishery
5. Closure of the bottom trawl fishery
6. Prohibition of the retention of rockfish of any species that is caught by any commercial fishery within the Puget Sound DPSs.

The bottom trawl, dogfish set net, and set line fisheries have documented catches of the three listed species and closure will provide increased conservation benefits (Federal Register 2009). The pelagic trawl and bottomfish pot fisheries pose an unknown risk to ESA-listed rockfish species; however, there has been little or no participation in these fisheries in recent years. Thus, their closure removes any potential risk with minimal adverse socio-economic impact.

As a precautionary measure, WDFW has permanently prohibited most commercial gears and fishing targeting bottomfish, forage fish, and scallops in an area larger than the designated DPSs for the three ESA-listed rockfish species. Extending the closure area west to Cape Flattery will provide extra protection in the event that the designated Puget



**Figure 2.** The Distinct Population Segment for the ESA-listed rockfish in Puget Sound.

<sup>1</sup> “Bottomfish” is a legal term (WAC 220-16 340) that defines a group of fish that are managed in aggregate. Rockfish are considered bottomfish as are sole, flounder, cod, sharks and similar species.



Sound DPS is determined to be inadequate, and will prevent commercial fishers from concentrating gear in the area just west of the DPSs.

### **Description of the Three Listed Rockfish Species**

(Adapted from Palsson et al. 2009, NMFS 2010, Love et al. 2002, and Federal Register 2009)

The life history patterns for all three species of listed rockfish are similar. All give birth to live larvae which generally occupy the upper portion of the water column and may be found at the surface. When young rockfish reach a few months in age they typically move into shallow, rocky inshore areas. Juvenile canary rockfish and bocaccio may occupy intertidal areas whereas juvenile yelloweye rockfish are rarely encountered in water depths less than 15 m. Adults of all three species typically occupy bottom habitats with complex bathymetry and moderate to extreme steepness. Adults typically are found at depths between 40 and 250 meters and are usually associated with rocky and hard seafloor but may occur on sand or mud substrates.

Yelloweye rockfish range from Alaska to Baja California. It is a sedentary species that lives in close association with the bottom and has a small home range. Yelloweye rockfish are less frequently observed in south Puget Sound (south of the seaward entrance to Admiralty Inlet and east of Deception pass) than in north Puget Sound (north of Admiralty Inlet and east of the Sekiu River). They are encountered infrequently in trawl and video surveys with limited occurrences in most of Puget Sound's hydrographically defined sub-basins<sup>2</sup>. The Hood Canal sub-basin has the greatest frequency of yelloweye rockfish observed in both trawl and scuba surveys (Palsson et al. 2009; WDFW, unpublished data). However, a recent survey with a remotely-operated vehicle in the San Juan Islands (SJI) estimated a population of 47,407 individuals. The maximum reported age is over 100 years and maximum reported length is 91 cm. The age of sexual maturity is not well known but may be around 17 years. Annual natural mortality rates in British Columbia are estimated to be between 0.015 and 0.02. Juvenile yelloweye rockfish are most common at depths greater than 30-40 m and adults are found in deeper water (90-180 m). Yelloweye rockfish feed on other fish and small crustaceans.

Canary rockfish occur from Alaska to northern Baja California and have been recorded in all of the Puget Sound sub-basins. The species has been captured on rare occasions during WDFW trawls, with all captures in the SJI region, and a remotely-operated vehicle survey of the SJI in 2008 estimated a population of 1,697 fish. Canary rockfish have a larger home range than yelloweye rockfish and are often found suspended in the

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<sup>2</sup> Including the Strait of Juan de Fuca, Strait of Georgia, Hood Canal, the Whidbey Basin, Main Basin, Southern Sound and the San Juan Island area.

water column. Juveniles can be found in the upper 100 m of the water column. Adult canary rockfish are usually found in deeper water (80-200 m) and tend to associate with pinnacles and other high-relief areas, but may be found over flat and mixed boulder habitat as well. They reach a maximum age of at least 84 years and may attain lengths of up to 76 cm. Age at sexual maturity is not certain, but probably is between 7 and 12 years, and their annual natural mortality rate is estimated from six to nine percent (Methot and Stewart 2005, Stewart 2007). Canary rockfish feed on other fish and small crustaceans.

Bocaccio occur from Alaska to central Baja California and are often associated with steep slopes consisting of sandy or rocky substrates. Bocaccio have been detected in central Puget Sound, Tacoma Narrows, and Ports Gardner and Susan, the San Juan Islands and along the Strait of Juan de Fuca. This species has not been encountered in WDFW trawl surveys, but a remotely-operated vehicle survey of the San Juan Islands in 2008 estimated a population of 4,606 fish. Similar to canary rockfish, adults can be found suspended in the water column well off of the bottom and may move long distances, especially juvenile bocaccio. The maximum size is 91 cm. Bocaccio are difficult to age but are thought to exceed 50 years in age. In Oregon waters, 100% of female bocaccio are sexually mature by the time they reach 61 cm. Adult bocaccio are most often found in high relief boulder fields and rocks and may live in caves. Juvenile bocaccio consume a wide variety of organisms and adults feed on other fish and squid. Natural mortality rates may approach 15% per year.

### **Management Areas and Distinct Population Segments of Listed Rockfish Species**

WDFW uses a system of Management and Catch Reporting Areas to manage salmon and marine fish, including rockfish. The Management Areas are used to define regulatory boundaries and also provide basic geographic units to estimate catch. Two different systems of catch management areas are used: 1) Recreational Marine Catch Areas (MCAs, Figure 3): and 2) Commercial Marine Fish-Shellfish Catch Reporting Areas (Figure 4). A detailed description of each area is given in Appendix 1.

The Biological Review Team (BRT), which provided scientific review of the status of the three listed species (Federal Register 2009), concluded that the most likely DPS for each of the three listed species consisted of all inland marine waters east of the central portion of the Strait of Juan de Fuca in Washington State and south of the northern portion of the Strait of Georgia in British Columbia (Figure 2). The western boundary of the DPSs was established at the Victoria Sill just to the east of Port Angeles (Federal Register 2009). This conservation plan addresses only the portions of the DPS within the waters of

Washington State. WDFW has no authority to conduct research or regulate fisheries within the Canadian portion of the DPS. The management and catch area boundaries used by WDFW, though similar, do not coincide exactly with the DPS boundaries established by the BRT. For the purposes of this conservation plan, we considered an area slightly larger than the defined DPS. For recreational fisheries, we included all of Puget Sound except for Management and Catch Reporting Areas 4 and 5 (Figure 3). For commercial fisheries we included all of Puget Sound except for Marine Fish-Shellfish Catch Reporting Areas 23C and 29 (which are outside the DPSs) (Figure 4).

### **Authority to Manage Commercial and Recreational Fisheries**

WDFW has the authority to manage all non-treaty commercial and recreational fisheries within the DPS areas. This authority includes the ability to specify the time, place and manner in which fishing operations are conducted, and to impose limits on the size and numbers of fish that can be harvested (RCW 77.04.0125). WDFW has used this authority to specify the type of fishing gear, depths and areas fished, fishing seasons, species, and quantities and sizes of fish that may be taken. Additionally, WDFW has the authority to establish Marine Protected Areas (MPAs) where fishing is prohibited or restricted. WDFW has established, by regulation, 24 marine protected areas in Puget Sound (Van Cleve et al. 2009).

### **Current Commercial and Recreational Fishery Gears in Puget Sound**

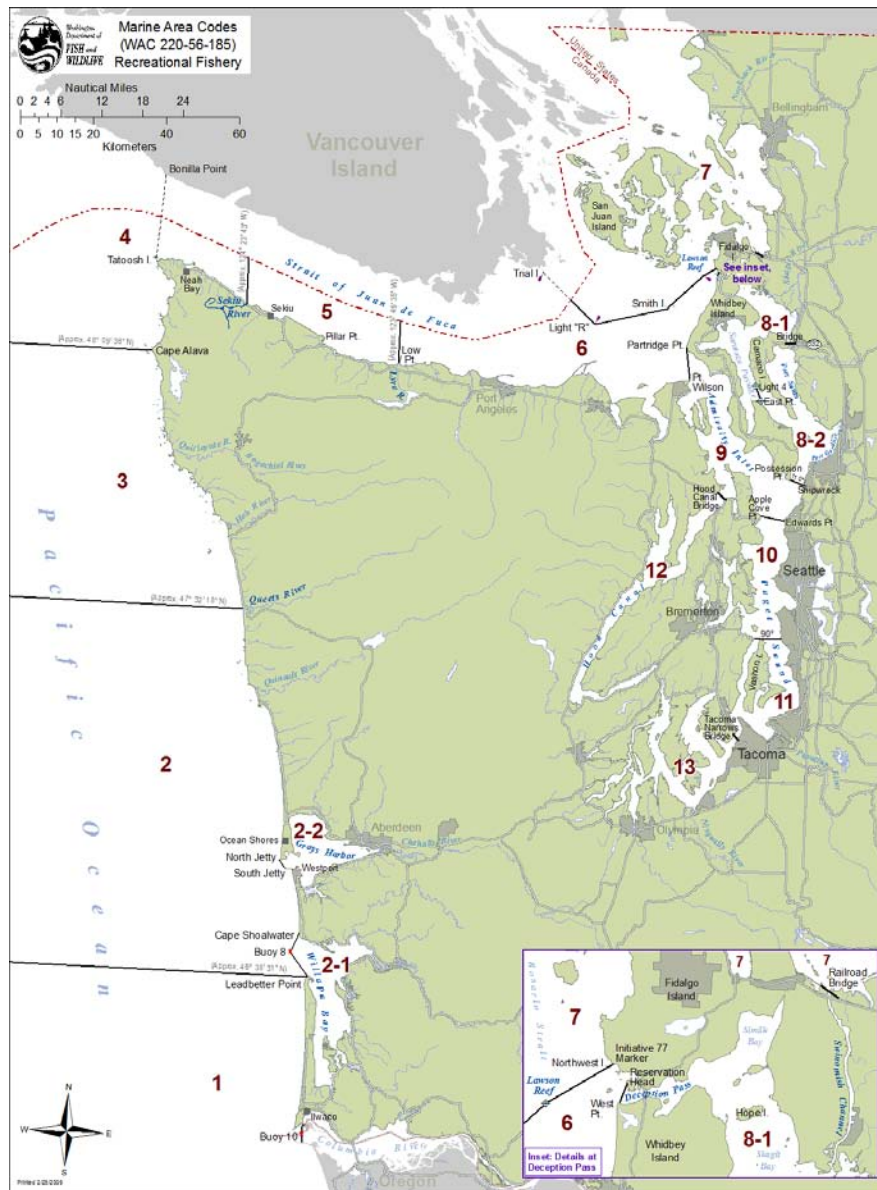
Within the DPSs area, a wide variety of commercial and recreational gears have been used to fish for and catch marine fish, forage fish, and shellfish. Some commercial fisheries operate under a limited entry program whereby no new licenses are issued, thus capping the maximum number of participants. Other commercial fisheries were open access, which means there was no limit on the number of licenses that may be issued. All recreational fisheries are open access fisheries with no limit on the number of participants.

With the permanent closure of the fisheries noted above in 2011, a total of 33 WDFW managed fisheries will be operating within the DPSs (Appendix 2). Fisheries for salmon or halibut are not included in this Fishery Conservation Plan as they have an existing federal nexus and are evaluated for their impact on rockfish separately. The remaining 27 fisheries were evaluated for their potential impact on ESA-listed rockfish. Twenty-five of these fisheries were deemed to pose little or no risk of encountering rockfish of any species due to one or more of the following: 1) gear characteristics; 2) locations where the fisheries occur, or; 3) lack of documented rockfish bycatch within the fishery. Two

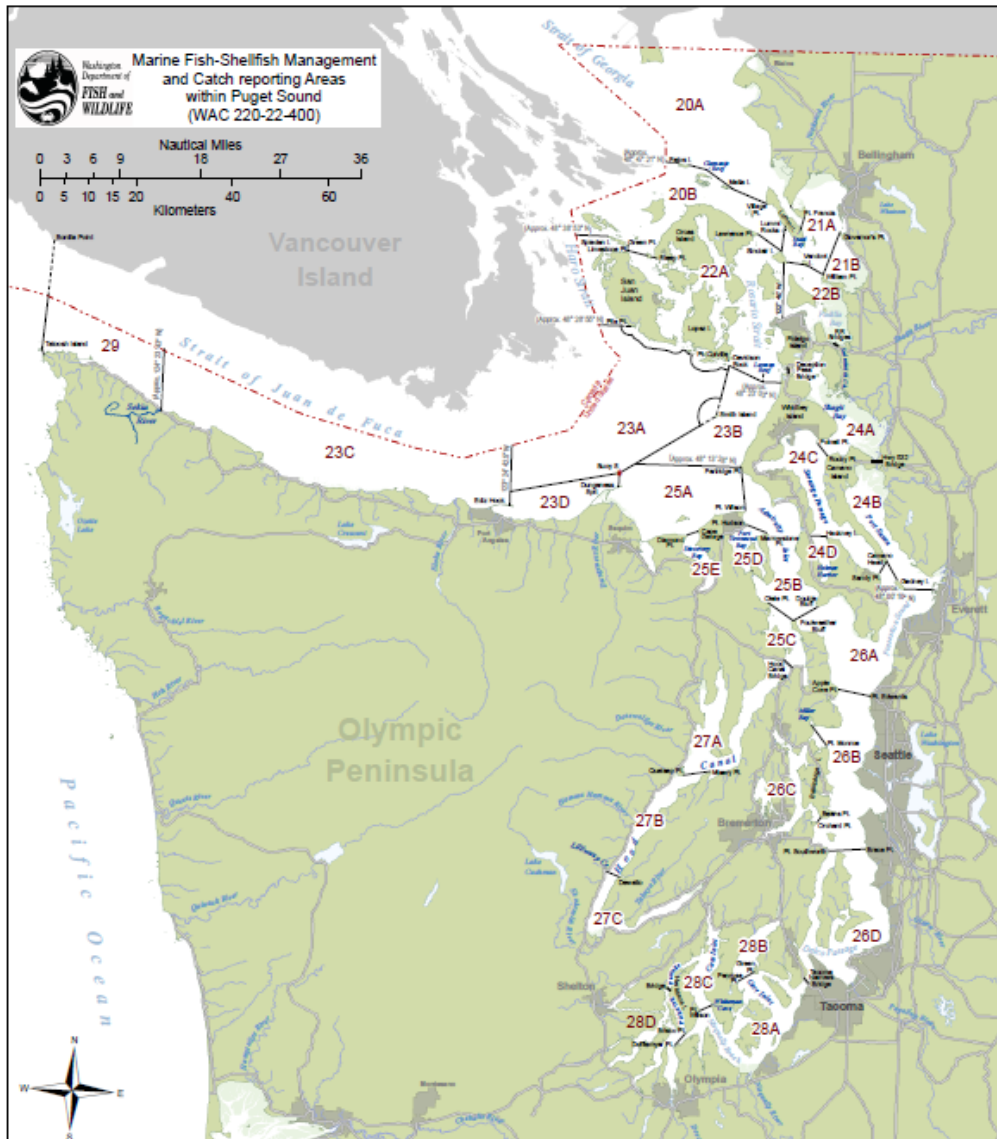
fisheries, however, were judged to have the potential to encounter ESA-listed rockfish species:

- shrimp beam trawl, and
- recreational fishing for bottomfish and other fish.

We have developed detailed narratives for each of these fisheries and include information on the encounters of other listed species.



**Figure 3. Recreational Marine Catch Areas.**



**Figure 4.** Commercial Marine Fish-Shellfish Catch Reporting Areas.

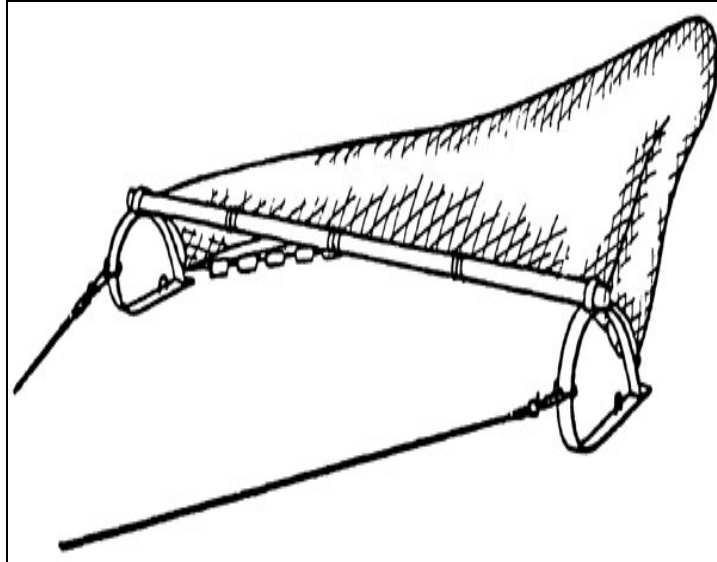
## FISHERY NARRATIVES

Both of the fisheries judged to have the potential for incidental encounters with ESA-listed rockfish were examined to evaluate the extent of the risk. This evaluation included the following elements:

- Fishery Description
- License Type
- Target Species
- Gear Specifications
- Areas of Activity
- Activity Trends- Landings, Licenses, Active Participants
- Recent Catches of Any Rockfish and Listed Species
- Current Monitoring
- Management Steps Taken to Reduce Rockfish Encounters Within the Fishery

**Puget Sound Shrimp Trawl and Beam Trawl Gear Description:** "Shrimp trawl", as defined in WAC 220-16-015, is a tapered, funnel-shaped trawl net in which the mesh size is two inches or less in the intermediate and codend sections of the trawl (Figure 5). Otter doors, otter boards, or a beam may be used to spread the mouth of the net horizontally as it is towed. The mouth of the net is formed on the upper edge by a line to which floats are attached (headrope) and on the lower edge by a line which is usually weighted (footrope). Additional webbing is frequently attached to the codend section to prevent the net from chafing. "Beam trawl" as defined in WAC 220-16-015 is a type of bottom trawl, consisting of a bag-shaped trawl net utilizing a beam to spread the mouth of the net horizontally as it is towed and not having weighted otter frames or otter doors.

Only "beam trawls" are legal trawl gear in the Puget Sound commercial shrimp fishery (WAC 220-52-051). The minimum mesh size for Puget Sound beam trawl nets is one and one-half inches stretch measure. The maximum beam width is 60 feet in the eastern Strait of Juan de Fuca (marine fish-shellfish catch reporting areas 23A, 23B and 25A), and 25 feet in the San Juan Islands (Marine Fish-Shellfish Catch Reporting Areas 20A, 20B, 21A and 22A) shrimp beam trawl fisheries.



**Figure 5.** Schematic of a shrimp beam trawl.

**Season Structure:** The shrimp beam trawl season is managed by emergency regulation, that is, it is always closed by permanent rule unless opened by emergency regulation. The season generally occurs from April 15 – Oct 31 in the Strait of Juan de Fuca beam trawl fishery, and from May 16 – Oct 15 in the San Juan Islands beam trawl fishery, unless the quotas are attained first (which often happens in some of the areas). Shrimp quotas for 2010 were 697,000 lbs in the Strait of Juan de Fuca east of Port Angeles and 75,000 lbs in the San Juan Islands.

**License type:** Limited entry. Beginning in 2011, an additional permit from WDFW was required that stipulates the conditions for carrying and supplying fishery observers on at least 10% of the commercial trips for shrimp trawling in Puget Sound.

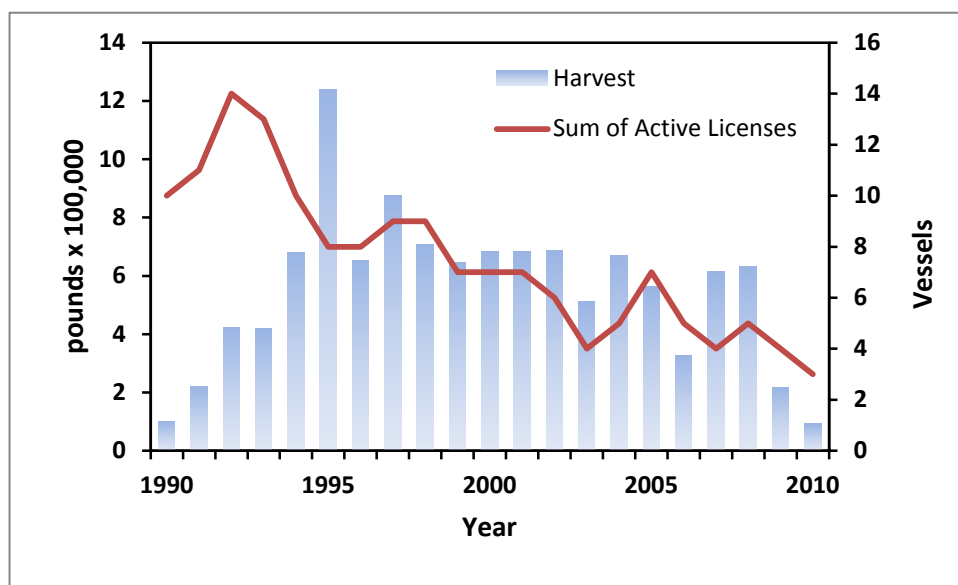
**Target species:** Overall, pink shrimp is the dominant shrimp species harvested in the Puget Sound DPS, but the target species varies by region. In the Strait of Juan de Fuca, northern pink shrimp (*Pandalus eous*) is the primary species harvested (Table 3). In the San Juan Islands, the primary species harvested are dock or coonstripe shrimp (*P. danae*) and sidestripe shrimp (*Pandalopsis dispar*).

**Area(s) of Operation:** Protection Island in the eastern Strait of Juan de Fuca, and the San Juan Islands to the Canadian border.

**Depth Fished:** No fishing is allowed in waters less than 120 feet in depth.

**Management Action(s) Taken to Reduce Impact to Rockfish:** In limited observations landings of listed rockfish species have not been documented with this fishing gear, and new regulations prohibit the retention of rockfish by commercial fishing. Observer coverage will enable tracking of rockfish bycatch and adaptive management measures to reduce bycatch of listed species, as necessary.

**Activity Trend:** Most of the effort since 2000 has been concentrated in Marine Fish-Shellfish Catch Reporting Area 25A, near Protection Island and the entrance to Discovery Bay in the eastern Strait of Juan de Fuca. There has been an overall trend in recent years toward declining catches accompanied by a decline from 14 active vessels in 1992 to only three active vessels in 2010 (Figure 6). Annual harvest peaked in 1995 at 1.2 million pounds (562 mt), held to the quota between 1996 to 2008, but substantially declined to 92,000 lbs (42 mt) in 2010 (Figure 6). The decline is greatly attributed to far fewer active vessels and trips taken in the eastern Strait of Juan de Fuca (Table 3).



**Figure 6.** Commercial shrimp trawl catch and effort in within the Puget Sound DPS.  
Source, WDFW unpublished data.



**Table 3.** Pounds of Shrimp By Species and Region Harvested by the Commercial, Non-tribal Fishery for Shrimp in Puget Sound (1990-2010).

Year	Pounds				Number of Trips
	Coonstripe	Pink	Sidestripe	Total	
<b>San Juan Islands</b>					
1990	83256	11814	0	95070	209
1991	66311	9455	370	76136	144
1992	77207	11781	61	89049	139
1993	75016	9943	5856	90815	138
1994	82069	5798	5839	93706	128
1995	86489	10866	3103	100458	64
1996	57110	6310	35	63455	48
1997	50083	11283	12765	74131	52
1998	23471	19875	9843	53189	52
1999	40107	16259	15593	71959	67
2000	48608	12774	12770	74152	150
2001	47515	21163	8659	77337	188
2002	44406	18178	4768	67352	165
2003	38545	17852	970	57367	149
2004	41506	11989	1815	55310	122
2005	34939	20222	1758	56919	118
2006	29996	22603	2789	55388	122
2007	33222	23165	1846	58233	141
2008	22114	27122	1135	50371	109
2009	32277	34204	3310	69791	144
2010	33242	36739	282	70263	134
<b>East Juan de Fuca</b>					
1990	4	5737	0	5741	16
1991	87	142711	1981	144779	89
1992	7	333226	437	333670	61
1993	139	326502	190	326831	64
1994	0	586598	0	586598	66
1995	0	1139049	0	1139049	91
1996	0	588393	0	588393	51
1997	0	800420	0	800420	64
1998	4320	648252	1774	654346	62
1999	1627	570931	801	573359	62
2000	261	609448	70	609779	56
2001	0	606448	0	606448	80

2002	10	616712	2629	619351	81
2003	184	452684	1233	454101	92
2004	242	609858	4376	614476	75
2005	1261	502141	1702	505104	106
2006	498	271257	605	272360	79
2007	210	554527	165	554902	78
2008	759	577783	1874	580416	59
2009	967	144486	1916	147369	36
2010	337	16807	4802	21946	34

**Current Monitoring:** In accordance with WAC 220-52-075, a Puget Sound Shrimp Beam Trawl Logbook must be obtained from WDFW and accurately maintained while fishing for, or in possession of, shrimp taken by trawl gear from anywhere in Puget Sound. The logbook data must be submitted to WDFW within ten days following any month in which fishing activity occurred and by the tenth day following the termination of fishing activity. All retained catch must be recorded on a fish receiving ticket and forwarded to WDFW in accordance with WAC 220-20-026. This ticket records the type of fishing gear used, the area fished and the catch by species and weight. Electronic records of the fish tickets generally are available for use within 2 weeks of the landing date and the information can be summarized in a variety of ways.

A limited program of on-board observation of fishing activities has been conducted by WDFW in the San Juan Islands and historically in the eastern Strait of Juan de Fuca (Table 4). Temporal and spatial coverage of the observations are sparse. Beginning in 2011, on-board observers were required to record tow-by-tow information on encounter rates, catch composition, size, and other biological data from not less than 10% of the shrimp trawl trips occurring in the rockfish DPSs.

**Take of Listed Species:** Finfish (including rockfish, eulachon, green sturgeon, steelhead, and Chinook salmon) were not reported on fish receiving tickets between 1971 and 2009. In limited observations, no listed rockfish, salmonids, or sturgeon have been observed by WDFW in the commercial shrimp trawl fishery in the San Juan Islands or in the eastern Strait of Juan de Fuca. Of the 4,834 pounds of shrimp observed in the San Juan Islands (Catch Areas 20A, 20B, and 22A), only 2 individual eulachon were counted (Table 4). In the eastern Strait of Juan de Fuca (Catch Area 25A), a 2-day study of the beam trawl fishery was conducted in August 1996 by WDFW and the Suquamish Indian Tribe. Shipboard observers sampled 27,890 pounds of shrimp and 528 pounds of fish (30 species) collected over eleven short tows (Palsson et al. 1999). Two Puget Sound rockfish (*Sebastes emphaeus*) were the only rockfish encountered, and 144 eulachon weighing a total of 2.5 pounds were caught.

**Table 4.** Observations of listed rockfish and eulachon in the Commerical Shrimp Trawl Fishery in Northern Puget Sound.

<b>Date</b>	<b>Area</b>	<b>Observed Shrimp (Pounds)</b>	<b>Listed Rockfish (numbers)</b>	<b>Eulachon (numbers)</b>
24-Sep-10	20A	27	0	0
14-Sep-10	22A	808	0	0
15-Jun-10	22A	272	0	0
21-May-10	22A	863	0	0
23-May-05	22A	397	0	2
19-May-03	22A	227	0	0
17-May-02	22A	645	0	0
07-Sep-00	22A	475	0	0
14-Oct-99	20B	1120	0	0
6-7-Aug-96	25A	27,890	0	144

### **Predicted Annual Take for Shrimp Trawl Fishery**

Based on over 20 years of data from the WDFW fish receiving ticket database, limited at-sea monitoring, anecdotal evidence from past and present fishers, and strict harvest regulations, WDFW concludes that the risk posed by the shrimp trawl fishery to ESA-listed rockfish or other listed species is relatively low. This is because shrimp trawl gear is not typically fished near rocky habitats or steep-sloped habitats; however, since the trawl nets are fished close to the bottom, the potential for incidental encounters with yelloweye rockfish, canary rockfish and bocaccio does exist, as well as for Chinook salmon and green sturgeon that occupy these waters. Annual take estimates are for no more than five bocaccio, and ten each of canary and yelloweye rockfishes per year by this gear (Table 5). These takes would be expected to be lethal. Up to one green sturgeon and up to 50 Chinook salmon are estimated to be taken per year by this gear, and this take will also be lethal (Table 5).

**Table 5.** Annual shrimp trawl take estimates.

<b>Species</b>	<b>Annual Take Estimate</b>
Bocaccio	5
Canary rockfish	10
Yelloweye rockfish	10
Eulachon	3,240

Chinook salmon	50
Green Sturgeon	1

The limited observer data for eulachon was used to predict the take in the two shrimp beam trawl fisheries in the Strait of Juan de Fuca and northern Puget Sound. Based on the ratio of eulachon to shrimp caught (2.52/27,890 lbs) and the non-tribal catch quota in the eastern Strait of Juan de Fuca, we predict that 56 pounds of eulachon are caught annually. The average weight of eulachon in the bycatch study was 0.0175 lbs, thus 3,210 individual eulachon might be expected to be taken for the quota of 621,500 pounds in the eastern Strait of Juan de Fuca. With a frequency of two eulachon per 4,834 lbs observed in the San Juan shrimp trawl fishery, we predict that 31 eulachon may be taken per year in the San Juan Islands for a quota of 75,000 lbs. These estimates, especially for the fishery in the eastern Strait of Juan de Fuca, are limited in geographic and temporal scope.

## **Puget Sound Recreational Fisheries for Bottomfish and Other Fish**

### **Fishery Description**

Recreational fisheries for bottomfish and other fish such as salmon and halibut occur in the ESA-listed rockfish Puget Sound DPSs (Recreational MCAs 6-13). Species classified as “Bottomfish” by WDFW include rockfish, lingcod, greenlings, flatfishes (except Pacific halibut), codfishes, sharks and skates, surfperches (except shiner perch), and a variety of other larger bottom-dwelling species. It should be noted that many species of bottomfish such as small sculpins and other fishes seldom captured by hook-and-line are not included in the “Bottomfish” classification, but are instead classified by WDFW as “Unclassified Marine Fish”. Thus, other fish might include salmon, halibut, Unclassified Marine Fish, or any of several marine fish species that may occur irregularly in State waters, such as mackerel, tuna, barracuda, and yellowtail. Fishers use a variety of gears and techniques that are similar to those used in the recreational salmon fishery. Effective May 1, 2010, it became unlawful to fish for or retain rockfish of any species within the DPS area. This analysis excludes fisheries that target salmon or halibut. Most recreational fisheries for bottomfish occur by boat-based hook-and-line anglers, but anglers from docks, piers, and the shore account for a small proportion of the bottomfish harvest. Additionally, divers spear lingcod, cabezon and some other bottomfish species but are not authorized to harvest rockfish within the DPS. More restrictive regulations have reduced the numbers of rockfish landed in recent years, but the number of rockfish released while targeting other species is substantial. In 2010, new regulations for

bottomfish (as defined by WAC 220-16-340)<sup>3</sup> were implemented to reduce the incidental harvest and mortality of rockfish within the DPSs by recreational fishers. Specifically, retention of rockfish within the DPS was prohibited, and fishing for bottomfish was prohibited in waters deeper than 120 feet (20 fathoms).

### Seasons, Areas, and Catch Limits

Within the Puget Sound DPS, fishing seasons for bottomfish have been reduced substantially since the early 2000s. A few species, such as flatfish (other than Pacific halibut) and surfperch, can be legally harvested year round, but most other fisheries have temporally defined seasons. During May and the first half of June, anglers are permitted to fish for lingcod throughout most of Puget Sound. Fishing for cabezon in MCAs 6 to 13 is only permitted from May 1<sup>st</sup> to November 30<sup>th</sup>, and fishing for codfishes is allowed year round in MCAs 6 and 7, but prohibited in MCAs 8 to 13. Hood Canal (MCA 12) has been closed to fishing for bottomfish since 2002 due to the adverse impacts of hypoxia.

As detailed in the introduction of this document, rockfish seasons and limits have undergone drastic changes during the past three decades. Anglers were once allowed to harvest fifteen rockfish per day but are no longer allowed to harvest rockfish within the Puget Sound DPS. Beginning in 2010, rockfish harvest was not allowed in MCAs 6 to 13, and fishing for bottomfish (except halibut) is not allowed in waters deeper than 120 feet. From 2000 to 2009, the catch limit for rockfish in MCAs 6 to 13 was one rockfish per angler per day. During recent years, fishers were only allowed to harvest rockfish in MCAs 6, 7, and 9 from May 1<sup>st</sup> to September 30<sup>th</sup>. In MCAs 8-1, 8-2, 10, 11, and 13, rockfish could only be harvested during open seasons for lingcod and salmon. Spearfishing for rockfish in the Puget Sound DPS has been prohibited since 2004.

### Fishing Techniques

Most bottomfish anglers fish from boats and jig with lures or bait as they drift over bottomfish habitat or while the boat is anchored. While jigging, anglers lower their lure or bait to just above the seafloor and rapidly raise and lower their rods to simulate live action of their terminal tackle. Anglers fishing for lingcod and rockfish locate rocky

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<sup>3</sup> **WAC 220-16-340 General definitions -- Bottomfish.** The term "bottomfish," unless otherwise provided, is defined as including Pacific cod, Pacific tomcod, Pacific hake, walleye pollock all species of dabs, sole and flounders (except Pacific halibut), lingcod and all other species of greenling, ratfish, sablefish, cabezon, buffalo sculpin, great sculpin, red Irish lord, brown Irish lord, Pacific staghorn sculpin, wolf-eel, giant wry mouth, plainfin midshipman, spiny dogfish, six gill shark, soupfin shark and all other species of shark, and all species of skate, rockfish, rattails and surfperches except shiner perch.

habitats or steep slopes with their depth finders and global positioning systems usually aided by nautical charts, fishing maps, and local knowledge. Some anglers use lighter tackle when targeting flatfish and other non-rockfish species. Prior to recent regulation changes, anglers could fish deeper than 120 feet for bottomfish, though most fished in shallower nearshore areas. For flatfish, hook sizes are typically smaller and bait is more often used. Lures used by lingcod anglers include heavy “leadhead” jigs, darts, diamond jigs, and other fish or squid-like lures. Baits used by these anglers include dead adult or juvenile herring, squid, and octopus or live baits such as herring, small flatfish, greenlings, and other bottomfish jigged just prior to targeting lingcod. Until 2007 in MCAs 6 to 13, most bottomfish lures were equipped with barbless treble hooks, but in 2008, these hooks were prohibited in these areas and only two single-point, barbless hooks are allowed on each line.

Bottomfish are also caught by recreational anglers that are not targeting a specific species, or that are targeting both salmon and bottomfish. Other anglers may jig for bottomfish or use salmon fishing techniques such as mooching, fly fishing, or trolling.

Other modes of bottomfish angling include shore fishing from beaches, banks, and piers, but generally employ the same types of terminal gear as boat-based anglers.

### Species-Specific Fisheries

Lingcod – Adult lingcod inhabit all depths in Puget Sound where rocky habitats or artificial structures occur and may occupy the same habitats as some rockfish species, particularly those that associate most closely with structured seafloor habitats. They can also be found at times on unstructured habitat such as sand or smooth hard-pan. Lingcod are almost exclusively piscivorous, consequently anglers using dead or live fish or fish-like lures with large hooks and heavy tackle tend to be the most successful. The use of live-bait (such as flatfishes) has become more popular in recent years.

Cabezon and kelp greenlings – Though not a dominant fishery, anglers fishing in kelp beds and shallow rocky habitats occasionally target cabezon, large sculpins (e.g. red Irish lord), and kelp greenlings. These species eat shrimp, crabs, and other invertebrates, so anglers typically use leadhead jigs or other crab-like lures. Cabezon and greenlings co-occur with rockfish throughout Puget Sound.

Flatfish – Flatfish are ubiquitous throughout Puget Sound, especially on sandy and muddy bottoms. Anglers may target flatfish using small, baited hooks or lures and typically catch starry flounder, English sole, rock sole, and Pacific sanddab. Flatfish

occur at all depths, but most are caught in nearshore waters and rarely co-occur with rockfish.

**Perch** – Striped seaperch and pile perch are the most commonly-harvested perches. They are most often caught in the nearshore environment near pilings, rocky habitats, and eelgrass beds by anglers using small baited hooks and jigs with light tackle.

**Other bottomfish** - Other bottomfishes may be caught incidentally to fisheries for the fishes described above. Many species such as spiny dogfish, small sculpins, skates, and spotted ratfish may be harvested or released back into the water.

**License Type**- A recreational fishing license is required for individuals fifteen years or older. There is no limit on the number of licenses that can be issued in a given year.

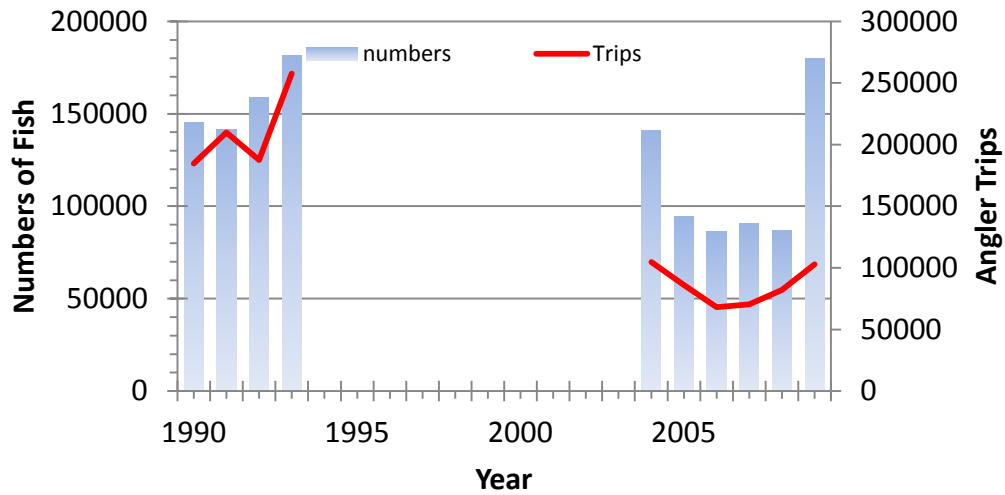
**Target Species** - Lingcod, cabezon, greenlings, flatfishes (other than halibut), perches, other bottomfish.

**Gear Specifications** - One rod per angler, with up to 2 barbless hooks in Recreational MCAs 6-13. Use of downriggers is allowed. Spearfishing is allowed for bottomfish species other than rockfish.

**Area of Operations** – Recreational MCAs 6-13. MCA 12 (Hood Canal) is currently closed to bottomfishing.

**Activity Trend** - Declining. Recreational fishing effort in the Puget Sound DPS for boat-based anglers targeting bottomfish and other fish ranged between 185,000 and 258,000 angler trips during the early 1990s (Figure 7). Due to extensive recreational fishing closures for salmon, and the nature of the previous catch estimation system, complete effort and catch estimates were not available for Puget Sound between 1994 and 2003. After catch and effort estimation systems were improved in 2004, fishing effort estimates declined by 49% from the early 1990s and ranged between 68,000 and 105,000 angler trips per year through 2009. Within the DPS, the San Juan Islands (MCA 7) has had the most angler activity for bottomfish among the Recreational MCAs, whereas Hood Canal (MCA 12) has the least amount of fishing activity (Figure 8).

### MCA 6-13



**Figure 7.** Total bottomfish harvest (in numbers of fish) and angler trips by boat-based anglers fishing for bottomfish or other fish in the Puget Sound DPS (MCAs 6-13).

**Recent Harvests** - WDFW has implemented new restrictions for bottomfish and rockfish fisheries that have substantially altered recent harvest patterns compared to historical patterns. However, these recent harvests and estimated releases will help guide and refine future take estimates of ESA-listed rockfish. Recent harvests of marine fish in Puget Sound by boat-based anglers targeting bottomfish and other fish are declining and are now half of what harvests were during the early 1990s (Figure 7). During the early 1990s, bottomfish harvests ranged from 141,000 to 181,000 fish per year, averaging 157,000 per year. After complete catch estimates became available again in 2004, harvest was estimated at 141,000 fish, comparable to values in the early 1990s, but annual harvests were erratic and generally in decline, reaching a low of 86,000 fish in 2006, remaining low through 2008, and increasing to 180,000 in 2009. During the years 2003-2009, the harvest of bottomfish averaged 113,000 fish in Puget Sound, a decline of 28% compared to the early 1990s. For the Puget Sound DPSs, flatfish dominate the recreational harvest at 68% of the bottomfish average harvest (Table 6). Rockfish comprised 10%, kelp greenling 8%, and lingcod 4% of the harvest. The average released catch of bottomfish by boat-based anglers targeting bottomfish and other fish in the Puget Sound DPS is 93,000 fish, slightly less than the average harvest (Table 6). Flatfishes are the most common species released, followed by spiny dogfish. The greatest average harvests of bottomfish occur in the Tacoma, Seattle, and Everett areas (MCAs 11, 10, and



8-2, respectively, Figure 9). Eulachon have not been observed in boat-based recreational fisheries for bottomfish and other fish in Puget Sound. A small number of Chinook salmon are incidentally caught in the recreational bottomfish fishery.

**Recent Rockfish Catches** - On average, 12,086 rockfish were harvested (retained) by bottomfish and other anglers from the Puget Sound DPSs from 2003 to 2009 (Table 6). The San Juan Islands (MCA 7) had the greatest proportion of harvested rockfish (44%, Table 6, Figure 10) seconded by the Tacoma area (MCA 11) with 18% of the harvest. In the other MCAs, the rockfish harvest ranged from an average of 141 fish in South Puget Sound I (MCA 13) to 1,229 fish in the Admiralty Inlet (MCA 9). Recent annual rockfish harvests by bottomfish and other anglers from the Puget Sound DPSs have ranged from 7,770 in 2006 to 14,110 in 2007 (Table 7). Harvest estimates for 2003-2009 that have species catches apportioned to include the unidentified rockfish category show that bottomfish and other anglers have not harvested bocaccio, 30 yelloweye were illegally harvested in 2007 from the San Juan Islands (MCA 7), and from 0 to 34 canary rockfish have been harvested from the Strait of Juan de Fuca (MCA 6), the San Juan Islands, Admiralty Inlet, and southern Puget Sound (MCA 13) (Tables 6 and 7).

Prior to the 2010 rule that prohibits the harvest of any rockfish species, rockfish were nonetheless often captured and released back to the water. On average, for every rockfish that was harvested by bottomfish and other anglers in the Puget Sound DPSs, one or more was released (Tables 6 and 7). The average annual number of rockfish released by anglers targeting bottomfish and other fish from 2003 to 2009 was 16,204 and ranged from 11,382 in 2006 to 23,685 in 2009. The greatest number of releases was from the San Juan Islands with an average of 9,103 fish released per year.

Releases in other areas range from 0 fish in Hood Canal (by anglers fishing for other species) to 1,422 fish in Admiralty Inlet. Bocaccio was not reported as released between 2003 and 2009 by bottomfish or other anglers. Annual releases of canary rockfish ranged from 0 in 2006 to 373 in 2004. Annual releases of yelloweye rockfish have ranged from 33 fish in 2004 to 566 in 2003. Preliminary estimates for 2010 include 22 bocaccio released by bottomfish anglers in MCA 6 but it is not known if these were from within the DPSs (a portion of MCA 6 is westward of the DPS). Yelloweye and canary rockfishes were not reported as caught or released during 2010.

**Terminology used:**

**Harvested:** A rockfish that is caught and retained by an angler.

**Released:** A rockfish that is caught and released by an angler. Released fish may be dead or alive at the time of release.

**Encountered:** The sum of the number of harvested and released rockfish. Sometimes called total catch.

Total encounters include both harvested (retained) and released fish. The San Juan Islands had the greatest annual average encounter rate of rockfish in the DPSs (Figure 11, Table 7). Among the ESA-listed rockfishes, the San Juan Islands (MCA 7) had the highest encounters of canary rockfish at 76 encounters per year, followed by the southern Puget Sound area (MCA 13) at 49 fish (Figure 12, Table 7). Zero to 22 canary rockfish have been encountered in the other marine catch areas in an average year (Table 7). On average, 194 encounters of canary rockfish occur per year (Table 7), but annually, encounters ranged from 0 in 2006 to as many as 387 in 2004 (Table 8). Yelloweye rockfish encounters were greatest in the San Juan Islands with an average of 126 (Table 7), but elsewhere, yelloweye rockfish encounters ranged from 0 to 81 in other marine catch areas (Figure 13, Table 7). Annual encounters of yelloweye rockfish have ranged between 33 in 2004 to 566 in 2003 (Table 8), and have averaged 219 encounters per year (Table 7). Bocaccio have not been encountered by anglers fishing for bottomfish or other fish between 2003 and 2009 (Tables 7 and 8). As noted above, 22 bocaccio were encountered by bottomfish anglers in 2010.

**Table 6.** Average Annual Harvest (retained catch) and Released Catch (in numbers of fish) of Bottomfishes in ESA-listed Rockfish Distinct Population Segments by Boat-based Anglers Targeting Bottomfish and Other Fish, 2003-2009.

Species	Harvested	Released	Encountered
Rockfishes	12,086	16,204	28,290
Lingcod	4,595	16,323	20,918
Kelp greenling	9,044	4,741	13,785
Other greenlings	940	445	1,385
Cabezon	990	662	1,652
Other sculpins	1,973	6,106	8,078
Pacific halibut	160	45	205
Flatfish	77,333	25,334	102,667
Pacific Cod	27	105	132
Other codfishes	272	180	452
Surfperches	3,452	869	4,321
Spiny dogfish	2,280	21,562	23,842
Other sharks	1	88	88
Skates	0	41	42
Other bottomfish	299	473	772
Total	113,452	93,178	206,630

**Table 7.** Average Harvest (retained catch) and Released Catch (in numbers of fish) by Marine Catch Area of Rockfishes in Puget Sound Distinct Population Segments by Boat-based Anglers Targeting Bottomfish and Other Fish, 2003 to 2009, Unidentified Rockfish Apportioned to Identified Species.

<b>Species</b>	MCA 6	MCA 7	MCA 8-1	MCA 8-2	MCA 9	MCA 10	MCA 11	MCA 12	MCA 13	DPS
<b>Harvested</b>										
Black Rockfish	201	98	271	18	33	27	188	18	0	855
Blue Rockfish	0	0	0	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0	0	0	0
Brown Rockfish	2	3	0	3	61	204	1398	0	21	1693
Canary Rockfish	0.3	2	0	0	2	0	0	29	0.1	34
China Rockfish	8	0	0	0	0	0	0	0	0	8
Copper Rockfish	197	3,803	323	804	619	282	394	145	60	6,626
Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	2	0	0	7	0	0	0	0	9
Quillback Rockfish	139	1,292	75	204	503	156	254	90	60	2,773
Redstripe Rockfish	0	0	0	0	0	0	0	0	0	0
Tiger Rockfish	3	7	2	0	0	0	0	0	0	12
Vermillion Rockfish	0	0	0	1	3	1	0	0	0	5
Yelloweye Rockfish	0	4	0	0	0	0	0	0	0	4
Yellowtail Rockfish	10	51	5	0	1	0	0	0	0	67
<b>Total Rockfish</b>	<b>561</b>	<b>5,263</b>	<b>676</b>	<b>1,030</b>	<b>1,229</b>	<b>672</b>	<b>2,234</b>	<b>281</b>	<b>141</b>	<b>12,086</b>
<b>Released</b>										
Black Rockfish	415	454	199	0	12	8	44	0	0	1,133
Blue Rockfish	0	0	0	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0	0	0	0
Brown Rockfish	2	0	0	0	12	205	669	0	136	1,024
Canary Rockfish	10	74	0	10	20	0	0	0	49	160

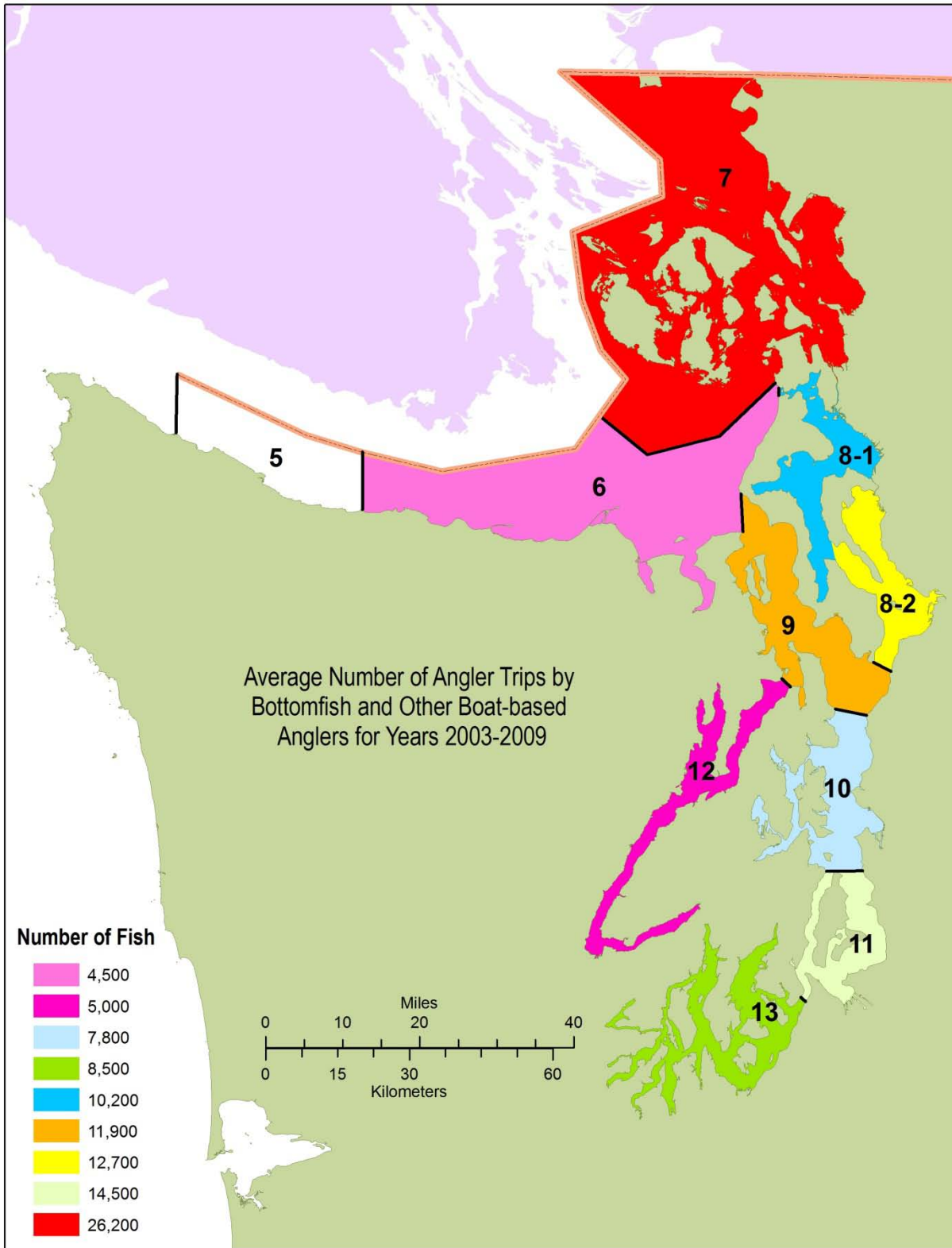
China Rockfish	6	0	0	0	0	0	0	0	0	6
Copper Rockfish	104	5,750	384	734	704	548	464	125	167	8,981
Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	0	0	0	7	0	0	0	0	7
Quillback Rockfish	155	2,595	96	114	543	434	298	0	159	4,394
Redstripe Rockfish	0	2	0	0	0	0	0	0	0	2
Tiger Rockfish	5	0	0	44	0	0	0	0	0	49
Vermillion Rockfish	1	0	0	0	2	0	0	0	20	23
Yelloweye Rockfish	81	122	5	3	4	0	0	0	0	215
Yellowtail Rockfish	19	106	7	0	0	19	62	0	0	212
<b>Total Rockfish</b>	<b>798</b>	<b>9,103</b>	<b>691</b>	<b>905</b>	<b>1,300</b>	<b>1,215</b>	<b>1,536</b>	<b>125</b>	<b>531</b>	<b>16,204</b>
<b>Encountered</b>										
Black Rockfish	617	552	470	18	45	36	232	18	0	1,988
Blue Rockfish	0	0	0	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0	0	0	0
Brown Rockfish	4	3	0	3	73	409	2,067	0	157	2,716
Canary Rockfish	10	76	0	10	19	2	0	29	49	194
China Rockfish	14	0	0	0	0	0	0	0	0	14
Copper Rockfish	301	9,553	707	1,538	1,323	830	857	270	227	15,607
Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	2	0	0	13	0	0	0	0	15
Quillback Rockfish	294	3,887	171	318	1,047	590	551	90	219	7,167
Redstripe Rockfish	0	2	0	0	0	0	0	0	0	2
Tiger Rockfish	8	7	2	44	0	0	0	0	0	61
Vermillion Rockfish	1	0	0	1	5	1	0	0	20	28
Yelloweye Rockfish	81	126	5	3	4	0	0	0	0	219
Yellowtail Rockfish	29	157	11	0	1	19	62	0	0	280
<b>Total Rockfish</b>	<b>1,359</b>	<b>14,365</b>	<b>1,366</b>	<b>1,935</b>	<b>2,529</b>	<b>1,887</b>	<b>3,770</b>	<b>407</b>	<b>671</b>	<b>28,290</b>

**Table 8.** Annual Harvest and Released Catch (in numbers of fish) of Rockfishes in the Puget Sound Distinct Population Segment by Boat-based Anglers Targeting Bottomfish and Other Fish, 2003 to 2009.

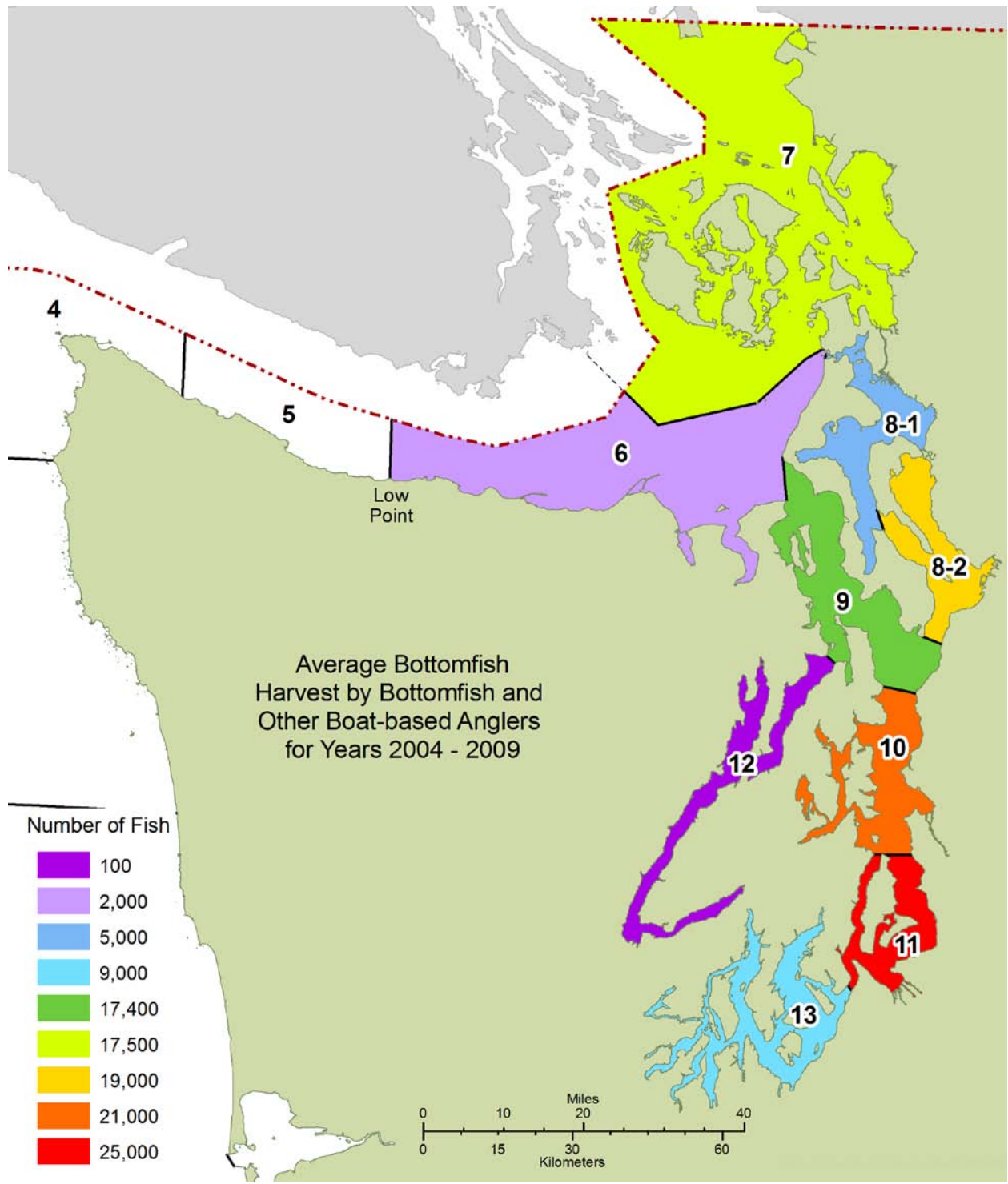
Species	Year						
	2003	2004	2005	2006	2007	2008	2009
<b>Harvested</b>							
Black Rockfish	1,254	748	1,409	732	192	515	1,138
Blue Rockfish	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0
Brown Rockfish	2,492	1,194	2,534	318	3,776	687	849
Canary Rockfish	214	14	1	0	11	0	0
China Rockfish	52	5	0	0	0	0	0
Copper Rockfish	6,797	6,807	5,088	4,938	7,512	7,375	7,867
Greenstriped Rockfish	0	0	0	0	0	0	0
Puget Sound Rockfish	0	0	12	0	50	0	0
Quillback Rockfish	3,102	3,887	2,034	1,657	2,422	2,676	3,631
Redstripe Rockfish	0	0	0	0	0	0	0
Tiger Rockfish	6	11	1	32	0	0	31
Vermillion Rockfish	0	3	20	5	5	0	0
Yelloweye Rockfish	0	0	0	0	30	0	0
Yellowtail Rockfish	9	112	34	88	111	80	35
Total Rockfish	13,926	12,782	11,133	7,770	14,110	11,333	13,551

	2003	2004	2005	2006	2007	2008	2009
<b>Released</b>							
Black Rockfish	728	787	960	1,418	229	630	3,179
Blue Rockfish	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0
Brown Rockfish	3,176	1,383	721	494	84	544	763
Canary Rockfish	0	373	5	0	87	300	354
China Rockfish	0	0	1	0	0	0	38
Copper Rockfish	8,305	8,450	7,844	7,140	7,727	10,553	12,849
Greenstriped Rockfish	0	0	0	0	0	0	0
Puget Sound Rockfish	0	0	0	0	42	0	0
Quillback Rockfish	4,355	7,552	2,548	2,131	3,528	4,941	5,703
Redstripe Rockfish	0	0	0	0	0	0	12
Tiger Rockfish	0	291	0	17	0	0	38
Vermillion Rockfish	0	3	17	0	0	0	137
Yelloweye Rockfish	566	33	314	74	297	78	143
Yellowtail Rockfish	0	6	8	108	378	518	469
Total Rockfish	17,130	18,878	12,418	11,382	12,371	17,564	23,685

<b>Encountered</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Black Rockfish	1,982	1,536	2,369	2,150	421	1,146	4,316
Blue Rockfish	0	0	0	0	0	0	0
Bocaccio	0	0	0	0	0	0	0
Brown Rockfish	5,668	2,576	3,256	812	3,859	1,231	1,612
Canary Rockfish	214	387	6	0	98	300	354
China Rockfish	52	5	1	0	0	0	38
Copper Rockfish	15,102	15,258	12,931	12,078	15,239	17,928	20,716
Greenstriped Rockfish	0	0	0	0	0	0	0
Puget Sound Rockfish	0	0	12	0	92	0	0
Quillback Rockfish	7,457	11,439	4,581	3,787	5,950	7,617	9,334
Redstripe Rockfish	0	0	0	0	0	0	12
Tiger Rockfish	6	302	1	49	0	0	69
Vermillion Rockfish	0	6	37	5	5	0	137
Yelloweye Rockfish	566	33	314	74	327	78	143
Yellowtail Rockfish	9	118	42	196	490	598	504
<b>Total Rockfish</b>	<b>31,055</b>	<b>31,659</b>	<b>23,550</b>	<b>19,152</b>	<b>26,481</b>	<b>28,897</b>	<b>37,236</b>

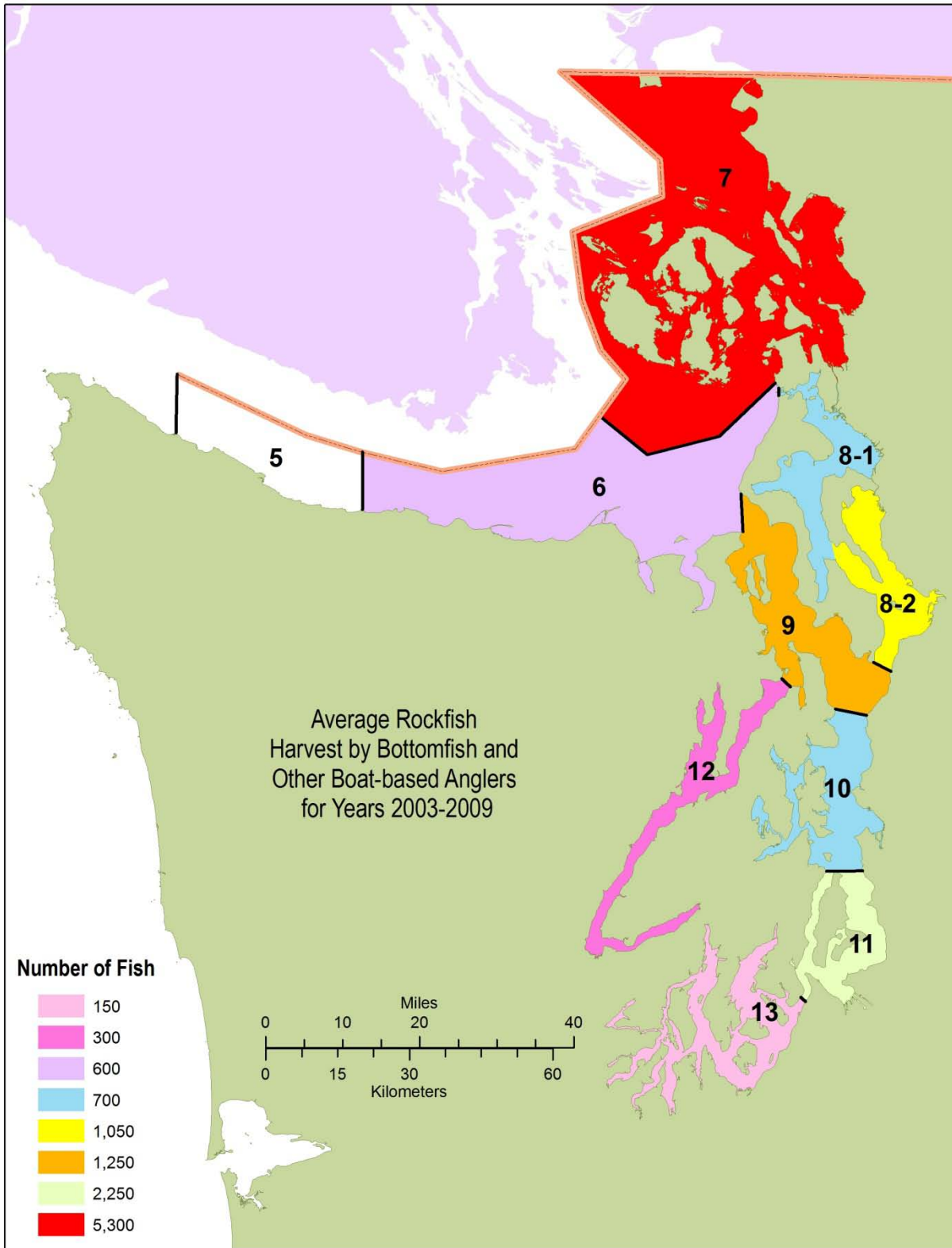


**Figure 8.** Average number of boat-based recreational fishing trips for bottomfish or other fishes by marine catch area, 2003-2009.

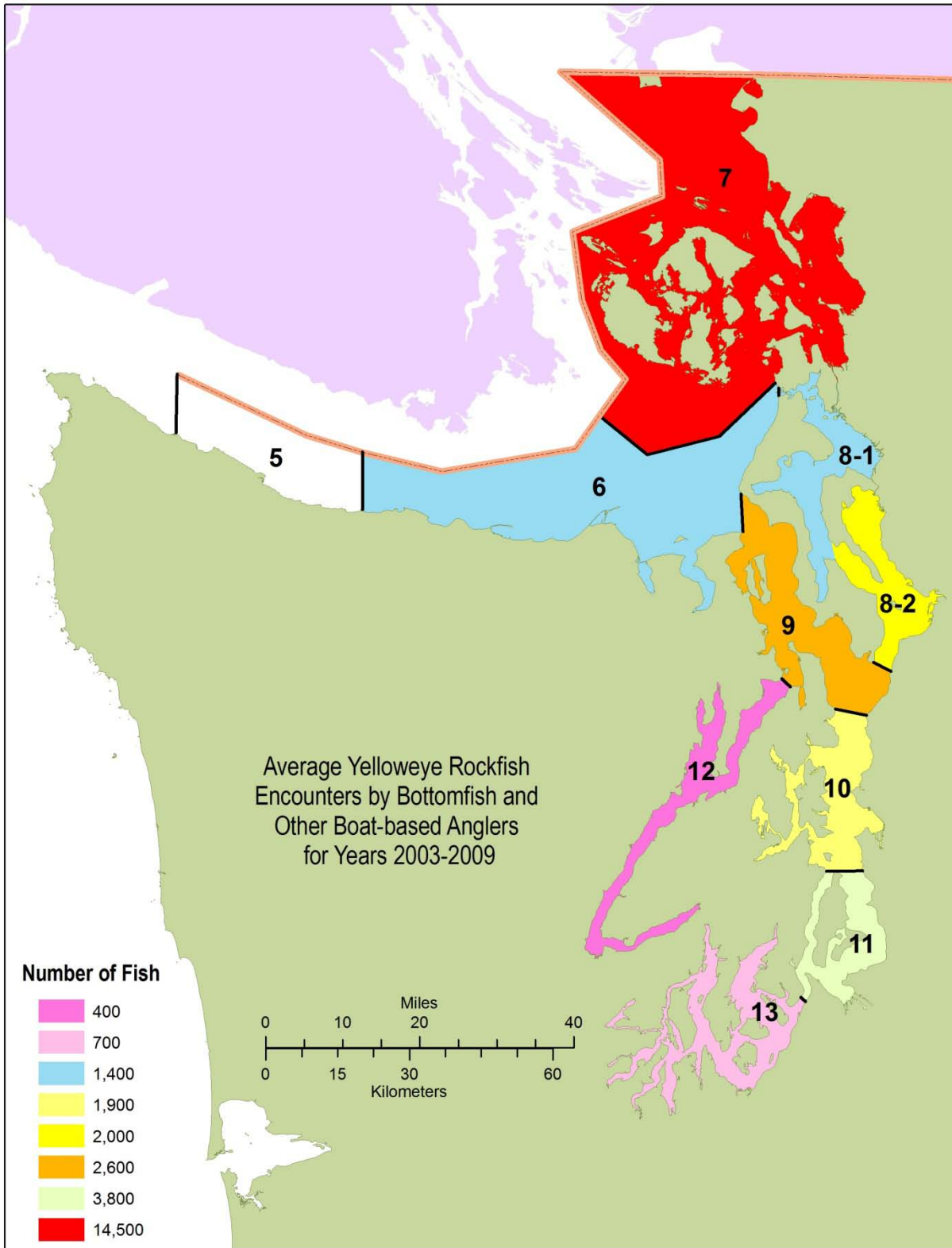


**Figure 9.** Average harvest of bottomfish (in numbers of fish) by boat-based anglers fishing for bottomfish or other fishes by marine catch area, 2004-2009.

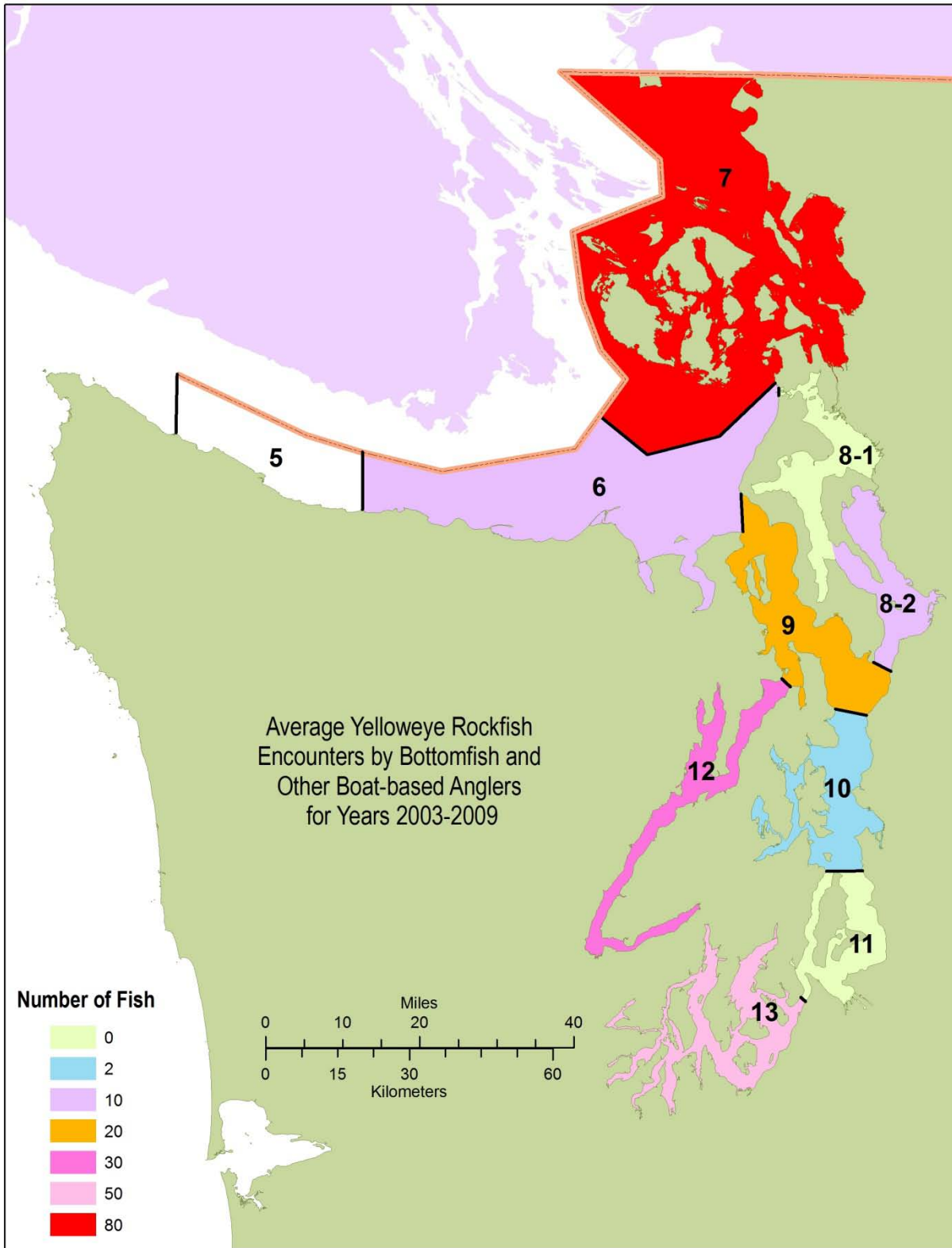




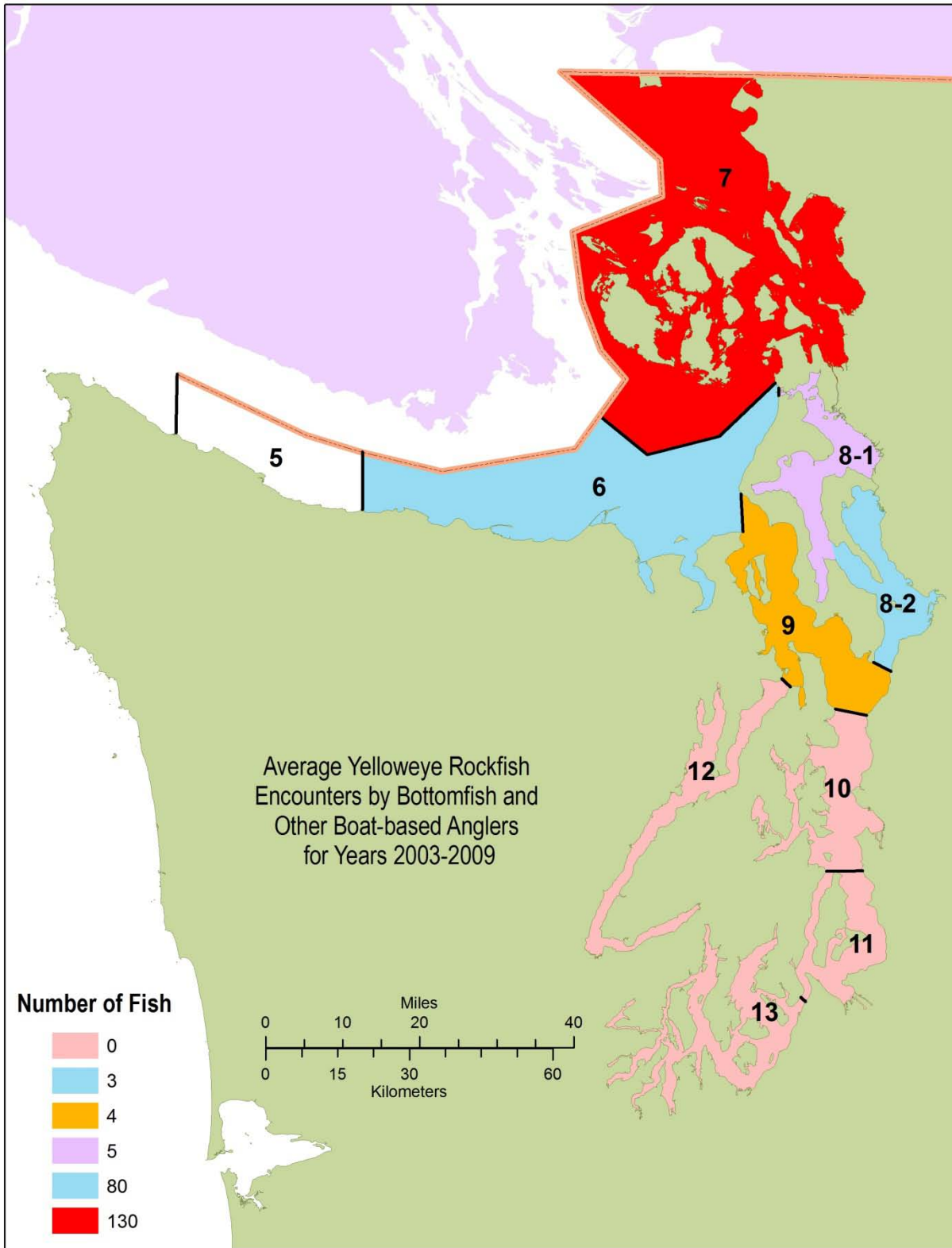
**Figure 10.** Average harvest of rockfish (in numbers of fish) by boat-based anglers fishing for bottomfish or other fishes by marine catch area, 2003-2009.



**Figure11.** Average encounters of rockfish (in numbers of fish) by boat-based anglers fishing for bottomfish or other fishes by marine catch area, 2003-2009.



**Figure 12.** Average encounters of canary rockfish (in numbers of fish) by boat-based anglers fishing for bottomfish or other fishes by marine catch area, 2003-2009.



**Figure 13.** Average encounters of yelloweye rockfish (in numbers of fish) by boat-based anglers fishing for bottomfish or other fishes by marine catch area, 2003-2009.

## Monitoring of Incidental Catch

**Current Catch Monitoring** - Monitoring of recreationally-caught bottomfish in the Puget Sound DPS is part of a larger marine fish catch estimation program (Cheng et al. 2010). There are two survey components to the sampling design: a telephone survey to estimate fishing effort (angler trips) and field-based intercept surveys to estimate catch per unit effort (“CPUE”, catch-per-angler-trip). Effort (numbers of licensed angler trips) is estimated through telephone surveys of licensed anglers. Catch-per-angler-trip and the expansion factor for expanding licensed trips to the total number of trips are estimated through intercept (creel) surveys at sites selected throughout Puget Sound. Catch from charter/party, beach/bank, and manmade structures (e.g. piers, docks, etc.) is not included in these estimates; however, effort from these modes is monitored. WDFW also conducts regular hook-and-line surveys to mimic the behavior of recreational boat-based fisheries. These surveys are used to independently document the encounter rates of salmon and other fishes, estimate tagging rates, and obtain biological information.

### Effort:

Telephone surveys are conducted using a list of license holders generated from the Washington Integrated License Database (WILD) to generate an estimate of angler effort. In the WILD phone interviews, each angler contacted is asked to report the number of trips they made in a 2-month period (wave). For each trip, they are asked the date of their trip; the catch area they fished in; the county, catch area and specific location to which they returned; what gear type they used; the fishing mode used (private/rental, charter/private, etc.) and if fishing from a private or rental boat, the number of anglers on board; the species targeted, and; the time of return. Each phone survey begins about one week after the close of a 2-month wave.

Although CPUE is not estimated for the non- private/rental boat modes, effort for these modes is monitored and estimated (with the exception of smelt fishing effort). Not sampling these modes for CPUE is expected to introduce a small bias (<3% by weight) to the catch estimates. Total numbers of fish may be underestimated, however.

### Catch per Angler-trip Estimation:

Several pieces of information are estimated through creel (intercept) surveys at access sites in Puget Sound by the Puget Sound Sampling Program (PSSP). The primary information obtained is the catch per angler trip and an estimate of the ratio of unlicensed anglers to licensed anglers. This latter ratio is to adjust effort estimates made for licensed anglers and account for the catch and effort by youths fourteen years and younger and for other fishers who do not have a license. Descriptions of the current sampling methods (including data recording sheets) are available in “The Puget Sound Recreational Fishery Sampling Manual” (WDFW 2010). At each access site sampled, anglers leaving the fishing grounds are asked questions about the angler’s catch, mode of fishing, and gear type. Sites and days to be sampled are chosen based on the expected effort at a site, the season (fishery openings), type of day (weekend, Friday, or Monday-Thursday weekday) and time of year. At each site, the sampler attempts to intercept all anglers as they return to port and inspects the angler’s catch to determine the species and number of fish retained.

Since sites and days to be sampled are selected based on expected effort, CPUE estimates are stratified based on sampling intensity: stratified by month, Catch Area where fishing occurred, and day type (weekend/holiday, Monday-Thursday or Friday). This is done to minimize any effects that differential sampling rates may have on the CPUE estimates. The mean number of fish per angler (by species and Catch Area) is estimated for each group of anglers (per boat) intercepted within each level of stratification. Stratification also includes the fishing season (salmon, lingcod, halibut, etc. openings). The most recent phone surveys have included a question asking for the specific site from which the angler launched their vessel (or in the case of land-based effort, where the angler fished). Hence, from the phone survey we can determine where the angler returned at the end of the fishing trip (site where they would be intercepted by the WDFW sampling crews).

During the intercept survey, samplers attempt to interview one angler from each boat that returns to the selected site (launch or marina). At sites where many boats return in a short time period, as many of the returning boats as possible are interviewed. No attempt is made to target certain types of boats (e.g., salmon trips vs. marine fish trips), and the sampler will not be present during the entire day.

During the interview, the individual is asked how many anglers were on board the boat fishing, how many fish were kept and what species, where the catch was caught, and how many fish (and which species) were discarded. The anglers are asked which area they caught each fish. Anglers are shown photos of various fish species to aid in their identification of released fish. Since only boat access sites are sampled, CPUE is available only for the private boat/rental mode.

In recent years, 15% to 21% of angler trips within the DPS have been captured in the intercept survey and this range of sampling effort is anticipated to continue for the term of this conservation plan (Table 9).

**Table 9.** Coverage of the Intercept Survey Within the DPSs Area.

<b>Year</b>	<b>2008</b>	<b>2009</b>
Number of angler trips made	380,339	711,059
Number of angler trips intercepted	81,499	110,277
% Coverage	21%	15%

Source: WDFW unpublished data

Although sampling is conducted at the boat level, in each interview the total numbers of anglers and the total number of fish are recorded. Hence, we have a direct observation of the catch per angler for that boat (interview). Since all fish and all anglers on board are included in the calculation of catch per angler for any given boat, there is no variance of the mean catch-per-angler for any boat – that is, each boat encountered is censused rather than sampled.

Catch Estimation:



Catch is estimated as the product of angler trips and catch per trip (by species and catch area of harvest) within each catch area of intercept, month, fishing season and day type. The sequence of estimation procedure can be outlined in four steps. 1) Recreational saltwater trips occurring in Puget Sound during a given wave (defined as a two-month period), are classified into trip classes by MCA and target species (salmon, halibut, bottomfish, and other). 2) For a given trip class, the following parameters are estimated from the intercept survey: catch per angler trip for each landed species (analogous to CPUE), release per angler trip for each reported species, and the ratio of total angler trips to total licensed angler trips. 3) For each reported trip class, the following parameter is estimated from the telephone survey: mean angler trips per licensed angler (so-called trip-rate). 4) Final estimates of total number of angler-trips are calculated for each trip class as the product of trip-rate, total licensed anglers during a given wave, and the ratio of total angler trips to total licensed angler trips. Final estimates for total catch and total release for each species are calculated as the product of the catch/release per angler trip and the estimated total angler trips. The final estimates for effort and catch are calculated for each trip class reported in the telephone survey. It is to be noted that shore-based and scuba modes are excluded from the estimation.

All the final estimators require input data from both intercept and telephone surveys that must be matched at the trip class level. The missing data case, hence missing estimate, can occur when either (or both) of the surveys is not conducted for some MCAs in a given wave. Any MCA that did not have any fishing activities, based on telephone survey, will be recorded as MCA with zero fishing effort. However, when there is effort estimated by the telephone survey for a given trip class but there are no matching data available from the intercept survey, the missing catch rate was borrowed from the average catch rates from previous year's information for the same trip class.

**Management Steps Taken to Reduce Rockfish Catch** - In May 2010, WDFW imposed substantial new restrictions to reduce the rockfish catch, especially those in deeper waters. The recreational rockfish harvest was eliminated in the Puget Sound DPS, Recreational MCAs 6 to 13, and anglers were prohibited from fishing for bottomfish deeper than 120 feet in Puget Sound. Fisheries for salmon and halibut were not modified by these regulations. WDFW expects that these new restrictions will reduce encounters with rockfish, particularly deepwater species such as ESA-listed rockfish, and change fishery patterns because these deepwater rockfish species are typically in waters deeper than 120 feet.

## Annual Take Estimates for the Recreational Fishery for Anglers Targeting Bottomfish and Other Fish

Because of the new restrictions prohibiting the retention of rockfish by recreational anglers in the Puget Sound DPSs and prohibiting fishing for bottomfish in depths greater than 120', past fishery and catch patterns cannot be directly used to predict the take of ESA-listed rockfish in the Puget Sound DPSs. To estimate take for ESA-listed rockfish, we used the annual patterns of rockfish harvest and release from all Marine Catch Areas lying partly or fully within the DPSs (Table 10), and modified them with observations of capture depth zones in Puget Sound and adjacent waters and modeled barotrauma mortalities for several depth ranges.

**Table 10.** Total Number of Encounters (in numbers of fish) of Listed Rockfishes in the Puget Sound DPSs by Boat-based Anglers Targeting Bottomfish and Other Fish from 2003 to 2009.

	2003	2004	2005	2006	2007	2008	2009	MAXIMUM	AVERAGE
Bocaccio	0	0	0	0	0	0	0	0	0
Canary rockfish	214	387	6	0	98	300	354	387	194
Yelloweye rockfish	566	33	314	74	327	78	143	566	219

Depth-related occurrence and barotrauma mortality rates were obtained from external sources (Table 11). From 1999 to early 2003, a different recreational survey was conducted in Washington. During the Marine Recreational Fisheries Statistical Survey (MRFSS), anglers returning to public boat launches were queried about the depth at which they conducted most of their fishing activity. WDFW obtained these data and extracted records for bocaccio, canary rockfish, and yelloweye rockfish in Puget Sound and associated the observed catch with the angler reported depths ([www.recfin.org](http://www.recfin.org)) and data provided by the Pacific States Marine Fisheries Commission). Bocaccio was not encountered in the Puget Sound MRFSS series, and only six canary rockfish and three yelloweye rockfish were encountered (Table 11). A second source of capture depth information comes from the WDFW Puget Sound Sampling Program. For the past several years, WDFW has asked anglers whether their bottomfish catch was made from depths shallower or greater than 60 feet. We used the results from this information to inform the likely capture rate from depths of 60 to 120 feet (WDFW informed). Other sources were used to identify the depth distribution of the listed species. Richards and Cass (1985) provided catch rates by depth zone from research angling surveys in British Columbia and Richards (1986) used a submersible to determine the depth distributions of small (<20 cm) and large yelloweye rockfish in British Columbia (also within the DPS). The depth specific densities were interpreted from this graph and pooled over both size classes to approximate the proportion of fish shallower than 40 m. Pacunski et al. (in preparation) conducted a comprehensive ROV



survey of the San Juan Islands focusing on rocky habitats and documented the proportion of ESA-listed rockfish in depths greater than and less than 120 feet. Barotrauma mortality estimates were obtained from the Pacific Fishery Management Council (PMFC 2008). These estimates are species specific and were made for several depth zones. The mortality rates for the 0- 60' and 60- 120' zones were averaged together for a single mortality rate for fish caught in less than 120 feet (Table 11).

**Table 11.** Proportion of ESA-listed Rockfishes Shallower than 120' and the Average Barotrauma Mortality from Depths Shallower than 120 feet.

Species	Maximum Proportion shallower than 120 feet (SOURCE)	% Mortality <120'
Bocaccio	0.0 (ALL)	32%
Canary Rockfish	0.33 (or 33%) (MRFSS)	37%
Yelloweye Rockfish	0.25 (or 25%) (WDFW)	39%

SOURCE: WDFW, Richards and Cass (1985), Richards (1986): [www.recfin.org](http://www.recfin.org), and PFMC (2009)

We estimated the likely take of ESA-listed rockfish species by assuming complete compliance with the new regulations enacted in 2010 (Table 12), and note that any anglers not in compliance with state fishing regulations are subject to enforcement. A range of takes was examined based upon the average or maximum encounters from 2004 to 2009 and the depth distribution described above. For canary and yelloweye rockfishes, we estimated the total take for each species by multiplying the average and maximum encounters for all depths by their maximum observed proportions in depths less than 120 feet (Table 12). The take was estimated by using the maximum observed total encounters for each species and applying the depth-of-capture proportions. The lethal take was estimated by multiplying the average and maximum total take by the barotrauma mortality rate for water depths less than 120 feet (Table 12). Because we were concerned that bocaccio will eventually be taken by anglers fishing for bottomfish and other fish as observed in 2010, we included information for bocaccio encounters from the recreational fishery for salmon and the 2010 bocaccio estimate by bottomfish anglers. In 2008, an estimated 47 bocaccio were caught and released by salmon anglers and in 2009, 7 bocaccio were harvested and 124 bocaccio were caught and released. In 2010, 66 bocaccio were released by salmon anglers.

### **Incidental Take Estimates for the Recreational Bottomfish Fishery**

The estimated total take of the ESA-listed rockfish will be limited to the shallow water encounters, and maximum values were considered as the worst case scenario (Table 12b). Under these conditions, no bocaccio would be expected to be caught based upon the above analysis, 64

to 128 canary rockfish would be expected to be caught, and from 55 to 142 yelloweye rockfish would be expected to be caught. Lethal take of canary rockfish could range from 24 to 48 individuals, and lethal take of yelloweye rockfish could range from 21 to 55 individuals. Using the maximum range, we anticipate the annual total take of canary rockfish to be 128 and yelloweye rockfish to be 142, and the corresponding maximum annual lethal take to be 48 and 55 fish, respectively. We used the average encounters from 2003 to 2010 to estimate a potential take for bocaccio in the bottomfish and other fish fishery. This average was 38 bocaccio taken per year. We applied the barotrauma mortality to estimate the lethal take of bocaccio but did not apply the depth encounter rate. We estimate that 38 bocaccio could be taken each year with 12 of these takes being lethal (Table 12a).

These take estimates can only be viewed as approximating the expectation of encounters, barotrauma, and depth of capture. All of these, especially encounter rates, are variable and subject to biases. The data for depth distribution are also sparse. WDFW depends upon the veracity and accuracy of angler reports of released catch which are major component of the encounter rate. Fishers have a poor ability to correctly identify rockfish to species (Bargmann 1981, and recent survey at Neah Bay, WDFW unpublished data). Additionally, reports of released canary and yelloweye rockfish may be confused with released vermilion rockfish which have increased in abundance in recent years in Puget Sound (Palsson et al. 2009). Catch estimates are subject to non-sampling bias, especially under-reporting as observed by Diewert et al. (2005) who found higher proportions of released rockfish in independently observed, released catch compared to released catch reported during creel checks. WDFW encounter rates for listed rockfish are highly variable, ranging from 0 to almost 600 individuals among years (Table 10). Extreme values may be higher than those observed in recent years, or may be higher as recruitment and recovery occurs. Further research is required to document these biases and patterns and the results should be considered in the Adaptive Management Framework.

We estimate an annual maximum bycatch of 42 Puget Sound Chinook salmon by anglers targeting bottomfish (12 anticipated to be lethal). Given the lack of catch records for green sturgeon from the critical habitat for the southern DPS, we do not anticipate any take of this species by the recreational fishery for bottomfish or other fish. Given the lack of catch records for eulachon in Puget Sound by bottomfish or other fish anglers, and based on the methods used by anglers to catch bottomfish, we do not anticipate any take of this species by that fishery.

**Table 12.** Likely Annual Incidental Take Estimates (in numbers of fish) from the Recreational Fishery for Bottomfish and Other Fish. Part A gives take based on average annual encounters and Part B on maximum annual encounters

A. Estimated take assuming average annual encounters (2003-2009).

<b>SPECIES</b>	<b>Total Recent Encounters</b>	<b>Proportion &lt;120'</b>	<b>Projected Take</b>	<b>Mortality &lt;120'</b>	<b>Lethal Take</b>	<b>Non-Lethal Take</b>
Bocaccio	38*	0	38	0.32	12	26
Canary Rockfish	194	0.33	64	0.37	24	40
Yelloweye Rockfish	219	0.25	55	0.39	21	34

B. Estimated take assuming maximum annual encounters (2003-2009).

<b>Species</b>	<b>Total Recent Encounters</b>	<b>Proportion &lt;120'</b>	<b>Projected Take</b>	<b>Mortality &lt;120'</b>	<b>Lethal Take</b>	<b>Non-Lethal Take</b>
Bocaccio				0.32		
Canary Rockfish	387	0.33	<b>128</b>	0.37	47	81
Yelloweye Rockfish	566	0.25	<b>142</b>	0.39	55	87

\*Total Encounters from Table 8, but modified with recreational salmon catch and preliminary 2010 estimates for bocaccio.

Proportion <120' from Table 9

Projected take = (Total Encounters) \* (Proportion less than 120'), but all bocaccio assumed to be shallower than 120'

Mortality < 120 ft from Table 9

Lethal take = (Projected take) \* (Mortality < 120')

Nonlethal take = (Projected take) – (Lethal take)

## **WDFW Marine Fish Research and Monitoring Activities in Puget Sound**

In order to have informed current and future management and conservation of marine fishes, WDFW conducts a number of research and monitoring activities on an annual basis. These activities facilitate adaptive management for the conservation of ESA-listed rockfish within this ITP. Some of these activities have very little potential for incidental take of ESA-listed fish, but are listed and described here because they nonetheless will improve our understanding of ESA-listed rockfish abundance and distribution, as well as the status of the ecosystem in which they live. However, some of the activities have the potential for incidental encounters with ESA listed rockfish. These activities usually involve capturing fish using a net, bringing the captured fish on board a vessel, and obtaining biological information on the target species. Thus far, all of these activities have received section 4(d) take permits for ESA-listed steelhead, Chinook salmon, and summer-run chum salmon. Research activities with the potential for take would receive ESA section 10(a)(1)(A) coverage, and are described here because they may inform future adaptive management for listed species.

During the course of research and monitoring activities, WDFW will implement a number of provisions to minimize the number of incidentally taken ESA-listed rockfish species, as well as reduce injury to caught fish, as applicable. As with past ESA section 10(a)(1)(A) permits, we will adhere to the following protocols for each activity:

1. WDFW must ensure that all ESA-listed species are taken only at the levels, by the means, in the areas, and for the purposes stated in the ITP and according to the terms and conditions of the ITP.
2. WDFW must not intentionally kill or cause to be killed any ESA-listed species covered within the ITP.
3. WDFW must handle all ESA-listed fish with extreme care and keep them in cold seawater to the maximum extent possible during sampling and processing. When fish are transferred or held live, a healthy environment must be provided; e.g., the holding units must contain adequate amounts of well-circulated seawater. When using gear that captures a mixture of species, ESA-listed fish must be processed first in order to minimize handling stress.
4. If WDFW anesthetizes ESA-listed fish to avoid injuring or killing them during handling, the fish must be allowed to recover before being released. Fish that are only counted, and not otherwise handled, must remain in seawater and not be anesthetized.
5. WDFW will use sterilized instruments for all invasive sampling, tissue excisions, and tag insertions for ESA-listed fish.
6. If WDFW unintentionally captures any ESA-listed adult fish while sampling for juveniles, the adult fish must be released without further handling and the take must be reported to NMFS.
7. WDFW must obtain approval from NMFS before substantially changing sampling locations or research protocols.

8. WDFW will notify NMFS as soon as possible, but no later than two days, after any authorized level of take is exceeded or if such an event is judged likely to occur. WDFW will submit a written report detailing why the authorized take level was exceeded or is likely to be exceeded.
9. WDFW will retain possession of any biological samples collected from ESA-listed species. WDFW will not transfer biological samples to anyone (aside from NMFS personnel) not listed in the application without prior written approval from NMFS.
10. A copy of the permit must accompany any WDFW designee that is conducting research or monitoring activities that are authorized by the permit.
11. WDFW will allow any NMFS employee or NMFS-designated representative to accompany field personnel while they conduct the research and monitoring activities.
12. WDFW will allow any NMFS or NMFS-designated representative to inspect any records or facilities related to the permit upon request.
13. WDFW will not transfer or assign this permit to any other person(s) as defined in section 3(12) of the ESA. The ITP ceases to be in effect if transferred or assigned to any other person(s) without NMFS' written authorization.
14. NMFS may amend the provisions of this permit after giving the permit holder reasonable notice of the amendment.
15. WDFW will obtain all other Federal, state, and local permits/authorizations needed for the designated activities, as applicable.
16. On or before January 31 of every year, the permit holder must submit to NMFS a post-season report in the prescribed format describing the research and monitoring activities, the number of listed fish taken and the location, the type of take, the number of fish intentionally and unintentionally killed, the take dates, and a brief summary of the research and monitoring results. Falsifying annual reports or permit records is a violation of this permit.
17. If WDFW violates any permit condition they will be subject to any or all penalties provided by the ESA. NMFS may revoke this permit if the authorized activities are not conducted in compliance with the permit and the requirements of the ESA or if NMFS determines that its ESA section 10(d) findings are no longer valid. "Permit holder" means the permit holder or any employee, contractor, or agent of the permit holder. Also, NMFS may include conditions specific to the proposed research and monitoring activities in the permit.

When ESA-listed rockfish are encountered and cannot be returned to the water live, WDFW will provide to NMFS the following:

- Length of fish
- Precise location of the encounter
- Tissue for genetic analysis
- Preservation of the entire fish or selected organs or tissues.
- Otoliths for age analysis (unless otherwise processed by WDFW).

## **Research Activities without Potential Takes for ESA-listed Rockfishes and Eulachon**

WDFW employs scuba and video survey methods to estimate the relative or absolute abundances of rockfish and other demersal marine fishes. These methods employ visual means to estimate the density of marine fish at selected locations. Changes in densities are used to model changes in population abundance. No species, ESA-listed or otherwise, are killed, removed from the water, or handled during these surveys and disturbance of a fish's behavior is minimal, similar to the impact of a recreational diver. WDFW will continue to conduct these surveys as funding allows. The surveys provide information on the abundance, distribution, and habitat quality for many species of fish, including ESA-listed species of rockfish. Past results of these surveys have been used by NMFS to evaluate potential ESA-listed species (Federal Register 2009) and WDFW anticipates that future results will be useful to monitoring the current status and future recovery of ESA-listed rockfish.

Surf smelt (*Hypomesus pretiosus*), Pacific herring (*Clupea pallasii*), and Pacific sand lance (*Ammodytes hexapterus*) are important forage species for seabirds and other fishes, and smelt and herring are targeted in several small commercial and recreational fisheries. Smelt and sand lance are beach spawning fish that are difficult to assess because they are either difficult to catch or are found almost exclusively in the extreme nearshore zone. WDFW will explore and evaluate methods to assess surf smelt and sand lance populations in Puget Sound and will collect biological information from Pacific herring. Smelt and sand lance assessment methods will be evaluated using beach seine and surface tow-net gear (Nordic surface trawl) through field-based testing in areas of north Puget Sound where most commercial harvest of surf smelt currently occurs. For herring, we will use a variable mesh gill net in nearshore spawning areas to collect specimens for biological samples. The biological information and the assessment techniques will fulfill requirements and needs for WDFW to successfully implement the Puget Sound Forage Fish Plan and to manage sustainable fisheries on healthy populations of forage fish. These activities would be covered under ESA 4(d) Research Permits.

## **Take of ESA-Listed Fish by Research and Monitoring Activities for Characterizing Marine Fish Populations**

### **Acoustic-Trawl Surveys**

Acoustic-midwater trawl studies for Pacific herring (*Clupea pallasii*) and Pacific hake (whiting, *Merluccius productus*) are designed to estimate the abundance of these pelagic species in key areas of Puget Sound and to obtain important demographic information. The trawl component of the survey has the potential to capture (incidentally take) several listed species in the Puget Sound DPSs including Chinook and chum salmon, steelhead, eulachon, bocaccio, canary

rockfish, and yelloweye rockfish. Any listed species will be handled and released, except rockfish specimens will have genetic and other tissue sampled removed before release.

WDFW conducts midwater trawl surveys to estimate the abundance of Pacific hake (whiting) and Pacific herring in the inland marine waters of Washington (Puget Sound and adjacent water bodies) using scientific acoustic technology coupled with midwater trawling. For both species, the goals are to characterize the population abundance and biological characteristics in key basins and holding areas. Specific objectives are to: 1) Estimate the abundance with scientific echosounders: 2) Obtain species composition information on concentrations of herring and hake from trawl samples: 3) Collect and analyze age, length, genetic, and other biological information from captured specimens: 4) Evaluate population trends in comparison to surveys conducted in the past; and 5) Provide information on population trends and management issues to local, state, tribal, and federal fishery and ecosystem managers and scientists. Other benefits of the survey are to collect biological and distribution information on other marine fish species including protected species. During certain years, we may partner with the PSAMP Fish Toxics unit to analyze the chemical contamination and pathology of Pacific herring and other pelagic species.

The coordinated survey is conducted from two vessels in defined and usual areas where these species are concentrated for spawning. While the equipment and procedures are similar for the two species, the surveys differ in timing, areas, and depth ranges. Each area may be surveyed several times per season. Acoustic-trawl surveys for Pacific herring occur from January to May at approximately twenty known herring spawning areas (Figure 14). Hake surveys are focused on Port Susan, Port Gardner, Saratoga Passage, and Hood Canal between February and April during the spawning period. Herring surveys are generally conducted in the upper water column shallower than 60 m while the hake surveys focus hake schools in waters deeper than 70 m.

The acoustic survey consists of a Biosonics 120 scientific echosounder fitted with a 105 Khz single beam transducer. This was one of the first units and examples of a sonar to integrate and quantify the echo returns to relate to the relative acoustic strength of a volume or area of nekton. The survey vessel is piloted along preselected zig-zag or parallel transects over defined survey areas known to contain pre-spawning hake or herring and the returned sonar signals are recorded over a measured area. These measurements are averaged for each transect then averaged again to represent the mean acoustic density of the nekton. The acoustic density is converted to biomass with a target strength of -33 dB/kg for adult herring and -36 dB/kg for adult hake. The total survey area is then multiplied by the biomass density to estimate the acoustic abundance of the nekton. Information from the midwater trawl is then applied to this abundance estimate to apportion species and length composition.

Midwater trawling operations are conducted from a 58' steel fishing vessel that is used to tow a midwater rope trawl. The rope trawl has meshes ranging in size from 0.8 m at the throat, and mesh sizes decrease to 3.8 cm at cod end of the net. There is a liner in the codend that consists of 1 cm knotless mesh. The net is held open by steel doors developed for midwater trawling.

The net is deployed at targets identified by a second vessel conducting the acoustic survey. The paired towing cables are paid out based upon the relationship of observed net depth to vessel speed that are based upon previous studies. Net position is measured by depth-time sensors attached to the net that provide a record of the net's vertical location after the tow. Depending upon the intensity of the acoustic sign and the required sample size, the net is towed for a duration of 10 minutes to 2 hours at a speed of two to three knots. The cable and net are then retrieved and the catch is placed into a bin to be either entirely processed or a random sample processed to represent the catch. The entire catch is weighed and the processed catch is separated into species which are counted and weighed. Random or systematic samples are taken for length measurements, age structures, and other biological analysis. Except for biological samples, the entire catch is returned to the water. When targeting herring, the net is typically fished between a depth of 20 and 60 m. When targeting hake, the net is fished in depth ranges from 30 to 80 meters. If herring or other species are taken for chemical or pathological analysis, PSAMP procedures will be followed for tissue sampling.

We do not directly target salmonids, rockfishes, eulachon or other listed species during the acoustic-midwater trawl survey, and most of these species tend to be rare in the catch (Table 13). Chinook salmon occur in approximately 25% of the trawl samples, eulachon in less than 1%, but listed rockfish have not been recently encountered. Most salmonids are directly released in a vital condition or held on board in a tank with running seawater until they are re-oriented and then released. Approximately one quarter of the salmonids do not recover and appear dead. The midwater trawl has the potential to capture canary, yelloweye, and bocaccio rockfishes, and eulachon. These specimens typically encounter severe barotrauma and should be considered mortalities, and after sampling for genetic, age, and other tissues, the carcasses are returned to the water. Because the net fishes off of the bottom, there is little likelihood of capturing a green sturgeon.

Acoustic sampling has no known effects on insonified fish with the frequencies and power of scientific echosounders used in our surveys. The midwater trawl will capture fish, most of which will be sacrificed. Each trawl sample may catch several hundred kilograms of fish, and single catches occasionally range up to 1 or 2 tons of herring, hake, spiny dogfish, flatfishes, and several salmon at times. During each year, ten tons of fish might be captured. Past performance of the herring survey indicates a salmon encounter rate of 1 salmon in every 8 tows (Table 13). We have not captured steelhead, bocaccio, yelloweye rockfish, canary rockfish, green sturgeon, seabirds, or marine mammals during the past ten years. Eulachon have been taken in midwater trawls for herring in the Strait of Georgia.

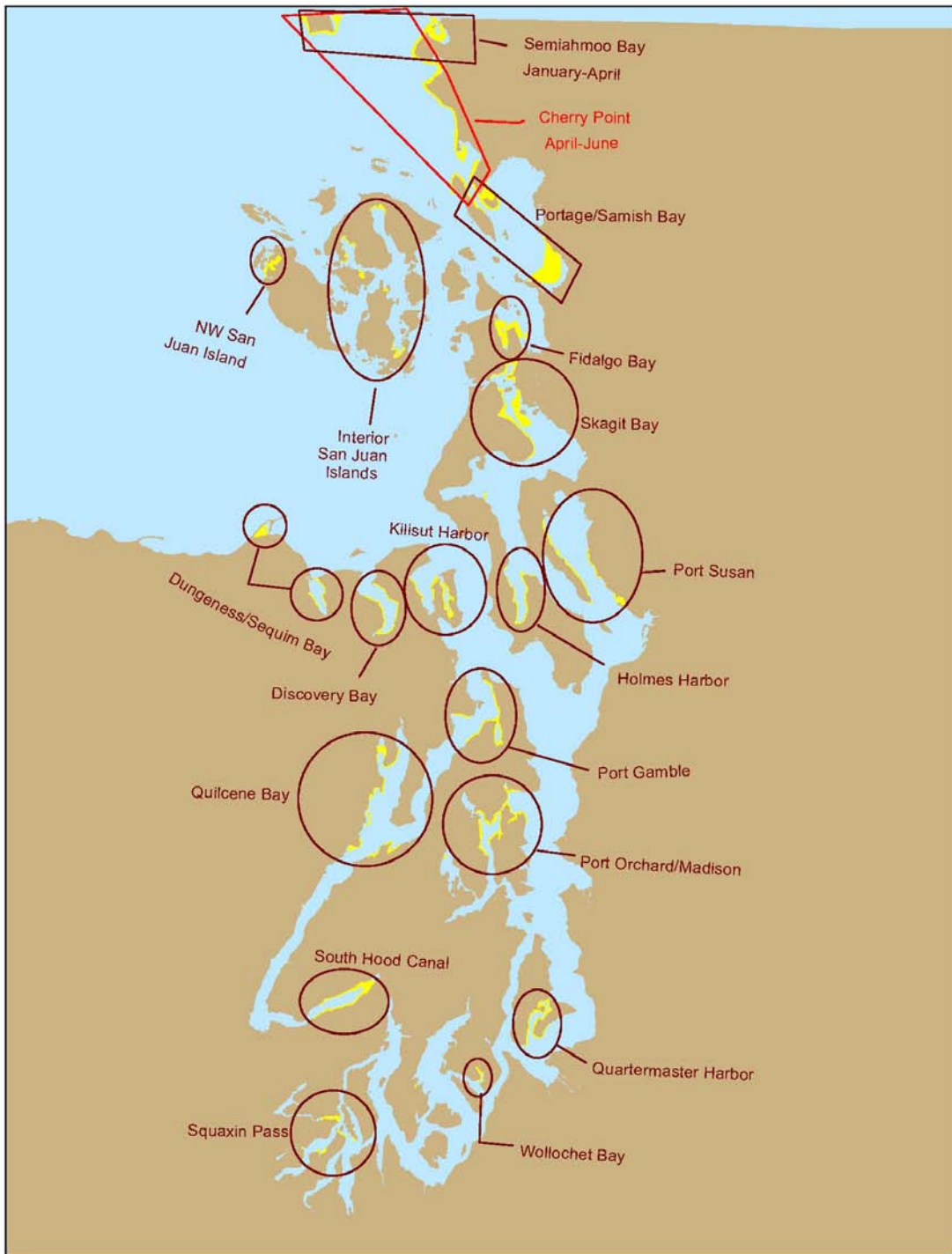
When salmon are captured, one of two procedures is conducted to minimize impacts. If a salmon is observed caught in the net, the net is winched to the transom and the fishing crew carefully cuts the webbing to release the salmon back into the water. If salmon are mixed in the catch, they are either immediately removed by hand and returned to the water or held in a flow-through seawater tank until oriented. They are then returned to the water by transferring them



with a smaller container. Holding the fish in running seawater often does allow for the fish to become re-oriented, however, they often suffer substantial scale loss and may have net marks. We consider adult salmon to be fish 24 inches or greater in length.

Rockfish and eulachon are usually not viable upon capture. If any bocaccio, yelloweye rockfish, canary rockfish, or eulachon are captured, they will be weighed and measured, and a fin clip, otoliths or other tissues may be removed for later analysis. After sampling the carcasses will be returned to the water. Genetic, age, and other samples and tissues will be held by WDFW's Genetics, Ageing, and marine fish laboratories. We often receive requests for sharing tissues and we make these tissues available for WDFW, NMFS, and other scientists.

For rockfishes, we determine maturity using maturity-at-length estimates from the literature. For bocaccio, Canadian assessments identify the 50% maturity between 55 and 60 (57.5 cm). For canary rockfish, the 50% maturity is 40.5 cm based upon West Coast assessments, and for yelloweye rockfish, 39 cm is the reported length-at-maturity in a study from the Oregon coast. Eulachon mature at 17.5 cm in the Columbia River, but this length increases farther north this species occurs. WDFW's intended annual incidental takes of ESA-listed fish are based upon past catch rates, maximum takes within a season, the possibility of encountering a listed species, and anticipated sampling activity during the next five years (Table 14).



**Figure 14.** Principal herring spawning locations in Puget Sound.

## **Puget Sound Bottom Trawl Surveys**

Each year, WDFW conducts a systematic index survey of Puget Sound with a bottom trawl. These surveys are conducted in the eight sub-basins of Puget Sound; West and East Strait of Juan de Fuca, the Strait of Georgia, the San Juan Islands, central Puget Sound, Hood Canal, the Whidbey Basin, and Southern Sound (Figure 15). Surveys were conducted at infrequent intervals from 1987 to 2000 but have been conducted annually since 2000. At other times, WDFW may conduct stratified-random surveys or special studies to evaluate the performance of the bottom trawl, the trawls impact on the substrate, or for comparison to ROV studies. The purposes of the bottom trawl index survey are to (1) Estimate the relative numerical and biomass abundance of groundfish and macro-invertebrates in the basins of Puget Sound over time, (2) Obtain distributional and biological information from key marine resources, (3) Provide other Puget Sound agencies and entities information about the ecosystem status of bottomfish; and (4) Provide data to fishery managers regarding the productivity and fishery potential of key bottomfish species. Abundance indices are estimated from trawl stations and provide a time series of population trends for Pacific cod, flatfishes, spotted ratfish, and other economically or ecologically important marine fishes in Puget Sound. We are testing the null hypotheses that abundance does not vary over time, among regions, or among depth zones. Resulting information may be used to determine the status of groundfish stocks, the biology and distribution of key and minor groundfish species, foodweb and ecosystem model inputs, and commercial and recreational fishery management. Biological samples are taken from key species and include length measurements, age structures such as otoliths and bones, stomach samples, and genetic tissues. Results from these samples provide scientists and managers information about the demographic structure of populations, growth rates, genetic structure, and food web relationships.

The index survey is conducted from a chartered fishing vessel that is used to deploy a research bottom trawl twice at 51 pre-selected, permanent stations. The stations are stratified by depth and were initially selected at random within one of four depth zones: 5 to 20 fathoms, 21 to 40 fathoms, 41 to 60 fathoms, and greater than 60 fathoms. The bottom trawl is a 400 mesh Eastern Trawl fitted with a 3 cm mesh liner. The net is attached to heavy steel doors (~400 kg/door) on each side and the entire assembly is towed along the seafloor for a distance of up to 0.74 km at a speed of 2 knots. The typical trawl duration is 10-12 minutes, but may be as short as 5 minutes or up to 20 minutes depending upon current and weather conditions encountered at each station. Afterwards, the net is retrieved and the catch is placed on a sorting table. The catch is then carefully sorted, and each fish and most invertebrates are identified to the species level. Each taxon is weighed and counted or sub-sampled for expanded counts. When catches are large, only a random portion of the catch is processed and the remainder is weighed and returned to the sea. Unless the catches are exceptionally large, we will select all ESA species within the catch, or if necessary, expand the subsample to represent the entire catch. Selected species of interest are

sampled for length, age, genetic, and other biological data and some specimens may be retained, otherwise, the catch is returned to the water. Additional trawl stations may be occupied or stations repeated if problems are encountered during fishing operations.

Stratified-random surveys and special studies will occasionally be conducted to estimate regional abundances and to evaluate the performance of the trawl and other gear. Stratified-random surveys differ from the index surveys by randomly selecting new stations to sample within a region and within a stratum. Usually 40 to 50 stations are sampled within a region and are sampled within a two-week period. Otherwise, the sampling methods are the same. We may conduct comparative trawl versus remotely-operated vehicle surveys on trawlable habitats in the San Juan Islands or in other regions. An ROV will transect systematically selected stations and the bottom trawl will follow the path of the ROV as closely as possible.

The bottom trawl survey targets demersal fishes and invertebrates. During the course of the survey, we will capture 10 to 20 tons of fishes and invertebrates representing approximately 50 to 100 fish species and up to 50 invertebrate species. Specimens are identified, weighed, counted, and many are measured for length or other biological information.

Since 1987 we have conducted 1,713 trawl sets in Puget Sound and have encountered 22 Chinook salmon, one green sturgeon, six yelloweye rockfish, 26 canary rockfish, and 2,134 eulachon (Table 13). All but 19 canary rockfish were in their respective DPSs. About half of the Chinook salmon are dead or severely impaired. About 75% of the Chinook held in live tanks become re-oriented and appear to be viable upon release, however, the remaining fish may have severe scale loss or lacerations from the net. The single green sturgeon was very vital upon release. Captured rockfishes generally show signs of severe barotrauma and are either dead or unlikely to survive if returned to the water. Eulachon also suffer from handling and are dead. We have never captured or had direct encounters with killer whales, other whales, pinnipeds, bocaccio, chum salmon, bull trout, or steelhead. WDFW's intended annual incidental takes of ESA-listed fish are based upon past catch rates, maximum takes within a season, the possibility of encountering a listed species, and anticipated sampling activity during the next five years (Table 14). We anticipate our capture rates to be similar during our future trawling operations and takes will vary with the number of trawls we conduct each year, typically from 102 to 200 trawl samples. Because canary rockfish is a schooling species, we list 10 specimens per year as a potential take.

If a salmon is observed caught in the net upon retrieval, the meshes around the fish are cut and the salmon returned to the water. The catch is immediately observed for salmon, and any salmon is taken by hand is held in flowing seawater tanks until oriented and then returned to the water. We measure or estimate the length of all salmonids. We are unable to distinguish between un-marked hatchery and natural run salmon and steelhead, and we do not want fish to detect a coded-wire tag. We note whether the adipose fin has been clipped to determine the wild or hatchery origin. Salmonids greater than 24 inches in length are considered mature.

Eulachon are relatively fragile and are dead upon retrieval from the trawl. The carcasses are returned to the water after opportunistic tissue sampling and measurement. Any green sturgeon will be held in a live tank until re-oriented or if obviously vital, immediately returned to the water. Yelloweye and canary rockfish and bocaccio are subject to extreme barotrauma upon retrieval from the trawl. They are dead upon retrieval, sampled for biological information, and released to the water.

Genetic, age, and other samples and tissues will be held by WDFW's Genetics, Ageing, and marine fish laboratories. We often receive requests for sharing tissues and we make these tissues available for WDFW, NOAA, and other scientists.

### **Puget Sound Assessment and Monitoring Program (PSAMP)**

In cooperation with the Puget Sound Partnership, the Washington Department of Fish and Wildlife is a participant in the Puget Sound Assessment and Monitoring Program (PSAMP), a multi-agency effort to monitor the health of Puget Sound. The WDFW effort is a long-term (1989 to present) ongoing study of contaminants in biota of the inland marine waters of Washington State. Specific goals are to (1) Assess the status and spatial and temporal trends of chemical contamination in Puget Sound fishes, invertebrates and plankton, (2) Assess the effects of contamination on the health of Puget Sound fishes, invertebrates and plankton, and (3) Provide information that can be used by health care professionals to assess if Puget Sound seafood is safe to eat. Levels of tissue contamination, frequencies of pathological disorders and biological effects are monitored for selected biota from the North and South Puget Sound, Admiralty Inlet, Hood Canal, Strait of Juan de Fuca and Strait of Georgia (Figure 16). Long-term results help to characterize the study areas by degree of tissue contamination, pathological disorders, and biological effects. This characterization will serve as an indicator of the effects of contamination on Puget Sound biota and will allow evaluation of the potential impacts that consumption of that biota has on human health. PSAMP scientists and technicians primarily collect fish with a trawl and fixed and focused stations on a biennial basis. Fish are then dissected for blood, liver, bile, otolith, and other tissues of interest. Tissues are then sent to laboratories for chemical and pathological analysis. Other studies may arise focusing on specific areas or sites or on ecosystem effects of chemical contamination. Results are analyzed for geographic and temporal trends and are integrated into scientific papers and as a dashboard indicator for the Puget Sound Partnership.

To meet its objectives, the PSAMP Survey staff conducts a bottom trawl survey during odd years 2011, 2013, and 2015. This survey makes use of a research bottom trawl and a chartered fishing vessel to sample at fixed locations and places of interest to collect English sole (*Parophrys vetulus*) and other species of interest. English sole is a well-studied species used to model the

fate and impact of toxic contamination in Puget Sound. Scientists sample tissues from specimens in order to determine tissue concentrations of contaminants and the pathology of tissues including liver and gonads. Sampling sites are distributed among four Puget Sound Marine Zones including two stations in North Puget Sound at Vendovi Island and the central Strait of Georgia, one station at Port Gardner in the Whidbey Basin, one station in northern Hood Canal, and six stations in south Puget Sound including Nisqually Reach, Commencement Bay, Sinclair Inlet, Elliott Bay, Duwamish River and Eagle Harbor. In addition, the PSAMP Survey may develop new studies to understand the fate and pathways of pollutants at specific sites, over time, and with different restoration techniques. Such studies may be to collect plankton, forage fishes, benthic and pelagic fishes, and partner with wildlife researchers to determine the origin, fate, and effects of chemical contaminants in the food web.

English sole is the primary target of this study and is collected with the bottom trawl. Other species sampled by the bottom trawl may be analyzed on an opportunistic basis. Specimens will be collected with a 400-mesh Eastern otter trawl equipped with 5-inch cookie gear (tightly packed, non-moving, rubber disks, installed on the footrope to reduce both wear and snags). The net is primarily a commercial net with synthetic twine making up 10 cm meshes. The codend of the net contains a liner with a mesh size of 3.2 cm. The net is towed for 5 to 20 minutes at a speed of 2 to 3 knots, at depths ranging from 5 to greater than 60 fathoms. The various fish and invertebrate species caught may be sorted by species, counted, and weighed; non-target species may be released immediately. Tissue or whole body samples are taken from species for contaminant analysis. Fish and invertebrates taken for contaminant analysis may be held in a live tank until they can be processed. Tissue samples are either taken in the field or the organisms are held on ice or frozen for transport to the lab for tissue resection.

At each baseline station, fish processing will begin on the vessel. One hundred twenty live English sole will be randomly selected from the holding tank, assigned a sequential FishID number and in the order they are processed, assigned to six muscle tissue composite groups (20 fish per group). All fish will be measured and age structures removed for age determination.

For the first sixty English sole or other fish selected, the FishID number, composite group, length, sex and maturity of each individual is recorded on a Specimen Form. From the 60 fish, the first 20 males and 5 females, will have blood drawn. Then, using clean techniques, each fish will be dissected to collect liver and gonad tissue for histology, liver tissue for chemistry (RNA analysis), and from those fish with sufficient bile, composite samples will be compiled according to the corresponding muscle tissue composite groups. To facilitate sample collection, the internal organs are to be removed and placed on a clean surface and once sampling is completed they are disposed of (unless needed for other purposes). Once processing is completed for a fish, the carcass is placed in an individual ziplock bag along with its corresponding FishID label, then bagged with its composite group and frozen.

Once the dissections are completed, a second group of 60 fish are to be randomly selected from the holding tank, assigned FishIDs and assigned to muscle tissue composite groups. They are then bagged individually in ziplock bags, along with their corresponding FishID tag, bagged by composite group and then frozen. The Specimen forms list both the FishID numbers and identify the composite groups to which the fish are assigned, and must accompany the fish back to the lab.

Blood is collected from live English sole (immediately after removal from the live tank) and opportunistically from rockfishes using syringes to draw it from the caudal vein. To ensure that the blood does not coagulate during processing, the syringes must be pretreated with an anticoagulant: English sole - 3cc syringes (23G1 needles) treated with heparin, rockfish - 3cc syringes (1½ 21GTW IV needles) treated with ethylenediaminetetraacetic acid (EDTA). It is critical that each rockfish syringe contain at least 10 µl of EDTA per ml of blood (a small puddle). Once a blood sample is drawn, using an auto-pipette, add 10 µl of 0.1 M (molar) Phenylmethylsulfonyl Fluoride (PMSF) per cc of blood. The samples are then spun in a centrifuge (3,000 rpm) to separate the plasma and red blood cells. For each sample, using a squeeze bulb pipette, the plasma is drawn off, split into 2 or 3 aliquots (up to 0.5 ml per aliquot) and held at -20°C until analysis.

At each station, 3 bile composite samples are to be compiled, each composed of bile from up to 20 fish, with one or two drops of bile from each fish. Each bile composite sample corresponds to a muscle tissue composite sample (i.e. the fish which comprise a bile composite sample will be used to make up most or all the corresponding muscle tissue composite sample: some of the fish in the muscle composite may not have bile to contribute). For the 2011 survey, bile is added to the composite, the remaining bile from each fish will be used to make up individual bile samples.

Bile is extracted using a tuberculin syringe and placed in an amber glass vial. Great care must be taken to draw only bile into the syringe, avoiding tissues and exterior fluids. Within a composite sample, each fish is to contribute an equal amount of bile (equal number of drops). The samples must be kept on ice during processing, after which they are frozen and kept in the dark.

A liver and gonad section will be taken from each English sole dissected on the boat. Both tissue sections are to be placed together in a tissue cassette that is labeled with the FishID and preserved in Dietrich's solution (up to 30 cassettes per 2000 ml jug).

In general, with the liver lying shiny side up, a 3 to 4 mm wide cross-section through the entire depth is excised across the anterior/posterior axis at the center of the liver at its broadest point. To ensure proper fixation, one dimension of the sample should not exceed 4 mm in thickness. The sample is positioned in a tissue cassette with the shiny edge towards the top of the cassette. Prior to sectioning, each liver is scanned for grossly visible abnormalities, with particular attention paid to abnormal foci and nodules. Anomalies are to be described on the Specimen Form under Observations. When visible abnormalities are present, the tissue section is taken at

the border between the normal and abnormal tissue and includes both types of tissue. If more than one type of abnormality is visible within a liver, each is described and sampled. Multiple sections are to be coded separately (e.g. 042134A and 042134B) to ensure that histological preparations will be related to the specific gross observation. For a gonad section, the whole gonad is taken for small males, a section in larger males and a midsection for females. The section taken from the female gonad should also be cut and laid open so as to expose the interior of the gonad to the preservative.

From the remaining liver tissue, a small section is to be excised and placed in a cryovial that has been prefilled with 1 ml of RNA stabilization solution "RNAlater". A set of designated tools will be used to excise and handle the liver-RNA sample and will be wiped/cleaned with propanol between fish to prevent cross-contamination.

Once the bile, liver and histology samples are taken, the carcasses are then bagged individually in ziplock bags along with a FishID label and frozen. The cassette storage bottles should be inverted regularly to remove any air bubbles trapped in the tissue cassettes.

No listed (threatened) species are targeted in our sampling effort. Of the listed species, those that could potentially be encountered in this survey are Chinook salmon (hatchery and wild juvenile and adults), steelhead, eulachon, bocaccio, yelloweye rockfish, canary rockfish and green sturgeon. Of these, the PSAMP program captured a total of 30 Chinook salmon, 1 yelloweye rockfish and 26 eulachon in 1,158 bottom trawl efforts over a 13 year period (1989 through 2001). No steelhead, canary rockfish, bocaccio, or green sturgeon were captured during that period or since (Table 13). Since 2002, only one eulachon was captured in 2011 in the Duwamish River.

Any listed species encountered will be handled and may be sampled for tissues and/or age structures prior to release back into the water. Some indirect mortality may occur as a result of barotrauma or the handling process. Chinook salmon and eulachon are occasionally caught and yelloweye rockfish are infrequently caught in this gear. Our request also includes a small allotment for steelhead, bocaccio, canary rockfish and green sturgeon since there is the potential for capture. About half of the captured Chinook salmon are dead or severely impaired. About 75% of the Chinook held in live tanks become re-oriented and appear viable upon release, however, the remaining fish may have severe scale loss or lacerations from the net. The single green sturgeon captured by the WDFW Bottom Trawl Survey was very vital upon release. Captured rockfishes generally show signs of severe barotrauma and are usually dead or unlikely to survive. Eulachon also suffer trauma from capture and handling and are dead. We have never captured or had direct encounters with killer whales, other whales, pinnipeds, bocaccio, chum salmon, bull trout, or steelhead. We anticipate our capture rates to be similar during our future trawling operations, and that takes will vary with the number of trawls we conduct each year, typically from 20 to 30 trawl samples. WDFW's intended annual incidental takes of ESA-listed fish are based upon past catch rates, maximum takes within a season, the possibility of



encountering a listed species, and anticipated sampling activity during the next five years (Table 14). Because canary rockfish is a schooling species, we list 5 specimens per year as a potential take.

If a salmon is observed caught in the net upon retrieval, the meshes around the fish are cut and the salmon returned to the water. The catch is immediately observed for salmon, and any salmon is taken by hand and returned to the water or is held in flowing seawater tanks until oriented and then returned to the water. We are unable to distinguish between un-marked hatchery and natural run salmon and steelhead. Any green sturgeon will be held in a live tank until re-oriented or if obviously vital, immediately returned to the water. Eulachon are relatively fragile and are dead upon retrieval from the trawl. They are returned to the water after opportunistic tissue sampling and measurement. Yelloweye and canary rockfish and bocaccio are subject to extreme barotrauma upon retrieval from the trawl. They are dead upon retrieval, sampled for biological information, and released to the water. For salmonids, we note whether the adipose fin has been clipped to determine the wild or hatchery origin but we do not "wand" the fish to detect coded wire tags. For Chinook and chum salmon caught in marine waters, we are classifying them as either "adult" or "juvenile". As defined by the WDFW Sport Fishing Regulations, adult Chinook are fish 24 inches or more in length and adult chum are 12 inches or more in length. Fish that are less than these lengths we deem juveniles. During the sorting of a catch, if a listed species is seen, it is placed immediately into a live tank and held for observation. After a period of recovery, fish that display "normal swimming activity" are returned to the water.

### **Biological Sampling of Puget Sound Groundfish**

The Washington Department of Fish and Wildlife co-manages over 150 species of groundfish in the inland marine waters of Washington State east of Cape Flattery, here defined as Puget Sound. WDFW manages groundfishes in Puget Sound under the auspices of the Puget Sound Groundfish Management Plan and is a regulatory agency charged with the sound stewardship of Washington fish and wildlife resources. With federal, tribal, and academic partners, WDFW continues to learn more about the stock structure, life history, biology, and foodweb relationships of these poorly known species by conducting routine and specialized sampling. The primary sampling method for the Biological Sampling of Puget Sound Groundfish is hook-and-line capture of specimens that may be sampled for a tissue, held for broodstock, or sacrificed for more in-depth analysis. The primary species of interest are lingcod, greenlings, flatfishes, greenlings, wolf-eels, rockfishes, and codfishes. During the next two years, we will be partnering with NOAA's National Marine Fisheries Service to examine the genetic structure of Pacific cod populations in Puget Sound and will partner with University of Washington professors to examine the stock structure of black rockfish (*Sebastes melanops*). During the next five years, we anticipate conducting a diet analysis of lingcod in central and southern Puget Sound, movement studies of rockfishes, and life history studies of a variety of marine species in order to determine growth rates, maturity patterns, food habits, and movement patterns. The

potential ESA-listed species in the Puget Sound DPSs include Chinook salmon, bocaccio, canary and yelloweye rockfishes.

Under the biological Sampling of Puget Sound Groundfish Program, we plan to use hook-and-line angling as the primary method to collect and sample the adult and juvenile phases of rockfishes, lingcod, Pacific cod, flatfishes, and other groundfish species. We will not target bocaccio, canary, or yelloweye rockfishes and will reduce their probability of capture by restricting our scientific angling activities to water depths less than 39 m (120 feet), the same restriction that is in place for recreational anglers targeting bottomfish in Puget Sound. Fishing gear will be lowered to or moored in likely habitats for each of the targeted species. The gear will be retrieved to the surface and catch identified and held in running seawater until tagged and sampled and returned to the water or until lethally sampled. Other collection methods may include beach seining dipnetting, hand netting, spearfishing, and other methods where the specimen is positively identified before capture and therefore does not require ESA coverage through this Section 10 permit, but may be permitted through the 4(d) process for listed salmonids.

Hook-and-line angling consists of rods-and-reels or handlines fitted with monofilament or other synthetic lines and rigged with baited hooks or lures and a weight. Fishing will be conducted from a WDFW research vessel with up to six persons fishing at any time, and whenever possible we will use non-toxic lures and sinkers. The gear is lowered to the desired depth and jugged or worked up and down the water column with hooks and lines matched to the expected size and weight of the specimen. All hooks will be barbless with up to three hooks on a line. Lures may consist of leadheads, chrome diamonds, fish-like objects, or other popular jigs. Baits may consist of herring, squid, or small groundfish.

Sites will be selected and occupied based upon the knowledge of target species distribution, habitat relationships, depth, and season. We will utilize GPSs, depth sounders, and local knowledge to occupy study sites shallower than 120 feet in depth. For example, we anticipate collecting spawning Pacific cod during the winter at an historical spawning ground in Agate Passage. Fishing will target depths of 20 to 30 m over a sand flat where cod were once aggregated. As another example, we intend to collect black rockfish in central Puget Sound in water depths less than 30 m where steep slopes, high current velocities, and rocky habitats tend to attract this schooling species.

Captured fish will be sampled or studied by collecting length and weight measurements; tagging and release; removal of fin clips and other tissues of interest for genetic studies, removing diet samples through gastric lavage or lethal removal of stomachs; removal of age structures including otoliths, fins, and scales; and removal of gonads for fecundity and maturation analysis.

Lethal tissue sampling may include the removal of the otoliths, the stomach, the ovaries, the testes, or other organs or tissues of interest. Most samples are preserved in fixative or frozen, and most of these will be processed in WDFW or collaborators' laboratories

Non-lethal tissue sampling may consist of clipping a small (~ 1 centimeter) portion of fin tissue for genetic analysis or conducting a gastric lavage to obtain stomach contents for diet studies. Genetic samples are placed into 95% ethanol and transferred to the WDFW laboratory for later analysis. Gastric lavage consists of inserting a tube down the alimentary canal of the specimen and injecting saline water into the stomach to force any food contents back out of the mouth and into a bucket. All stomach contents are placed in a jar or mesh bag and fixed in 10% Formalin for laboratory processing.

Tagging may utilize one or more of the following techniques; insertion of an acoustical tag in the body cavity with surgical techniques, placing an external tag in the musculature, or injecting an elastomer plastic below the specimen's epidermis.

After non-lethal sampling, fish will be allowed to reorient in circulating seawater before being released back into the water, either directly (if it has no swimbladder) or by lowering the fish to depth with a cage that allows the fish to be released remotely from the surface. After lethal sampling all carcasses will be returned to the water unless it is specifically requested that they be retained.

Specimens of Pacific cod and other species may be held for broodstock and used in hatchery rearing or genetic experiments. Specimens will be examined for viability, de-hooked, and transferred to holding tanks with circulating seawater or bubbled air. These specimens will be transferred to nearby rearing facilities equipped to deal with disease outbreaks and standard laboratory procedures.

We do not intend to directly take any listed salmonids or green sturgeon, eulachon, or bocaccio, yelloweye and canary rockfishes. However, some specimens may be captured incidentally and some may suffer barotrauma and indirect mortality. By mimicking the hook-and-line practices of the recreational fishery targeting bottomfish and other fish, we expect a very low encounter of listed species. We expect a minimal capture of Puget Sound Chinook salmon and listed rockfishes by reducing the depth of fishing and using fishing techniques targeted towards bottomfish. We do not expect to capture eulachon by hook-and-line. In 2010, WDFW restricted fishing for bottomfish to depths less than 120 feet and prohibited the retention of rockfish in most Puget Sound waters. For rockfish, we expect that some captures may result in indirect mortality due to barotrauma, stress, and handling from the fishing process, but we will avoid locations and depths where the listed species have been known to occur. We do not expect to capture green sturgeon in our sampling process but have estimated one lethal take per year to account for unusual occurrences.

WDFW's intended annual incidental takes of ESA-listed fish are based upon past catch rates, maximum takes within a season, the possibility of encountering a listed species, and anticipated sampling activity during the next five years (Table 14). With up to six persons fishing during 20 days of research operations (120 person/day fishing trips), our expected take would be one to two Chinook salmon, and less than one or no bocaccio, canary, or yelloweye rockfishes, green sturgeon, or other listed species. There may be indirect mortality on captured specimens due to stress, barotrauma, and handling resulting from the fishing process. Non-listed species may encounter similar barotrauma and handling stress and mortality, but we will take measures to minimize mortality of non-target species.

For salmonids, we note whether the adipose fin has been clipped to determine whether fish are from wild or hatchery origin but we do not "wand" the fish for a coded wire tag.

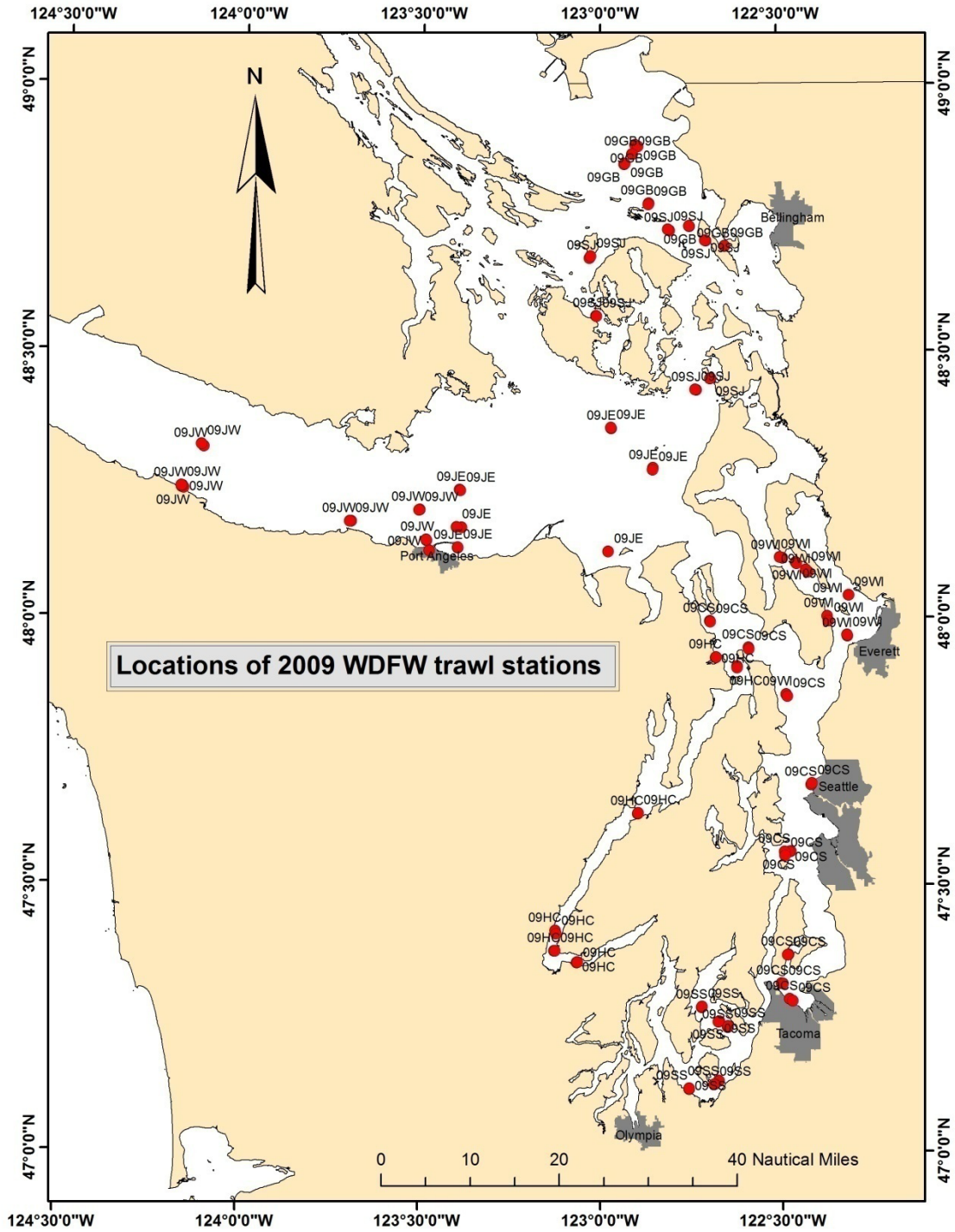
We intend to minimize the impact on salmonids and sturgeon by using the same capture, handling, and release methods for listed rockfishes. We will minimize the potential take of listed salmonids by not fishing gears in the upper water column or extreme nearshore habitats where they occur. Any captured salmonid will be kept in the water, unhooked, or disentangled and released. If the specimen appears moribund, it will be taken aboard and held in a seawater tank until it is re-oriented or 30 minutes has elapsed, at which time the specimens will be returned to the water and released.

For listed rockfishes, we will unhook or disentangle them as quickly as possible. Fish captured from less than 60 feet that do not exhibit significant barotrauma effects will be released immediately. For other specimens, we will use rapid submergence to return the fish back to its depth of capture to minimize barotrauma effects. Fish will be placed into a cage that can be lowered back to the depth of capture and allows the fish to be released remotely from the surface. For listed rockfish that suffer indirect mortality as a result of our sampling, we will weigh and measure the fish and collect fin clips and otoliths before returning the carcass to the water.

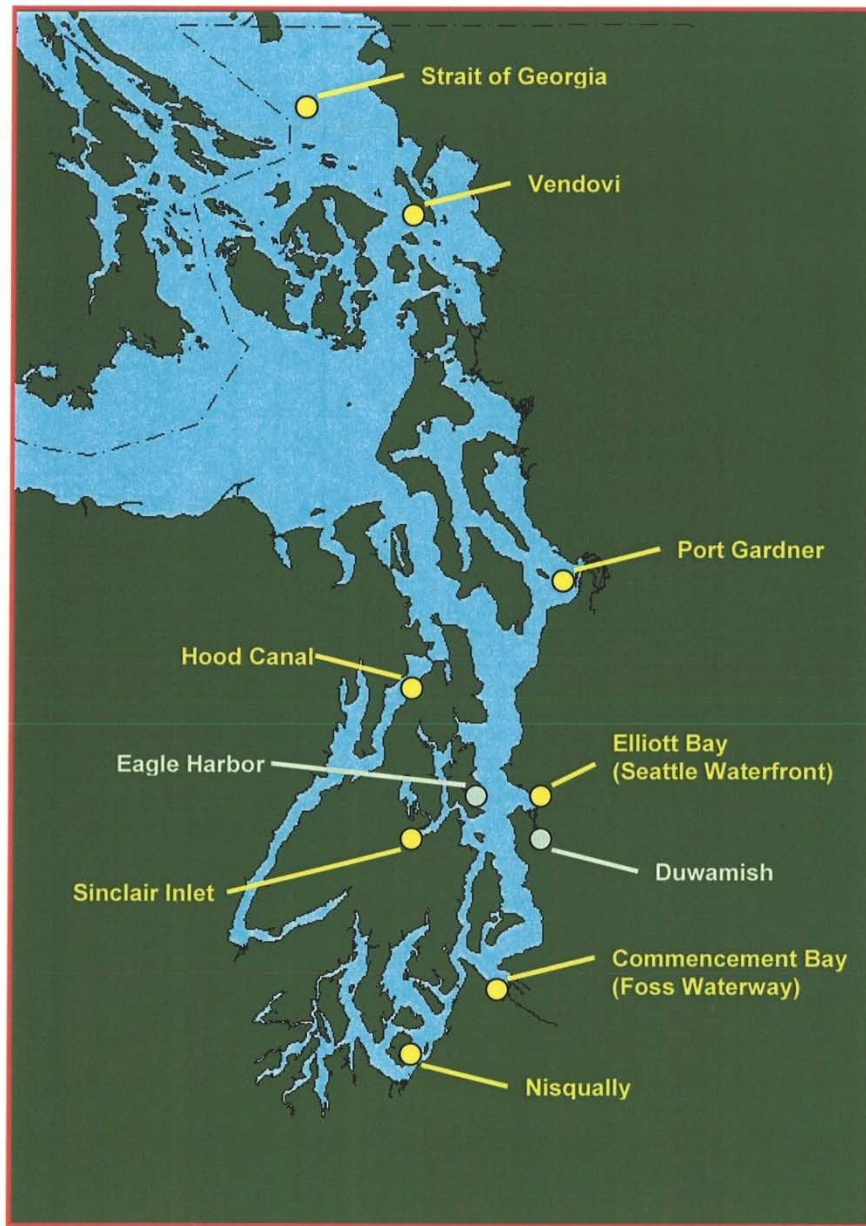
Genetic tissues and age structures will be held by the WDFW Genetics and Ageing Laboratories for analysis by WDFW scientists and partners. Gonads, stomachs, and other tissues will be retained by WDFW investigators and collaborators for subsequent analysis.

**Table 13.** Frequency of Positive Encounters with Listed Species by WDFW Marine Fish Sampling Activities Within the Respective DPSs.

	Bottom Trawl	Midwater Trawl	PSAMP Trawl 1992-2001	PSAMP Trawl 2002-2010
Number of Tows	1,713	126	1,158	134
Bocaccio	0	0	0	0
Canary rockfish	5	0	0	0
Yelloweye rockfish	6	0	1	0
Eulachon	2,134	1	26	1
Green Sturgeon	1	0	0	0
Chinook Adult-Natural	2	0		2
Chinook juvenile-Natural	20	21		9
Chinook Adult-Hatchery	0	0		1
Chinook juvenile-Hatchery	0	13		32
Chinook, other			30	



**Figure 15.** Index stations occupied during annual WDFW bottom trawl surveys.



**Figure 16.** Biennial PSAMP trawl stations.

**Table 14.** Anticipated Annual Incidental Takes of ESA-Listed Species in the Puget Sound DPS for Research Conducted by WDFW.

SPECIES	PRODUCTION /ORIGIN	LIFE STAGE	Biological Sampling		Bottom Trawl		Midwater Trawl		PSAMP		Total	
			Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality
Eulachon	Natural	Adult			300	300	40	40	60	60	400	400
		Juvenile			100	100	20	20	100	100	220	220
Bocaccio	Natural	Adult	1	1	1	1	1	1	1	1	4	4
		Juvenile	1	1	1	1	1	1	1	1	4	4
Canary rockfish	Natural	Adult	1	1	5	5	1	1	5	5	12	12
		Juvenile	1	1	5	5	1	1	5	5	12	12
Yelloweye rockfish	Natural	Adult	1	1	2	2	1	1	1	1	5	5
		Juvenile	1	1	2	2	1	1	1	1	5	5
Chinook salmon	Listed Hatchery Adipose Clip	Adult	2	1	4	2	2	1	2	1	10	5
		Juvenile	5	1	15	7	20	5	20	10	60	23
	Natural	Adult	2	1	2	1	2	1	2	1	8	4
		Juvenile	5	1	5	2	10	3	10	5	30	11
Chum salmon	Natural	Adult	0	0	1	1	1	1	1	1	3	3
		Juvenile	0	0	2	1	5	1	1	1	8	3
Steelhead	Listed Hatchery Adipose Clip	Adult	0	0	2	1	1	0	1	1	4	2
		Juvenile	0	0	2	1	5	1	1	1	8	3
	Natural	Adult	0	0	2	1	1	0	1	1	4	2
		Juvenile	0	0	2	1	5	1	1	1	8	3
Green sturgeon	Natural	Adult	0	0	1	0	0	0	1	0	2	0



## **WDFW Fishery Monitoring Programs in Puget Sound**

Bottomfish in Puget Sound are managed under the auspices of WDFW and the Puget Sound Groundfish Management Plan (Palsson et al. 1998) and the WDFW Rockfish Conservation Plan (<http://wdfw.wa.gov/conservation/fisheries/rockfish/>). In accordance with the plan, WDFW conducts both fishery dependent and independent monitoring of marine fishes in Puget Sound including rockfishes, lingcod, flatfishes, codfishes, forage fishes, and other saltwater fishes. The purpose of the monitoring is to accurately monitor and estimate harvest and released catch, obtain biological data from harvest and research catches to estimate important life history parameters, and to estimate the abundance of marine fishes for the management of recreational and commercial fisheries. Several key surveys have taken place for the past thirty years that provide long-term measures of fishery trends and population abundance that lead to the assessment of marine fish stocks. These surveys include the recreational fishery monitoring program, commercial catch monitoring and vessel observations, and population surveys using acoustic, trawl, scuba, and video techniques. The results of these surveys can be found in Palsson et al. (1997) as updated by PSAT (1998, 2000, 2002, 2007), Palsson et al. (2004, 2009), Palsson (2009), and other reports and publications.

### **Recreational Fishery Monitoring**

The recreational monitoring systems are described above. During the creel sampling portion of that survey, samplers may collect length, genetic tissues, and age structures from bottomfish species including canary rockfish, yelloweye rockfish, and bocaccio even though these species have been prohibited from harvest. These materials are transferred into computer databases or held by WDFW laboratories for subsequent processing and analysis. In recent years, few of these species have been encountered by creel samplers, but up to 20 might be encountered each year. Any such takes would be unlawful, and not covered under section 10(a)(1)(B) of the ESA.

### **Commercial Fishery Monitoring**

All commercial landings are required to be reported to the WDFW as described above. At present, commercial fishing effort is low, but samplers may be put aboard vessels or sample catches at commercial fish processing facilities. Length measurements, genetic tissues, gonads, age structures, and other samples may be obtained from bocaccio, canary, and yelloweye rockfishes and other listed species that are observed during these sampling events.

All shrimp trawl fishers are required to maintain a logbook of their fishing activities and will be required to have observers on at least 10% of their fishing trips. Completed logs will give detailed information on the amount and location of shrimp trawling. WDFW observers also conduct direct catch monitoring on commercial fishing vessels in order to sample the retained

harvest and released bycatch. On-board observers will be randomly deployed on not less than 10% of these trips. The minimum target monitoring rate of 10% was selected following examination of similar monitoring efforts for Section 10 Incidental Take Permits (Pate 2005) and consultation with regional NMFS staff. As part of the adaptive management approach, the target monitoring rates may be adjusted up or down in coordination with NMFS. A possible reason for increasing the target monitoring rate is that the 10% rate does not provide sufficiently precise results to meet management needs. A possible reason for decreasing the rate is that results indicate a lower sampling rate would produce satisfactory results. Any adjustment will occur only after at least one full year of monitoring and with the approval of NMFS. The take of listed species by the commercial beam trawl fishery for shrimp will be based upon information from completed logbooks, commercial fish tickets, and catch rates of listed species taken from observed catches and trips.

WDFW will develop or improve existing monitoring programs for recreational and commercial fisheries. Both monitoring programs will include:

- A statistically valid method to deploy monitoring resources.
- Estimation of the monthly take in numbers of fish by species.
- Prorating the total take into lethal and non-lethal takes based on best available science and angler handling/release practices.
- Annual reporting of the results to NMFS.

Commercial shrimp fishers will be required by regulation to allow an observer on board the vessel while fishing within the rockfish DPSs. Participation by recreational anglers will be voluntary.

All of the catch of ESA-listed rockfish and other listed species will be considered as lethal take. Takes of ESA-listed rockfish in the recreational fishery will be prorated into lethal and non-lethal takes using methods developed by the Pacific Fishery Management Council to manage fisheries in coastal waters (PFMC 2008).

## **Adaptive Management Plan**

Adaptive management has been defined<sup>4</sup> as:

“...a type of natural resource management in which decisions are made as part of an ongoing science-based process. Adaptive management involves testing, monitoring, and evaluating applied strategies, and incorporating new knowledge into management approaches that are based

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<sup>4</sup> Federal Register 65 no. 202 October 19, 2000, page 62571

on scientific findings and the needs of society. Results are used to modify management policy, strategies and practices.”

Adaptive management promotes flexible decision making, placing emphasis on uncertainty about responses to management actions. Decisions can be adjusted as outcomes from management actions and other events become better understood. Adaptive management recognizes the importance of natural variability and emphasizes learning while doing. It is not a trial and error process (Williams et al. 2009).

The Department of Interior (Williams et al. 2009) has determined that the following questions must be answered in the affirmative for Adaptive Management to be successful:

- Is some type of management decision needed?
- Can stakeholders be engaged?
- Can management objectives be stated explicitly?
- Is decision making confounded by uncertainty?
- Can resource relationships and management impacts be represented in models?
- Can monitoring be designed to inform decision making?
- Can progress be measured in achieving management objectives?
- Can management actions be adjusted in response to what has been learned?
- Does the whole process fit within the appropriate legal framework?

WDFW has concluded that all of these questions can be answered affirmatively and will apply Adaptive Management as part of fisheries management to help recover the three listed species of rockfish, and meet the needs of section 10(a)(1)(B). Successful application of Adaptive Management will entail monitoring, research, evaluation and adjustment of management actions.

On an annual basis, WDFW will:

Monitor - Monitor the bycatch of yelloweye rockfish, canary rockfish, and bocaccio (as well as other rockfish species) in recreational bottomfish fisheries within the Puget Sound DPSs. WDFW will also employ methods to track the bycatch of ESA-listed rockfish and other listed species in the commercial shrimp trawl fishery that occurs within the Puget Sound/Georgia Basin DPS.

Research - Conduct research of Puget Sound marine biota and track incidental bycatch of yelloweye rockfish, canary rockfish, bocaccio and other listed species within WDFW-lead research efforts. Research will focus on producing estimates of abundance, demographics, and the spatial distribution of ESA-listed rockfish, eulachon, and other marine fish and invertebrates throughout the Puget Sound/Georgia Basin DPS. In addition, any new (or better understood) environmental/habitat threats or improvements can be assessed in the context of stock survival and recovery.

Evaluate - Produce an annual report that: 1) estimates bycatch for each ESA-listed rockfish and other listed species within the Puget Sound DPSs from covered fisheries, 2) provides incidental bycatch numbers for each all ESA-listed species encountered during WDFW-lead research and monitoring efforts, 3) details any new research results for each ESA-listed rockfish species and other listed species, and 4) assesses the potential need for modifications of fisheries regulations or reporting methodologies, or other management measures to protect these species.

Adjust Management Actions - Management actions often entail changes in regulations governing the conduct of fisheries. These changes are legally binding and WDFW has the authority to enact and enforce regulations.

### **Annual Timing of Evaluation and Coordination with NMFS**

WDFW will produce an annual report containing results of research and monitoring efforts by the end of March for the preceding year (e.g. the report for 2011 will be available by the end of March 2012).

WDFW will coordinate with NMFS as needed and anticipates that coordination will occur annually at a minimum. Planned coordination meetings will be held during the spring months of each year. This coordination will include estimates of retained catch by all fisheries, estimates of discarded catch for selected fisheries, results of scientific studies and monitoring efforts, and coordination of planned activities.

The purpose of the annual coordination meetings is to assess any new information about yelloweye rockfish, canary rockfish, bocaccio and eulachon stock status within the Puget Sound/Georgia Basin DPS. Updated bycatch numbers will also be assessed relative to the information described above. In addition, each agency will discuss future needed research and monitoring efforts necessary to better understand the stock status and recovery actions that would benefit each species.

### **Adjustment of Management Actions and Five Year Take Request**

Management actions to further conserve ESA-listed fish may occur under three scenarios: 1) additional scientific information regarding species status that includes abundance, distribution or productivity within the DPSs, showing that any of these factors are diminishing, 2) bycatch numbers that exceed certain thresholds (as discussed below), or 3) as a result of unforeseen or changed circumstances that are causing numbers of ESA-listed fish to decrease. Unforeseen or changed circumstances could include natural or human-induced changes to the environment (such as oil spills) that place covered fish species at greater risk.

As noted above, WDFW has the authority to enact regulations to conserve ESA-listed rockfish, eulachon, and other listed species. This authority includes specifying the time, place, and manner by which ESA-listed rockfish and other listed species are captured (and measures to avoid possible capture). There are two types of rule making authority: emergency and permanent. An emergency rule is designed to deal with emerging, urgent situations. The Director has the authority to issue an emergency rule and this can be done within a few days. Emergency rules last a maximum of 120 days, but can be renewed for an additional 120 days under certain circumstances. A permanent rule is designed to deal with long-term foreseeable issues and has no set expiration date. Permanent rules are adopted by the FWC and usually require a process that occurs at least three months prior to permanent rule changes. Usually, the WDFW considers changes in permanent rules for recreational fishing on a biennial basis. Typically, WDFW staff prepares suggestions for rules changes and request ideas from stakeholders during the spring and summer. These suggestions are evaluated and an opportunity for public comment is provided prior to the FWC taking action on any proposal. Proposed changes to commercial fishing rules can be heard by the FWC at any of its meetings, which means that a rule can be adopted within approximately six months of its formulation.

As seen in Table 8, the estimated annual catch of ESA-listed rockfish can be quite variable and we also anticipate that take of eulachon will be variable. In order to accommodate this variability, we propose that take of ESA-listed rockfish from recreational bottomfish fisheries and commercial shrimp trawls, and eulachon take from commercial shrimp trawls be tracked on an annual and cumulative five-year basis. Annual take estimates are provided (Table 15), but if the cumulative annual take of fish is exceeded it would not result in loss of section 10(a)(1)(B) coverage (unless the take exceeded the five year estimate). If, on an annual basis through years one, two and three of the ITP, the cumulative annual take estimate by the combined, covered fisheries for any ESA-listed species is exceeded by 20 percent or more, we propose that an adaptive management trigger occur and WDFW and NMFS meet and discuss the possible need to implement fishery changes to reduce bycatch (Table 15). If, by year three and four of the ITP, it appears that the five-year combined, cumulative take may be exceeded, WDFW and NMFS will discuss any necessary fishery changes to reduce this possibility.

**Table 15.** Projected takes and adaptive management triggers for bocaccio, canary rockfish, yelloweye rockfish, and eulachon

<b>Species</b>	<b>Projected Annual Take for Rec. Bottom Fish and Shrimp Trawl</b>	<b>Year 1, 2 &amp; 3 Adaptive Management Trigger</b>	<b>5-Year Cumulative Take Limit</b>
Bocaccio	42 (5 from shrimp trawl)	50	210
Canary Rockfish	138 (10 from shrimp trawl)	166	690
Yelloweye Rockfish	152 (10 from shrimp trawl)	180	760
Eulachon	3,240 (all from shrimp trawl)	3,889	16,205

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## Appendix 1. Management and Catch Reporting Areas

### Recreational Marine Catch Areas.

(1) **Area 4B** shall include those waters of Puget Sound easterly of a line projected from the Bonilla Point light on Vancouver Island to the Tatoosh Island light, thence to the most westerly point on Cape Flattery and westerly of a line projected true north from the fishing boundary marker at the mouth of the Sekiu River.

(2) **Area 5** shall include those waters of Puget Sound easterly of a line projected true north from the fishing boundary marker at the mouth of the Sekiu River and westerly of a line projected true north from Low Point.

(3) **Area 6** shall include those waters of Puget Sound easterly of a line projected from the Angeles Point Monument to the William Head light on Vancouver Island, northerly of a line projected from the Dungeness Spit light to the Partridge Point light, westerly of a line projected from the Partridge Point light to the Smith Island light, and southerly of a line projected from the Smith Island light to vessel traffic lane buoy R to the Trial Island light.

(4) **Area 6A** shall include those waters of Puget Sound easterly of a line projected from the Partridge Point light to the Smith Island light to the most northeasterly of the Lawson Reef lighted buoys (RB 1 Qk5/6/2010 2:18 PM Fl Bell) to Northwest Island to the Initiative 77 marker on Fidalgo Island and westerly of a line projected from Reservation Head on Fidalgo Island to West Point on Whidbey Island.

(5) **Area 6B** shall include those waters of Puget Sound southerly of a line projected from the Dungeness Spit light to the Partridge Point light, westerly of a line projected from the Partridge Point light to the Point Wilson light and easterly of a line projected 155° true from Dungeness Spit light to Kulo Kala Point.

(6) **Area 6C** shall include those waters of Puget Sound easterly of a line projected true north from Low Point and westerly of a line projected from the Angeles Point Monument to the William Head light on Vancouver Island.

(7) **Area 6D** shall include those waters of Puget Sound westerly of a line projected 155° true from Dungeness Spit light to Kulo Kala Point.

(8) **Area 7** shall include those waters of Puget Sound southerly of a line projected true east-west through Sandy Point Light No. 2 (48 degrees, 47.2 minutes north latitude, 122 degrees, 42.7 minutes west longitude as per U.S. Coast Guard Light List No. 19880), northerly of a line projected from the Trial Island light to vessel traffic lane buoy R to the Smith Island light to the most northeasterly of the Lawson Reef lighted buoys (RB 1 Qk Fl Bell) to Northwest Island to the Initiative 77 marker on Fidalgo Island, and westerly of a line projected from Sandy Point Light No. 2 to Point Migley, thence along the eastern shore-line of Lummi Island to Carter Point, thence to the most northerly tip of Vendovi Island, thence to Clark Point on Guemes Island following the shoreline to Southeast Point on Guemes Island, thence to March Point on Fidalgo Island, excluding those waters of East Sound northerly of a line projected due west from Rosario

Point on Orcas Island.

(9) **Area 7A** shall include those waters of Puget Sound northerly of a line projected true east-west through Sandy Point Light No. 2 (48 degrees, 47.2 minutes north latitude, 122 degrees, 42.7 minutes west longitude as per U.S. Coast Guard Light List No. 19880), terminating on the west at the international boundary and on the east at the landfall on Sandy Point.

(10) **Area 7B** shall include those waters of Puget Sound westerly of a line projected 154 degrees true from Sandy Point Light No. 2 (48 degrees, 47.2 minutes north latitude, 122 degrees, 42.7 minutes west longitude as per U.S. Coast Guard Light List No. 19880) to the landfall on Gooseberry Point, easterly of a line projected from Sandy Point Light No. 2 to Point Migley, thence along the eastern shoreline of Lummi Island to Carter Point, thence to the most northerly tip of Vendovi Island, thence to Clark Point on Guemes Island following the shoreline to Southeast Point on Guemes Island, thence to March Point on Fidalgo Island, northerly of the Burlington Northern railroad bridges at the north entrances to Swinomish Channel and westerly of a line projected from William Point light on Samish Island 28° true to Whiskey Rock on the north shore of Samish Bay and southwesterly of the mouth of Whatcom Creek, defined as a line projected approximately 14 degrees true from the flashing light at the southwest end of the Port of Bellingham North Terminal to the southernmost point of the dike surrounding the Georgia Pacific treatment pond.

(11) **Area 7C** shall include those waters of Puget Sound easterly of a line projected from William Point light on Samish Island 28° true to Whiskey Rock on the north shore of Samish Bay.

(12) **Area 7D** shall include those waters of Puget Sound easterly of a line projected 154 degrees true from Sandy Point Light No. 2 (48 degrees, 47.2 minutes north latitude, 122 degrees, 42.7 minutes west longitude as per U.S. Coast Guard Light List No. 19880) to the landfall on Gooseberry Point and south of a line projected true east from Sandy Point Light No. 2 to the landfall on Sandy Point.

(13) **Area 7E** shall include those waters of Puget Sound within East Sound northerly of a line projected due west from Rosario Point on Orcas Island.

(14) **Area 8** shall include those waters of Puget Sound easterly of a line projected from West Point on Whidbey Island to Reservation Head on Fidalgo Island, westerly of a line projected from the light on East Point 340° true to the light on Camano Island (Saratoga Pass light #2, Fl Red 4 Sec) southerly of the Burlington Northern railroad bridges at the north entrances to Swinomish Channel and northerly of the state highway 532 bridges between Camano Island and the mainland.

(15) **Area 8A** shall include those waters of Puget Sound easterly of a line projected from the East Point light on Whidbey Island 340° true to the light on Camano Island (Saratoga Pass light #2, Fl Red 4 Sec), northerly of a line projected from the southern tip of Possession Point 110° true to the shipwreck on the opposite shore, southerly of the State Highway 532 bridges between Camano Island and the mainland excluding those waters of Area 8D.

(16) **Area 8D** shall include those waters of Puget Sound inside and easterly of a line projected 225 degrees from the pilings at old Bower's Resort to a point 2,000 feet offshore, thence northwesterly to a point 2,000 feet off Mission Point, thence across the mouth of Tulalip Bay to a point 2,000 feet off Hermosa Point, thence northwesterly following a line 2,000 feet offshore to the intersection with a line projected 233 degrees from the fishing boundary marker on the shore at the slide north of Tulalip Bay.

(17) **Area 9** shall include those waters of Puget Sound southerly and easterly of a line projected from the Partridge Point light to the Point Wilson light, northerly of the site of the Hood Canal Floating Bridge, northerly of a line projected true west from the shoreward end of the Port Gamble tribal dock on Point Julia to the mainland in the community of Port Gamble, excluding those on-reservation waters of Hood Canal north of Port Gamble Bay to the marker at the north end of the Port Gamble Indian Reservation, southerly of a line projected from the southern tip of Possession Point 110° true to the shipwreck on the opposite shore and northerly of a line projected from the Apple Cove Point light to the light at the south end of the Edmond's breakwater at Edwards Point.

(18) **Area 9A** shall include those waters of Puget Sound known as Port Gamble Bay southerly of a line projected true west from the shoreward end of the Port Gamble tribal dock on Point Julia to the mainland in the community of Port Gamble and those on-reservation waters of Hood Canal north of Port Gamble Bay to the marker at the north end of the Port Gamble Indian Reservation.

(19) **Area 10** shall include those waters of Puget Sound southerly of a line projected from the Apple Cove Point light to the light at the south end of the Edmond's breakwater at Edwards Point, westerly of a line projected 233° true from the Azteca Restaurant near Shilshole Marina through entrance piling No. 8 to the southern shore of the entrance to the Lake Washington Ship Canal, westerly of a line projected 185° true from the southwest corner of Pier 91 through the Duwamish Head light to Duwamish Head, northerly of a true east-west line passing through the Point Vashon light, easterly of a line projected from Orchard Point to Beans Point on Bainbridge Island, and northerly and easterly of a line projected true west from Agate Point on Bainbridge Island to the mainland.

(20) **Area 10A** shall include those waters of Puget Sound easterly of a line projected 185° true from the southwest corner of Pier 91 through the Duwamish Head light to Duwamish Head.

(21) **Area 10C** shall include those waters of Lake Washington southerly of the Evergreen Point Floating Bridge.

(22) **Area 10D** shall include those waters of the Sammamish River south of the State Highway 908 Bridge and Lake Sammamish.

(23) **Area 10E** shall include those waters of Puget Sound westerly of a line projected from Orchard Point to Beans Point on Bainbridge Island and southerly and westerly of a line projected true west from Agate Point on Bainbridge Island to the mainland.

(24) **Area 10F** shall include those waters of Puget Sound easterly of a line projected 233° true from the Azteca Restaurant near Shilshole Marina through entrance piling Number 8 to the southern shore of the entrance to the Lake Washington Ship Canal and those waters of the Lake Washington Ship Canal westerly of a line projected from Webster Point true south to the Evergreen Point Floating Bridge including the waters of Salmon Bay, the Lake Washington Ship Canal, Lake Union and Portage Bay.

(25) **Area 10G** shall include those waters of Lake Washington northerly of the Evergreen Point Floating Bridge, easterly of a line projected from Webster Point true south to the Evergreen Point Floating Bridge and those waters of the Sammamish River north of the State Highway 908 Bridge.

(26) **Area 11** shall include those waters of Puget Sound southerly of a true east-west line passing through the Point Vashon light, northerly of a line projected 259 degrees true from Browns Point to the land fall in line with the site of Asarco smelter stack on the opposite shore of Commencement Bay, and northerly of the Tacoma Narrows Bridge.

(27) **Area 11A** shall include those waters of Puget Sound southerly of a line projected 259 degrees true from Browns Point to the land fall in line with the site of Asarco smelter stack on the opposite shore of Commencement Bay.

(28) **Area 12** shall include those waters of Puget Sound southerly of the site of the Hood Canal Floating Bridge and northerly and easterly of a line projected from the Tskutsko Point light to Misery Point.

(29) **Area 12A** shall include those waters of Puget Sound northerly of a line projected from Pulali Point true east to the mainland.

(30) **Area 12B** shall include those waters of Puget Sound southerly of a line projected from Pulali Point true east to the mainland, northerly of a line projected from Ayock Point true east to the mainland, and westerly of a line projected from the Tskutsko Point light to Misery Point.

(31) **Area 12C** shall include those waters of Puget Sound southerly of a line projected from Ayock Point true east to the mainland and northerly and westerly of a line projected from Ayres Point to the public boat ramp at Union.

(32) **Area 12D** shall include those waters of Puget Sound easterly of a line projected from Ayres Point to the public boat ramp at Union.

(33) **Area 13** shall include those waters of Puget Sound southerly of the Tacoma Narrows Bridge and a line projected from Green Point to Penrose Point and northerly and easterly of a line projected from the Devil's Head light to Treble Point, thence through lighted buoy No. 3 to the mainland and westerly of the railroad trestle at the mouth of Chambers Bay.

(34) **Area 13A** shall include those waters of Puget Sound northerly of a line projected from Green Point to Penrose Point.

(35) **Area 13C** shall include those waters of Puget Sound easterly of the railroad trestle at the mouth of Chambers Bay.

(36) **Area 13D** shall include those waters of Puget Sound westerly of a line projected from the Devil's Head light to Treble Point, thence through lighted buoy Number 3 to the mainland, northerly of a line projected from Johnson Point to Dickenson Point, northerly of a line projected from the light at Dofflemeyer Point to Cooper Point, easterly of a line projected from Cooper Point to the southeastern shore of Sanderson Harbor, easterly of a line projected from the northern tip of Steamboat Island to the light at Arcadia to Hungerford Point and southerly of a line projected true east-west through the southern tip of Stretch Island.

(37) **Area 13E** shall include those waters of Puget Sound southerly of a line projected from Johnson Point to Dickenson Point.

(38) **Area 13F** shall include those waters of Puget Sound southerly of a line projected from the light at Dofflemeyer Point to Cooper Point.

(39) **Area 13G** shall include those waters of Puget Sound southerly of a line projected from Cooper Point to the southeastern shore of Sanderson Harbor.

(40) **Area 13H** shall include those waters of Puget Sound southwesterly of a line projected from the northern tip of Steamboat Island to the light at Arcadia and those waters easterly of a line projected 64° true from Kamilche Point to the opposite shore.

(41) **Area 13I** shall include those waters of Puget Sound southwesterly of a line projected 64° true from Kamilche Point to the opposite shore.

(42) **Area 13J** shall include those waters of Puget Sound northwesterly of a line projected from the light at Arcadia to Hungerford Point.

(43) **Area 13K** shall include those waters of Puget Sound northerly of a line projected true east-west through the southern tip of Stretch Island.

#### Commercial Marine Fish Reporting Areas

**Area 20A** shall include those waters of Puget Sound north of a line projected from Village Point, Lummi Island through the navigation buoy just east of Matia Island thence to the buoy at Clements Reef thence to the easternmost point of Patos Island and from the westernmost point of Patos Island due east to the international boundary; and west of a line from Point Francis through the marker north of Inati Bay, Lummi Island to Lummi Island.

(2) **Area 20B** shall include those waters of Puget Sound southerly of Area 20A, westerly of a line from Lummi Island through Lummi Rocks to the northernmost tip of Sinclair Island, and northerly of a line from the northernmost tip of Sinclair Island to Lawrence Point on Orcas Island and a line which runs from Steep Point on Orcas Island to Limestone Point on San Juan Island

and then to Green Point on the eastern tip of Speiden Island and from the western tip of Speiden Island true west to the international boundary.

(3) **Area 21A** shall include those waters of Puget Sound southerly and easterly of Areas 20A and 20B, and westerly of a line from William Point to Governor's Point, and northerly of a line from William Point to the southernmost tip of Vendovi Island to the Sinclair Island light.

(4) **Area 21B** shall include those waters of Puget Sound easterly of and adjacent to Area 21A.

(5) **Area 22A** shall include those waters of Puget Sound south of Area 20B, westerly of 122° 40' W between Sinclair Island and Fidalgo Island and the Deception Pass Bridge; northerly of a line due east from the international boundary to a point 1 nautical mile from Pile Point, San Juan Island, thence southeasterly along a line 1 nautical mile from the southern shores of San Juan Island and Lopez Island to Davidson Rock near Point Colville, then easterly to a point one nautical mile south of the buoy at Lawson Reef and then due east to Whidbey Island.

(6) **Area 22B** shall include those waters of Puget Sound south of Area 21A, east of 22A, and north of the railroad bridges at Swinomish Channel.

(7) **Area 23A** shall include those waters of Puget Sound southerly of Area 22A; westerly and northerly of a line described as follows: A line segment from Davidson Rock near Point Colville, Lopez Island to a point 2 nautical miles from the Smith Island light thence continuing westerly and southerly 2 nautical miles from the Smith Island light until the line intersects with a line between Smith Island light and the vessel traffic service buoy north of Dungeness Spit, thence to the vessel traffic service buoy, thence southerly and westerly to a point 1 1/2 nautical miles north of the Ediz Hook light thence north to the international boundary.

(8) **Area 23B** shall include those waters of Puget Sound southerly of Area 22A; easterly of 23A; and northerly of a line due west from Partridge Point, Whidbey Island to its intersection with Area 23A.

(9) **Area 23C** shall include those waters of Puget Sound westerly of Area 23A and a line due north from the Ediz Hook light to the international boundary; and easterly of a line projected due north from the mouth of the Sekiu River.

(10) **Area 23D** shall include those waters of Puget Sound southerly of Area 23A and easterly of Area 23C and westerly of a line from the Dungeness light to the vessel traffic service buoy north of Dungeness light.

(11) **Area 24A** shall include those waters of Saratoga Passage and Skagit Bay east of a line between Polnell Point and Rocky Point, Camano Island; south of Area 22B; and east of Area 22A, and north of the Highway 532 Bridge between Camano Island and the mainland.

(12) **Area 24B** shall include those waters of Port Susan south of Area 24A and north of a line from Camano Head on Camano Island to the north tip of Gedney Island and from the southern tip of Gedney Island east to the mainland.

(13) **Area 24C** shall include those waters of Saratoga Passage west of Area 24A; north of a line projected due west of Hackney Island; and northwest of a line from Sandy Point, Whidbey Island to Camano Head, Camano Island.

(14) **Area 24D** shall include Holmes Harbor south of a line projected due west from Hackney Island to Whidbey Island.

(15) **Area 25A** shall include those waters of Puget Sound south of Areas 23A and 23B; east of Area 23D; north of a line projected from Diamond Point to Cape George, and westerly of a line projected from Point Partridge on Whidbey Island to Point Wilson.

(16) **Area 25B** shall include those waters of Admiralty Inlet east of Area 25A; northeast of a line projected from Point Hudson to Marrowstone Point; and north of a line projected from Olele Point to Foulweather Bluff continuing to Double Bluff on Whidbey Island.

(17) **Area 25C** shall include those waters of Hood Canal south of Area 25B and north of the Hood Canal Floating Bridge.

(18) **Area 25D** shall include those waters of Port Townsend Bay southwest of Area 25B.

(19) **Area 25E** shall include those waters of Discovery Bay south of Area 25A.

(20) **Area 26A** shall include those waters of Puget Sound south of Areas 24B, 24C, and 25B and northerly of a line from Apple Cove Point to Point Edwards.

(21) **Area 26B** shall include those waters of Puget Sound south of Area 26A, and east of a line from Point Monroe, Bainbridge Island to the mouth of Miller Bay, and east of a line from Beans Point on Bainbridge Island to Orchard Point, and northerly of a line from the ferry dock at Point Southworth to Brace Point.

(22) **Area 26C** shall include those waters of Puget Sound westerly and adjacent to Area 26B.

(23) **Area 26D** shall include those waters of Puget Sound southerly of Area 26B and northerly of the Tacoma Narrows Bridge.

(24) **Area 27A** shall include those waters of Hood Canal southerly of the Hood Canal Floating Bridge and northerly of a line from Misery Point to Quatsap Point.

(25) **Area 27B** shall include those waters of Hood Canal south of Area 27A and north of a line from Lilliwaup Creek to Dewatto.

(26) **Area 27C** shall include those waters of Hood Canal south of Area 27B.

(27) **Area 28A** shall include those waters of Puget Sound southerly and westerly of the Tacoma Narrows Bridge, south of a line projected from Penrose Point to Green Point in Carr



Inlet, south of a line projected from Point Wilson to Whiteman Cove in Case Inlet, and east of a line projected from Brisco Point to Dofflemyer Point.

(28) **Area 28B** shall include all waters of Carr Inlet north of a line projected from Penrose Point to Green Point.

(29) **Area 28C** shall include those waters of Case Inlet and Pickering Passage north of a line projected from Wilson Point to Whiteman Cove, and north of the highway bridge from the west side of Hartstene Island.

(30) **Area 28D** shall include those waters west of Area 28A and south of Area 28C.

(31) **Area 29** shall include those waters of the Strait of Juan de Fuca west of Area 23C and east of a line projected from the Bonilla Point light on Vancouver Island to the Tatoosh Island light, then to the most westerly point of Cape Flattery.

## Appendix 2. Commercial and Recreational Fisheries in Puget Sound and Their Relative Risk to ESA-Listed Rockfish

License Type	License Group	Gear	Potential To Encounter ESA listed Rockfish	Fishery Access	Comments
Commercial	MARINE FISH				
		Forage Fish Lampara	Low	Open access	This gear type has little or no risk of bycatch.
		Beach Seine	None	Open Access and Limited Entry	This gear type has little or no risk of bycatch.
		Herring Dip Net	None	Limited Entry	Closed due to low abundance
		Herring Purse Seine	Low	Limited Entry	Closed due to low abundance
		Herring Gillnet	Low	Limited Entry	Closed due to low abundance
	SALMON				
		Recreational			Not included in the Conservation Plan. Covered in Section 7 (a) 2.
		Gill Net		Limited Entry	Not included in the Conservation Plan. Covered in Section 7 (a) 2.
		Purse Seine		Limited Entry	Not included in the Conservation Plan. Covered in Section 7 (a) 2.
		Reef Net		Limited Entry	Not included in the Conservation Plan. Covered in Section 7 (a) 2.
		Beach Seine		Limited Entry	Not included in the Conservation Plan. Covered in Section 7 (a) 2.
	SHELLFISH				
		Crab Ring Net	None		This gear type has little or no risk of bycatch.
		Dungeness Crab	Low (Mostly Derelict Gear)	Limited Entry	This gear type has little or no risk of bycatch.
		Clam Mechanical Harvester	None		This gear type has little or no risk of bycatch.
		Geoduck Dive	None		This gear type has little or no risk of bycatch.
		Sea Cucumber Dive	None	Limited Entry	This gear type has little or no risk of bycatch.
		Sea Urchin Dive	None	Limited Entry	This gear type has little or no risk of bycatch.
		Shellfish Pot	None	Limited Entry	This gear type has little or no risk of bycatch.
		Burrowing Shrimp	None	Open Access	This gear type has little or no

License Type	License Group	Gear	Potential To Encounter ESA listed Rockfish	Fishery Access	Comments
					risk of bycatch.
		Shrimp Trawl	Low	Limited Entry	Covered fishery in the plan.
		Squid	None	Open access	This gear type has little or no risk of bycatch.
Recreational	Salmon	Hook and Line	Moderate		Not included in the Conservation Plan covered in Section 7 (a) 2.
	Halibut	Hook and Line	Low		Not included in the Conservation Plan. Will be covered under Section 7 (a) 2.
	Halibut	Spear Fishing	None		Not included in the Conservation Plan. Will be covered under Section 7 (a) 2.
	Lingcod	Hook and Line	High		Covered fishery in the plan under the general bottomfish and other fish category.
	Lingcod	Spear Fishing	None		Covered fishery in the plan under the general bottomfish and other fish category.
	Other Bottomfish	Hook and Line	Low		Covered fishery in the plan.
	Other Bottomfish	Spear Fishing	None		Covered fishery in the plan.
	Forage Fish	Hook and Line	None		This gear type has little or no risk of bycatch.
	Forage Fish	Dip Net	None		This gear type has little or no risk of bycatch.
	Other Fish	Hook and Line	Low		Covered fishery in the plan.
	Crab	Ring & Trap	Low(Mostly Derelict Gear)		This gear type has little or no risk of bycatch.
	Crab	Dip Net	None		This gear type has little or no risk of bycatch.
	Shrimp	Trap	Low		This gear type has little or no risk of bycatch.
	Squid	Hook and Line	none		Conducted from piers. This gear type has little or no risk of bycatch.
	Bivalves	Shovel or Tube	None		Intertidal. This gear type has little or no risk of bycatch.