CONSERVATION PLAN FOR REDUCING THE IMPACT OF SELECTED FISHERIES ON ESA LISTED SPECIES IN PUGET SOUND, WITH AN EMPHASIS ON BOCACCIO, YELLOWEYE, AND CANARY ROCKFISH

Prepared for the

National Marine Fisheries Service

by the

Washington Department of Fish & Wildlife

Washington Department of FISH and WILDLIFE

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Executive Summary

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) listed the Puget Sound/Georgia Basin (PSGB) 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) on April 28, 2010 (75 FR 22276). Canary Rockfish were subsequently proposed for delisting in July of 2016 (81 FR 43979). This conservation plan (hereafter, the plan) assesses selected Washington State Department of Fish and Wildlife (WDFW) authorized recreational and commercial fisheries and research activities that may encounter listed rockfishes and offers collateral information on the potential take of other ESA-listed fish in the U.S. portion of the PSGB DPSs, including Chinook Salmon, southern Eulachon, and southern Green Sturgeon. The plan also addresses WDFWs efforts to reduce the biological impact of the requested fisheries on these ESA-listed species. NMFS is authorized to provide an incidental take permit (ITP) under Section 10 of the ESA for non-federal activities when deemed appropriate. Section 10(a)(1)(A) allows for the scientific take of listed species, and Section 10(a)(1)(B) allows for incidental take of listed fish during otherwise lawful activities. The WDFW is requesting coverage under Section 10(a)(1)(B) for the four fisheries addressed in this plan: the recreational marine fishery for Bottomfish (as defined by Washington Administrative Code (WAC) 220-16-340) and other fish (defined herein as Shiner Perch, Food Fish[1] (other than salmon, Pacific Halibut, and legally defined Bottomfish), Forage Fish[2], and Anadromous Game Fish[3]; the commercial shrimp trawl fishery; and the recreational and commercial shrimp pot/trap fisheries.

The geographic areas considered in this plan are the U.S. portion of the DPSs for ESA-listed rockfishes. The boundaries of the DPSs are approximated by WDFW Recreational Marine Catch Areas (MCAs) 6-13, though the westernmost portion of MCA 6 lies outside the DPSs, and all Commercial Marine Fish-Shellfish Management and Catch Reporting Areas except 23C and 29. WDFW does not manage tribal fisheries, so they are not assessed within this plan. This plan also does not address recreational or commercial fisheries for salmon and Pacific Halibut that occur within the listed rockfish DPSs. These fisheries are currently addressed under separate NOAA consultations because they each have a federal nexus.

During the development of this updated 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. Prior to being issued an ITP for ESA-listed rockfish in 2012, WDFW closed several fisheries identified as having unacceptably high

[1] WAC 220-12-010
[2] WAC 220-16-475
[3] WAC 220-56-100

risks for incidental catch of ESA-listed rockfish. Of the remaining active fisheries reviewed for this updated FCP, two were included in the original ITP and two others have since been identified as having a low risk of encountering listed rockfish. All four of these fisheries are therefore proposed for coverage under a single take permit. The specific gears, locations, and relative risks of incidentally catching rockfish and other listed species are described in this plan, as well as any management measures that have been implemented to reduce encounter 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 if it becomes necessary. In the WDFW Marine Fish Research and Biological Monitoring 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 these activities. Finally, in the Adaptive Management Plan section we discuss the synthesis of WDFW research and monitoring findings and our planned coordination with NOAA to continually reduce impacts to ESA-listed species.

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 recreational fisheries for Bottomfish (as defined by WAC), commercial shrimp-trawl fisheries, and commercial and recreational shrimp pot fisheries occurring within the Puget Sound/Georgia Basin 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 (as 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.

The initial ITP granted to WDFW in 2012 was for a period of 5 years. However, due to the long-life histories of ESA-listed rockfish and the expectation that recovery trends will likely not be measureable for at least a decade (Federal ESA Recovery Plan), WDFW is requesting a ten-year take permit to cover incidental take of ESA-listed rockfishes, Chinook Salmon, Eulachon, and Green Sturgeon in the four fisheries requested for ITP coverage in this plan. WDFW feels that a 10-year permit is justified based on the agency's commitment to

protecting rockfish populations via the closure of fisheries and the implementation of restrictive fishing rules designed to minimize incidental take of rockfish (including listed species). Further, WDFWs research and monitoring of rockfish populations within the DPSs is ongoing and will continue as long as funding allows. Research surveys conducted in 2015 and 2016 within the DPSs have identified discrete habitats where ESA-listed rockfish are most likely to be found, which will enable WDFW to produce timely and statistically robust, habitat-based population estimates. Results of these on-going surveys will provide the most up-to-date information on rockfish stock status, abundance, demographics, and spatial structure. This information will be critical to WDFWs Adaptive Management strategy and will provide WDFW, in cooperation with NMFS, with the ability to effectively manage listed rockfish to ensure their long-term recovery and meet the objectives of the Federal ESA Recovery plan (81 FR 158) and the Puget Sound Rockfish Conservation Plan (PSRCP, WDFW 2011b), 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 species and activities proposed for Section 10(a)(1)(B) coverage, and conservation measures enacted by WDFW to minimize impacts to and encounter with listed species (Table 1).

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

Covered ESA-Listed Species	Status	Covered Activities[a]			Conservation Measures
		Recreational Bottomfish	Commercial Shrimp Trawl	Recreational and Commercial Shrimp pot	
Puget Sound/Georgia Basin (PS/GB) Bocaccio (*Sebastes paucispinis*)	Endangered	Yes	Yes	Yes	1. Permanent closure, by regulation, of the set net, set line, bottom fish trawl, bottom fish pot, and scallop trawl fisheries;
PS/GB Canary Rockfish (*S. pinniger*)	Threatened	Yes	Yes	Yes	2. Continue to prohibit fishing for rockfish throughout the DPSs;
PS/GB Yelloweye Rockfish (*S. ruberrimus*)	Threatened	Yes	Yes	Yes	3. Continue to prohibit retention of rockfish caught in any fishery throughout the DPSs;
Puget Sound (PS) Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	Yes	No[b]	4. Continue to prohibit bottom fishing in waters deeper than 120 feet throughout the DPSs;
Southern Green Sturgeon (*Acipenser medirostris*)	Threatened	No[b]	Yes	No[b]	5. Require permit holders in the shrimp trawl fishery to have on-board observers on 5 percent of all trips to identify and track bycatch.
Southern (S) Eulachon (*Thaleichthys pacificus*)	Threatened	No[b]	Yes	No[b]	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.

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

Introduction

Human use of rockfish in Puget Sound has occurred for centuries, but large-scale targeted fisheries on rockfish only developed within the past 50 years. Beginning in the early 1970s and continuing through the early 1990s, rockfish landings by both commercial and recreational fishers increased substantially (Figure 1). Subsequent to this increase, the populations of some rockfish species declined dramatically, prompting the Washington Department of Fish and Wildlife (WDFW) to promulgate a series of increasingly restrictive regulations intended to reduce directed and incidental take of all rockfishes within the DPSs (although prior to when the DPSs were defined) in order to initiate recovery of their populations (Table 2). These restrictions included the prohibition of certain types of commercial fishing gear, regulations designed to keep fishing gear and fishing activities away from rockfish habitat, and the establishment of seasons and 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). Rockfish retention has been prohibited since 2010 in the recreational Bottomfish fishery, and excepting illegal take, rockfish landings in this fishery have been reduced to zero.

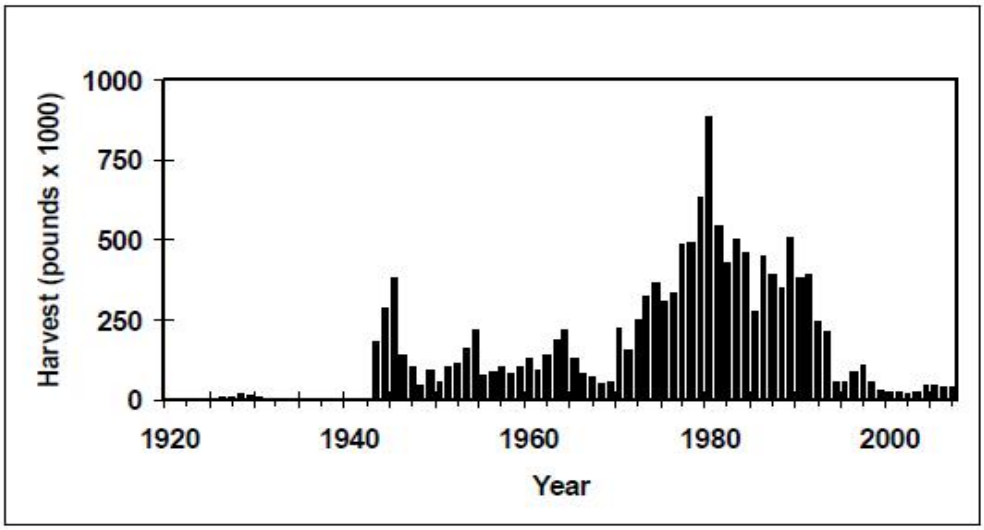


Figure 1. Annual combined commercial and recreational rockfish landings from Puget Sound.

In 2010, NOAA's National Marine Fisheries Service (NMFS) concluded that the abundance of several species of rockfish had declined to a level such 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). Based on genetic information obtained after the initial listing (Andrews et al., in prep), Canary Rockfish were subsequently proposed for delisting in July of 2016 and the northern border of the DPS for Yelloweye Rockfish was amended to extend into Queen Charlotte Channel, Canada (81 FR 43979).

The information presented in this updated Fishery Conservation Plan (FCP) supports the application for a renewed Incidental Take Permit (ITP) for ESA-listed rockfishes occurring in the U.S. portion of the Puget Sound/Georgia Basin DPSs under Section 10 (a)(1)(B) of the ESA for four WDFW-managed fisheries that were determined to have a potential to take (i.e., catch) the listed rockfish species. Within this plan, incidental take refers to the catching or capturing of a non-target species during permitted fishing activities, and we use the terms incidental catch and bycatch synonymously to refer to this take. The four fisheries being requested for coverage are: the recreational marine Bottomfish[4] and other fish[5] fishery targeting any fish species other than salmon and Pacific Halibut; the commercial shrimp beam trawl fishery; and the recreational and commercial shrimp pot fisheries. This FCP also includes information on the potential take, and measures to reduce the take, of ESA-listed Puget Sound Chinook Salmon (both native and hatchery produced), southern Eulachon, and

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

[4] As defined by the Washington Administrative Code (WAC) 220-16-340.
[5] The term "other fish" refers to marine fish (except salmon and Pacific Halibut) not legally defined as "Bottomfish"and species included in one of the following categories; Forage Fish (WAC 220-56-225), Food Fish (WAC 220-12-10), and Anadromous Game Fish (WAC 220-56-105).

173 southern Green Sturgeon by the requested fisheries. Supplementary information is also
174 presented in context of the fishery and population management regime that supports
175 individual applications for research focused on bottomfishes under Section 10 (a)(1)(A),
176 as the results of these activities will be used to inform adaptive management decisions
177 during the requested ITP period (2017-2022). Coverage for the incidental take of listed
178 rockfishes and other ESA-listed species by WDFW-managed salmon fisheries is
179 separately covered by the Puget Sound Chinook Harvest Management Plan. WDFW is
180 not seeking coverage for commercial and recreational crab fisheries that have been
181 identified as having an extremely low encounter potential for ESA-listed rockfishes
182 (Appendix 2). Any encounters of listed rockfishes by these fisheries would be addressed
183 through a separate Section 10(a)(1)(B) permit, as necessary.

184

185 **Table 2.** Conservation Measures Taken by WDFW to Protect Rockfish in Puget Sound since
186 1983.

YEAR	RECREATIONAL	COMMERCIAL
1983	10 fish bag limit for rockfish in North Sound, 5 in South Sound	
1984		Permanent closure of San Juan Islands 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 3 in South Sound	Bottom trawl fishing for food fish prohibited in Admiralty Inlet and the 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. Barbless hooks required for Bottomfish.	
2003	Permanent rule prohibiting harvest of Yelloweye Rockfish and Canary Rockfish	
2004	Daily rockfish limited to first rockfish caught. Rockfish seasons instituted (only open during lingcod and salmon season). Closed to spearfishing for rockfish.	

YEAR	RECREATIONAL	COMMERCIAL
2010	Prohibition of all rockfish retention within the DPSs. No fishing for any species of Bottomfish (including rockfish) in waters deeper than 120 feet throughout all of the DPSs.	Temporary closure of the bottom trawl, Bottomfish pot, set line, and set net fisheries within the DPSs.
2011		Permanent closure of bottom trawl, set net, set line, Bottomfish pot, pelagic trawl, and scallop trawl throughout all of the DPSs.

In 2010, the Washington Fish and Wildlife Commission (FWC) formally adopted regulations prohibiting the retention of all 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 of 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 pot fishery
5. Closure of the bottom trawl fishery
6. Closure of the scallop bottom trawl fishery
7. Prohibition of the retention of rockfish of any species that is caught by any commercial fishery within the Puget Sound DPSs.

The above closures and regulations remain in effect and thus remove any potential risk to ESA-listed rockfish species, with minimal adverse socio-economic impact. From 2000 to 2010 less than a dozen landings were made using any of these gear types from areas inside the DPSs (WDFW Commercial Fish Ticket Database). As a precautionary measure, these closures apply to an area larger than the designated DPSs for the ESA-listed rockfish species. By extending the closure area west to Cape Flattery, extra protection is provided to listed rockfish in the event that the designated Puget Sound/Georgia Basin DPSs are determined to be inadequate, and will prevent commercial fishers from concentrating gear along the western boundary 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)

Bocaccio, Yelloweye Rockfish, and Canary Rockfish share similar life history characteristics. All give birth to live larvae which generally occupy the upper portion of the water column and may be found at the surface. After several months the juveniles typically settle to the seafloor and move into shallow, nearshore areas. Preferred juvenile habitats include rocky areas with attached macrophytes, sandy bottoms with eelgrass, and drift kelp. 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 are typically found between depths of 40 and 250 m, and are usually associated with complex seafloor habitats with moderate to extreme vertical relief. Preferred substrates include bedrock, boulders, and hard (compacted) seafloors, although these species may occasionally be encountered over sand or mud.

Yelloweye Rockfish range from Alaska to Baja California. It is primarily a benthic species with both sub-adults and adults occupying small home ranges. Yelloweye Rockfish are less frequently observed in southern Puget Sound (south of the seaward entrance to Admiralty Inlet and east of Deception past) than in northern 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[6]. The Hood Canal sub-basin has the greatest frequency of Yelloweye Rockfish observed in trawl, scuba, and remotely-operated vehicle (ROV) surveys (Palsson et al. 2009; WDFW, unpublished data). ROV surveys in the San Juan Island (SJI) region in 2008 (focused on rocky substrate) and 2010 (across all habitat types) estimated a population of 47,407±11,761 and 114,494±31,036 individuals, respectively. A 2015 ROV survey of that portion of the DPSs south of the entrance to Admiralty Inlet estimated the population size of Yelloweye Rockfish at ±XX,XXX 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 1.5 and 2%. Juvenile Yelloweye Rockfish are most commonly encountered at depths greater than 30 m while adults are typically found in deeper water (90-180 m). Adult and sub-adult rockfish prefer highly complex seafloor habitats with extreme vertical relief but may occur over less complex or featureless (flat) habitats between complex habitats. Yelloweye Rockfish feed mainly on small crustaceans and fish.

[6] Including the Strait of Juan de Fuca, Strait of Georgia, San Juan Island area, Hood Canal, Whidbey Basin, Main Basin, and South Sound .

Canary Rockfish range 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 inside their DPS occurring in the eastern Strait of Juan de Fuca. An ROV survey of rocky habitats in the San Juan Islands region in 2008 sighted only a single fish, producing a population size estimate of 1,697 fish, with a coefficient of variation of 100% due to the extremely low encounter rate. A later 2010 survey of the same area that included all habitat types also encountered only a single fish, but produced a population estimate of 4,880±4,001 because of differences in the survey design. Canary Rockfish is a schooling species and tends to have a larger home range than Yelloweye Rockfish. Juveniles typically occur at depths less than 100 m whereas adults are usually found in deeper water (80-200 m). Canary Rockfish are usually associated with pinnacles and other high-relief seafloor features, but may also be found over flat and mixed boulder habitat, often suspended in the water column. They reach a maximum age of at least 84 years and may attain lengths up to 76 cm. Age at sexual maturity is not certain, but is believed to be between 7 and 12 years, and their annual natural mortality rate is estimated from 6-9% (Methot and Stewart 2005, Stewart 2007). The primary prey of Canary Rockfish are fish and small crustaceans.

Bocaccio range from Alaska to central Baja California and 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. WDFW trawl surveys captured one Bocaccio in 2012 and 11 Bocaccio in 2016 at two stations lying outside of the DPS. An ROV survey of the San Juan Islands in 2008 estimated a population of 4,606±4,606 (based on four fish observed along a single transect), but no estimate could be obtained in 2010 because this species was not encountered. A single Bocaccio encountered in a 2015 ROV survey produced a population estimate of XX individuals for that portion of the DPS lying south of the entrance to Admiralty Inlet and east of Deception Pass. Adult Bocaccio are most often found in high relief boulder and rock seafloor habitats and may live in caves. In Puget Sound, the species has been found in close association with high-complexity habitat and steeply-sloped sand and mud bottoms. Similar to Canary Rockfish, adults can be found suspended in the water column well off of the bottom, and the species has been known to move long distances, especially as juveniles. Bocaccio are difficult to age but are thought to exceed 50 years in age. The maximum reported size is 91 cm. In Oregon waters, 100% of female Bocaccio are sexually mature at 61 cm (Love et al. 2002). Juvenile Bocaccio consume a wide variety of organisms and adults feed on 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 provided in Appendix 1.

The Biological Review Team (BRT) provided scientific review of the status of the listed rockfish species prior to ESA listing (Federal Register 2009), and concluded that the most likely DPS for each 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 (Federal Register 2009) (Figure 2). The western boundary of the DPSs was established at the Victoria Sill just to the east of Port Angeles (Federal Register 2009) (Figures 2, 3, and 4). Based on the recommendation of the BRT (Tonnes et al., 2016), and heavily weighting newly collected genetic data, a proposal to move the boundary of the Yelloweye Rockfish DPS northerly into Johnstone Strait, B.C. and abolish the Canary Rockfish DPS due to lack of genetic discreteness was made in the Federal Register 2016 (NMFS, 2016). This FCP addresses only that portion of the DPSs within Washington State, as WDFW has no authority to conduct research or regulate fisheries within the Canadian portion of the DPSs. It should be noted that the management and catch area boundaries used by WDFW do not coincide exactly with the DPS boundaries established by the BRT, thus, for the purposes of this FCP, we considered an area slightly larger than the defined DPSs. For recreational fisheries we included all of Puget Sound except for Management and Catch Reporting Areas (MCAs) 4 and 5, and note that the westernmost portion of MCA 6 extends beyond the western boundary of the DPSs (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). By maintaining these management areas within this FCP, WDFW eliminates the need to establish additional fishing boundaries which would add further complexity to existing regulations and be potentially confusing to fishery participants.

Authority to Manage Commercial and Recreational Fisheries

WDFW has the authority to manage all non-treaty (i.e., not associated with Native American tribes) commercial and recreational fisheries within the DPSs. 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(s) 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).

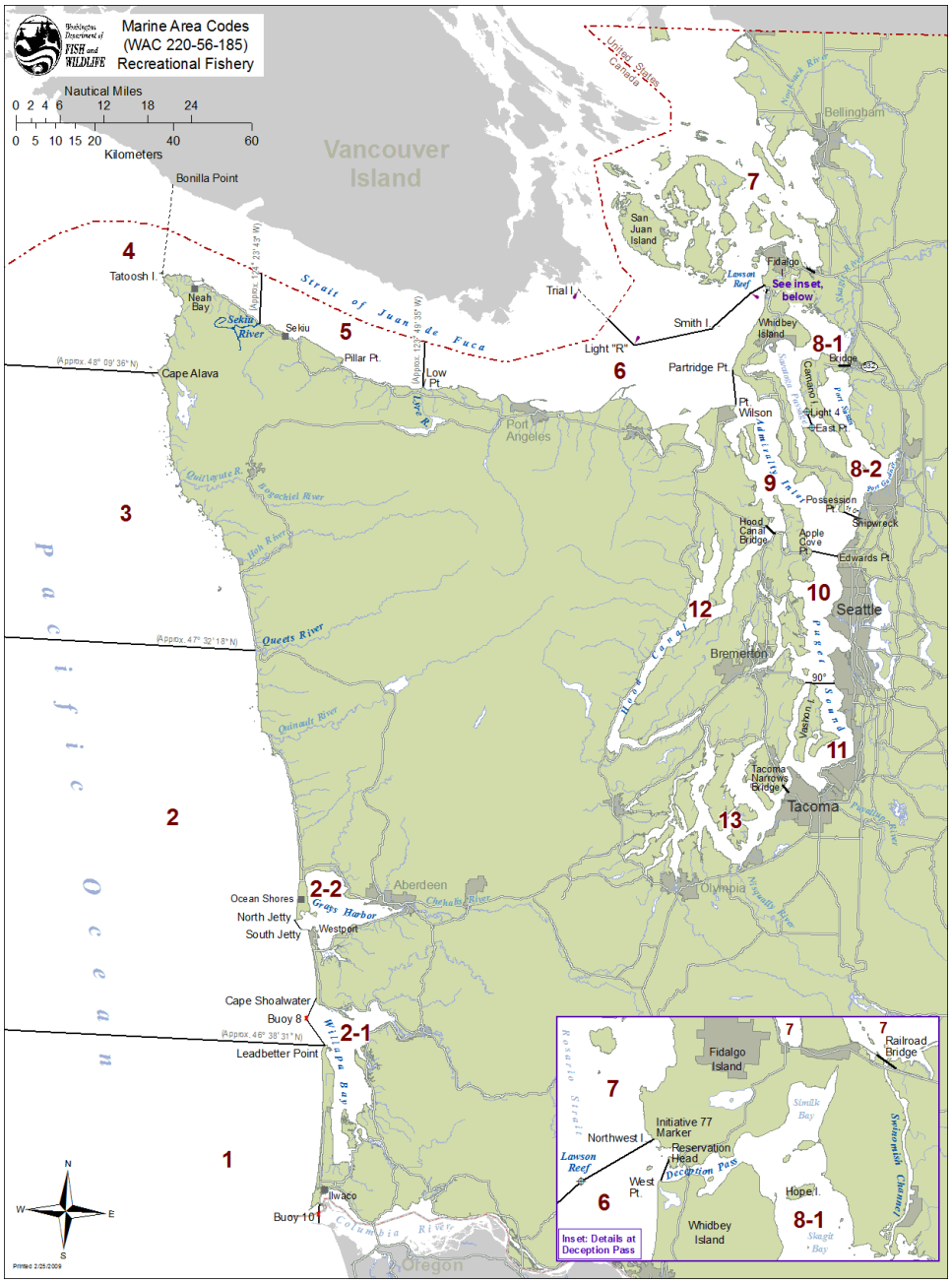
Current Commercial and Recreational Fishery Gears in Puget Sound

Within the DPSs, 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 are open access, which means there is 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 in 2011as noted above, 33 WDFW-managed fisheries are operating within the DPSs in 2016 (Appendix 2). Four fisheries targeting salmon and Pacific Halibut are not addressed in this FCP as they have an existing federal nexus and are evaluated for their impact on rockfish separately. The remaining 29 fisheries were evaluated for their potential impact on ESA-listed rockfish, and 25 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. The four fisheries that were determined to have the potential to encounter ESA-listed rockfish species are:

- recreational fishing for Bottomfish and other fish (excluding salmon or Pacific Halibut)
- commercial shrimp beam trawl
- commercial shrimp pot, and
- recreational shrimp pot

Detailed narratives for each of these fisheries are provided in the following section.



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

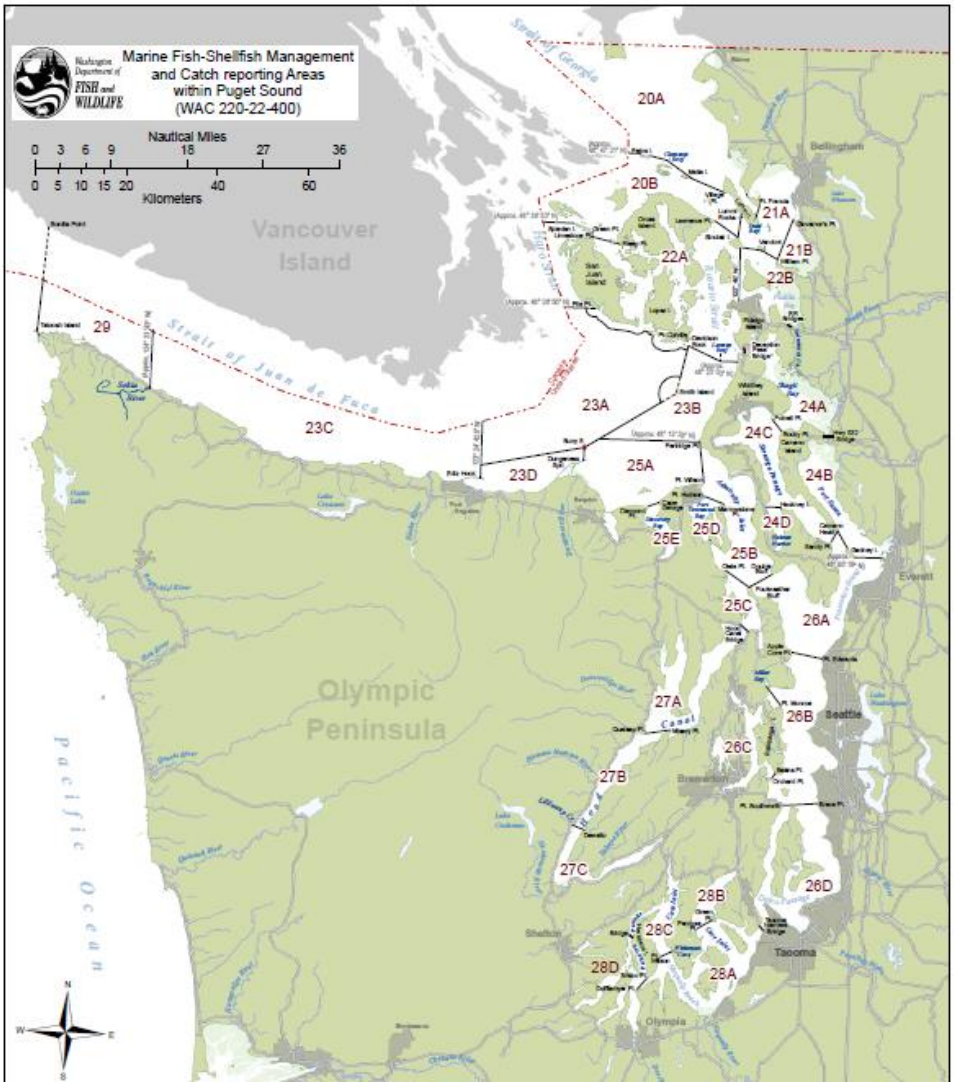

Figure 4. Commercial Marine Fish-Shellfish Catch Reporting Areas.

FISHERY NARRATIVES

The four fisheries being requested for coverage under Section 10(a)(1)(B) of the ESA were critically reviewed to evaluate the extent of risk to ESA-listed rockfish and other listed species from incidental encounters. 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 Commercial Shrimp Beam Trawl Fishery

Shrimp Trawl and Beam Trawl Gear Description

A "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 cod end 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 that is usually weighted (footrope). Additional webbing is frequently attached to the cod end 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 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 State-managed Puget Sound commercial shrimp fishery (WAC 220-52-051), though Tribally-managed non-treaty fisheries allow the use of otter trawls. The minimum mesh size for Puget Sound beam trawl nets is one and one-half inch 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.

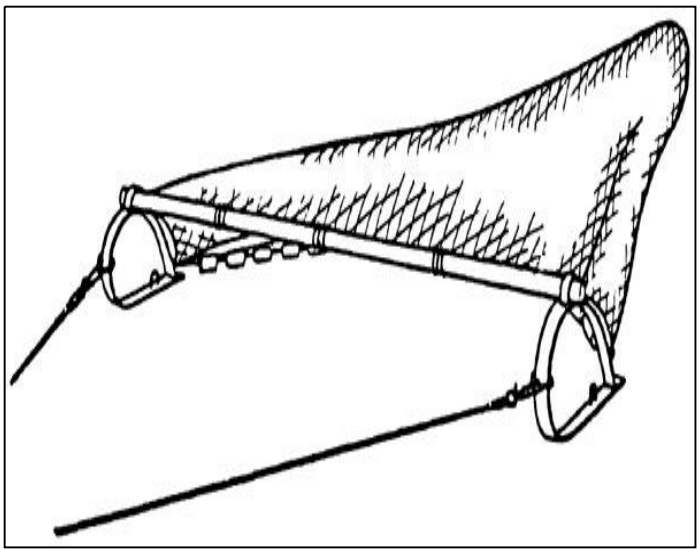

Figure 5. Schematic of a shrimp beam trawl.

Areas of Operation: Protection Island in the eastern Strait of Juan de Fuca (Marine Fish-Shellfish Catch Reporting Areas 23A, 23B and 25A), and the San Juan Islands to the Canadian border (Marine Fish-Shellfish Catch Reporting Areas 20A, 20B, 21A and 22A).

Target species: Northern pink shrimp (*Pandalus eous*) is the dominant species harvested in the Puget Sound DPSs and is the primary species harvested in the Strait of Juan de Fuca (Table 3). In the San Juan Islands, the primary species harvested are coonstripe (a.k.a., dock) shrimp (*P.danae*), northern pink shrimp, and sidestripe shrimp (*Pandalopisis dispar*), although humpy shrimp (*Pandalus goniurus)* also compose a large portion of the catch in some years (there is no fish ticket code for humpy shrimp so they generally are recorded on fish tickets as pink shrimp).

Season Structure: The shrimp beam trawl season is managed by emergency regulation; it is always closed by permanent rule unless opened by emergency regulation. The season generally occurs from May 1 – September 30 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 areas). Since 1997, the State adjusted (i.e., non-tribal) shrimp trawl fishery quotas have been maintained at 621,500 pounds in the Strait of Juan de Fuca east of Port Angeles and 83,000 pounds 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.

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

Management Action(s) Taken to Reduce Impact to Rockfish: Shrimp beam trawls are generally towed at 1.5-2.0 knots over muddy bottoms, making encounters with, let alone entrapment of, rockfish of any species unlikely. In limited observations, no landings of listed rockfish species have been documented with this fishing gear and current regulations prohibit the retention of rockfish taken with any commercial fishing gear. Observer coverage was required in this fishery in 2011 and provides in-season tracking of rockfish bycatch that can be used to initiate adaptive management measures to reduce bycatch of listed species, as necessary. To date, observers have recorded no bycatch of rockfish of any of the listed species in the shrimp beam trawl fishery. WDFW has been working to promote the use of bycatch reduction devices (i.e., excluders) on shrimp trawls, although these devices are primarily aimed at reducing Spot Shrimp bycatch. Excluders are not currently required by WDFW although their use is incentivized as a condition of their operating permit. Specifically, in the Straits of Juan de Fuca, fishery participants are only required to have 10% observer coverage if an excluder is affixed to the net, whereas if no excluder is used, 20% observer coverage is required until reaching 50K pounds landed, after which coverage is reduced to 10%. Early observations suggest that an excluder can reduce Spot Shrimp bycatch by up to 90% with 20-25% loss of fishery efficiency, but this can be made up for with longer tow durations with no appreciable effect on product quality.

Activity Trend: Most of the fishery 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. Fishery participation and catches vary considerably over the past 25 years (Figure 6). The number of active vessels peaked in 1992 at 14, declined to a low of 2 in 2011, but has since increased to four active vessels in 2013-2015. Prior to 1998 the catch was weakly negatively correlated with the number of active vessels, but since then has shown a strong positive correlation. Annual catch peaked at 1.2 million pounds in 1995. As a direct consequence of the Rafeedie decision (United States v. Washington, 873 F.Supp. 1422 W.D. Wash. 1994), an annual quota of 704,500 pounds was established in 1997, with catches holding near the quota from 1997 to 2008. Catches declined to a low of 92,000 lbs (42 mt) in 2010, but have increased in recent years due to an increase in the number of active vessels and trips taken (Figure 6, Table 3). The value of this fishery from 2004 to 2015 generally mirrors

the pattern of catches over this time period, ranging from a high of $443K in 2008 to a low of $59K in 2011 (Table 4).

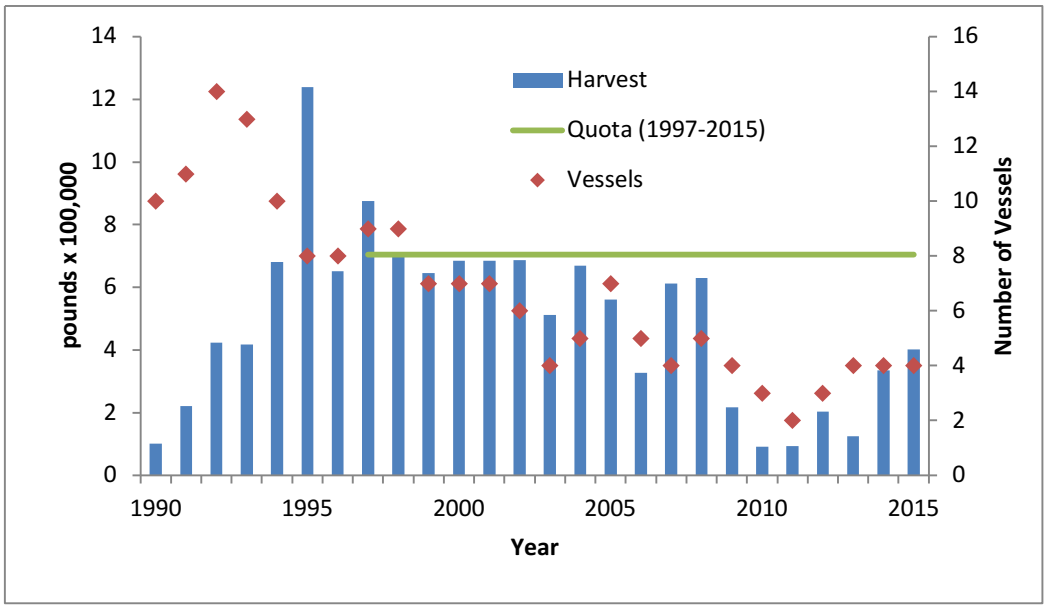

Figure 6. Commercial shrimp trawl catch and effort within the Puget Sound DPSs from 1990 to 2015 (Source, WDFW unpublished data).

Catch Compliance 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. Completed logs provide detailed information on the location (latitude, longitude, depth) and catch amount of individual shrimp trawls. 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.

476 **Table 3.** Shrimp Harvest (in pounds) by Species and Region by the Commercial, Non-tribal
477 Beam Trawl Fishery in Puget Sound (1990-2015).

Year	Pounds				Number of Trips
	Coonstripe	Pink	Sidestripe	Total	
San Juan Islands					
1990	83,256	11,814	0	95,070	209
1991	66,311	9,455	370	76,136	144
1992	77,207	11,781	61	89,049	139
1993	75,016	9,943	5,856	90,815	138
1994	82,069	5,798	5,839	93,706	128
1995	86,489	10,866	3,103	100,458	64
1996	57,110	6,310	35	63,455	48
1997	50,083	11,283	12,765	74,131	52
1998	23,471	19,875	9,843	53,189	52
1999	40,107	16,259	15,593	71,959	67
2000	48,608	12,774	12,770	74,152	150
2001	47,515	21,163	8,659	77,337	188
2002	44,406	18,178	4,768	67,352	165
2003	38,545	17,852	970	57,367	149
2004	41,506	11,989	1,815	55,310	122
2005	34,939	20,222	1,758	56,919	118
2006	29,996	22,603	2,789	55,388	122
2007	33,222	23,165	1,846	58,233	141
2008	22,114	27,122	1,135	50,371	109
2009	32,277	34,204	3,310	69,791	144
2010	33,242	36,739	282	70,263	134
2011	35,700	26,182	30	61,912	103
2012	30,074	35,935	640	66,649	107
2013	47,423	29,225	489	77,137	126
2014	51,861	25,581	0	77,442	129
2015	42,936	34,147	0	77,083	99

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Table 3 (continued). Shrimp Harvest (in pounds) by Species and Region by the Commercial, Non-tribal Trawl Fishery in Puget Sound (1990-2015).

Year	Pounds				Number of Trips
	Coonstripe	Pink	Sidestripe	Total	
East Juan de Fuca					
1990	4	5,737	0	5,741	16
1991	87	142,711	1,981	144,779	89
1992	7	333,226	437	333,670	61
1993	139	326,502	190	326,831	64
1994	0	586,598	0	586,598	66
1995	0	1,139,049	0	1,139,049	91
1996	0	588,393	0	588,393	51
1997	0	800,420	0	800,420	64
1998	4,320	648,252	1,774	654,346	62
1999	1,627	570,931	801	573,359	62
2000	261	609,448	70	609,779	56
2001	0	606,448	0	606,448	80
2002	10	616,712	2,629	619,351	81
2003	184	452,684	1,233	454,101	92
2004	242	609,858	4,376	614,476	75
2005	1,261	502,141	1,702	505,104	106
2006	498	271,257	605	272,360	79
2007	210	554,527	165	554,902	78
2008	759	577,783	1,874	580,416	59
2009	967	144,486	1,916	147,369	36
2010	337	16,807	4,802	21,946	34
2011	364	23,368	8,461	32,193	41
2012	170	129,763	7,767	137,700	65
2013	0	46,960	1,374	48,334	35
2014	755	256,591	790	258,136	72
2015	5,036	315,208	12,628	325,414	99

Table 4. Value of the commercial shrimp beam trawl fishery in ex-vessel dollars, from 2004 to 2015.

Year	Total pounds landed (x 100,000)	Ex- Vessel Value
2004	6.698	$435,215
2005	5.620	$340,024
2006	3.277	$172,593
2007	6.131	$386,651
2008	6.308	$443,612
2009	2.167	$161,513
2010	0.922	$64,546
2011	0.941	$58,533
2012	2.043	$127,793
2013	1.255	$189,795
2014	3.356	$208,013
2015	4.025	$210,908

From 1996 to 2011, a limited program of on-board observation of fishing activities was conducted by WDFW in the San Juan Islands and the eastern Strait of Juan de Fuca, although the temporal and spatial coverage of these observations was sparse (Table 5). Beginning in 2011, WAC 220-52-051 required fishery participants to provide on-board observers on not less than 10% of the shrimp trawl trips occurring in the rockfish DPSs to record tow-by-tow information on encounter rates, catch compostion, size, and other biological data. The minimum target monitoring rate of 10% in the current Incidental Take Permit (ITP) (2012-2017) was selected following examination of similar monitoring efforts for Section 10 ITPs (Pate 2005), consultation with regional NMFS staff, and in consideration that no listed species had been observed on any trawl trips from 1999 to 2010. From 2011 to 2015, observer coverage of shrimp beam trawl trips ranged from 9.3% and 12.6% (Table 5). As part of the adaptive management approach, the target monitoring rates may be adjusted up or down in coordination with NMFS and, under the conditions of the current ITP, any adjustment can only occur after at least one full year of monitoring and with the approval of NMFS. No listed species have been encountered on 90 observed shrimp trawl trips over the last five years, therefore, within this renewed FCP, WDFW proposes to reduce the observer coverage rate, from 10% to 5% for the next ITP period (2017-2022). In order to further decrease bycatch in this fishery, WDFW is promoting the requirement of "grate style" Biological Reduction Devices on all shrimp

trawl nets, which could allow a further decrease in the observer sampling rate if fully implemented by the fishery.

WDFW will develop or improve existing monitoring programs for commercial fisheries, which will include the following elements:

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

Any catch of ESA-listed rockfish and other listed species will be considered as lethal take. If encountered by on-board observers, length measurements, genetic tissues, gonads, age structures, and other samples may be obtained from Bocaccio, Canary, and Yelloweye Rockfishes and other listed species observed during these sampling events. The take of listed species by the commercial shrimp beam trawl fishery will be based upon information from completed logbooks, commercial fish tickets, and catch rates of listed species taken from observed catches and trips.

Table 5. Number of commercial shrimp beam trawl trips and annual observer coverage rates in northern Puget Sound (2011-2015).

	Number of Trips	Observer trips	% coverage
2011	144	15	10.4
2012	172	16	9.3
2013	161	15	9.3
2014	201	19	9.5
2015	198	25	12.6

Take of Listed Species: Finfish (including rockfish, Eulachon, Green Sturgeon, and Chinook Salmon) were not reported on fish receiving tickets between 1971 and 2015. 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 (SJI) or in the eastern Strait of Juan de Fuca (ESJF). 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 6). In August 1996, WDFW and the Suquamish Indian Tribe conducted a 2-day bycatch study of the beam trawl fishery in the eastern Strait of Juan de Fuca (Catch Area 25A). Shipboard observers sampled 27,890 pounds of shrimp and 528 pounds of fish (30 species) collected over eleven 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. From 2011 to 2015, on-board observers recorded a total of 82 Puget Sound Rockfish in the beam-trawl fishery, and the only ESA-listed species encountered was a single Eulachon weighing 0.03 pounds in 2011 (Table 6).

Table 6. WDFW Observations of listed rockfish and Eulachon in the shrimp beam trawl fishery in northern Puget Sound.

Date	Area	Observed Shrimp (Pounds)	Listed Rockfish (numbers)	Eulachon (numbers)
24-Sep-2010	20A (SJI)	27	0	0
14-Sep-2010	22A (SJI)	808	0	0
15-Jun-2010	22A (SJI)	272	0	0
21-May-2010	22A (SJI)	863	0	0
23-May-2005	22A (SJI)	397	0	2
19-May-2003	22A (SJI)	227	0	0
17-May-2002	22A (SJI)	645	0	0
07-Sep-2000	22A (SJI)	475	0	0
14-Oct-1999	20B (SJI)	1,120	0	0
13-May-2011	23B (ESJF)	7,284	0	1
6-7-Aug-1996	25A (ESJF)	27,890	0	144

Predicted Annual Take for the Shrimp Beam Trawl Fishery

Based on over 25 years of data from the WDFW fish receiving ticket database, on-board observer monitoring, strict harvest regulations, and anecdotal evidence from past and present fishers, 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 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. Because these species have never been documented in the catch history, WDFW has no data to estimate potential take by this fishery; however, in order to provide adequate protection for listed species while allowing the beam-trawl fishery to operate, we are requesting an annual allowance of five Bocaccio, ten Canary Rockfish, ten Yelloweye Rockfish, 50 Chinook Salmon, and one Green Sturgeon (Table 7). The requested allowances are for any life stage, and any take is expected to be lethal. These are the same take values authorized under WDFWs current ITP for this fishery.

Table 7. Estimated Annual Take of ESA-listed species by the shrimp beam trawl fishery in northern Puget Sound.

Species	Annual Take Estimate
Bocaccio	5
Canary Rockfish	10
Yelloweye Rockfish	10
Eulachon	3,243
Chinook Salmon	50
Green Sturgeon	1

To predict the take of Eulachon by the shrimp beam trawl fishery, the maximum encounter rate of Eulachon from the historical observer data (see Table 5) was extrapolated to the shrimp quota in each area. Based on the ratio of Eulachon to shrimp caught (2.52/27,890 lbs) and an average eulachon weight of 0.0175 pounds (1996 bycatch study), we estimate that up to 56 pounds of eulachon representing 3,209 individuals may be taken for the non-tribal catch 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 from 1999 to 2010, we estimate that up to 34 eulachon may be taken per year in the San Juan Islands for a quota of 83,000 lbs. Summing the values for the eastern Strait of Juan de Fuca and San Juan Islands, the total estimated take of Eulachon in the north Puget Sound beam trawl fishery is 3,243 fish (Table 7). It should be noted that this estimate is based on observations that are limited in geographic and temporal scope, especially for the fishery in the eastern Strait of Juan de Fuca.

Puget Sound Recreational Fisheries for Bottomfish and Other Fish

Terminology

The term “bottomfish” is commonly used by anglers to refer to a variety of marine fish species that live on or near the seafloor. However, as defined by Washington Administrative Code (WAC) 220-16-340[7] and as managed by WDFW, “Bottomfish”

[7] **WAC 220-16-340 General definitions -- Bottomfish.** The term "bottomfish," unless otherwise provided, is defined as including Pacific Cod, Pacific Tomcod, Pacific Hake (Whiting), Walleye Pollock, all species of dabs, sole and flounders (except Pacific Halibut), Lingcod and all other species of greenling, Spotted Ratfish, Sablefish, Cabezon, Buffalo Sculpin, Great Sculpin, Red Irish lord, Brown Irish Lord, Pacific Staghorn Sculpin, Wolf-eel, Giant Wry Mouth, Plainfin Midshipman, North Pacific Spiny Dogfish, Sixgill

includes all species of rockfish, Lingcod and other greenlings, flatfishes (except Pacific Halibut), codfishes, sharks and skates, surfperches (except Shiner Perch), and a variety of other larger bottom-dwelling species. All other species of bottomfish, such as small sculpins, eelpouts, gunnels, and other bottom-dwelling fishes seldom captured by hook-and-line are classified and managed by WDFW as "Unclassified Marine Fish" (WAC 220-56-130), and no harvest is permitted within the U.S. portion of the listed rockfishes DPSs, except for Shiner Perch. Anchovy, Sand Lance, Pacific Herring, Pacific Sardine, and all species of smelt are defined as "Forage Fish" (WAC 220-16-475). Salmon, Pacific Halibut, Green and White Sturgeon, American Shad, Cutthroat Trout (sea-run phase), and several marine fish species that may occur irregularly in State waters, such as mackerel, various species of tuna, Pacific Barracuda, and Yellowtail are legally defined as either "Food Fish" (WAC 220-12-010) or "Anadromous Game Fish" (WAC 220-56-100). Hereafter we use the term "other fish" in reference to the collective group of "Forage Fish", "Food Fish" (except Bottomfish, salmon, and Pacific Halibut), "Anadromous Game Fish", and Shiner Perch.

Fishery Description

Recreational fisheries for Bottomfish and other fish occur in the ESA-listed rockfish DPSs throughout Puget Sound (Recreational MCAs 6-13). The data and analyses presented in this FCP exclude fisheries that specifically target salmon or Pacific Halibut, as these fisheries have a Federal nexus and the take of listed species is currently covered under a separate Section 7 consultation. Historically, Bottomfish and other fish fisheries have occurred concurrently with fisheries for salmon and Pacific Halibut, thus anglers responding to WDFW monitoring surveys (described below) who indicated they were fishing for any marine fish species (including salmon or Pacific Halibut) are included in our analyses except where otherwise noted. Most recreational fisheries for Bottomfish occur by boat-based hook-and-line anglers, but anglers from docks, piers, and the shore account for a proportion of the Bottomfish harvest. Fishers use a variety of gears and techniques that are similar to those used in the recreational salmon fishery. Additionally, divers spear Lingcod, Cabezon, and some other Bottomfish species but are prohibited from harvesting rockfish of any species within the DPSs. More restrictive regulations have reduced the numbers of rockfish landed in recent years, but the number of rockfish released while targeting other species can be substantial. In 2010, new regulations for Bottomfish (as defined by WAC 220-16-340) were implemented to reduce the incidental harvest and mortality of rockfish within the DPSs by recreational Bottomfish and other

Shark, Soupfin (Tope) Shark and all other species of shark, and all species of skate, rockfish, rattails and surfperches (except shiner perch).

fish anglers. Effective May 1, 2010, it became unlawful to fish for or retain rockfish of any species within the DPSs (MCAs 6-13), and fishing for Bottomfish was prohibited in waters deeper than 120 feet (20 fathoms). It should be noted that no depth restrictions were placed on fisheries for Forage Fish, sturgeon, mackerel, and species classified as "Other Food Fish" by WDFW, as fisheries for these species typically occur in water depths <120 feet.

Seasons, Areas, and Catch Limits

Within the Puget Sound DPSs, recreational fishing seasons for Bottomfish and other fish vary by species and species group. Harvest of all species of rockfish, Wolfeel, Sixgill and Sevengill sharks, and Common Thresher Sharks is prohibited. Fishing is allowed year-round for flatfish (other than Pacific Halibut), greenlings (other than Lingcod), sculpins (other than Cabezon), surfperches, and other Food Fish (e.g., carp, tuna, shad). Additionally, the season for sturgeon is open on a year-round basis but is catch-and-release only. Anglers are permitted to fish for Lingcod from May 1st to June 15th, with spearfishing allowed only from May 21st to June 15th, and for Cabezon from May 1st to November 30th. Fishing for codfishes is allowed year round in MCAs 6 and 7, but prohibited in MCAs 8 to 13. Hood Canal (MCA 12) was closed to fishing for Bottomfish and other fish (except salmon) in 2002 to mitigate for the adverse impacts of hypoxia on fish and invertebrate resources; however, Quilcene Bay and the northern portion of Dabob Bay (Figure 7) were reopened for fishing for flatfish only (excluding halibut) in July 2015 following an extensive review of the potential risk to ESA-listed rockfish from incidental encounters. Fishing for Bottomfish (other than Pacific Halibut) is prohibited in water depths greater than 120 feet, except that anglers may retain Lingcod and Pacific Cod caught deeper than 120 feet in MCA 6 on days when the season is open for Pacific Halibut.

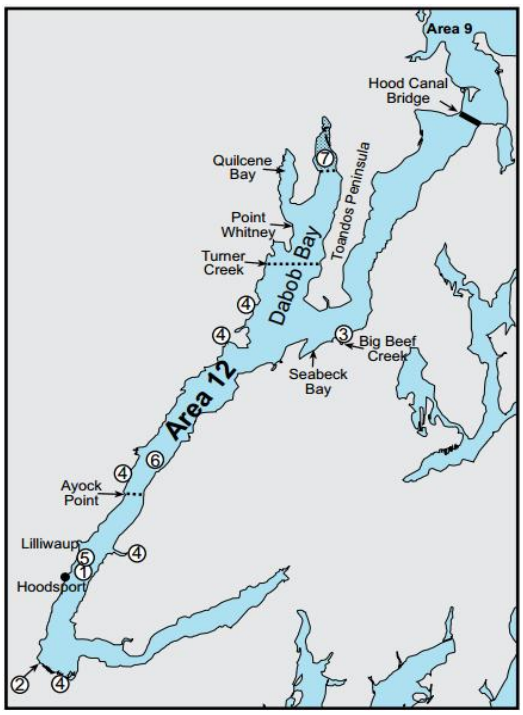


Figure 7. Map of Marine Catch Area 12 (Hood Canal). The area north of the line running due east from the mouth of Turner Creek in Dabob Bay is open for flatfishing only.

Fishing Techniques and Legal Gear (Tackle)

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. Other anglers may use salmon fishing techniques such as mooching, fly fishing, or trolling to target Bottomfish. Anglers fishing for Lingcod use nautical charts, fishing maps, depth finders, global positioning systems, and local knowledge to locate rocky and steep habitats preferred by this species. Some anglers use lighter tackle when targeting flatfish and other non-rockfish species. Bottomfish are also caught by recreational anglers that are not targeting a specific species, or that are targeting both salmon and Bottomfish. 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. While the intent of most of Bottomfish anglers is to harvest one or more legal species, some anglers practice catch-and-release for some or all species. Until 2010, anglers could fish deeper than 120 feet for Bottomfish, though most fishing activity occurred in shallower nearshore areas. Barbless hooks are required when fishing for any species other than forage fish in MCAs 6-13. Anglers are allowed up to 2 hooks per line and hooks may have up to 3-points (treble hook), although only single point hooks are allowed when targeting salmon.

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 live or dead fish or fish-like lures with large hooks and heavy tackle tend to be the most successful. Lures used by Lingcod anglers include “leadhead” jigs, darts, diamond jigs, and other fish- or squid-like lures. Baits used include dead adult or juvenile herring, squid, and octopus, or live baits such as herring, small flatfish, greenlings, and other Bottomfish (except rockfish, which are prohibited) jigged just prior to targeting lingcod.

Cabezon and Kelp Greenlings – Though not a dominant fishery, anglers fishing in kelp beds and shallow rocky habitats occasionally target Cabezon and other large sculpins (e.g., Red Irish Lord), and Kelp Greenlings. These species eat shrimp, crab, and other invertebrates, and are typically targeted using “leadhead” jigs or other crab-like lures. These species often co-occur with rockfish throughout Puget Sound.

Flatfish – Flatfish occur at all depths throughout Puget Sound, predominantly on sand, mud, and cobble bottoms, and rarely co-occur with rockfish. Rock Sole and Starry Flounder, however, may be common over gravel and cobble bottoms alongside juveniles of several species of rockfish. Anglers typically target flatfish using small, baited hooks or lures in nearshore waters (<100 ft), and in recent years flyfishing on mud flats has become increasingly popular. The catch is dominated by Starry Flounder, English Sole, Rock Sole, and Pacific Sanddab.

Perch – Striped Seaperch and Pile Perch are the most commonly harvested species and are a popular target of pier-based anglers. 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 North Pacific Spiny Dogfish, small sculpins, skates, and Spotted Ratfish may be harvested or released back into the water.

Areas of Operation: Recreational Marine Catch Areas (MCAs) 6, 7, 8-1, 8-2, 9, 10, 11, and 13. MCA 12 (Hood Canal) has been closed to all bottomfishing since 2002. In July 2015, fishing for flatfish only (except Pacific Halibut) was opened in Quilcene Bay and the northern portion of Dabob Bay, but the remaining portion of MCA 12 remains closed to bottomfishing (Figure 7).

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 and other greenlings, Cabezon and other sculpins, flatfishes (other than Pacific Halibut), surf perches (including Shiner Perch), North Pacific Spiny Dogfish, other Bottomfish, tuna, sea-run Cutthroat Trout, forage fish.

Gear Specifications: One rod per angler with up to 2 barbless hooks per line in Recreational MCAs 6-13. Hooks may have up to 3 points (treble hook). Use of downriggers is allowed. Bow and arrow and spearfishing are allowed for Bottomfish.

Activity Trend: Variable but stable. Recreational fishing effort in the Puget Sound DPSs for boat-based anglers targeting Bottomfish and other fish ranged between 185,000 and 258,000 angler trips during the early 1990s, with an average of 210,000 trips taken annually (Figure 8). 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 from 1994 to 2003. After catch and effort estimation

systems were improved in 2004, fishing effort estimates were substantially lower, ranging from 52,000 to 105,000 trips per year between 2004 and 2015, with an annual average of 74,000 trips, representing a 65% decline from the early 1990's (Figure 8). Within the DPSs, angler activity for Bottomfish and other fish has consistently been highest in the San Juan Islands (MCA 7) (Figure 9). Despite being closed to fishing for any species except salmon from 2002 to 2015, it was estimated that 56,521 Bottomfish and other fish trips occurred in Hood Canal (MCA 12) from 2004 to 2015. Of these, 51,804 trips were assigned to anglers who reported in the creel or telephone surveys that they were fishing for any species. However, because 78% of these trips occurred during the peak of the salmon season, we assume that most of these anglers were targeting salmon, thus the fishery statistics substantially overestimate the actual Bottomfish-focused effort in MCA 12. In comparison, only 4,717 fishing trips were estimated for anglers who responded that they were only targeting Bottomfish in MCA 12 from 2004 to 2015 (range = 0 - 2,067, average = 393 trips/year). Most of these trips can be assigned to one of two categories: 1) anglers being unaware of the MCA 12 area closure (and thus fishing illegally); or 2) anglers fishing north of the Hood Canal Bridge (MCA 12 boundary) but reporting that they were fishing in Hood Canal, resulting in the angler trip being assigned to the wrong MCA. In 2015, a single respondent in the telephone survey reported fishing for any species for 61 days within a single 2-month wave in MCA 12, which produced an effort estimate of 32,008 angler trips and a corresponding catch estimate of 75,000 flatfish. Despite the opening of the flatfish fishery in Hood Canal during this period, both of these estimates are considered extremely unrealistic and this situation highlights one of the main deficiencies of the current catch and effort estimation system, whereby a single report from a very active fisher can substantially bias the fishery statistics. Because of this, only estimates from anglers who indicated that they were targeting Bottomfish in MCA 12 in 2015 are included in the estimate of total angler trips in the DPSs in 2015 (Figure 8).

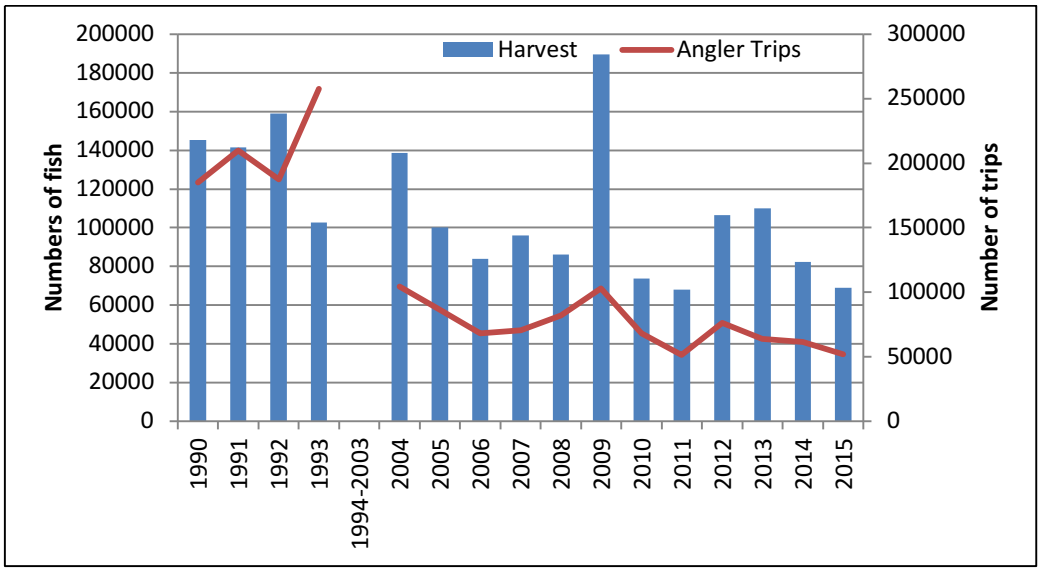


Figure 8. Total Bottomfish harvest (numbers of fish) and angler trips by boat-based anglers targeting Bottomfish or other fish in the Puget Sound DPSs (MCAs 6-13).

Bottomfish Catches (2004-2015): The method for estimating catch and effort in Puget Sound recreational fisheries has changed substantially since the original FCP (WDFW 2011a) was submitted in 2012. The previous method incorporated sampler site-selection probabilities (weighted model), but this method has proven to be problematic and is undergoing extensive internal and external review. Beginning in 2015, site-selection probabilities are no longer used (unweighted model), thus catch and effort estimates provided in the original FCP are no longer considered valid and may vary considerably from estimates presented in this updated plan. Until such time as a revised version of the weighted model is approved, estimates derived from the unweighted model are the most accurate representation of fishing effort and catch numbers available. None of the catch and effort estimation methods employed by the Department at any time have attempted to account for illegal harvest/poaching, and all have relied upon angler recall to provide accurate information about the timing of trips, the number of angler fishing from their vessel, the identification of species, and the retention status of encountered fish. However, it should be noted that

Catch Terminology:

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

Released: A fish 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 fish. Synonymous with total catch.

illegally retained rockfish encountered during dock-side intercept surveys are included in the catch reporting, and catch estimates are made for these species.

The implementation of increasingly restrictive harvest regulations in 2004 and 2010 on Bottomfish and rockfish fisheries has substantially altered recent harvest patterns relative to historical patterns. From 2004 to 2015, harvests of marine fish in Puget Sound by boat-based anglers targeting Bottomfish and other fish averaged nearly 102,000 fish per year; a decline of 33% from the early 1990's when the average annual harvest was 157,000 fish (Table 8, Figure 10). Bottomfish harvests in 2004 and 2009 were comparable to catches in the early 1990's despite substantially lower effort in both years (Figure 8). The increased catches in 2004 and 2009 corresponded to high catches of flatfish, mainly Pacific Sanddab. As mentioned above, a single phone survey respondent accounted for a catch of 75,000 flatfish in Hood Canal in 2015, but this estimate is considered unrealistic and has been excluded from the analysis.

Flatfish dominate the recreational catch within the Puget Sound DPSs, comprising 72% of the average Bottomfish harvest, followed by Kelp Greenling (10%), rockfish (6%), and Lingcod (5%) (Table 8). On average, anglers released nearly 81,000 Bottomfish per year, about 84% of the average annual harvest (Table 8). Flatfishes are the most common species released, followed by smaller but similar amounts of rockfish, Lingcod, and North Pacific Spiny Dogfish. The greatest average harvest of Bottomfish occurs in MCA 11, with somewhat smaller but similar harvests occurring in MCAs 10, 7, 8-2, and 9, respectively, Figure 10).

Rockfish Catches (2004-2015): Based on the current catch estimation system (unweighted model), an average of 11,679 rockfish were harvested each year by Bottomfish and other fish anglers from the Puget Sound DPSs from 2004 to 2009 (Tables 7 and 8), with the greatest proportion of harvest (47%) occurring in the San Juan Islands (MCA 7), followed by Tacoma (MCA 11) with 17% of the harvest (Table 9, Figure 11). Following the 2010 prohibition of rockfish retention in the DPSs, the average annual harvest of rockfish from 2010 to 2015 dropped dramatically to 185 fish per year (Table 8). As this take should be zero, any fish retained in this fishery represent an illegal harvest. After apportioning the unidentified rockfish catch to individual species, it was estimated that 26 Canary Rockfish and 27 Yelloweye Rockfish were harvested within the DPSs from 2004 to 2009 (Table 9). No Yelloweye or Canary Rockfish were harvested from 2010 to 2015, and no Bocaccio have been documented in the harvest since 2004 (Table 9).

847 **Table 8.** Average Annual Harvest and Released Catch (in numbers of fish) of Bottomfishes in
848 ESA-listed Rockfish Distinct Population Segments by Boat-based Anglers Targeting Bottomfish
849 and Other Fish, 2004-2015.
850

Species	Harvested	Released	Encountered
Rockfishes 2004-2009[1]	11,679	15,762	27,441
Rockfishes 2010-2015[2]	185	18,220	18,405
Rockfishes 2004-2015	5,932	16,989	22,921
Lingcod	4,643	15,912	20,555
Kelp Greenling	9,607	4,455	14,062
Other greenlings	646	249	895
Cabezon	739	548	1,287
Other sculpins	1,428	4,549	5,977
Pacific Halibut	218	36	254
Flatfish	68,341	22,339	90,680
Pacific Cod	20	59	79
Other codfishes	78	7	85
Surfperches	2,195	579	2,774
Sturgeon (Green)	0	<1	<1
Sturgeon (White)	12	9	21
North Pacific Spiny Dogfish	1,564	14,474	16,038
Other sharks	1	50	51
Skates	2	30	32
Spotted Ratfish	15	269	284
Total (2004-2015)	95,440	80,554	175,994

851 [1] 6-week rockfish season established. Anglers limited to first legal rockfish caught.
852 [2] Rockfish retention prohibited. Fishing for Bottomfish restricted to depths <120 feet.
853
854
855 Prior to the 2010 rule prohibiting rockfish harvest, rockfish were nonetheless often
856 captured and released back to the water. It was common practice among anglers to
857 release small rockfish until a larger rockfish was caught (i.e., high-grading), or to release
858 rockfish because they were a non-target species. From 2004 to 2009, Bottomfish anglers
859 released an average of 15,762 rockfish per year, with an average of 264 Canary Rockfish
860 and 164 Yelloweye Rockfish released each year (Tables 8 and 9). From 2010 to 2015, the
861 average number of rockfish released increased to 18,220 fish per year, with an average of
862 50 Bocaccio, 157 Canary Rockfish, and 2 Yelloweye Rockfish released each year (Tables
863 8 and 9). The majority of Canary Rockfish and Yelloweye Rockfish releases occur in the
864 San Juan Islands (MCA 7), whereas the majority of Bocaccio are released in the Tacoma-
865 Vashon area (MCA 11) (Table 10).

From 2004 to 2015, the San Juan Islands (MCA 7) had the greatest annual average encounter rate of rockfish in the DPSs (Figure 12, Table 10), with encounters dominated by Yellowtail, Copper, and Quillback Rockfish. Among ESA-listed rockfishes, encounter rates vary by species and MCA. Bocaccio have only been encountered in two years and primarily in the Tacoma-Vashon Island area (MCA 11); 16 and 282 fish were released in 2010 and 2011, respectively (Table 10). Annual encounters with Canary Rockfish range from 0 to 847 and averaged 213 fish per year (Tables 9 and 10), with the highest encounter rate occurring in south Puget Sound (MCA 13) at 81 fish per year (Table 10, Figure 13). Annual encounters with Yelloweye Rockfish ranged from 0 to 318 and averaged 85 fish per year, with the greatest proportion of encounters (68%) occurring in the San Juan Islands (Tables 9 and 10, Figure 14).

879 **Table 9.** Average (2004-2009) and Annual (2010-2015) Harvest and Released Catch (in numbers of fish) of Rockfishes in the Puget
880 Sound DPSs by Boat-based Anglers Targeting Bottomfish and Other Fish.

	Year									
Harvested	**2004-2009* Range**	**(Total)**	**2004-2009* average**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2010-2015 average**
Black Rockfish	194 - 1,410	(4,583)	764	121	27	17	4	10	2	30
Blue Rockfish		0	0	0	0	0	0	0	0	0
Bocaccio		0	0	0	0	0	0	0	0	0
Brown Rockfish	304 - 3,760	(9,272)	1,545	41	15	3	0	10	2	12
Canary Rockfish	0 - 14	(26)	4	0	0	0	0	0	0	0
China Rockfish	0 - 5	(5)	1	0	0	0	0	0	0	0
Copper Rockfish	4,863 - 7,803	(39,211)	6,535	365	74	60	30	37	23	98
Greenstriped Rockfish		0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0 - 52	(64)	11	0	0	0	0	0	0	0
Quillback Rockfish	1,911 - 3,788	(16,313)	2,719	156	0	36	7	57	6	44
Redstripe Rockfish		0	0	0	0	0	0	0	0	0
Tiger Rockfish	0 - 33	(76)	13	0	0	0	0	0	0	0
Vermilion Rockfish	0 - 22	(36)	6	0	0	0	0	0	0	0
Yelloweye Rockfish	0 - 27	(27)	5	0	0	0	0	0	0	0
Yellowtail Rockfish	34 -116	(458)	76	0	6	0	0	0	0	1
Total Rockfish		(70,071)	11,679	683	122	116	41	114	33	185

Table 9 (continued). Average (2004-2009) and Annual (2010-2015) Harvest and Released Catch (in numbers of fish) of Rockfishes in the Puget Sound DPSs by Boat-based Anglers Targeting Bottomfish and Other Fish.

	Year									
Released	**2004-2009* Range**	**(Total)**	**2004-2009* average**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2010-2015 average**
Black Rockfish	149 - 3,236	(7,276)	1,213	2,981	1,366	1,268	596	3,318	2,103	1,939
Blue Rockfish		0	0	0	0	0	0	0	0	0
Bocaccio		0	0	16	282	0	0	0	0	50
Brown Rockfish	0 - 1,396	(2,816)	469	268	0	69	0	0	0	56
Canary Rockfish	0 - 847	(1,585)	264	0	216	287	304	94	43	157
China Rockfish	0 - 38	(39)	7	0	0	0	0	0	0	0
Copper Rockfish	7,303 - 12,981	(55,144)	9,191	13,823	3,324	2,833	2,972	3,887	7,717	5,759
Greenstriped Rockfish		0	0	0	0	0	0	0	0	0
Puget Sound Rockfish		0	0	0	36	0	0	0	0	6
Quillback Rockfish	1,315 – 5,676	(24,255)	4,043	6,300	2,297	4,545	1,906	3,295	3,172	3,586
Redstripe Rockfish	0 - 29	(29)	5	0	0	0	0	0	0	0
Tiger Rockfish	0 - 560	(613)	102	0	0	0	10	0	0	2
Vermilion Rockfish	0 -154	(161)	27	0	0	0	40	173	0	36
Yelloweye Rockfish	28 - 319	(984)	164	0	0	12	0	0	0	2
Yellowtail Rockfish	6 - 628	(1,662)	277	3,718	5,653	11,488	10,512	7,793	602	6,628
Total Rockfish		(94,564)	15,762	27,106	13,174	20,502	16,340	18,560	13,637	18,220

Table 9 (continued). Average (2004-2009) and Annual (2010-2015) Harvest and Released Catch (in numbers of fish) of Rockfishes in the Puget Sound DPSs by Boat-based Anglers Targeting Bottomfish and Other Fish.

	Year								
Encountered	**2004-2009* Range**	**(Total)**	**2004-2009* average**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	
Black Rockfish	149 - 3,236	(11,859)	1,977	3,102	1,393	1,285	600	3,328	2,105	1,969
Blue Rockfish		(0)	0	0	0	0	0	0	0	0
Bocaccio		(0)	0	16	282	0	0	0	0	18
Brown Rockfish	0 - 3,760	(12,088)	2,015	309	15	72	0	10	2	68
Canary Rockfish	0 - 847	(1,611)	268	0	216	287	304	94	43	157
China Rockfish	0 - 38	(44)	8	0	0	0	0	0	0	0
Copper Rockfish	7,303 - 12,981	(94,355)	15,726	14,188	3,398	2,893	3,002	3,924	7,740	5,858
Greenstriped Rockfish		(0)	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0-52	(64)	11	0	36	0	0	0	0	0
Quillback Rockfish	1,315 – 5,676	(40,568)	6,762	6,456	2,297	4,581	1,913	3,352	3,178	3,630
Redstripe Rockfish		(0)	4	0	0	0	0	0	0	0
Tiger Rockfish	0 - 560	(689)	115	0	0	0	10	0	0	2
Vermilion Rockfish	0 - 154	(197)	33	0	0	0	40	173	0	36
Yelloweye Rockfish	0 - 319	(1,011)	169	0	0	12	0	0	0	2
Yellowtail Rockfish	6 - 628	(2,120)	353	3,718	5,659	11,488	10,512	7,793	602	6,629
Total Rockfish		(164,635)	27,441	27,789	13,296	20,618	16,381	18,674	13,670	18,405

881 *Annual harvest and released numbers for the individual years 2004 to 2009 are reported in WDFW 2011a (original FCP). NOTE: values
882 in WDFW 2011a vary from values reported in this document due to changes in the catch and effort estimation methods.

Table 10. 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 from 2004 to 2015, with Unidentified Rockfish Apportioned to Identified Species.

Species Harvested	MCA 6	MCA 7	MCA 8-1	MCA 8-2	MCA 9	MCA 10	MCA 11	MCA 12	MCA 13	DPS
Black Rockfish	103	58	75	12	19	19	111	0	0	397
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	1	2	0	2	32	96	634	0	12	779
Canary Rockfish	0.2	1	0	0	1	0	0	0	0.1	2
China Rockfish	0.4	0	0	0	0	0	0	0	0	1
Copper Rockfish	85	2,001	134	401	343	149	150	26	28	3,317
Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	1	0	0	4	0	0	0	0	5
Quillback Rockfish	52	676	61	92	278	87	98	0	37	1,381
Redstripe Rockfish	0	0	0	0	0	0	0	0	0	0
Tiger Rockfish	2	4	1	0	0	0	0	0	0	7
Vermilion Rockfish	0	0	0	0.2	2	0.5	0	0	0	3
Yelloweye Rockfish	0	2	0	0	0	0	0	0	0	2
Yellowtail Rockfish	6	29	2	0	1	1	0	0	0	39
Total Rockfish	250	2,774	273	529	680	515	808	26	77	5,932
Released	MCA 6	MCA 7	MCA 8-1	MCA 8-2	MCA 9	MCA 10	MCA 11	MCA 12	MCA 13	DPS
Black Rockfish	301	668	357	15	38	163	3	0	30	1,575
Blue Rockfish	0	0	0	0	0	0	0	0	0	0
Bocaccio	1	0	0	0	0	0	24	0	0	25
Brown Rockfish	1	0	0	0	0	177	63	0	21	262
Canary Rockfish	19	44	0	37	30	0	0	0	81	211
China Rockfish	3	0	0	0	0	0	0	0	0	3
Copper Rockfish	340	4,534	310	450	921	446	222	0	252	7,475

Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	3	0	0	0	0	0	0	0	3
Quillback Rockfish	222	1,848	153	146	810	212	138	0	285	3,814
Redstripe Rockfish	0	2	0	0	0	0	0	0	0	2
Tiger Rockfish	3	1	0	48	0	0	0	0	0	52
Vermilion Rockfish	4	0	0	0	0	0	0	0	27	31
Yelloweye Rockfish	0.2	74	2	4	3	0	0	0	0	83
Yellowtail Rockfish	85	3,205	22	40	0	7	94	0	0	3,453
Total Rockfish	979	10,379	844	740	1,802	1,005	544	0	696	16,989
Encountered	MCA 6	MCA 7	MCA 8-1	MCA 8-2	MCA 9	MCA 10	MCA 11	MCA 12	MCA 13	DPS
Black Rockfish	404	726	432	27	57	182	117	0	30	1,972
Blue Rockfish	0	0	0	0	0	0	0	0	0	0
Bocaccio	1	0	0	0	0	0	24	0	0	25
Brown Rockfish	2	2	0	2	32	435	512	0	33	1,018
Canary Rockfish	19	45	0	37	31	0	0	0	81	213
China Rockfish	4	0	0	0	0	0	0	0	0	4
Copper Rockfish	425	6,535	444	851	1,264	595	372	26	280	10,792
Greenstriped Rockfish	0	0	0	0	0	0	0	0	0	0
Puget Sound Rockfish	0	4	0	0	4	0	0	0	0	8
Quillback Rockfish	274	2,524	214	238	1,088	299	236	0	322	5,195
Redstripe Rockfish	0	2	0	0	0	0	0	0	0	2
Tiger Rockfish	5	5	1	48	0	0	0	0	0	59
Vermilion Rockfish	4	0	0	1	2	1	0	0	27	34
Yelloweye Rockfish	0.2	76	2	4	3	0	0	0	0	85
Yellowtail Rockfish	91	3,234	24	40	1	8	94	0	0	3,492
Total Rockfish	1,229	13,153	1,117	1,269	2,482	1,520	1,352	26	773	22,921

Recent Catches of Other ESA-listed Species: Seasons for Bottomfish and other fish overlap with salmon seasons throughout the DPSs, thus anglers targeting Bottomfish and other fish may retain salmon when legal to do so. For the following analysis, we assume that anglers who retained salmon but were assigned to the "other fish" category were likely targeting salmon, and we excluded the harvest and release numbers for this target type from the following analysis. The number of Chinook Salmon harvested by anglers fishing for Bottomfish, including targeted trips for Lingcod, from 2004 to 2015 was 56 fish per year, with an average of 150 Chinook released each year (Table 11). The ratio of hatchery-produced to natural run (i.e., wild) Chinook in Puget Sound varies annually. Because WDFW does not monitor these proportions in the Bottomfish fishery, we used a combination of voluntary trip reporting (VTR) by salmon anglers and the results of WDFW test-fishing studies conducted in MCAs 6-13 to estimate the proportions of hatchery and natural run Chinook encountered by Bottomfish anglers. In 2012, 2014, and 2015, 75% of encountered Chinook were adipose-clipped (i.e., marked); whereas 54% of Chinook encountered in 2013 were clipped. We used the average of these two values (64.5%) to estimate take of Chinook Salmon by the Bottomfish fishery for the renewed ITP (see below). We note here that most, but not all, hatchery produced Chinook are adipose-clipped; however, for the purposes of this FCP, we assume that all unmarked fish are of natural origin. WDFW has no method to estimate the proportions of juvenile and adult salmon released in the Bottomfish fishery, and we assume that all Chinook encountered by Bottomfish anglers are adults. To estimate the mortality of released Chinook in recreational salmon fisheries, WDFW salmon managers use a mortality rate of 15% for adults.

Table 11. Number of Chinook Salmon harvested and released by anglers targeting Bottomfish only, 2004-2015.

	Harvested	Released
2004	2	165
2005	5	40
2006	124	716
2007	42	297
2008	317	113
2009	54	87
2010	0	45
2011	54	87
2012	0	45
2013	5	57
2014	33	35
2015	34	74
Total	**675**	**1799**

A total of 180 Eulachon were estimated to have been harvested by recreational Bottomfish and other fish anglers in 2012 (34) and 2013 (146); however, we are skeptical of this estimate as this species had never before been recorded in the boat-based recreational catch. Also, further review

of the catch statistics shows that most of these catches were reported by the same sampler from a single location where it would be more likely to encounter Surf Smelt or Longfin Smelt. Nevertheless, if it is assumed that the species ID was correct, this take would represent an illegal harvest and would not count against the estimated take values in the ITP. Green Sturgeon were only encountered in 2008, when it was estimated that four fish were released by boat-based Bottomfish anglers.

The harvest and release estimates presented above and generated in the future will be used to inform and refine future take estimates of ESA-listed rockfish in the context of adaptive management. It should be noted that the catch and effort estimation system has been undergoing substantial review over the past 5 years to update and refine the modelling procedures, thus values reported herein may change if or when a new system is implemented. However, the numbers provided in this plan represent the best estimates of catch and effort currently available, and NOAA will be apprised of any changes to the estimation system occurring within the requested coverage period of the Incidental Take Permit associated with this FCP.

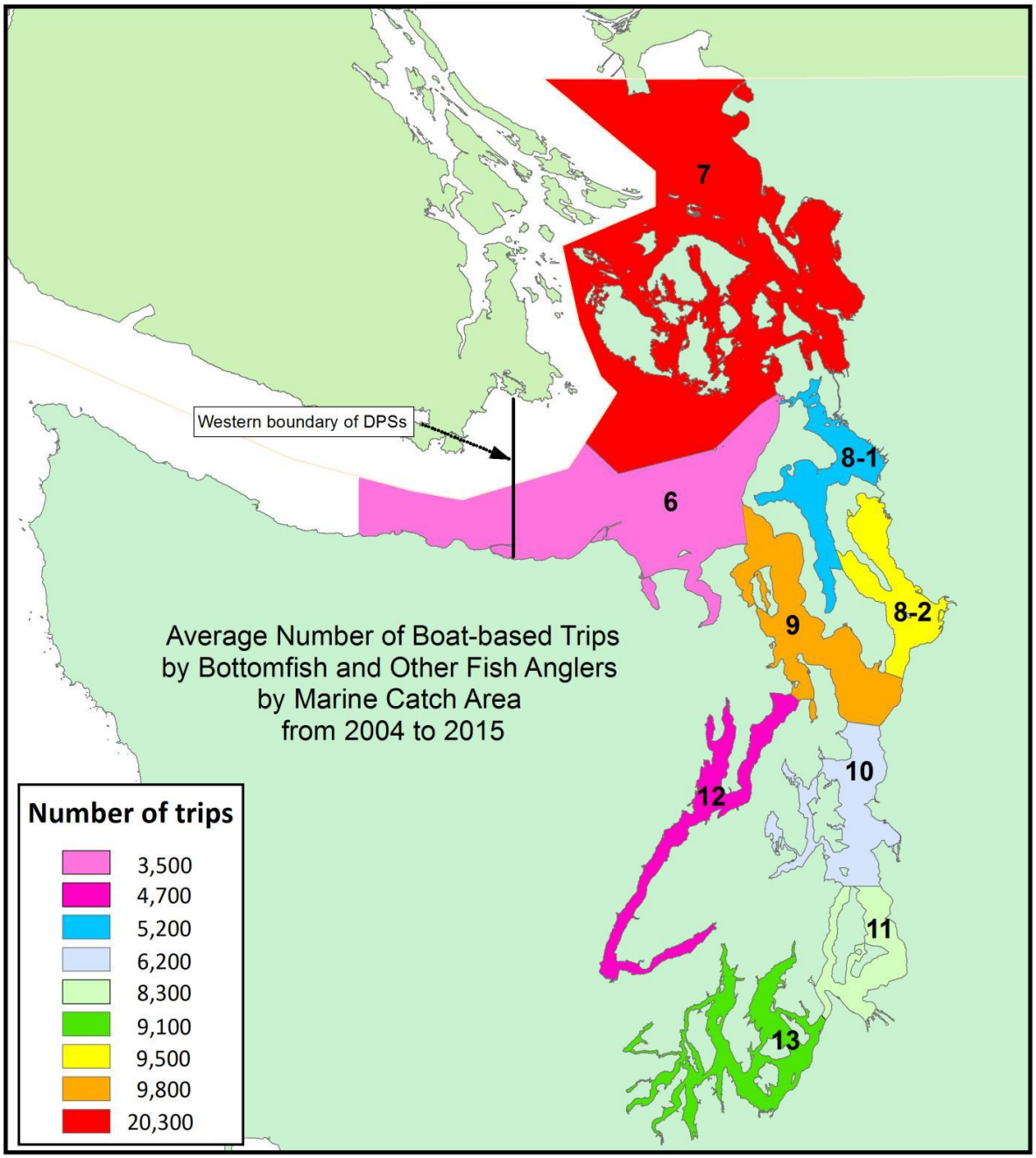


Figure 9. Average number of boat-based recreational fishing trips for Bottomfish and other fishes by Marine Catch Area, 2004-2015.

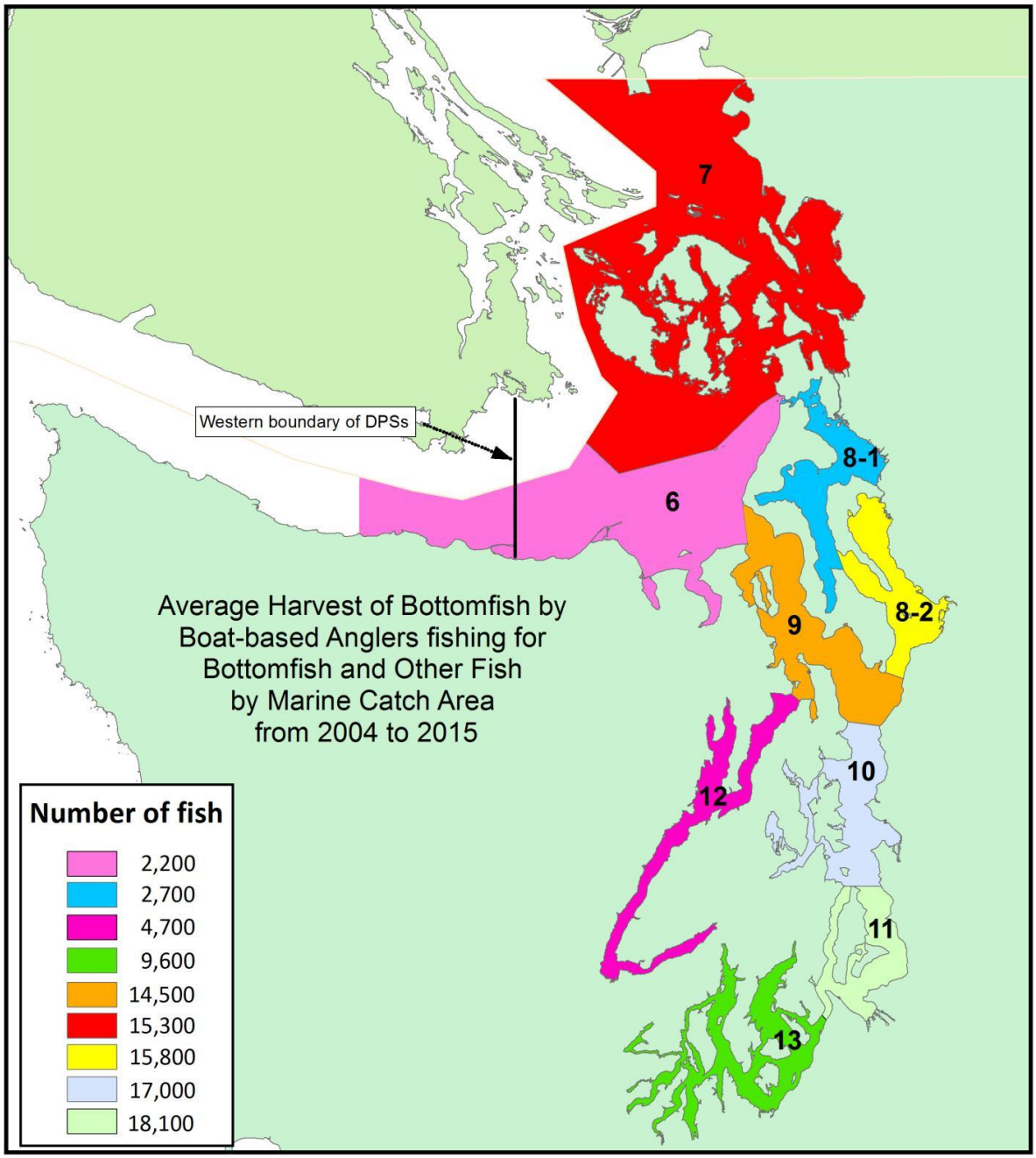


Figure 10. Average harvest of Bottomfish (in numbers of fish) by boat-based anglers fishing for Bottomfish or other fishes by marine catch area, 2004-2015.

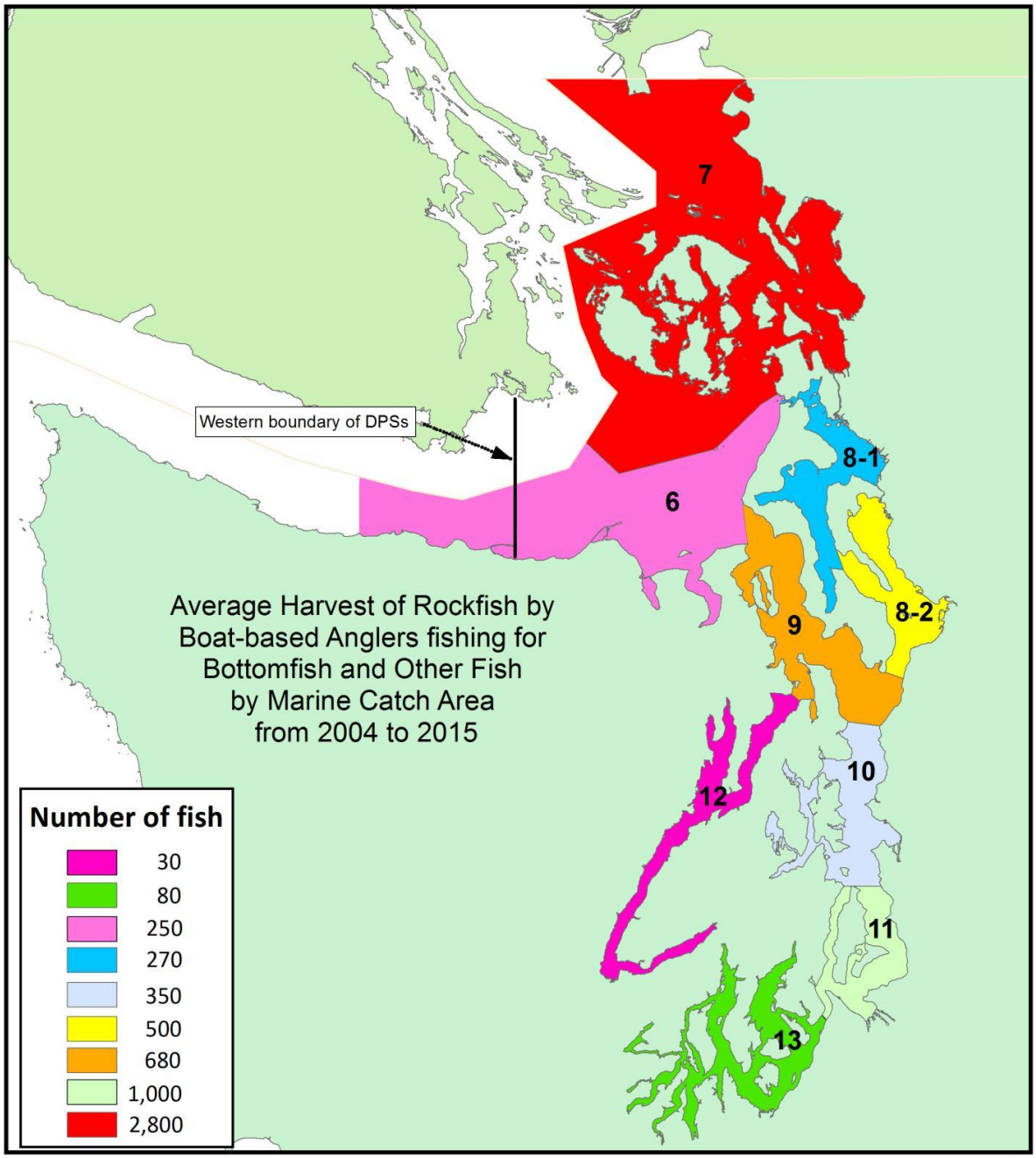
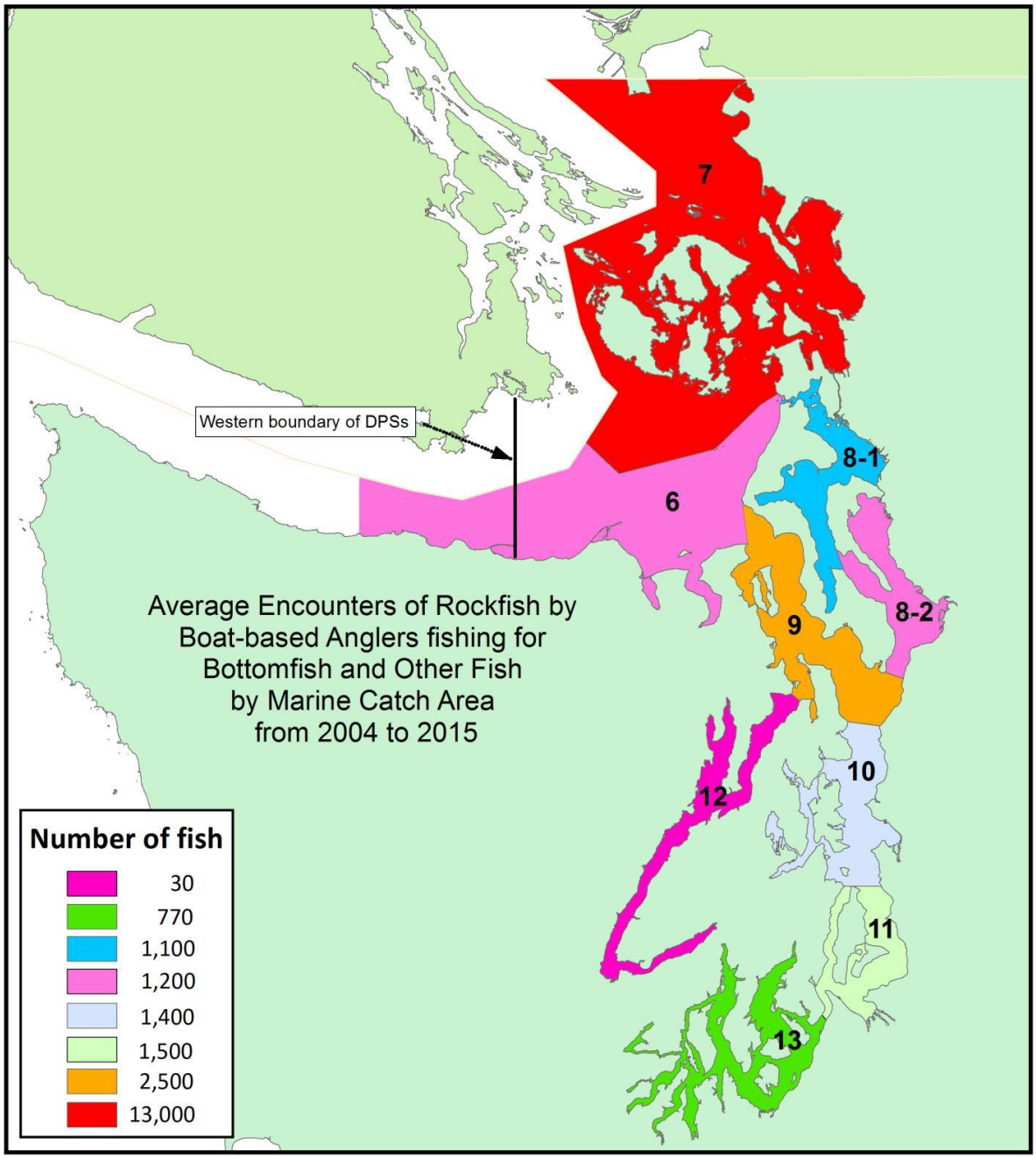
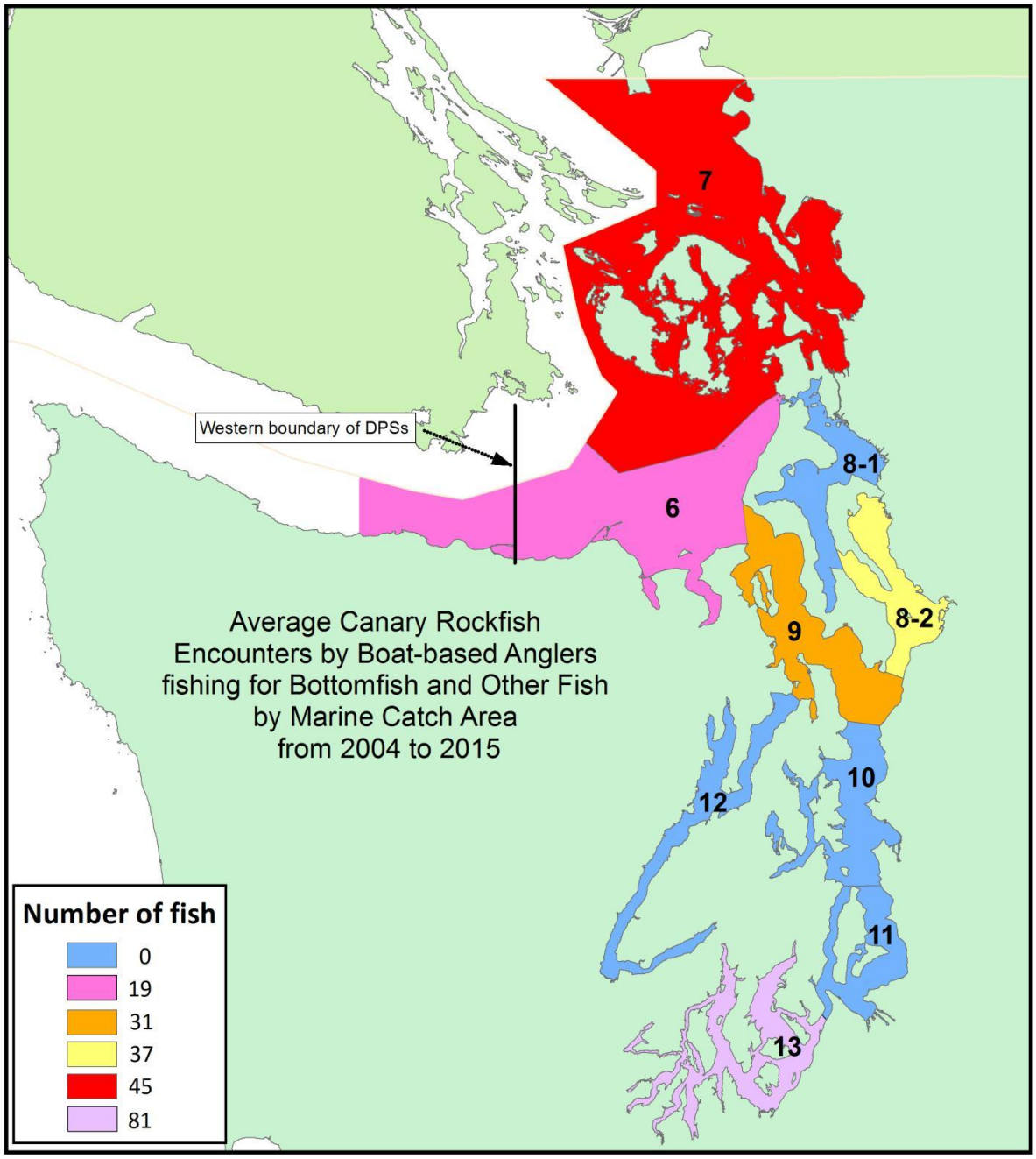


Figure 11. Average harvest of rockfish (in numbers of fish) by boat-based anglers fishing for Bottomfish or other fishes by marine catch area, 2004-2015.



941

942 **Figure 12.** Average encounters of rockfish (in numbers of fish) by boat-based anglers fishing for Bottomfish by
943 Marine Catch Area, 2004-2015.



944

945 **Figure 13.** Average Canary Rockfish encounters (in numbers of fish) by boat-based anglers fishing for Bottomfish
946 by Marine Catch Area, 2004-2015.

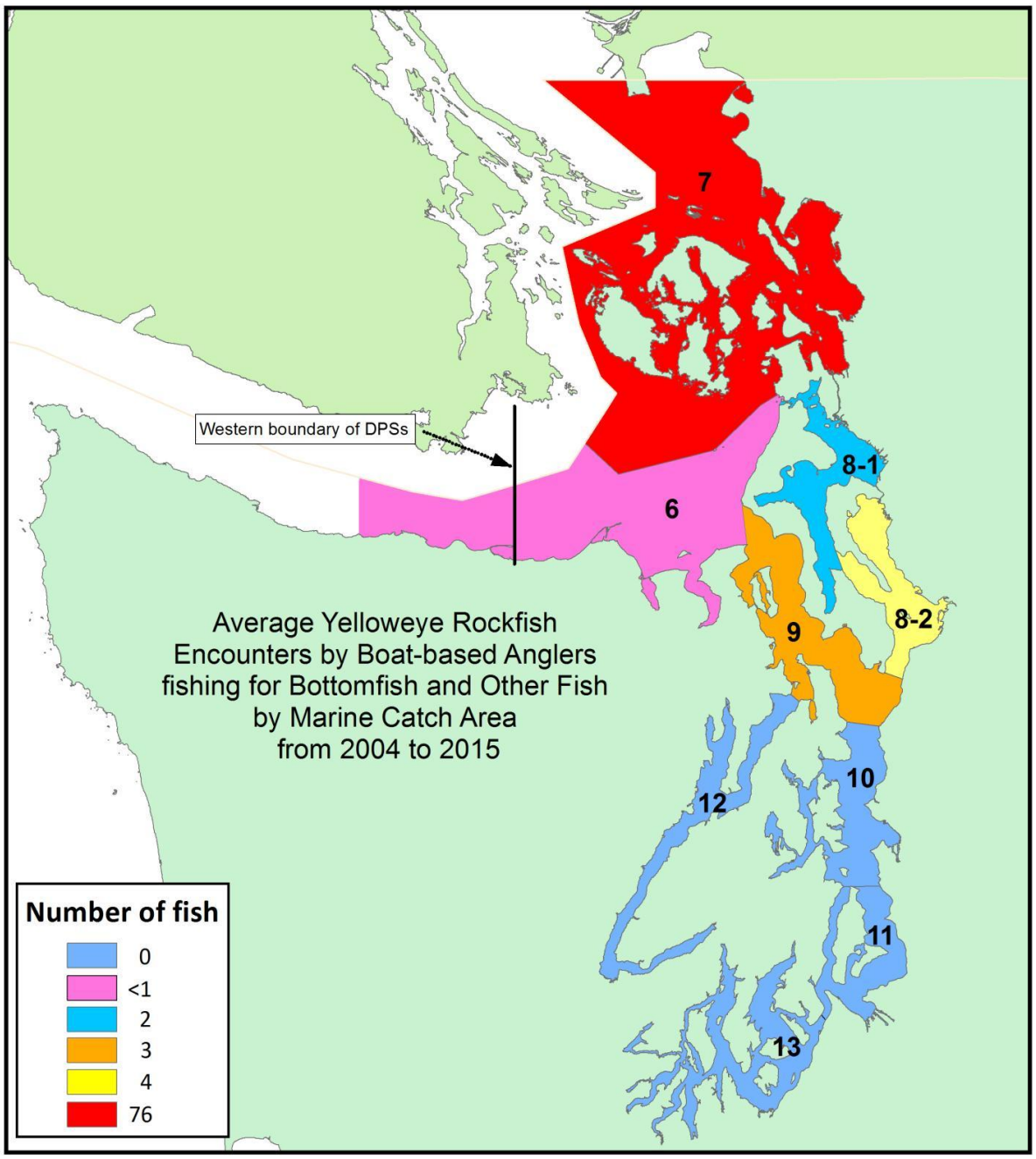


Figure 14. Average Yelloweye Rockfish encounters (in numbers of fish) by boat-based anglers fishing for Bottomfish by Marine Catch Area, 2004-2015.

Compliance Monitoring of Incidental Catch by Bottomfish Anglers

Current Catch Monitoring - Monitoring of recreationally caught Bottomfish in the Puget Sound DPSs is part of a larger marine fish catch estimation program (Cheng et al. 2010). There are two 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, measured as the number of licensed angler trips, is estimated through randomized telephone surveys of licensed anglers that occur every two months. 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) 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 encounter rates of salmon and other fishes, estimate tagging rates, and obtain biological information and samples. We also note that directed (i.e., non-incidental) illegal take is expected in any fishery, and that the above methods have a low probability of capturing this take. Hence, the catch and effort estimates presented herein and the incidental take estimates derived from those estimates represent only the legal permitted take of the listed species.

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, anglers are asked the date of their trip; the catch area (MCA) they fished in; the county, catch area, and specific location to which they returned; what gear type they used (trolling, mooching, jigging, etc.); 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 following 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 types 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-unit-effort (CPUE, calculated as 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, who do not require a license, and for other fishers who do not have a license (and thus fished illegally). 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 their catch (both retained and released), 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 wave, Catch Area where fishing occurred, and target type (salmon, Bottomfish, halibut, other fish). 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. 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 it can be determined 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 are interviewed as possible. No attempt is made to target certain types of boats (e.g., salmon trips vs. marine fish trips). Depending upon their assignment schedules, samplers may not be present at any given ramp for the entire fishing day, although some ramps do receive pre-dawn to post-dusk sampling effort.

During the creel interview, the individual is asked how many anglers on the boat were fishing, the target species, how many fish of each species were kept, what Marine Catch Area each fish was caught in, and how many fish of each species were released. Anglers are shown photos of various fish species to aid in their identification of released fish, and the Department has made a variety of visual identification aids freely available through webpages and in hard copy (e.g., rockfish identification keychain cards and an online Bottomfish identification guide). Since only boat access sites are sampled, CPUE is available only for the private boat/rental mode. Although sampling is conducted at the boat level, the total numbers of anglers and the total number of fish caught and released are recorded in each boat interview. Since all fish and all anglers on board are included in the calculation of catch-per-angler for each intercepted boat, there is no variance

of the mean catch-per-angler-trip for an individual boat – that is, each intercepted boat is censused rather than sampled.

Since 2004, between 15% and 21% of angler trips targeting any fish species within the DPSs 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 12).

Table 12. Coverage of the Intercept Survey Within the DPSs Area, 2004-2015.

Year	# of angler trips	# of intercepted trips	Coverage
2004	441,511	62,954	14%
2005	441,582	78,179	18%
2006	407,485	60,017	15%
2007	438,184	93,119	21%
2008	379,029	79,424	21%
2009	710,890	107,115	15%
2010	389,527	71,110	18%
2011	511,260	83,232	16%
2012	514,469	73,977	14%
2013	610,188	93,219	15%
2014	471,189	73,011	15%
2015	498,538	82,513	17%

Source: WDFW unpublished data

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, wave, and target 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 by Target Type (a.k.a. trip class - Salmon, Halibut, Bottomfish, and Other) by MCA and target species[8]; 2) for each 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); and 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

[8] The target species represents the primary species (or species group) targeted by the angler, but is not exclusive of other species. For example, an angler that is primarily targeting salmon but also fishes for Bbottomfish during a trip would be assigned to Target Type = Salmon. Anglers responding that they fished for "any species" are assigned to Target Type = Other.

class reported in the telephone survey. It should be noted that some anglers targeting salmon, Pacific Halibut, or Bottomfish may have been assigned to Target Type = Other based on unclear or vague responses to the creel or telephone interview, but WDFW has no method to identify these incorrectly assigned target types. As such, the Bottomfish (including rockfish) catches reported above may overestimate the actual catches in the Bottomfish and other fish fishery. It should also be noted that shore-based and scuba modes are excluded from the estimation process, but spearfishing is highly species-specific and harvest rates of ESA-listed species via this mode are assumed to be zero.

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 (even if fishing effort was reported from the intercept survey) will be recorded as an 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 is borrowed from the average catch rates from adjacent waves for the same trip class in the same MCA.

Management, Mitigation, and Enforcement Actions to Reduce Rockfish Catch - In May 2010, WDFW imposed severe restrictions intended to reduce the take of rockfish by recreational Bottomfish and other fish anglers; recreational rockfish harvest was eliminated in the Puget Sound DPSs, (MCAs 6 to 13), and anglers were prohibited from fishing for Bottomfish deeper than 120 feet in all Puget Sound MCAs, with the exception of fisheries for salmon and Pacific Halibut. Based on catch estimates since 2010, these restrictions have substantially reduced encounters with listed rockfish, which typically inhabit waters deeper than 120 feet. Encounters with most species of non-listed rockfishes have also declined, but increased for Yellowtail Rockfish, which appear to have shown a population increase in MCA 7 (Tables 9 and 10).

In 2016, a rule change was proposed that would require the use of descending devices for all fishing trips conducted within the DPSs where Bottomfish is the primary target, with the intent of reducing rockfish mortality resulting from barotrauma. The regulation, if adopted, would require all anglers to have a descending device readily available in order to descend all rockfish taken as bycatch, but is also an appropriate method for descending Pacific Cod and other gadid species that can experience barotrauma.

Enforcement of Washington State and Federal fishing regulations is conducted primarily by the WDFW Police, the law enforcement division of WDFW. Additionally, some local police departments have the authority to enforce marine fish and shellfish violations (e.g., Everett Police, Snohomish County Police). Within the WDFW Police Department, enforcement of recreational and commercial marine fish and shellfish fisheries within the DPSs is accomplished

mainly by the Marine Detachment, which consists of one captain, one lieutenant, two sergeants, 20 officers, and 4 detectives, although any WDFW police officer has the authority to enforce marine fishery regulations. The WDFW Police have the capacity to utilize motor vehicles, vessels, and aircraft to conduct overt and covert operations to enforce all WDFW regulations and permit requirements. Enforcement operations are conducted at boat ramps (vehicle intercepts), on the water (vessel intercepts), at point of sale/distribution, and at any location where a suspected violation or violator is reported or suspected. Recreational and commercial fishers found to be in violation of WDFW and/or Federal fishing regulations are subject to a range of penalties, including fines; arrest; forfeiture of gear, vessels and vehicles; suspension or revocation of fishing/hunting licenses; jail time; or any combination thereof. Statistics for angler encounter rate, infraction frequency, rule violation type, and other related parameters can be obtained directly from the WDFW Police upon request, but definitive species identification and quantification associated with specific incidents of illegal harvest are not always available. When possible, WDFW police officers will share seized specimens with WDFW Marine Fish Science staff for the collection of tissue and other biological samples.

Annual Take Estimates for ESA-listed species by Recreational Anglers Targeting Bottomfish and Other Fish

As a result of restrictions prohibiting the retention of rockfish by recreational anglers in the Puget Sound DPSs and 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 (i.e., total encounters) from all MCAs lying partly or fully within the DPSs (Table 13). For the years 2004 to 2009, the numbers were modified with observations of capture depth zones in Puget Sound and adjacent waters, and for the years 2010 to 2015 all encounters were assumed to be at depths <120' in compliance with state fishing regulations(Table 14). After adjusting for capture depth, we used modeled barotrauma mortalities to estimate lethal take occurring at depths <120'.

Depth-related occurrence and barotrauma mortality rates were obtained from external sources (Table 14). 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) 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. A second source of capture depth information comes from the WDFW Puget Sound Sampling Program. Dockside

samplers ask anglers whether their Bottomfish catch was made from depths shallower than 60 feet or between 60 and 120 feet. These results are then used to estimate the likely capture rate from depths of 60-120 feet (WDFW informed). Other sources were used to identify the depth distribution of the listed species and to determine the maximum proportion of each species occurring shallower than 120 feet. Richards and Cass (1985) provided catch rates by depth zone from research angling surveys in British Columbia. 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), and the depth-specific densities interpreted from this graph were pooled over both size classes to approximate the proportion of fish shallower than 40 m. Pacunski et al. (2013) conducted a comprehensive ROV survey of the San Juan Islands focusing on rocky habitats and documented the proportion of ESA-listed rockfish in depths less than and greater than 120 feet. Species-specific barotrauma mortality estimates were obtained from the Pacific Fishery Management Council (PMFC 2008), and we averaged the mortality rates for the 0-60' and 60-120' depth zones to estimate the mortality rate for fish caught in less than 120 feet (Table 14).

Table 13. 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 2004 to 2015.

Year	Bocaccio	Canary Rockfish	Yelloweye Rockfish
2004	0	861	28
2005	0	6	318
2006	0	0	103
2007	0	105	346
2008	0	306	81
2009	0	333	135
2010	16	0	0
2011	282	216	0
2012	0	287	12
2013	0	304	0
2014	0	94	0
2015	0	43	0
Total	**298**	**2,555**	**1,023**

Based on the maximum encounters with ESA-listed rockfish occurring <120' from 2004 to 2015, we project that up to 282 Bocaccio, 284 Canary Rockfish, and 87 Yelloweye Rockfish may be encountered annually (Table 15). Of this take, up to 90 Bocaccio, 105 Canary Rockfish, and 34 Yelloweye Rockfish would be mortalities (Table 15). We strongly emphasize that these take estimates are presented in the context of the best available data approximating the expectation of encounters, barotrauma, and depth of capture, and that these factors are variable and subject to biases, especially encounter rates. The data for depth distribution are sparse, and WDFW

depends upon the veracity and accuracy of angler reports of released catch, which are a major component of the encounter rate. Anglers have a poor ability to correctly identify rockfish to species (Bargmann 1981, Beaudreau et al. 2011, Sawchuk 2012). Additionally, reports of released Canary and Yelloweye Rockfish may be confused with released Vermilion Rockfish, which are similar in appearance and have increased in abundance in recent years in Puget Sound (Palsson et al. 2009). Catch estimates are also 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 861 individuals among years (Table 13), and may under- or overestimate the actual number of listed rockfish encountered in the Bottomfish and other fish fishery based on the factors described above. Also, as recruitment and recovery occurs, encounter rates may exceed the extreme values presented in this plan. Further research is required to understand these processes and the results should be considered in the Adaptive Management Framework.

Table 14. Proportion of ESA-listed Rockfishes Encountered 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	1.0 (WDFW informed)	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 ,and PFMC (2009)
*applied to 2004-2009 encounters only.

Table 15. Projected Maximum Annual Incidental Take Estimates (in numbers of fish) from the Recreational Fishery for Bottomfish and Other Fish**.**

Species	Maximum Encounters <120' 2004-2015*	Mortality	Lethal Take	Non-Lethal Take
Bocaccio	282	0.32	90	192
Canary Rockfish	284	0.37	105	179
Yelloweye Rockfish	87	0.39	34	53

*Maximum Encounters <120' from 2004 to 2009 were calculated using the values in Table 13.
Mortality from Table 14
Lethal take = (Projected take) * (Mortality)
Nonlethal take = (Projected take) – (Lethal take)

As described above, releases of Chinook Salmon by recreational botttomfish anglers averaged 150 fish per year from 2004 to 2015 (Table 11). The majority of these releases were reported between 2004 and 2009, when anglers released an average of 247 Chinook each year. In contrast, the number of released Chinook was 53 fish per year from 2010 to 2015. The reason for this decline is not clear, although because Chinook are often targeted near the bottom at depths up to 200 feet, it may be related to the institution of the 120' rule for Bottomfish. Assuming that average releases will remain consistent during the requested ITP period, we used the maximum number of releases reported from 2010 to 2015 to estimate potential take of Chinook by Bottomfish anglers, with up to 87 Chinook Salmon released in any given year; 56 from hatchery origin and 31 from natural origin based on an average value of 64.5% for hatchery produced fish. The proportions of adult and juvenile Chinook Salmon released vary between seasons and areas, and because WDFW has no mechanism to estimate these proportions, all fish encountered in this fishery are assumed to be adults. Based on a 15% post-release mortality rate for adult Chinook Salmon, we project a maximum incidental mortality of 13 hatchery and 5 wild Chinook Salmon per year in the Bottomfish fishery.

Reports of Eulachon in the Bottomfish and other fish catch are highly dubious and cannot be substantiated, but if true, would represent illegal take that does not fall under the coverage of the requested ITP. Hence, based on the methods used by anglers to catch Bottomfish, we do not anticipate any take of Eulachon by the recreational fishery for Bottomfish or other fish. Given the lack of catch records for Green Sturgeon from the critical habitat for the southern DPS, we also do not anticipate any take of this species by this fishery.

Puget Sound Recreational Shrimp Pot Fishery

Fishery Description

Recreational fisheries for several species of shrimp occur in the ESA-listed rockfish Puget Sound DPSs. The primary species harvested is Spot Shrimp (*Pandalus platyceros*), but two species of Pink Shrimp (*P. eous* and *P. jordani*) and two species of Coonstripe shrimp (*P. danae* and *P. hypsonotus*) are also taken in this fishery. The primary method of harvest is via the use of weighted pots (also called traps) deployed from vessels, although divers and shore-based fishers may harvest shrimp with dipnets and by hand. Pots are left in the water (soaked) for variable periods of time (hours to overnight) depending on the area fished, but typical soak times range from 1 to 3 hours, after which the pots are retrieved, either by hand or by winch. Typical depths fished range from 150 to 350 feet. The recreational Spot Shrimp fishery is a short duration "derby" style fishery that attracts thousands of participants, all competing for a limited resource within a restrictive time window. Typically, 4 to 5 days of harvest are allowed during the month

of May based on in-season quota assessments. The recreational pot fishery for other species (i.e., non-Spot Shrimp) is more protracted and has a much lower participation rate.

Areas of operation: Recreational Marine Catch Areas (MCAs) 6-13. MCA 6 includes the Discovery Bay Shrimp district, and the San Juan Island area (MCA 7) is divided into 3 sub-areas; East, West, and South (Figure 15).

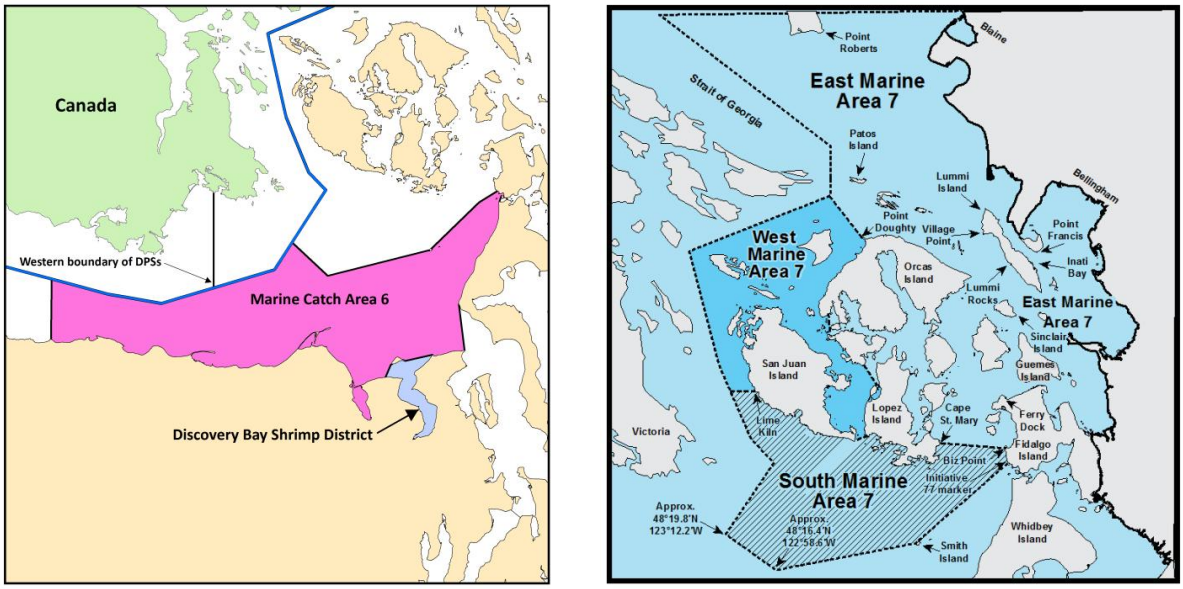


Figure 15. Shrimp sub-areas in Marine Catch Areas 6 and 7.

Season Structure: The Puget Sound shrimp fishery is managed on an area quota basis. The recreational shrimp season opens on the first Saturday in May for all species in MCAs 6-13. The season for all species is closed as soon as the Spot Shrimp quota has been attained, usually by the end of May in most MCAs. MCAs 7 South, 7 West, 10, 12, and the Discovery Bay Shrimp District remain closed once the Spot Shrimp quota is reached. All other MCAs reopen to the harvest of Coonstripe and Pink Shrimp only from June 1st to October 15th. From June 1st to October 15th the maximum fishing depth is 200' in MCA 6 and 7 East, 150' in MCAs 8-1, 8-2, 9 and 11, and 250' in MCA 13.

Fishery Management: The fishery is managed on an area-by-area and day-to-day basis using a combination of methods. On-water (vessel) and aerial surveys are used to count shrimp buoys and boats in order to generate an estimate of fishing effort. Creel interviews are conducted at boat ramps to estimate catch per unit effort (CPUE). The effort and CPUE results are combined to estimate the daily take (in pounds) of all species of shrimp for each MCA and continue or close the fishery as needed. These methods are detailed in Appendix 3. Although the recreational

fishery is managed by MCA (see WDFW regulation pamphlet), quota assessments are based on WDFW Fish-Shellfish Management and Catch Reporting Areas (FSMCRA), which have different boundaries than the MCAs (Figures 3 and 4). However, because creel sampling and on-water and aerial surveys are conducted within sub-units within each FSMCRA, it is a relatively straightforward process to convert MCA catches to FSMCRA catches.

License type: A Shellfish or Combination (fish and shellfish) license is required for all harvesters age 16 and older. Youths aged 15 and under may participate in the fishery and are accounted for in the effort and harvest estimation procedures. There is no limit on the number of licenses available per year.

Target Species; Spot Shrimp (*Pandalus platyceros*), Pink Shrimp (*P. eous* and *P. jordani*), Coonstripe (Dock) Shrimp (*P. danae*), and Coonstripe (Humpback) Shrimp (*P. hypsonotus*). In 2015, 99% of the estimated recreational harvest was Spot Shrimp, with the remaining 1% being all other pandalid species combined (non-Spot Shrimp).

Gear Specifications; All shrimp pots must be constructed of either flexible or rigid mesh material (no liners allowed). A minimum of 1" mesh size (1¾" stretch measure on flexible mesh pots) is required for all shrimp pots during the month of May. A minimum mesh size of ½" ($1^{1}/_{8}$" stretch measure on flexible mesh pots) is allowed after June 1st in any area closed for Spot Shrimp but open for Coonstripe and Pink Shrimp. Entrance tunnels may be constructed of any mesh size but must be on the sides, and may not exceed one-half the perimeter of the bottom of the pot. Pots must not exceed 10 feet in perimeter or 18" in height. All shrimp pots must be equipped with a biodegradable device (rot cord) as specified in the WDFW regulations to allow escapement of trapped animals should the pot become derelict.

Each harvester is allowed two pots, but no more than four pots may be onboard or fished by any one boat at a time. Every unattended pot must have its own buoy line and a separate yellow buoy constructed of durable material that is permanently and legibly marked with the operator's first name, last name, and permanent address. No harvester may pull gear from one hour after official sunset to one hour before official sunrise. All pots must be removed from the water on closed days.

Catch limits: From the first Saturday in May to May 31st the daily limit is 80 shrimp per fisher (if the area is open for Spot Shrimp). Shrimp heads may be removed while in the field but do not need to be retained. From June 1st to October 15th, the daily limit is 10 pounds of shrimp (including heads and tails) of all species combined, with a maximum of 80 Spot Shrimp if the season for Spot Shrimp is still open. Heads may be removed in the field but must be retained until ashore and finished fishing for the day. All harvesters must have a separate container for their catch, either in their possession or identified with their name.

Activity Trend: Increasing. From 2004 to 2015, the estimated number of recreational shrimp angler trips has ranged from 26,619 to 42,067, with 95% of this effort assigned to the Spot Shrimp fishery (Figure 16). The number of pots fished (i.e., pot pulls) typically ranges from 2% to 6% greater than the number of angler trips. Catches of Spot Shrimp comprise 98% to 99% of the total shrimp catch and were generally stable from 2004 until 2011, increased sharply from 2011 to 2013, then leveled off in subsequent years.

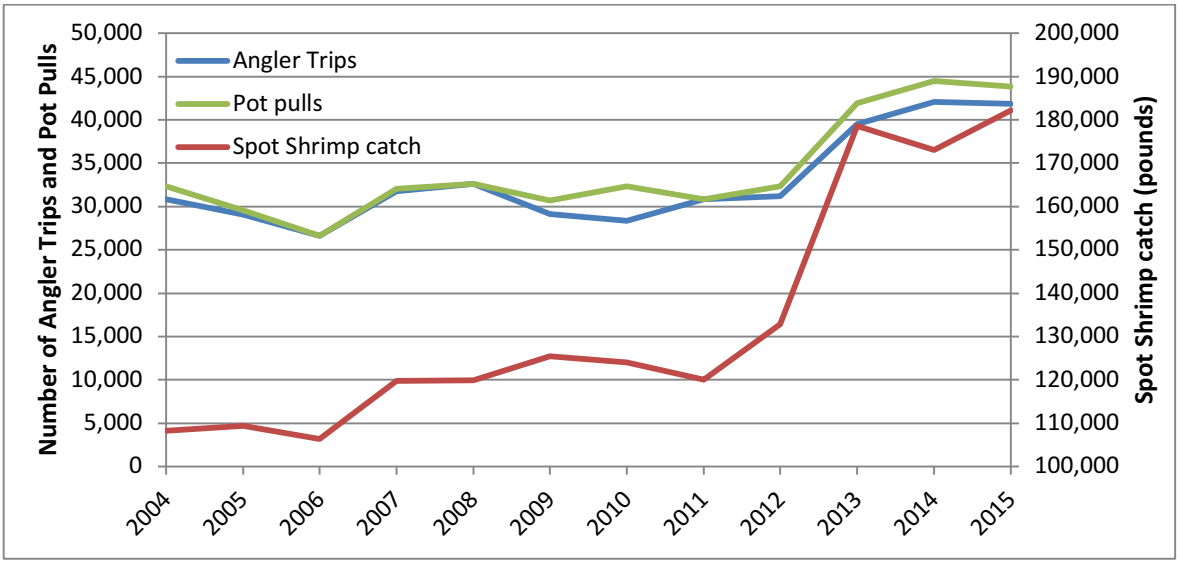


Figure 16. Number of trips and pot pulls, and catch of Spot Shrimp by recreational shrimp pot fishers from 2004 to 2015.

Puget Sound Commercial Shrimp Pot Fishery

Fishery Description

Commercial pot fisheries for shrimp occur within the Puget Sound portion of the DPSs of ESA-listed rockfish. This is a limited-entry fishery with the number of licenses capped at 18, all of which are active. This fishery targets both Spot and non-Spot Shrimp species.

Season Structure: The commercial shrimp pot fishery begins in early July and runs through September. Unlike the recreational fishery, this is not a derby-style fishery, and fishers generally fish 1 to 3 days per week until reaching their individual weekly or biweekly quota.

Fishery Management: This fishery is managed on an individual quota basis. The season is opened with biweekly limits of 1,200 pounds total per license, then after six weeks switches to weekly limits of 600 pounds total. Fishers may fish in any area that is open to them, but fishing typically occurs in the most popular areas first then becomes concentrated in less desirable areas

as the season progresses. If the quota is close to being reached in any given area, the weekly limit in that area may be dropped to 200 or 300 pounds for the last week of the season, but fishers are permitted to fill out their 600 pound weekly total in another area.

Areas of Operation: All Marine Fish-Shellfish Management and Catch reporting areas except 23C and 29, which lie outside the DPSs (see Figure 4).

License Type: Limited entry license. This fishery is capped at 18 licenses.

Target Species: Spot Shrimp (*Pandalus platyceros*), Pink Shrimp (*P. eous* and *P. jordani*), Coonstripe (Dock) Shrimp (*P. danae*), and Coonstripe (Humpback) Shrimp (*P. hypsonotus*).

Activity Trend: Increasing catch; declining effort (number of pulls). Commercial catches of Spot shrimp have shown an overall increase since 2004, reaching a high of 126,333 pounds landed in 2012 (Table 16, Figure 17). The average ex-vessel value of commercially landed shrimp has risen each year, from $3.93 per pound in 2004 to $9.21 per pound in 2015 (Table 16), with this increase being driven mainly by the demand for fresh (non-frozen) product. Catches of non-Spot shrimp have also shown an overall increase, and comprised from 21% to 32% of the total Puget Sound shrimp catch between 2004 and 2015 (Figure 17). Effort, measured as the number of pot pulls, declined by 47% for Spot shrimp and by 24% for non-Spot shrimp over the same period (Figure 18). It is assumed that fishing practices remain relatively constant from year to year; that is, fishers do not appreciably change their deployment patterns and pot soak times. Consequently, increased catches of shrimp with a concomitant decline in effort suggest that Puget Sound Spot shrimp populations are increasing.

Table 16. Annual catches and value of Spot Shrimp taken by the commercial shrimp pot fishery, 2004-2015.

Year	Commercial Catch (lbs)	Avg Ex-Vessel Price ($)/lb	Total Value ($)
2004	78,599	3.93	308,894
2005	83,567	4.18	349,310
2006	84,133	4.63	389,536
2007	86,930	4.70	408,571
2008	88,643	5.33	472,467
2009	92,562	4.95	458,182
2010	95,979	5.27	505,809
2011	106,372	5.90	627,595
2012	126,333	6.30	795,898
2013	103,541	6.83	707,185
2014	108,326	7.51	813,528
2015	114,504	9.21	1,054,582

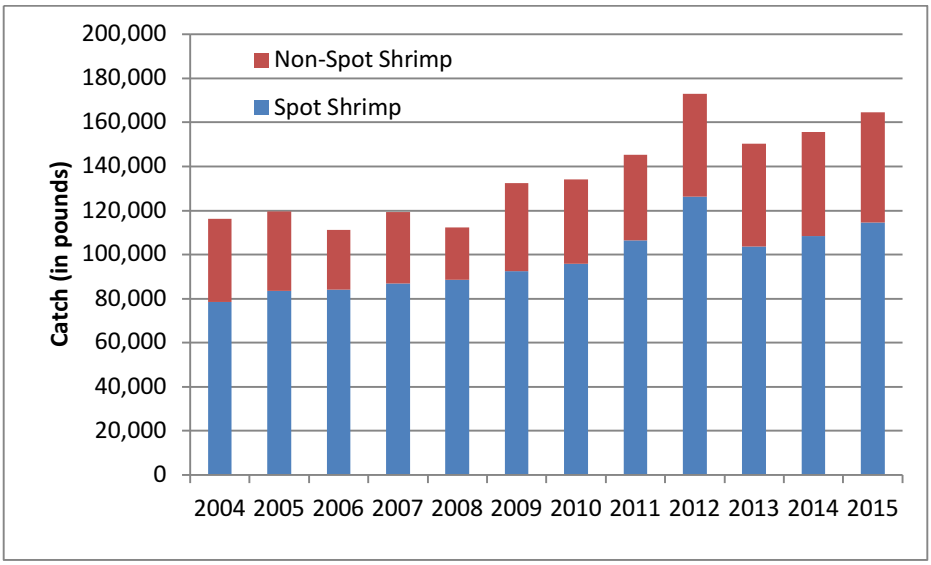


Figure 17. Annual shrimp catch by the commercial pot fishery.

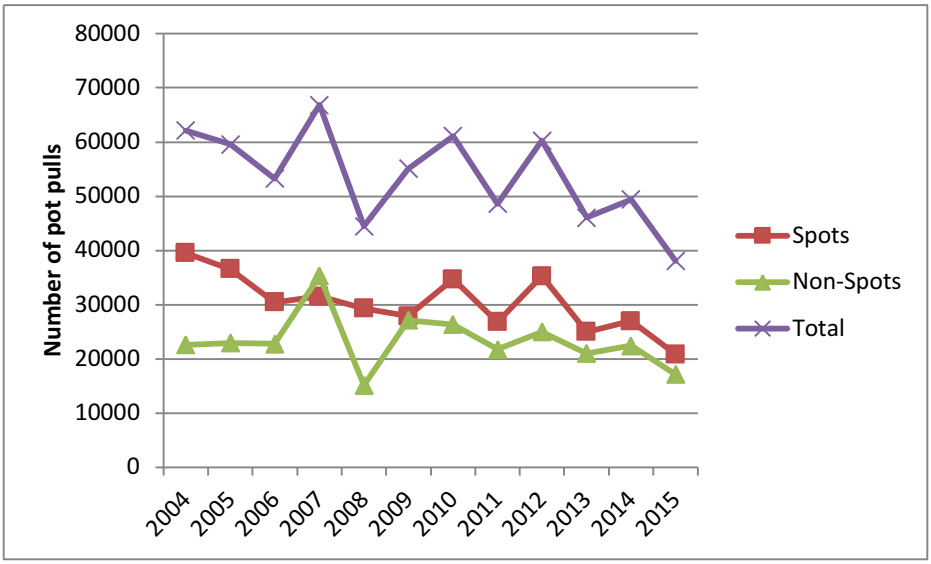


Figure 18. Annual commercial shrimp pot fishery effort by target type.

Potential to Take ESA-listed Rockfish in the Recreational and Commercial Shrimp Pot Fisheries: The recreational and commercial shrimp pot fisheries have not previously been covered under Section 10(a)(1)(B) coverage of the ESA. Since the initial ITP was issued to WDFW in 2012 for the recreational Bottomfish fishery and commercial beam-trawl fishery, two

studies have documented the take of rockfish as incidental catch in shrimp pot gear, with one study capturing Yelloweye Rockfish inside the Canadian portion of the DPS[9].

Favaro et al. 2010 examined the incidental catch rate of rockfish and other organisms captured in commercial-style shrimp traps in British Columbia from 1998 to 2008. The overall rate of rockfish catch was low at 0.015 rockfish per trap, but increased from 2004 to 2008 to 0.039 rockfish per trap. Over the 10-year study period, 264 rockfish were captured by 17,210 traps. Quillback Rockfish were the dominant rockfish species captured, comprising 85% of the rockfish incidental catch. Two Yelloweye Rockfish, representing 0.008% of the total rockfish catch, were reported as incidental catch but Canary Rockfish and Bocaccio were not encountered. The mean length of captured rockfish ranged from 11-23 cm, indicating that these fish are pre-productive juveniles. From these results Favaro et al. concluded that adult rockfish were too large to enter shrimp traps, essentially removing the potential loss of reproductively mature individuals to the fishery.

Antonelis et al. (in review) documented varying levels of rockfish incidental catch in WDFW shrimp pot test fisheries conducted in spring and fall from 2004 to 2013, and found that season, year, and area (MCA) were significant variables for predicting rockfish bycatch. In 4,231 traps, 119 rockfish were recorded in 97 traps (2.3% of pulls). Most traps (n = 78) contained only one rockfish, while 16 traps had two rockfish, and three traps had three rockfish. Copper and Quillback Rockfish comprised 68% of the rockfish incidental catch, with unidentified rockfish accounting for 18%, and Brown, Puget Sound, and Greenstriped Rockfish accounting for the remaining 14%. No ESA-listed rockfish were identified in their study, although the Unidentified Rockfish category had a small potential to contain listed species. If we assume that at least one of these unidentified fish was a listed rockfish, then the incidental catch rate of listed rockfish would match that of Favaro et al. 2010, at 0.008%. The overall rate of rockfish catch was 0.023 fish/trap, slightly higher than the rate reported by Favaro et al. 2010. The highest rate observed in the study was 0.058 rockfish/trap in 2009. Rockfish incidental catch was significantly higher in the fall versus spring (0.034 v. 0.012 rockfish/trap) and catch rates were highest in the Tacoma-Vashon area (MCA 11).

Despite the very low incidental catch rates of rockfish (including ESA-listed species) reported by Favaro et al. 2010 and Antonelis et al. (in review), WDFW has opted to solicit ITP coverage for the recreational and commercial shrimp pot fisheries to protect against the potential for future loss of large numbers of juvenile ESA-listed rockfish occurring from a large recruitment event.

[9] Yelloweye rockfish are not a listed as an endangered species in Canada under the Species At Risk Act (SARA), the Canadian equivalent of the Endangerd Species Act.

Annual Take Estimates for ESA-listed Species in the Recreational and Commercial Shrimp Fisheries: WDFW estimated the potential take of all species of rockfish using the highest reported incidental catch rate from the literature, multiplied by the greatest number of pot deployments estimated in each fishery between 2004 and 2015. Based on an incidental catch rate of 0.058 rockfish/trap (Antonelis et al. in review), 44,480 recreational pot deployments and 66,850 commercial pot deployments, we project that up to 2,580 rockfish and 3,877 rockfish may be taken in the recreational and commercial shrimp pot fisheries, respectively, in any given year (Table 17). Favaro et al. (2010) found that Yelloweye Rockfish comprised 0.008% of the total rockfish bycatch in their study. Using this value, we calculate that the annual incidental catch of Yelloweye Rockfish by the recreational and commercial pot fisheries could be as high as 21 and 31 fish, respectively (Table 17). Antonelis et al. (in review) did not identify any listed species among the 119 rockfish caught as incidental catch in their study, but did report 20 unidentified rockfish. Under the assumption that at least one of these unidentified fish was a listed species, the occurrence of listed rockfish in their catch would match that of Favaro et al. (2010), and we would expect up to 21 and 31 listed rockfish (of any or all species) could be captured by the recreational and commercial pot fisheries each year. Based on the size distribution of rockfish reported by Favaro et al. (2010) and Antonelis et al. (in review), all of these takes would be juvenile fish. Eulachon and Chinook Salmon were not documented as incidental catch in shrimp pots by Favaro et al. (2010) or Antonelis et al. (in review), thus we consider this gear to have no risk of bycatch for these species. Further, this gear poses no risk to Green Sturgeon because fishers do not operate in areas inhabited by this species.

Table 17. Annual take estimates of ESA-listed species by the recreational and commercial shrimp pot fisheries.

Species	Recreational Annual Take Estimate	Commercial Annual Take Estimate
Bocaccio	21	31
Canary Rockfish	21	31
Yelloweye Rockfish	21	31
Eulachon	0	0
Chinook salmon	0	0
Green Sturgeon	0	0

Recreational and Commercial Shrimp Pot Fishery Compliance and Bycatch Monitoring

The WDFW Enforcement program conducts routine patrols of the recreational shrimp pot fishery to monitor compliance with fishing regulations, but WDFW does not have the capacity (funding, staff, resources) to effectively monitor recreational and commercial shrimp pot landings at a level capable of accurately estimating incidental catch of listed rockfish and other species that would be expected to occur at very low levels. Further, due to difficulties with fish identification

by most shrimp pot fishery participants, WDFW cannot rely on the recreational shrimp creel survey or voluntary reporting by commercial fishers to obtain reliable bycatch information to estimate incidental take of listed species. Instead, WDFW proposes to monitor for incidental take of ESA-listed species in these fisheries through the test fisheries conducted by WDFW in the spring and fall of each year. The test fishery occurs in the same areas and uses the same gear as the commercial shrimp pot fishery, which is similar to the gear used by recreational harvesters. In this way, WDFW can ensure positive identification of all fishes incidentally captured in the test fisheries for shrimp. Test fishery incidental catch rates can then be extrapolated to the effort levels observed in the recreational and commercial fisheries to estimate total take of ESA-listed species by these fisheries.

WDFW Marine Fish Research and Biological 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. Some of these activities occur on an annual basis while others occur at less frequent intervals based on agency needs, available funding, and staffing levels. These activities provide fishery independent data for monitoring population trends and the biological response of selected species and species groups to the impacts of fishing, environmental factors, and pollution. The results of some of these activities will be used to facilitate adaptive management for the conservation of ESA-listed rockfish within the accompanying ITP. Some of these activities utilize non-lethal and minimally invasive methods that have little or no potential for incidental take of ESA-listed rockfish, but are presented within this FCP because they 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 these activities involve capturing fish with nets, thus the potential exists for incidental encounters with ESA-listed rockfish, salmonids, and other fish. All of these activities were historically authorized by Section 4(d) limit 7 for incidental take of ESA-listed Steelhead, Chinook Salmon, and summer-run Chum Salmon. Upon the listing of Bocaccio as “endangered”, 4(d) limit 7 could no longer authorize these activities; as the limit applies only to “threatened” species. Monitoring activities with the potential for take of any listed species are now covered under Section 10(a)(1)(A) of the ESA 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, 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, as practicable, 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, as requested
- Otoliths for age analysis (unless otherwise processed by WDFW)

WDFW Research and Monitoring Activities with no Potential Take of ESA-listed Fishes

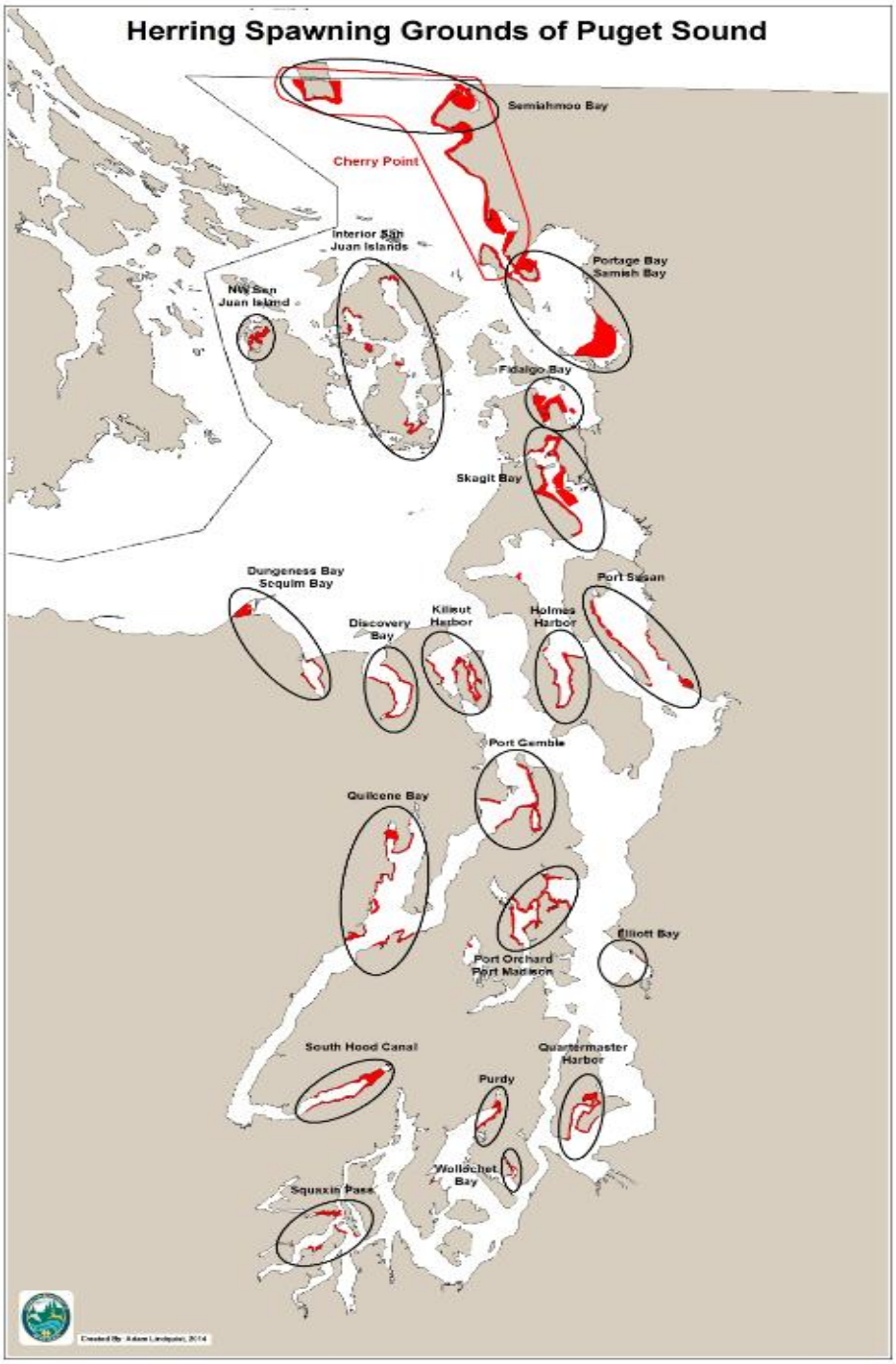
WDFW employs scuba and video survey methods to estimate the relative or absolute abundances of rockfish and other demersal marine fishes. These methods employ visual means to estimate the density of marine fish at selected locations that are then extrapolated to larger study areas. Changes in densities are used to model changes in population abundance. No species, ESA-listed are intentionally killed or injured, 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. These surveys provide information on the abundance, distribution, and habitat quality for many species of fish, including ESA-listed rockfish. Since 2008, WDFW has conducted five ROV studies within separate sub-basins of the U.S. portion of the PSGB DPSs to estimate the relative abundance of listed rockfish and other bottomfish species. The results of ROV surveys conducted in 2008 and 2010 were used by NMFS to evaluate potential ESA-listed species (Federal Register 2009). The results of more recent surveys (2012-13, 2015, 2016) will be used to establish baselines for evaluating the recovery of ESA-listed rockfish, to refine the critical habitat designations for these species, and to design future studies. WDFW will continue to conduct these surveys as funding and need allows.

WDFW Research and Monitoring Activities with the Potential to Take ESA-Listed Fish

Forage Fish Surveys

Surf smelt (*Hypomesus pretiosus*), Pacific herring (*Clupea pallasii*), and Pacific sand lance (*Ammodytes personatus*) are important forage species for seabirds and other fishes, and smelt and herring are targeted in small commercial fisheries, and recreational fisheries that receive little monitoring effort. Smelt and sand lance are beach spawning fish that are problematic to assess because they are either difficult to catch or are found almost exclusively in the extreme nearshore zone. WDFW has been exploring and evaluating methods to assess Surf Smelt and Sand Lance populations in Puget Sound and has utilized various methods to collect biological information from Pacific Herring. Surf Smelt and Sand Lance assessment methods currently under evaluation include beach seine and surface tow-net gear (Nordic surface trawl) deployed in areas of northern Puget Sound (e.g., Whidbey Basin) where most commercial harvest of Surf Smelt currently occurs.

Pacific Herring spawn in 21 known locations within the Puget Sound DPSs (Figure 19) and location-specific spawning abundance is determined annually via systematic vegetation rake surveys. The density of eggs deposited on vegetation collected with the rake is converted to female abundance using a standard value for mass-specific fecundity, and male abundance is estimated using a standard value for sex ratio in spawning schools. The methods used for these surveys have negligible risk of encountering any ESA-listed species. WDFW also uses a variable mesh gill net in shallow nearshore spawning areas to collect Pacific Herring specimens for biological sampling. The biological information and the assessment techniques fulfill the requirements for WDFW to successfully implement the Puget Sound Forage Fish Management Plan and to manage sustainable fisheries on healthy populations of forage fish. These activities are covered under ESA Section 4(d) Research Permits. While variable mesh gill net gear has the potential to take ESA-listed species, the risk to ESA-listed rockfishes is negligible. Whenever ESA-listed salmonids are encountered, every attempt is made to release fish alive as quickly as possible; however, in sets that capture large numbers of fish, WDFW estimate that up to 2% of fish may die (WDFW unpublished data). In 2015, WDFW was contracted by the U.S. Navy to conduct beach seining at selected locations in and around Puget Sound Navy facilities. Since then, only three juvenile non-listed rockfish have been captured in 461 seine sets, and all were released alive. A total of 15,849 salmonids, predominately Chum Salmon and Pink Salmon, have been captured. A total of 894 Chinook Salmon have been captured, and of these 554, or 62%, were adipose clipped. This proportion is nearly identical to the proportion WDFW used to estimate the ratio of hatchery to wild Chinook Salmon expected in the recreational Bottomfish and other fish fishery within this plan.



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1579 **Figure 19**. Principal herring spawning locations in Puget Sound.

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Acoustic-Trawl Surveys

WDFW conducts acoustic and mid-water trawl surveys to estimate the abundance of Pacific hake (whiting, *Merluccius productus*), Pacific herring (*Clupea pallasii*), smelt (all species, including Eulachon), Pacific Anchovy, and other pelagic species in the inland marine waters of Washington (Puget Sound and adjacent water bodies) using scientific acoustic technology coupled with mid-water trawling. The hydroacoustic and trawl methods employed in these surveys are similar to those used to assess herring spawning stocks prior to 2009 and the frequencies and power of scientific echosounders used have no known effects on ensonified fish. However, the trawl component of the survey has the potential to capture (i.e., incidentally take) several listed species in the Puget Sound DPSs, including Chinook and summer-run Chum Salmon, Steelhead, Eulachon, Bocaccio, Canary Rockfish, and Yelloweye Rockfish. For targeted species, the survey goals are to characterize the abundance, seasonal variation in distribution, and biological characteristics of the population in key basins and holding areas. Specific objectives are to: 1) Estimate the abundance with scientific echosounders; 2) Obtain species and age/size class composition information on concentrations of specimens 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.

The coordinated survey is conducted from two vessels; a 59-foot fishing vessel equipped with a mid-water trawl, and a smaller vessel equipped with a scientific echosounder. Sampling for this survey began in February of 2016 at 18 stations throughout the DPS selected for their proximity to upwelling areas, representativeness relative to local bathymetry, and dispersion throughout Puget Sound (Figure 20). Sampling all 18 stations takes an average of 10 days and the complete suite of stations has been visited every other month. Upon arriving at a station the hydroacoustics vessel calibrates the echosounder and then proceeds along a pre-defined transect at approximately 4 knots collecting acoustic data. When an aggregation of fish is encountered, the fishing vessel is notified and provided the location. The fishing vessel then sets the mid-water trawl in an effort to capture a representative sample of the aggregation for biological characterization and sampling. When a sufficiently dense aggregation of fish is not encountered the hydroacoustics vessels may direct the fishing vessel to conduct a “blind” set at a random depth to characterize background levels of mid-water biomass for further use in calibrating overall abundance estimates for non-schooling fish.

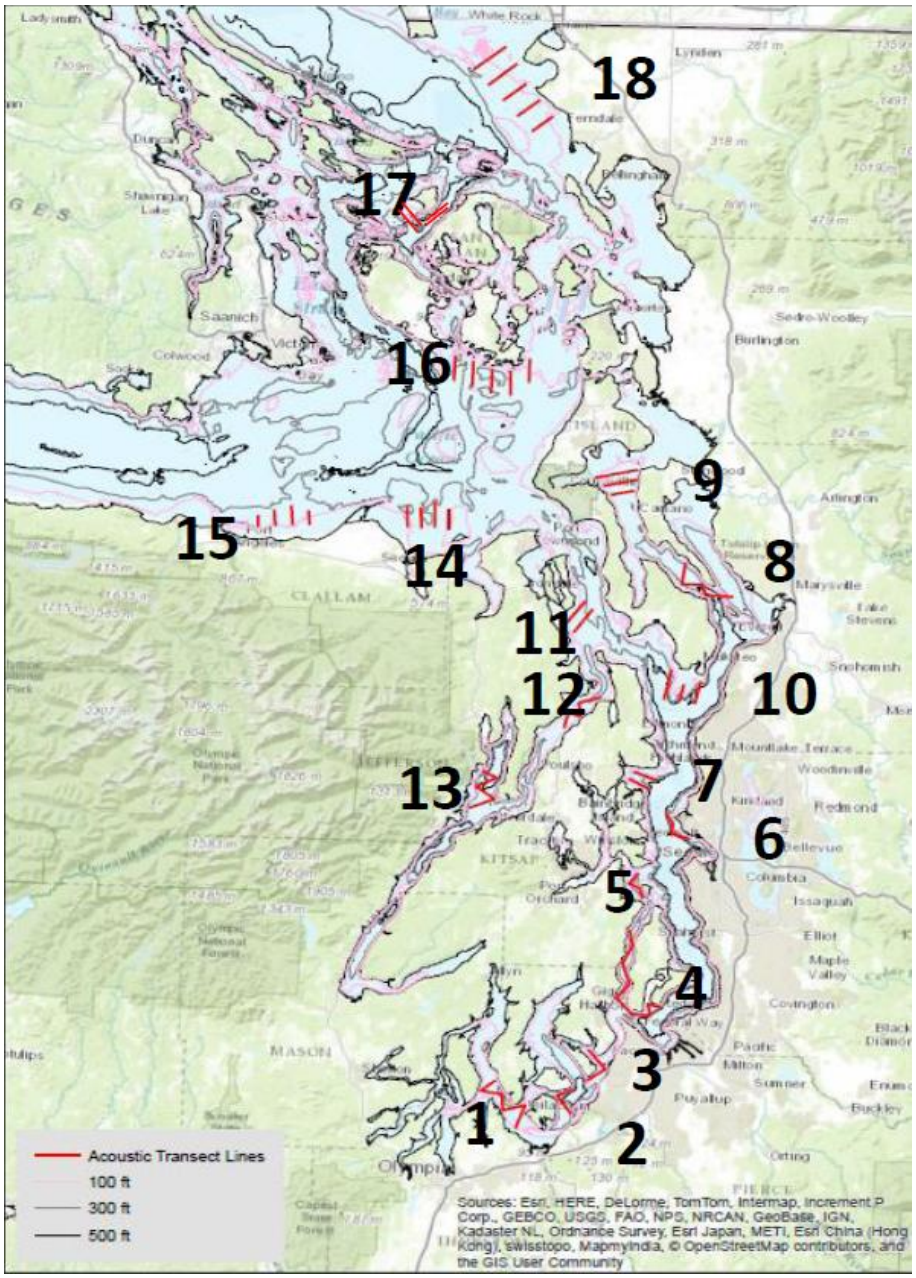


Figure 20. Sampling locations for mid-water trawl and hydroacoustics surveys conducted in 2016-17. Red lines represent acoustic survey locations, which were sampled ever two months. Mid-water trawling occurred along these lines at point of high fish density and at areas of "background" fish density.

The hydroacoustics vessel employs a Biosonics DTX scientific echosounder fitted with 38 KHz and 120 KHz split beam transducers to ensonify the water column. The fishing vessel uses a mid-water Polish rope trawl held open by steel doors developed specifically for mid-water trawling. Net mesh size decreases from 0.8 m at the throat to 3.8 cm at the cod end, with the cod

end fitted with a 1 cm knotless mesh liner. When the net is deployed as directed by the hydroacoustic vessel it is monitored in real-time by a sensor attached to the headrope that transmits the net's depth in the water column to the bridge of the fishing vessel. The net may be fished from 10-110 m deep depending on the position of fish in the water column. Depending upon the intensity of the acoustic sign and the required sample size, the net is towed for 10-15 minutes at a speed of 2-3 knots. The net is then retrieved and the catch is emptied 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, and when possible size classes, 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.

The survey does not directly target salmonids, rockfishes, Eulachon or other listed species , and most of these species tend to be rare in the catch (Table 18). In 105 trawls since February of 2016, a total of 48 Chinook Salmon have been captured, 40 of which were of known hatchery origin because they were either adipose-clipped (38) or implanted with a coded wire tag (2), and 100% of these fish were juveniles. Listed rockfish, Steelhead, Green Sturgeon, seabirds, or marine mammals have not been encountered or captured during the course of the survey.

Most salmonids not retained for special WDFW, NMFS, or UW studies are returned live to the water. 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 animal back into the water. If salmon are mixed in the catch, they are either: 1) immediately removed by hand and returned to the water; or 2) held in a flow-through seawater tank until oriented and then returned to the water by transferring them with a smaller container. Approximately one quarter of the salmonids fail to reorient and are considered mortalities. Salmon often suffer substantial scale loss and may have minor to major abrasions or lacerations resulting from contact with the net, and WDFW has no method to estimate mortality of fish released with these conditions.

The mid-water trawl has the potential to take rockfish, including Bocaccio, Yelloweye Rockfish, and Canary Rockfish, although the likelihood of capture is extremely low. To date, no ESA-listed rockfish species have been encountered, and only one Puget Sound Rockfish and three Splitnose Rockfish have been captured. Captured rockfish may suffer from the effects of barotrauma, and every effort will be made to return them to depth as quickly as possible using descending devices to counteract the effects of barotrauma and minimize mortality. Prior to descent, listed rockfish will be measured and a fin clip may be collected for DNA analysis. Rockfish that are dead or are not expected to survive descent may be sacrificed for the collection of age structures before returning the carcasses to the water.

Thus far in 2016, 49 Eulachon were taken in 105 trawls, and most of these fish were mortalities, although several fish in one trawl were released alive and observed to swim away from the

vessel. Seventy-three percent of these fish were juveniles (<180 mm). Dead Eulachon may be sampled for genetic, age, and other tissues before returning the carcasses to the water.

The risk to Green Sturgeon by the mid-water gear is extremely low because the net typically fishes well above the bottom.

Table 18. Number of Positive Encounters with Listed Species by WDFW Marine Fish Research and Monitoring Activities Within the Respective DPSs.

	Bottom Trawl 1987-2016	Mid-water Trawl 2004-2016	PSEMP Trawl 1989-2001	PSEMP Trawl 2002-2015	Beach Seine 2015
Number of Tows/sets	2,209	193	544	200	461
Bocaccio	0	0	0	0	0
Canary Rockfish	6	0	0	0	0
Yelloweye Rockfish	8	0	1	0	0
Chinook Adult-Natural	3	0	n/a	0	
Chinook juvenile-Natural	19	8	n/a	0	
Chinook Adult-Hatchery	0	0	n/a	0	
Chinook juvenile-Hatchery	4	40	n/a	6	
Chinook, juvenile-unknown origin		12	28		
Eulachon	1,688	1	29	1	0
Green Sturgeon	1	0	0	0	0

Puget Sound Bottom Trawl Surveys

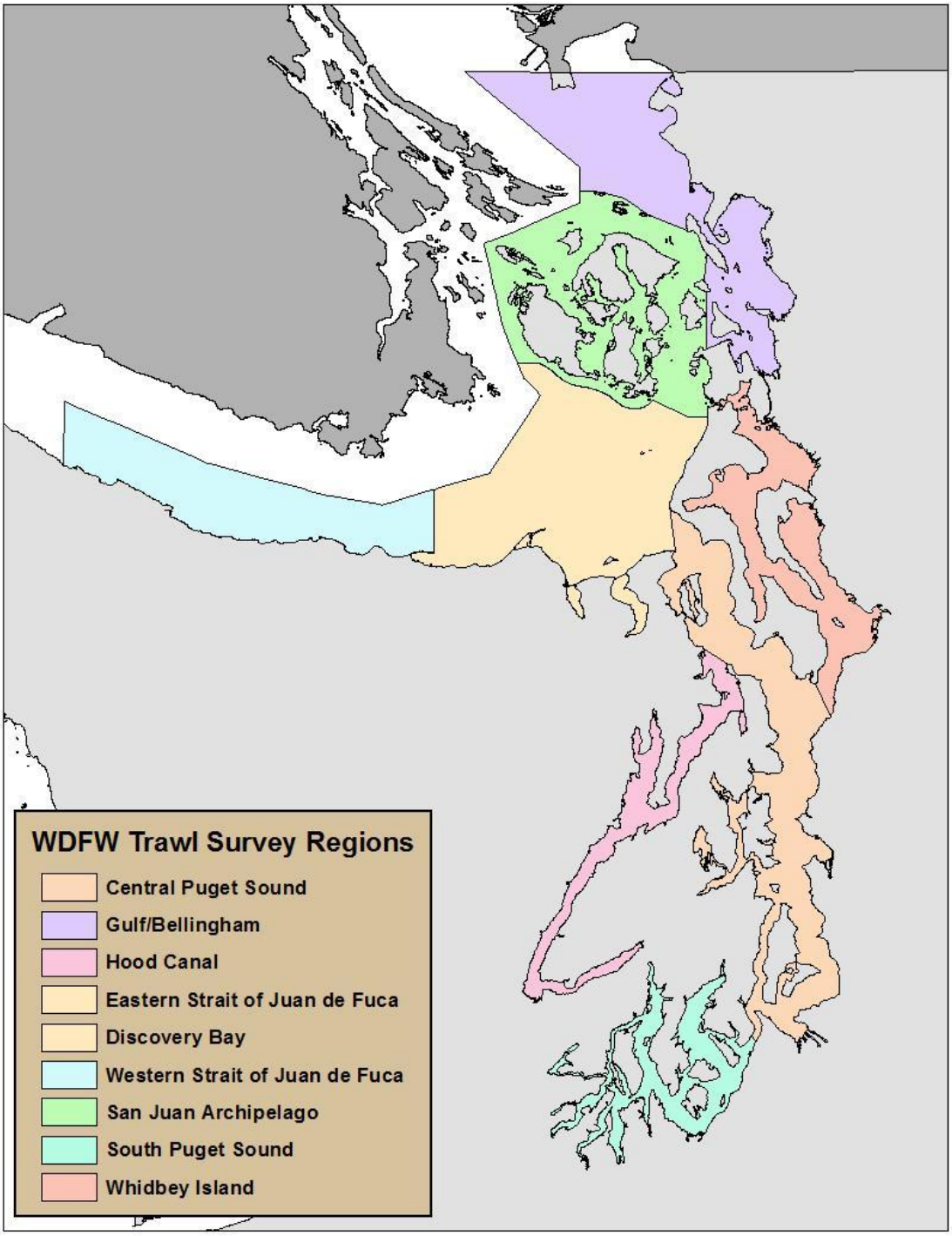
Since 1987, WDFW has been conducting surveys of Puget Sound using a scientific bottom trawl that targets demersal fishes (commonly referred to as groundfish) and invertebrates occurring over non-rocky bottoms. Trawl surveys were conducted at infrequent intervals from 1987 to

1999 but have been conducted annually in select regions of the Sound since 2000. 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 21). Survey stations are assigned to one of four depth zones: 5 to 20 fathoms, 21 to 40 fathoms, 41 to 60 fathoms, and greater than 60 fathoms. The purposes of these surveys 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 species; 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. All captured organisms are identified, weighed, and counted, and during a typical survey year up to 20 tons of fishes and invertebrates representing approximately 50 to 100 fish species and up to 50 invertebrate species may be captured. Abundance indices are estimated 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. Survey results may be used to assess the status of groundfish stocks, understand the biology and distribution of key and minor groundfish species, provide foodweb and ecosystem model inputs, and manage commercial and recreational fisheries. 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 with important information about the demographic structure of populations, growth rates, genetic structure, and food web relationships. In addition to these abundance surveys, WDFW may also conduct special studies to evaluate the performance of the bottom trawl, the impact of the trawl on the substrate, or for comparison to ROV studies (e.g., Pacunski et al. 2016).

From 1987 to 2007, WDFW used a randomized-station survey design that focused on two to three Puget Sound sub-basins each year, with all eight sub-basins sampled every three years. In 2008, the survey was redesigned as an index survey in order to sample all eight sub-basins annually, with 51 pre-selected permanent stations established throughout Puget Sound (Figure 22). These stations were stratified by depth zone as described above, with at least three depth zones sampled within each sub-basin. From 2008 to 2014, the bottom trawl was deployed twice at each station, with 102 tows made each year. At most stations the tows were conducted along parallel transects, but at several stations where the depth contour was too narrow to allow it, tows were conducted end-to-end. Analyses of the catch results from 2008 to 2014 showed no significant difference in catch composition at most stations with parallel transects, therefore, the survey design was modified for subsequent survey years. At parallel-tow stations, one of the two transect lines is randomly selected for towing, and upon completion of the tow the catch composition (density and numbers) of the top 5 vertebrate species is compared to the catch composition from that station (both transects combined) from the previous 5 years. Based on the observed range and standard deviation of each species, and considering catches at previous stations in the current survey, the Chief Scientist determines whether a second tow will be

conducted. If a second tow is deemed necessary because catch is aberrant, it is conducted along the second (non-selected) transect line. Both tows are always conducted at stations where the transects are laid out end-to-end.

The index survey is conducted from a chartered 58 foot steel fishing vessel using a 400 mesh Eastern bottom trawl equipped with 5-inch cookie gear (tightly packed, non-moving, rubber disks, installed on the footrope to reduce wear and minimize snagging). The net is primarily a commercial net constructed of synthetic twine with 10 cm meshes. The cod end of the net contains a liner with a mesh size of 3.2 cm. Heavy steel doors (~400 kg/door) are attached to each side of the net and the entire assembly is towed along the seafloor for a distance of 0.40-0.74 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. After completing each transect, the net is retrieved and the catch is emptied from the net onto a table where it is carefully sorted. All fish and most invertebrates are identified to the lowest practicable taxonomic level possible. Each taxon is then weighed and counted or sub-sampled for expanded counts. When catches are large, a randomly selected portion of the catch is processed and the remainder is weighed and returned to the sea. 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. All ESA species within the catch and processed regardless of catch size. Additional trawl stations may be occupied or stations repeated if problems are encountered during fishing operations. Genetic, age, tissues, and other samples will be held by WDFW's Genetics, Ageing, and marine fish laboratories. We often receive requests for sharing samples and make these samples available for WDFW, NOAA, and other scientists whenever possible.



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1741 **Figure 21.** WDFW trawl survey regions (note: Discovery Bay is a sub-region of the Eastern Strait of Juan
1742 de Fuca region).

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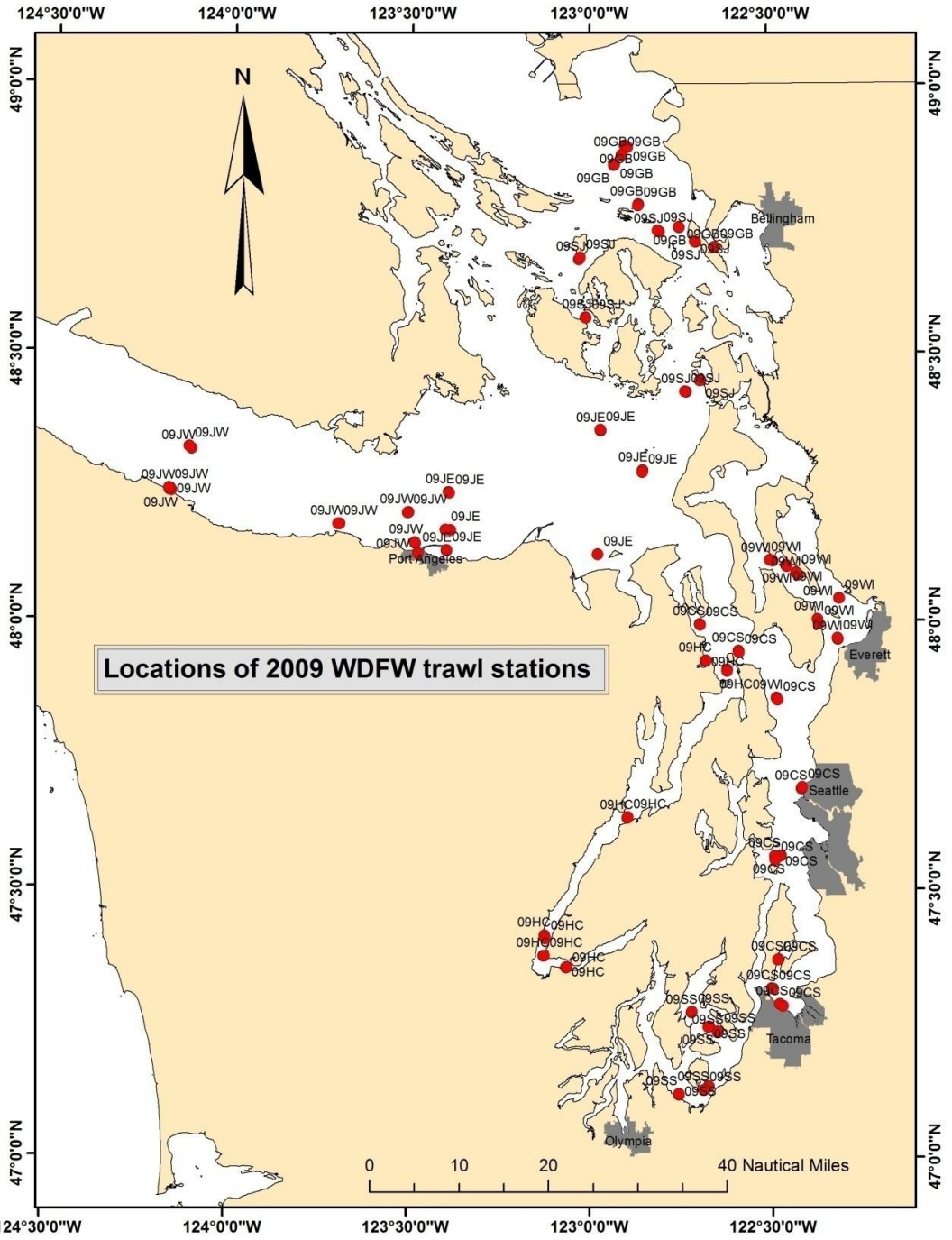

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1746 **Figure 22.** Index stations occupied during annual WDFW bottom trawl surveys.

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1748 Encounters with ESA-listed species and measures to reduce mortality

Since 1987, WDFW has conducted 2,209 trawl tows in Puget Sound and the inland waters of Canada, with 1,844 of these tows conducted within the U.S. portion of the ESA-listed rockfish DPSs. In total, we have encountered 12 Bocaccio, 20 Yelloweye Rockfish, 28 Canary Rockfish, 26 Chinook Salmon, one Green Sturgeon, and 1,688 Eulachon (Table 18). Among listed rockfish, only 8 Yelloweye Rockfish and 6 Canary Rockfish have been encountered in the U.S. portion of their DPSs, the remainder being taken in the Strait of Juan de Fuca west of the Victoria Sill, and the annual take limit of the existing Section 10(a)(1)(A) coverage for ESA-listed rockfish has never been exceeded.

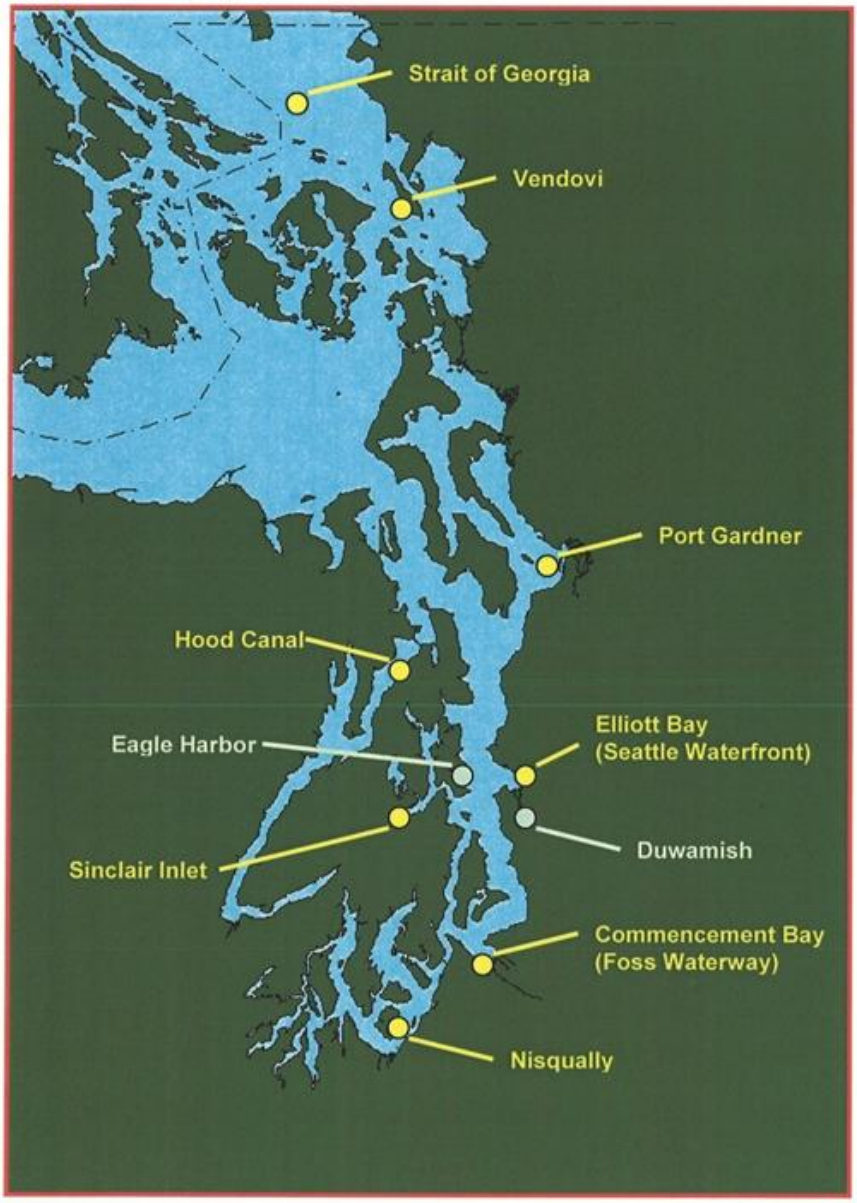
Captured rockfishes often show signs of barotrauma and some individuals are dead when retrieved from the net. Until 2008, rockfish showing signs of severe barotrauma were considered unlikely to survive if returned to the water. Since 2008, all live rockfish are immediately placed in a tank with running seawater until they can be sampled and returned to the water with a descending device. Less than 10% of descended rockfish have been observed to resurface after descent (WDFW unpublished data). All ESA-listed rockfish are measured, weighed, and sampled for genetic tissues. Age structures are collected from all dead, ESA-listed rockfish and those not expected to survive descent due to extensive barotrauma symptoms.

If a salmon (listed or not) is observed to be entangled in the net upon retrieval, the meshes around the fish are cut and the salmon returned to the water. During net spillage and catch processing, any live salmon encountered are transferred to a tank with flowing seawater until they appear viable enough to be sampled and returned to the water. The length of some, but not all, salmonids is measured, and some viable fish may be sampled for age structures (scales) and genetic tissues. The presence/absence of the adipose fin as a result of clipping is noted, which can be used to distinguish between wild and hatchery-origin fish. However, not all hatchery-produced salmonids are clipped, and because we do not wand fish to detect a coded-wire tag, we are unable to distinguish between unclipped hatchery and natural run salmonids. Of the 26 Chinook Salmon captured in WDFW trawls only four were adipose-clipped, thus we assume that the remaining fish were of natural origin. About half of trawl-caught Chinook Salmon are dead or so severely impaired that they are considered mortalities. About 75% of the Chinook Salmon held in live tanks become re-oriented and appear to be viable upon release, however, some fish may suffer severe scale loss, abrasions, or lacerations from the net, and we have no mortality rate estimates for these fish. Eulachon are relatively fragile and are usually dead upon retrieval from the trawl net or die quickly due to handling-induced stress, and the carcasses are returned to the water after opportunistic tissue sampling and measurement. Any Green Sturgeon are held in a live tank until re-oriented or, if obviously vital, immediately returned to the water. The only Green Sturgeon ever captured was very vital upon release. Orca Whales or other whales, pinnipeds, summer-run Chum Salmon, Bull Trout, and Steelhead have never been directly encountered or captured in bottom trawl surveys conducted by WDFW.

Puget Sound Ecological Monitoring Program (PSEMP, formerly PSAMP)

In cooperation with the Puget Sound Partnership, WDFW is a participant in the Puget Sound Ecosystem Monitoring Program (PSEMP), a multi-agency effort to monitor the health of Puget Sound. WDFW's 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 collected from the entirety of Puget Sound, Hood Canal, Strait of Juan de Fuca, and Strait of Georgia (including U.S. and Canadian waters). 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.

To meet its objectives, the PSEMP Survey staff conducts a bottom trawl survey during odd years. English sole (*Parophrys vetulus*) is the primary target of this study, although other species collected with the bottom trawl may be analyzed on an opportunistic basis. English sole is a well-studied species used to model the fate and impact of toxic contamination in Puget Sound. Collected fish are dissected for blood, liver, bile, otolith, and other tissues of interest, which are sent to laboratories for chemical and pathological analysis. Results are analyzed for geographic and temporal trends and are integrated into one of 25 dashboard indicators for the Puget Sound Partnership. 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 (Figure 23). This survey uses the same trawl net and chartered fishing vessel used for the annual WDFW bottom trawl survey (see previous section) and may be conducted concurrently with that survey. The net is towed for 5-20 minutes at a speed of 2-3 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. 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.



1823

1824 **Figure 23**. Biennial PSEMP trawl stations.

In addition to the standard survey, PSEMP may develop new studies to understand the ecosystem effects of chemical contamination at specific sites, over time, and with different restoration techniques. Such studies may be conducted 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.

Tissue Sampling

At each baseline station, fish processing begins on the vessel. One hundred twenty (120) live English Sole are 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 are 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 these 60 fish, the first 20 males and 5 females have blood drawn. Each fish is then dissected to collect liver and gonad tissue for histology, liver tissue for chemistry (RNA analysis), and bile for toxin accumulation analysis Once processing is completed, carcasses are placed in individual Ziplock bags and labeled, then bagged with the designated composite group and frozen. Once these dissections are completed, a second group of 60 fish are randomly selected from the holding tank and assigned to muscle tissue composite groups. They are then bagged and frozen. Specimen forms list both the FishID numbers and identify the composite groups to which the fish are assigned, and accompany 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. Once a blood sample is drawn, samples are treated with an anticoagulant then spun in a centrifuge (3,000 rpm) to separate plasma from red blood cells. The plasma is then 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 prepared, 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 Bile is extracted carefully, avoiding tissues and exterior fluids. A liver and gonad section will be taken from each English Sole dissected on the boat. Both tissue sections are placed together in a labeled tissue cassette and preserved in Dietrich's solution.

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

Although listed species are not targeted in PSEMP surveys, those that could potentially be encountered are Chinook Salmon, Steelhead, Eulachon, Bocaccio, Yelloweye Rockfish, Canary Rockfish, and Green Sturgeon. Of these, the PSEMP program captured a total of 34 Chinook

Salmon, 1 Yelloweye Rockfish, and 29 Eulachon in 744 bottom trawl tows from 1989 to 2015. No Steelhead, Bocaccio, Canary Rockfish, or Green Sturgeon were captured during that period (Table 18). Since 2002, only one Eulachon was captured (in 2011) in the Duwamish River. To minimize mortality of listed species, WDFW's PSEMP team uses the same methods as those described for the WDFW bottom trawl survey (see preceding section).

Biological Sampling of Puget Sound Groundfish

WDFW co-manages over 150 species of groundfish in Puget Sound. WDFW is a regulatory agency charged with the sound stewardship of Washington's fish and wildlife resources, and manages groundfishes in Puget Sound under the auspices of the Puget Sound Groundfish Management Plan (PSGMP). Within the scope of the PSGMP, groundfish includes all fish classified as "Bottomfish" and "Unclassified Marine Fish" by state law, as well as Pacific Halibut and Sablefish. In conjunction with federal, tribal, and academic partners, WDFW conducts routine and specialized research activities to learn more about the stock structure, life history, biology, and foodweb relationships of these species, some of which are poorly known.

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. ESA-listed species that may be encountered in the Puget Sound DPSs include Chinook Salmon, Bocaccio, Canary Rockfish, and Yelloweye Rockfishes. We will not target Bocaccio, Canary Rockfish, or Yelloweye Rockfish 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, sampled, and returned to the water, or until lethally sampled. Specimens may be sampled for a tissue, held for broodstock, or sacrificed for more in-depth analyses. Other collection methods may include beach seining, dipnetting, hand-netting with scuba, 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 is conducted from a WDFW research vessel with up to six persons fishing at any time, and whenever possible we use non-toxic lures and sinkers. Gear is lowered to the desired depth and jigged or worked up and down the water column with hooks and lines matched to the expected size and weight of the specimen. All hooks are barbless with up to three hooks on a line. Lures consist of leadheads,

chrome diamonds, fish-like objects, or other popular recreational and commercial fishing jigs. Baits consist of herring, other baitfish (smelt, anchovy, sardine), squid, or small bottomfish.

Sites are selected and occupied based upon the knowledge of target species distribution, habitat relationships, depth, and season. WDFW utilizes GPSs, depth sounders, and local knowledge to occupy study sites shallower than 120 feet in depth. Captured fish are sampled or studied by collecting length and weight measurements; tag 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. Genetic samples are placed into 95% ethanol and transferred to the WDFW laboratory for later analysis. Stomach contents from gastric lavage are placed in a jar or mesh bag and fixed in 10% Formalin for laboratory processing. 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 descending device that allows the fish to be released remotely from the surface. Otoliths, stomach, ovary/testes, or other organs or tissues of interest that require lethal sampling are preserved in fixative or frozen, and processed in WDFW or collaborators' laboratories. After lethal sampling all carcasses will be returned to the water unless specifically requested that they be retained for further analysis. 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.

Tagging may utilize one or more of the following techniques: insertion of an acoustic 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.

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

WDFW does not intend to directly take any listed salmonids or Green Sturgeon, Eulachon, or Bocaccio, Canary Rockfish, or Yelloweye Rockfish. Potential take of listed salmonids will be minimized by not fishing gears in the upper water column or extreme nearshore habitats where they occur. By restricting scientific angling to depths less than 120 feet, the same restriction imposed on the Bottomfish fishery in 2010, and avoiding locations where the listed species have been known to occur, minimal capture of listed rockfishes is expected. Eulachon are extremely rarely captured by hook-and-line and sampling will not occur in areas occupied by Green Sturgeon, thus WDFW does not anticipate any take of these species by this activity.

There may be indirect mortality on captured specimens due to stress, barotrauma, and handling resulting from the fishing process. To minimize impacts on captured listed rockfishes, WDWF 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, WDFW will use descending devices to rapidly submerge the fish back to its depth of capture to minimize and counteract the effects of barotrauma. Listed rockfish that suffer indirect mortality as a result of sampling will be weighed and measured, and fin clips and otoliths will be collected before returning the carcass to the water. Any captured salmonid or Green Sturgeon will be kept in the water, unhooked and/or disentangled, and released. For salmonids, the condition of the adipose fin will be noted to determine whether fish are of wild or hatchery origin, but fish will not be "wanded" for a coded wire tag unless a wand is readily available. If a specimen appears moribund, it will be brought aboard and held in a seawater tank until it is re-oriented or 30 minutes has elapsed, at which time the specimen will be returned to the water. Non-listed species may encounter similar barotrauma and handing stress and mortality, and WDFW will use the same measures as for listed species to minimize mortality of non-target species.

Estimated Take of ESA-listed species by WDFW Research and Monitoring Activities

The authorized takes for ESA-listed species by selected WDFW research and monitoring activities under existing Section 10(a)(1)(A) permits are listed in Table 19. These permits are set to expire in October 2017 and renewal efforts are currently underway. Capture rates are anticipated to be similar during the next requested coverage period, though takes will vary with the amount of activity conducted. Projected annual incidental takes of ESA-listed fish will be based on past catch rates, maximum takes within a season, the possibility of encountering a listed species, and anticipated sampling activity.

Rockfish takes are estimated for juvenile and adult fish based on maturity-at-length estimates from the literature. For Bocaccio, Canadian assessments predict that 50% of females are mature at 56 cm and 7.1 years of age (COSEWIC 2013). In contrast, Phillips (1964) and Gunderson et al. (1980) reported length at 50% maturity for female Bocaccio along the West Coast to be 40.4 cm and 48.6 cm, respectively. For Canary Rockfish, the 50% maturity is 40.5 cm based upon West Coast assessments (Methot and Stewart 2005). For Yelloweye Rockfish, length at 50% maturity is 39 cm based on a study from the Oregon coast (Hannah et al. 2009). Eulachon mature at 17.5 cm in the Columbia River (Clarke et al. 2007), and this length increases farther north, thus fish greater than 18 cm are considered adults. Per WDFW regulation, Chinook Salmon greater than 24 inches are considered adults, and Chum Salmon greater than 12 inches are considered adults. Based on the combination of voluntary trip reporting (VTR) and WDFW test-fishing activities, 75% of Chinook Salmon encountered by anglers were adipose clipped, indicating that they were of hatchery origin. An additional 7% of hatchery produced Chinook are implanted with coded wire tags but are not adipose clipped.

Mid-water trawling: Up to 150 trawls may be conducted annually. Based on an expected rate of 0.46 Chinook and 0.47 Eulachon from the 2016 survey, 69 Chinook and 70 Eulachon are estimated to be taken each year. For Chinook, 49 fish (71%) would be juveniles, and 53 fish (77%) would be of hatchery origin. For Eulachon, 51 fish (73%) would be juveniles. Based on encounter rates with listed rockfish, an estimated take of one Hood Canal Summer-run Chum Salmon, one Bocaccio, one Yelloweye Rockfish, and one Canary Rockfish of any life stage per year is expected. No Green Sturgeon are expected to be taken by this gear. Puget Sound Bottom Trawl survey: Up to 70 trawls may be conducted annually. No Bocaccio have ever been encountered in the DPSs, and historical encounter rates with Canary and Yelloweye Rockfish are extremely low (< 0.004 fish/trawl). However, to account for unusual occurrences, WDFW is authorized under Section 10(a)(1)(A) to take up to 2 Bocaccio, 10 Canary Rockfish, and 4 Yelloweye Rockfish on an annual basis (Table 19). The current permit also allows for the take of up to 400 Eulachon, 26 Chinook Salmon, 3 Summer-run Chum Salmon, 8 Steelhead, and 1 Green Sturgeon (Table 19).

PSEMP bottom trawl: Bocaccio is a schooling species and though they have never been captured in this survey, NOAA has authorized the take of 2 Boccacio per year (1 adult, 1 juvenile). The current Section 10(a)(1)(A) permit does not authorize the take of Canary Rockfish, Yelloweye Rockfish, or Eulachon, but does permit the take of up to 12 Chinook Salmon, 2 Hood Canal Summer-run Chum Salmon, 2 Steelhead, and one Green Sturgeon (Table 19).

Biological Sampling (hook-and-line): With up to six persons fishing during 20 days of research operations (120 person/day fishing trips), WDFW is authorized to take up to 12 Chinook Salmon, two Bocaccio, two Canary Rockfish, and two Yelloweye Rockfish (Table 19). Eulachon and Green Sturgeon are not expected to be taken in this effort are not covered under the existing permit. 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 handing stress and mortality, but we will use the same measures used for listed species (described above) to minimize mortality.

2000
2001

2002 **Table 19.** Currently authorized Section 10(a)(1)(A) Annual Takes for ESA-listed Species within the Puget Sound/Georgia Basin Rockfish DPSs by
2003 WDFW Research and Monitoring Activities with the potential to take rockfish (2012-2017) (note: blank cells indicate no coverage was requested).

			Biological Sampling		Bottom Trawl		Midwater Trawl		PSEMP Trawl		Total	
SPECIES	ORIGIN	LIFE STAGE	Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality	Expected	Indirect Mortality
Eulachon	Natural	Adult			300	300	40	40			340	340
		Juvenile			100	100	20	20			120	120
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			7	7
		Juvenile	1	1	5	5	1	1			7	7
Yelloweye Rockfish	Natural	Adult	1	1	2	2	1	1			4	4
		Juvenile	1	1	2	2	1	1			4	4
Chinook Salmon	Listed Hatchery Adipose Clip	Adult	2	1	4	2	2	1			8	4
		Juvenile	5	1	15	7	20	5			40	13
	Natural	Adult	2	1	2	1	2	1	2	1	8	4
		Juvenile	5	1	5	2	10	3	10	5	30	11
Hood Canal Chum Salmon	Natural	Adult			1	1	1	1	1	1	3	3
		Juvenile			2	1	5	1	1	1	8	
Steelhead	Listed Hatchery Adipose Clip	Adult			2	1	1	0			3	1
		Juvenile			2	1	5	1			7	2
	Natural	Adult			2	1	1	0	1	1	4	2
		Juvenile			2	1	5	1	1	1	8	3
Green Sturgeon	Natural	Adult			1	0			1	0	2	0

2004

WDFW Fishery Compliance and Biological Monitoring Programs in Puget Sound

Bottomfish in Puget Sound are managed under the auspices of WDFW using 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 marine fishes. The purpose of the monitoring is to adequately sample and estimate harvest and released catch, obtain biological data from harvest and research catches to estimate life history parameters, and estimate abundance of marine fishes for the management of recreational and commercial fisheries. Several key surveys have taken place for the past thirty-five years that provide long-term measures of fishery trends and population abundance that support the assessment of marine fish stocks. Fishery compliance monitoring includes the recreational fishery monitoring program, commercial catch monitoring via fish tickets, and onboard and dockside vessel observations, and enforcement actions by the WDFW Police. Biological (effects and effectiveness) monitoring consists of population surveys using acoustic, trawl, seine, hook-and-line, scuba, and underwater 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), Pacunski et al. (2013), and other reports and publications. Details of the fishery compliance and biological monitoring for each of the requested fisheries can be found in the preceding fishery narratives.

Adaptive Management Plan

Adaptive management has been defined[10] 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 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. Williams et al. (2009) contend that adaptive management is not a 'trial and error' process, but rather emphasizes learning while doing.

[10] Federal Register 65 no. 202 October 19, 2000, page 62571

The Department of the 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 facilitate recovery of 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 - Quantify incidental catch 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 incidental catch of ESA-listed rockfish and other listed species in the commercial shrimp trawl fishery, recreational shrimp pot fishery, and commercial shrimp pot fishery that occur within the Puget Sound/Georgia Basin DPS.

Research - Conduct research on Puget Sound marine biota and track incidental take of Yelloweye Rockfish, Canary Rockfish, Bocaccio and other listed species within WDFW-led research efforts. Research will focus on the production of abundance estimates, demographics, and spatial distribution of ESA-listed rockfish, Eulachon, and other marine fish and invertebrates throughout the Puget Sound/Georgia Basin DPSs. 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 incidental catch for each ESA-listed rockfish and other listed species within the Puget Sound DPSs from covered fisheries; 2) provides incidental catch numbers for 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 for all fisheries covered by this plan.

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 DPSs. Updated incidental catch numbers will also be assessed relative to the information described above. In addition, each agency will discuss future research and monitoring efforts necessary to better understand the stock status and recovery actions that would benefit each species.

Adjustment of Management Actions and Ten 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, and/or productivity within the DPSs, showing that any of these factors are diminishing; 2) incidental catch 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 rulemaking 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 Fish and Wildlife Commission (FWC) and usually require a process that occurs at least three months prior to permanent rule change adoption and implementation. Usually, WDFW considers changes in permanent rules for recreational fishing affecting marine species on a triennial 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 9, 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 20), 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 the first five years 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 incidental catch (Table 20). 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 20. Projected takes and adaptive management triggers for Bocaccio, Canary Rockfish, Yelloweye Rockfish, and Eulachon.

	Projected Annual Take for the Recreational Bottom Fish, Commercial Shrimp Trawl, and Recreational and Commercial Shrimp Pot Fisheries	**Years 1-5 Adaptive Management Trigger**	**10-Year Cumulative Take Limit**
Bocaccio	282+5+21+31 = **339**	407	3,390
Canary Rockfish	284+10+21+31 = **346**	415	3,460
Yelloweye Rockfish	87+10+21+31 = **149**	179	1,790
Eulachon	0+3,243+0+0 = **3,243**	3,892	32,430

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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.
	Forage Fish Beach Seine		None	Open Access and Limited Entry	This gear type has little or no risk of bycatch.
	Herring Dip Net		None	Limited Entry	Open with restrictions. Not included in the Conservation Plan.
	Herring Purse Seine		Low	Limited Entry	Closed due to low abundance
	Herring Gillnet		Low	Limited Entry	Closed due to low abundance
	SALMON				
	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 Pot		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		Low	Limited Entry	Covered fishery in the plan.
	Burrowing Shrimp	Hand Collection	None	Open Access	This gear type has little or no risk of bycatch.
	Shrimp	Beam Trawl	Low	Limited Entry	Covered fishery in the plan.

License Type	License Group	Gear	Potential To Encounter ESA listed Rockfish	Fishery Access	Comments
	Squid	Beach and Purse Seine	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.
	Forage Fish	Hook and Line (forage fish jig)	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 (excluding salmon and Pacific Halibut)	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.
	Crab	Hook and Line (snare and book trap)	None		This gear type has little or no risk of bycatch
	Shrimp	Trap	Low		Covered fishery in the plan.
	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.

Appendix 3: WDFW RECREATIONAL SPOT SHRIMP HARVEST ESTIMATION METHOD

BACKGROUND:

This appendix is a summary of the methodology used by WDFW for estimating recreational spot shrimp catch in Puget Sound Shrimp Management Regions 2E, 2W, 4, 6 and the Discovery Bay Shrimp District. Catch estimates are generated using the equation: (estimated effort) X (catch per unit effort (CPUE)). More specifically: Catch = (estimated number of recreational boats shrimp fishing) X (estimated catch per boat).

Recreational spot shrimp fisheries in Regions 2E, 2W, 4, 6 and the Discovery Bay Shrimp District have daily fishing hours from 7:00 a.m. to 3:00 p.m., and are generally open on consecutive Saturdays and Wednesdays beginning the first Saturday in May each year. The recreational shrimp seasons in these regions are short, typically lasting only one to four days.

EFFORT:

Recreational fishing effort is estimated by either counting shrimp pot buoys from a boat, or counting boats shrimp fishing by flying over the fishing grounds in a fixed wing aircraft. For the regions covered in this appendix, the usual method used is to count buoys by boat. Counts are made each day the fishery is open, and typically one boat covers Region 2E and one boat covers Regions 2W, 4 and Catch Area 26D (Figure 1). Effort surveys are conducted between 8:30 a.m. and 12:30 p.m., and survey start times and counts are recorded for specific sub-regional sectors within the region surveyed (Figure 2). Sub-regional start and end times are recorded for the purpose of applying an effort expansion factor described later in this appendix. Total buoy counts for a region are then converted to the number of boats shrimp fishing using the average number of pots per boat data collected from that day's offload site sampling (see below).

CATCH PER UNIT EFFORT:

CPUE data is collected at boat ramps (ramp sampling) through interviewing recreational shrimp fishers that have completed their shrimp fishing trip. Generally only "high use" ramps are sampled to maximize the number of fishers interviewed (Figure 1). Samplers attempt to interview as many boats as possible, and data collection includes time first pot dropped and time last pot pulled, number of pots fished per boat, number of fishers per boat, MFSF Catch Area fished, landmark, and catch per boat in total number of shrimp. Additionally, fisher catch is also sampled for count per pound/average weight per shrimp data. Typically a 20 shrimp sample is weighed from every fourth or fifth boat interviewed. Ramp sampling coverage takes place from about one hour after fishing starts until one to two hours after fishing closes (at the very earliest it takes a little over two hours for a boat to deploy gear, obtain limits, and return to the ramp). For each region and fishing day the average number of shrimp caught per boat is combined with the average count per pound to provide an estimate of the average number of pounds caught per boat (catch per boat) for that day. The average pounds per boat in conjunction with the estimated boat count is used to generate that day's catch estimate (see catch estimate example below).

EFFORT COUNT EXPANSION FACTOR:

Specific and pre-determined survey routes are used for collecting effort counts (buoy counts or boat counts). The time required to travel a survey route varies by region and the type of survey platform, i.e., airplane or boat. In general a survey route traveled by boat takes 2.5 to 3.5 hours, while an aerial survey takes approximately one hour. With daily fishing hours lasting eight hours (7:00 a.m. to 3:00 p.m.), some fishers may complete their fishing activity before the survey vessel enters their area and other fishers may enter the fishery after the survey vessel passes through their area. This results in

some buoys/boats being "missed" by the effort survey, requiring the effort count to be expanded by an "ingress-egress expansion factor".

Throughout the survey route, effort count start times are recorded for sub-regional sectors (Figure 2) and those data are compared to the first pot dropped time and last pot pulled time for each boat sampled at the various ramps along with the associated sub-regional sector fishing location (using Catch Area and landmark). This gives the number of boats interviewed that completed fishing before the buoy count vessel went through the area, and the number of boats interviewed that started fishing after the survey vessel went through, allowing a calculation of the number of boats sampled that were missed for each region and day. Those data are then compared to the total number of boats sampled to generate an estimate of the percentage of boats that were missed by the effort surveys for each region and day. The effort counts are expanded for each region to give a corrected (expanded) estimate of the total number of boats shrimp fishing. For the period 2009 to 2013, the combined annual ingress-egress expansion factor in these regions has averaged around 13 percent. Beginning in 2014 WDFW is using individual expansion factors for each region, rather than the "all regions combined" expansion factor. The 2014 Region 2E expansion factor estimates for were 11.1 percent on May 3rd, 12.1 percent on May 7th, and 10.0 percent on May 21st.

CATCH ESTIMATE:

For each region and day the catch estimate is derived in the following sequence of calculations:

- Number of buoys counted / average number of pots per boat = preliminary number of boats.
- Preliminary number of boats X ingress-egress expansion factor = total number of boats.
- Average no. of shrimp caught per boat X average lbs per shrimp = average lbs caught per boat.
- Total number of boats X average lbs caught per boat = catch for day and region.
- Catch for each day is added up to give the total catch estimate for each region.

CATCH ESTIMATE EXAMPLE:

As follows is a typical catch estimate; example is from Region 2E, 2014:
Saturday (5/3) buoy count = 1,583
Avg. no. pots/boat (5/3) = 3.30
Est. no. boats = 480
X ingress-egress expansion factor (11.9% @ 1.119) = 537 total est. no. boats
Avg. catch/boat (5/3) = 127.8 shrimp X .087 lbs per shrimp (11.5 ct/lb) = 11.1 lbs
Saturday (5/3) catch estimate = total est. no. boats X avg. catch/boat = 5,968 lbs
Wednesday (5/7) buoy count = 1210 pots
Avg. pots/boat (5/7) = 3.19
Est. no. boats = 379
X ingress-egress expansion factor (12.1% @ 1.121 = 425 total est. no. boats
Avg. catch/boat (5/7) = 175.9 shrimp X .087 lbs per shrimp (11.5 ct/lb) = 15.3 lbs
Wednesday (5/7) catch estimate = total est. no. boats X avg. catch/boat = 6,507 lbs
Wednesday (5/21) buoy count = 955 pots
Avg. pots/boat (5/21) = 3.33
Est. no. boats = 287
X ingress-egress expansion factor (10.0% @ 1.1) = 287 total est. no. boats
Avg. catch/boat (5/21) = 173.5 shrimp X .091 lbs per shrimp (11.0 ct/lb) = 15.8 lbs
Wednesday (5/21) catch estimate = total est. no. boats X avg. catch/boat = 4,981 lbs

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