

Washington and Oregon Eulachon Management Plan

2nd Edition

Prepared jointly by:

Washington Department of Fish and Wildlife and
Oregon Department of Fish and Wildlife

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LIST OF ABBREVIATIONS

BRT	Biological Review Team
CIT	Cowlitz Indian Tribe
CPUE	Catch-Per-Unit-Effort
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CTWS	Confederated Tribes of the Warm Springs Reservation
DPS	Distinct Population Segment
ESA	U.S. Endangered Species Act
NMFS	National Marine Fisheries Service
NPT	Nez Perce Tribe
ODFW	Oregon Department of Fish and Wildlife
OSP	Oregon State Patrol
PDO	Pacific Decadal Oscillation
SSB	Spawning Stock Biomass
SST	Sea Surface Temperatures
WDFW	Washington Department of Fish and Wildlife
WOEMP	Washington and Oregon Eulachon Management Plan
YN	Confederated Bands and Tribes of the Yakama Nation

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SECTION 1: FISHERIES MANAGEMENT

Introduction

Eulachon *Thaleichthys pacificus* are an anadromous species of smelt, native to the west coast of North America. The Columbia basin historically supported a very large and productive population of Eulachon; however, in 1994, stocks of Eulachon from the Columbia River to the Klinaklini River in British Columbia experienced a nearly simultaneous collapse (Gustafson et al. 2010; Hay and McCarter 2000; Hay et al. 2002).

The Washington Department of Fish and Wildlife (WDFW) developed the Forage Fish management Plan in 1998, which provided guiding principles for forage fish conservation and management within Washington (WDFW 1998). In October 2001, WDFW and the Oregon Department of Fish and Wildlife (ODFW), hereafter referred to as “The States”, developed the first Washington and Oregon Eulachon Management Plan (WOEMP). The goal of the WOEMP was to reassess the management framework specifically for Eulachon within the Columbia River (WDFW and ODFW 2001). The States determined that management had historically not been responsive to interannual changes in abundance or distribution and developed the 2001 WOEMP to provide abundance-based guidance for Eulachon management and research activities (WDFW and ODFW 2001).

In 2010, the Biological Review Team (BRT) categorized climate change impacts on ocean conditions (all subpopulations), and Eulachon bycatch in offshore shrimp fisheries (Columbia River and British Columbia subpopulations) as the most serious threats to the persistence of Eulachon (Gustafson et al. 2010). These threats, together with large declines in abundance, indicated to the BRT that Eulachon were at moderate risk of extinction throughout all of its range (Gustafson et al. 2010). These factors collectively led NMFS to list Eulachon as a threatened species under the ESA.

On March 18, 2010, the National Marine Fisheries Service (NMFS) published a final

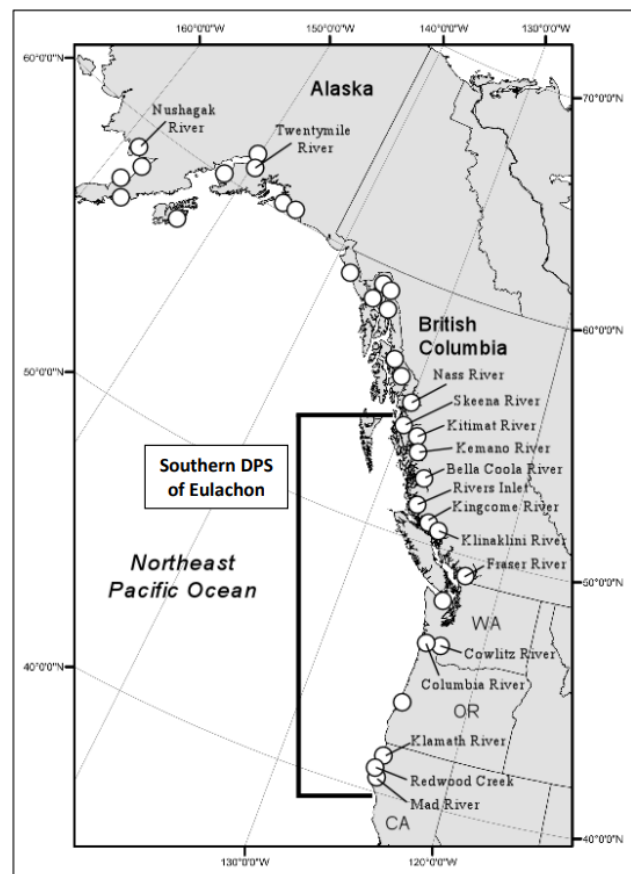


Figure 1. Distribution of the Southern Distinct Population Segment (DPS) of Eulachon *Thaleichthys pacificus* (figure from NMFS 2017).

rule in the Federal Register (75 FR 13012) to list the southern distinct population segment (DPS) of Eulachon, (hereafter referred to as Eulachon) as threatened under the United States Endangered Species Act (ESA). This listing encompassed all Eulachon within the states of Washington, Oregon, and California, and extended from the Skeena River in British Columbia south to the Mad River in Northern California (Figure 1), identified and reconfirmed as a distinct population through multiple genetic analyses (McLean et al. 1999, McLean and Taylor 2001, Beacham et al. 2005; Candy et al. 2015; Sutherland et al. 2021).

In 2017, NMFS released the ESA recovery plan for the Southern DPS of Eulachon (NMFS 2017). Within this plan, recovery actions were established, and included the implementation of a limited-opportunity Eulachon fishery (Recovery Action 5.16; NMFS 2017). The goals of this action are to “(1) provide essential context for interpreting historical harvest data to better understand trends and variability in Eulachon abundance; (2) filling critical information gaps such as the length and age structure of spawning Eulachon, as well as the temporal and spatial distribution of the run; (3) supporting the cultural traditions of Northwest tribes who rely on Eulachon as a seasonally important food source; and (4) providing a limited public and commercial opportunity for Eulachon harvest to maintain a connection between people and the Eulachon resource” (NMFS 2017). In reference to Tribal/First Nations fisheries, and recreational and commercial harvest, the recovery action includes a goal to “Minimize impacts related to a directed fishery on Eulachon by developing and implementing an abundance-based fishery management and evaluation plan to ensure that exploitation rates do not negatively impact subpopulation productivity” (Recovery Actions 5.16.1-3; NMFS 2017). As of completion of the 2022 5-year review, the listing status of Eulachon remains unchanged; however, NMFS included the development of recovery abundance targets (Gustafson et al. 2022; NMFS 2022).

Considering changes in population status, federal regulations, and new information learned since the first WOEMP was developed, an updated management plan is warranted to adaptively manage the Columbia River Eulachon population. With this update, we intend to provide a flexible and transparent approach to sustainably manage Columbia River Basin Eulachon harvests consistent with conservation constraints. Additionally, we hope to provide the necessary information to obtain take coverage for Eulachon fisheries under a 4(d) rule, should coverage be required in the future.

Objectives of Management Plan

The States coordinated the development of this management plan with representatives from NMFS, WDFW, ODFW, the Confederated Bands and Tribes of the Yakama Nation (YN), the Confederated Tribes of the Warm Springs Reservation (CTWS), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the Nez Perce Tribe (NPT), and the Cowlitz Indian Tribe (CIT).

The objective of this management plan is to update the 2001 Washington and Oregon Eulachon Management Plan for the purpose of sustainably harvesting Eulachon in a manner that does not jeopardize their survival and recovery.

Management Area/Time Period

The management area covered by this plan includes the Columbia River mainstem from the mouth, at a true north-south line through Buoy 10, upstream to Bonneville Dam, and adjacent tributaries including the Cowlitz River, Lewis River, Elochoman River, Kalama River, Grays River, and Deep River in Washington and the Sandy River in Oregon (Figure 2). The Eulachon fishing period may extend from December through May, with fishing generally occurring in February through April.

This plan was written to cover a ten-year management period; however, to account for changes in conservation and recovery status of the species, and consistent with an adaptive management philosophy, The States may periodically review, update, and/or revise this plan.



Figure 2. Map of management area captured by this plan, including the mainstem Columbia River and major tributaries downstream of Bonneville Dam.

Management Structure

Eulachon, in common with other fish in the Columbia River system, inhabit a complex regulatory environment. The lower Columbia River marks the border between the states of Washington and Oregon. Management actions for Columbia River fish and fisheries in the trans-boundary mainstem reaches of the lower basin are decided jointly by The States through the Columbia River Compact.

Columbia River Compact

Under the Congressionally approved Columbia River Compact, The States jointly regulate commercial fishing on the Columbia River. Through the Columbia River Compact, The States can open a commercial fishery only with the “mutual consent and approbation of both states” (RCW 77.75.010; ORS 507.010) The States’ Fish and Wildlife Commissions, through their delegated authority, represent the states of Washington and Oregon on the Columbia River Compact. The Commissions have delegated to their respective directors (or designees) the authority to make rules for Eulachon fishing.

Joint State Fishery Management

A similar consensus policy is in place for The States to make management decisions for recreational fisheries in the trans-boundary mainstem reaches of the lower Columbia River. This, however, is rarely an issue in Eulachon sport management since very little sport effort historically occurred in the mainstem Columbia River, and The States have restricted recreational Eulachon fishing opportunity to Columbia River tributaries since 2011.

Individual State Jurisdictions

Recreational and commercial fisheries in the tributaries are managed by the individual states. In recent years, each state has managed the tributary fisheries consistent with the mainstem fisheries, to meet conservation needs. Additionally, both states have designated Eulachon as a species of greatest conservation need due to their federal listing status as threatened species and their importance as a food fish species (ODFW 2016; WDFW 2015).

Federal Regulations

The Southern DPS of Eulachon was listed as a threatened species under the ESA on March 18, 2010 (75 FR 13012). Critical habitat was designated under the ESA for Eulachon on October 20, 2011 (76 FR 65324). The 2015 and 2022 five-year review concluded that the DPS’s threatened designation remained appropriate (NFMS 2016; NMFS 2022).

The term “4(d) rule” refers to protective regulations issued under section 4(d) of the ESA for threatened species. Unlike endangered species, when a species is listed as threatened, the prohibitions identified in section 9 of the ESA do not automatically apply to that species. To

date, NFMS has not issued a 4(d) rule to customize prohibitions and regulate activities to conserve Eulachon.

Commercial Fisheries:

License Requirements

In Washington, commercial harvesters must obtain a Columbia River smelt commercial license for the harvest of smelt in the mainstem Columbia River and adjacent Washington tributaries, and to sell their harvest to wholesale buyers. As of 2022, the Columbia River smelt commercial license costs \$500.00 annually for Washington residents and \$885.00 annually for non-residents (RCW 77.65.200). Additionally, commercial anglers may purchase a Limited Fish Seller Endorsement, allowing a commercial harvester to sell directly to the public at retail. As of 2022, the Limited Fish Seller Endorsement costs \$175 annually for Washington residents and \$560 annually for non-residents (RCW 77.65.510).

In Oregon, commercial harvesters must obtain a commercial bait fishing license for the harvest of smelt in the mainstem Columbia River and adjacent Oregon tributaries, and to sell their harvest to wholesale buyers (ORS 508.235). As of 2022, the commercial bait fishing license costs \$125 annually for Oregon residents and \$175 annually for non-residents (ORS 508.285). Additionally, commercial anglers may purchase a Fish Bait Dealer license, which allows a commercial harvester to sell directly to the public at retail, as bait only (ORS 508.306). As of 2022, the Fish Bait Dealer license costs \$125 annually for both Oregon residents and non-residents (ORS 508.285).

Seasons and Harvest

Historically, Eulachon were commercially fished in the mainstem Columbia River and major tributaries downstream of Bonneville Dam, including the Grays, Cowlitz, Kalama, Lewis, and Sandy rivers. Commercial seasons and landings were relatively stable during 1938-1989 and landings averaged 2.1 million pounds annually. The mainstem Columbia River commercial fishery was open 255 days per year during 1960–1977, year-round during 1978–1985, and seven days per week from December 1 to March 31 during 1986–1994. Mainstem and tributary commercial fisheries were restricted in terms of the number of days open to fishing in 1995 following several years of poor returns. In 1998, the mainstem commercial fishery transitioned into a test fishery with two-12-hour periods per week from January 4 through mid-February. Washington’s commercial tributary smelt fisheries were also restricted to two to three opening per week beginning in 1998. Mainstem and tributary commercial fisheries were closed effective December 2010, following the ESA listing of Eulachon as a threatened species. Tributary commercial fisheries have not been re-established since closing.

Prior to ESA listing and the fishery closure in 2010, the Cowlitz River commercial fishery often yielded the highest landings and accounts for a major source of historical landings data (Table

A-3). Since 1990, mainstem commercial fisheries have been fished during the peak run window, which generally occurs between February and March (calendar weeks 5–12; Table A-4). Historically, mainstem commercial fisheries typically relied upon the use of gillnets or trawl gear to capture smelt, whereas in the shallower waters of the tributaries, handheld dipnets fished from shore or vessel were the common gear type for commercial harvest of smelt. Following the ESA listing of Eulachon in 2010, and despite only being ranked a “low” threat to species persistence (Gustafson et al. 2010), commercial fisheries in both the mainstem Columbia River and tributaries were closed to all harvest. In 2014, The States worked closely with NMFS to reinstate a limited, conservation-minded commercial fishery in the mainstem Columbia River only using gillnets as the preferred gear type from which The States collect monitoring data; however, commercial fisheries in the Cowlitz River and other tributaries have remained closed. Additional details regarding mainstem and tributary commercial fisheries can be found in Table A-1 and Table A-2. As a result of the limited commercial harvest opportunity since 2010, the lack of market demand, and an aging workforce, the total number of commercial fishers that once participated in this fishery has dwindled to a handful of vessels annually.

Performance Indicators:

- Total fishing effort and fishing opportunity, including total number of anglers, days and hours fished, and open areas (including mainstem and tributary rivers).
- Total harvest by fishery in total deliveries and pounds landed monitored by fish tickets.

Recreational Fisheries:

License Requirements

As of 2022, there is no recreational license required to harvest smelt in freshwater in the state of Washington; however, it is unlawful to fish for or possess Eulachon from Washington waters unless authorized by emergency rule (WDFW 2022).

In Oregon, a recreational angling license has been required to harvest Eulachon since 2017. In 2022, Oregon’s recreational angling annual license is \$44.00 for residents and \$110.50 for non-residents. A one-day angling license is \$23.00 regardless of residency status (ODFW 2022). In Oregon, it is unlawful to fish for or possess Eulachon in inland waters unless authorized by emergency rule.

Seasons and Harvest

Historically, participation and success in the mainstem recreational smelt fishery has been minimal. In general, the breadth of the mainstem lower Columbia and propensity for smelt to remain off the bank during daylight hours, especially in clear water, make Eulachon difficult to target in the mainstem for recreational dippers. Once smelt enter a tributary en masse, they

are relatively easier to catch. Since 2011, the mainstem Columbia has been closed to recreational smelt fishing.

Recreational fisheries for Eulachon in the tributaries of the lower Columbia historically occurred in the Grays, Elochoman, Cowlitz, Kalama, and Lewis rivers in Washington and the Sandy River in Oregon depending on which rivers smelt would use in a given year. In all areas, the primary gear type used for recreational harvest has been the handheld dipnet fished from shore.

In the Sandy River, the Hwy 30 Alternate Bridge in Troutdale is the upstream boundary for the commercial fishery (adopted in 1943), and the Bridge at Viking Park (the Stark Street Bridge) was the upstream boundary for recreational dippers also adopted in 1943. The Hwy 30 Alternate Bridge in Troutdale is still the upstream boundary for the commercial fishery, but there is no upper boundary in the recreational fishery. A \$0.50 license was adopted in 1929 for sport dippers, and commercial fishers were exempt until 1931 when a \$5.00 license was established. The smelt license requirement for recreational dippers was eventually repealed. A daily limit of 25 pounds/person was adopted in 1947 for recreational dippers and remained effective until 2009.

Recreational fisheries in lower Columbia River tributaries were open year-round with a 20-pound daily limit in Washington and a 25-daily pound limit in Oregon during 1960–1996. In the following years, Washington closed tributaries to recreational fishing effective February 28, 1997 and February 2, 1998 due to poor abundance indicated by the commercial fishery (1998 JSR). Additionally, in 1998 WDFW changed the recreational limit to 10-pounds (1998 JSR). On May 1, 1999, WDFW closed tributaries to recreational dip netting by permanent regulation, with periodic opportunity for dippers in the Cowlitz River only by special regulation in years of high abundance. The recreational smelt fisheries in the Cowlitz and Sandy rivers were closed in 2011–2013 after the southern DPS of the Eulachon population was listed as ‘threatened’ under the ESA (effective May 2010). Since 2014, recreational fisheries are periodically reopened by emergency rule only, but limited to the Cowlitz River, WA or the Sandy River, OR with a daily limit of 10 pounds per angler. Additional details regarding 1960–2022 recreational fisheries can be found in Table A-5.

Performance Indicators:

1. Total fishing effort and fishing opportunity, including total number of anglers, hours fished, days of opportunity, and open area in river miles.
2. Total harvest by fishery in total pounds landed, monitored by creel survey.

SECTION 2: MONITORING AND EVALUATION

Fishery Monitoring and Biological Sampling

Commercial Fisheries

The commercial fishery serves as an important source of monitoring data to evaluate the biomass of the spawning run. Adult Eulachon caught in commercial fisheries in the lower Columbia River are purchased by WDFW from commercial fishers and sampled for biological data; fork length, weight, fecundity, and sex are obtained from individual fish. The biological data is then applied to the calculations for spawning stock biomass (SSB). The age composition of a run is determined by extracting and examining otoliths to determine the age of each fish. Assessing the age composition of the run contributes to our understanding of brood-year or cohort strength and is an important data component for forecasting future run sizes.

Commercially harvested Eulachon landings (pounds) by fisher are reported to The States via fish tickets and are used to calculate the daily catch-per-unit-effort (CPUE) in terms of pounds per delivery. This information is used to inform in-season run size estimates and roughly correlates with post-season SSB estimates.

Recreational Fisheries

Recreational Eulachon fishers are interviewed by staff to collect effort and harvest data, including total catch by weight, number of fishers per party, and duration of time spent fishing. Staff also subsample catch for sex, spawn status, and weight. A total estimate of harvest and fishing effort per day is derived from counts of fishers actively dipping combined with interview data. These data are used to generate harvest estimates for the recreational fishery and contribute to our understanding of the migratory behaviors of adult spawning Eulachon within tributaries.

Spawning Stock Biomass (SSB)

The SSB is a weight-based estimate of the minimum spawning adults needed to have produced the Eulachon larval outflow observed. The SSB is estimated using a combination of adult biological sampling data, derived from the commercial fishery, and egg and larval density data, derived from plankton tow surveys collected weekly on the mainstem Columbia River, January through May. The plankton tow data is collected independently of fisheries and provides the least biased estimate of abundance currently available. This data is used post-season to evaluate run abundance through time and within-year harvest impacts (Table A-7).

Review of Plankton Tow Surveys

A smelt larval sampling project was initiated in the Cowlitz River in 1994 and in the Columbia River in 1995. This program was developed to answer questions about spawning location, but larval sampling can also help determine relative spawning success of the population when compared to other years. The smelt larval sampling project was the prototype for the SSB project in the Columbia, which measures larval density in the Price/Clifton area of the lower Columbia and hindcasts the minimum abundance of spawning Eulachon upstream of the collection site needed to produce the observed larval density each year. Estimates of Eulachon spawning downstream of Price/Clifton are not included in the minimum SSB estimate.

In the Columbia River basin, WDFW has led annual studies to estimate Eulachon SSB in the Columbia River (2011–2022), Grays River (2011–2013, 2015–2016), and Lewis River (2022). Additionally, the Cowlitz Indian Tribe has been monitoring larval densities within the Cowlitz River (2015–2022). Eulachon larvae were captured during each year of these studies. Additionally, WDFW has retrospectively estimated SSB in the Columbia River for 2000–2010 using pre-2011 expansions of Eulachon larval densities.

Outside of the Columbia River basin, WDFW led studies to estimate Eulachon SSB in the Chehalis River (2015–2018) and Naselle River (2015–2017). Additionally, the Lower Elwha S'klallam Tribe has sampled Eulachon adults and/or larvae in the Elwha, Dungeness, and Lyre rivers on the Olympic Peninsula of Washington (NMFS 2016, NMFS 2022).

In 2022, WDFW began a project to estimate Eulachon larvae presence and timing in the lower Lewis River near Woodland, WA. This project is funded by the Washington State Department of Transportation to satisfy a requirement in the Biological Opinion for the new Horseshoe Lake pump installed in 2020. The project will occur for 5 consecutive years, with sampling conducted a minimum of once per week between November and June.

Eulachon SSB sampling in the mainstem Columbia was concentrated during estimated periods of peak larval abundance in the late-winter in 2000–2010. Since 2011 sampling efforts have encompassed the majority of the larval outflow period, with weekly sampling occurring in January through May.

Monitoring Recommendations

The States support the addition of the below mentioned monitoring tools to supplement the available information for sustainable harvest management of Eulachon in the future as funding allows as described in the five-year review (NMFS 2022).

- **Increased Public Outreach:** Increased public outreach could include identifying communities with a historical, cultural, sociological, or economic interest in Eulachon and effectively working with these communities to raise awareness of the species'

importance. This could also include citizen science initiatives and gaining local support for restoration and conservation actions that would benefit recovery of the species.

- **eDNA monitoring:** Development of an environmental DNA (eDNA) monitoring survey within the lower Columbia River basin and throughout the species range could be used to inform species presence/absence in key tributaries during the spawning runs and to evaluate the overall spatial and temporal distribution of those spawning runs within a given year. This monitoring data would fill key data-gaps identified within the recovery plan (NMFS 2017), provide important context to the existing SSB surveys, and inform predictive models for run timing and forecasting.
- **Test Fishery:** The development of a state- or federally funded test fishery could be operated similar (e.g., gear types, fishing periods, etc.) to the existing commercial fishery, but it would include adoption of a standardized sampling design. Implementation of a test fishery using a standardized sampling design would eliminate market effects on fishing effort and CPUE, thereby improving The States' ability to track the adult run size in-season and more effectively target sustainable harvest limits.
- **Acoustic Surveys:** Acoustic surveys could be developed within the Columbia River estuary and lower river to evaluate run size and inform harvest management goals. Similar type surveys are used to monitor other forage fish species (e.g., herring) and help inform run-timing to the spawning grounds. This type of information could be useful to managers in determining the timing of harvest seasons upstream of the Columbia estuary.

SECTION 3: DECISION MAKING FRAMEWORK

Sustainable Harvest

Our goal is to develop and implement fisheries management strategies to harvest Eulachon in a manner that will not jeopardize the survival and recovery of the species. To accomplish this goal, this management plan uses an abundance-based management approach, meaning the harvest rate is higher when the Eulachon abundance is large or increasing and the harvest rate is lower when the population is small or decreasing. Lower harvest rates on the population when it is small or decreasing supports population persistence and enables population growth.

The highest harvest rate considered in this management plan (10%) when the population is large and increasing is low relative to typical harvest rates on forage fish stocks and is equivalent to the most-conservative harvest rate considered in the 2001 Washington and Oregon Eulachon Management plan. Although it is likely that a higher harvest rate would be sustainable to manage this forage fish stock, The States recognize the importance of an improved quantitative analysis to inform this value. In a meta-analysis of abundance time series for 55 stocks of forage fish, the average harvest rate not associated with stock collapses was

26% and the average rate associated with collapse was 44% (Essington et al. 2015); our proposed 10% maximum rate is well below these values. As another point of reference, the harvest rate on Fraser River Eulachon in 2017–2022 was set at 3.5% of the average of the previous 9 years of the SSB index, which was considered a conservative harvest rate that could be increased to accommodate requests for additional harvest by Indigenous peoples (Fisheries and Oceans Canada 2022).

Recent (2013–2022) harvest rates ranged from 0.03–3.02%, including the total harvest from non-treaty commercial, recreational, and tribal ceremonial and subsistence fishing (Table A-8). The low harvest rates identified in this plan make it unlikely that biological characteristics of the population will be affected. Furthermore, the timing of fisheries is unlikely to disproportionately affect early- or late-migrating fish.

The following section outlines pre-season harvest considerations to inform target harvest rates at the onset of the season. Although monitoring has improved over the past decade, Eulachon are still largely a data-poor species. This plan uses the best scientific information available and a precautionary approach with low harvest rates until more information becomes available. The States will strive to improve the information base for Eulachon to better inform conservation and management actions.

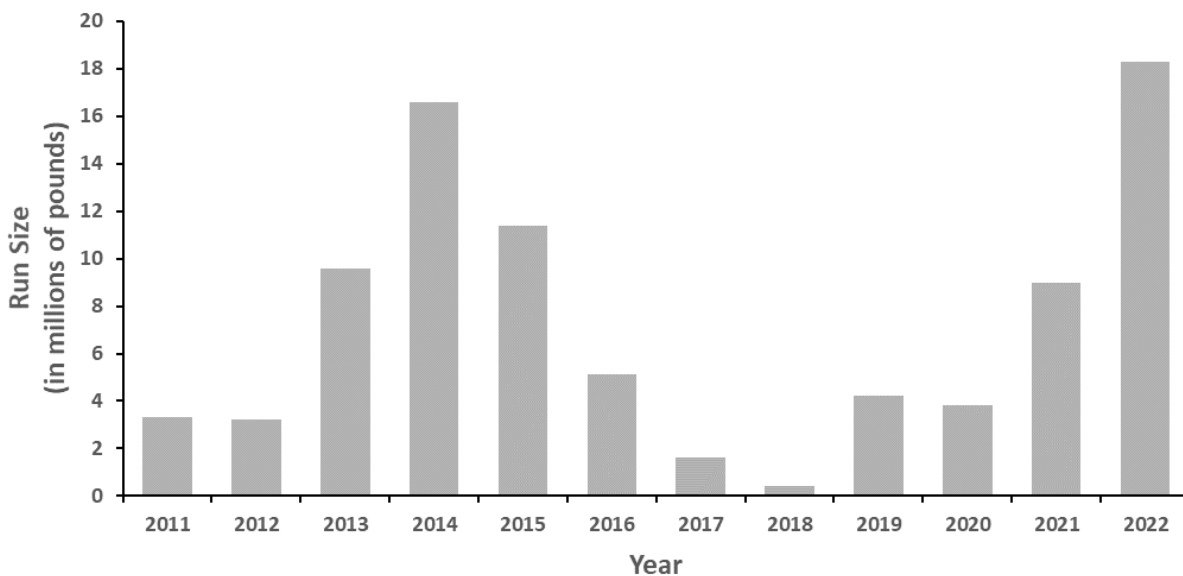


Figure 3. The 2011–2022 mean estimated Columbia River Eulachon run size in millions of pounds of spawning adult fish. The 2020 run size estimate is considered incomplete due to a truncated sampling season as a result of the COVID-19 pandemic.

Pre-Season Planning:

At the onset of a given season, three pre-season harvest indicators will be evaluated to assign an initial Harvest Phase. These pre-season harvest indicators, described in more detail below, include an analysis of (P1) the mean run-size over the previous three years, (P2) the two-year trend in abundance (i.e., has the abundance been increasing or decreasing over the previous two seasons), and (P3) the trend in forecasted abundance for the upcoming season (i.e., is the run size projected to increase or decrease from the previous season abundance). The Harvest Phases range from Harvest Phase 0 (lowest harvest rate) to Harvest Phase 4 (highest harvest rate) and represent a stepwise approach to determining a sustainable target harvest rate and informing the commercial and recreational harvest opportunities available at the onset of a given season (Table 1).

Table 1. Evaluation of the P1, P2, and P3 pre-season harvest indicators inform the selection of the Harvest Phase and target Harvest Rate, thereby determining the commercial and recreational fishing opportunities at the onset of the season.

Harvest Phase	Harvest Rate	P1 (in millions)		P2	P3
		min	max		
0	Research-Only Impacts	0.0	0.9	--	--
		1.0	5.9	negative	negative
1	2%	1.0	5.9	positive	negative
		1.0	5.9	negative	positive
		6.0	12.9	negative	negative
2	4%	1.1	5.9	positive	positive
		6.0	12.9	positive	negative
		6.0	12.9	negative	positive
		13.0	20.4	negative	negative
3	6%	6.0	13.0	positive	positive
		13.0	20.4	positive	negative
		13.0	20.4	negative	positive
4	10%	13.0	20.4	positive	positive
		20.5	+	--	--

Pre-Season Harvest Indicators

P1: Mean run-size over previous three years.

P1 is the first pre-season harvest indicator used to evaluate recent run-sizes. P1 is calculated using a three-year arithmetic mean adult smelt run-size to the Columbia River. Three years is the average age-at-return for Eulachon in the Columbia River and represents the most relevant recent information for determining the upcoming run-size, due to extreme annual variability and the cyclical nature of forage fish species, as observed in Figure 3.

In the five-year review, NMFS outlined the target abundances for the Columbia River Eulachon sub-population to evaluate recovery. The low target abundance of 66,500,000 spawners equates to approximately 5.9 million pounds of fish, and the high target abundance of 229,500,000 spawners equates to approximately 20.5 million pounds of smelt (NFMS 2022). These values were used to inform the ranged values of the P1 indicator. We also incorporated an extreme low value, for which only research-level impacts are allowable, and a mid-range value (between the low and high target abundance values) to moderate the extreme variability of the run sizes represented. The P1 values were then blocked into ranges of 0.9 million pound of fish or fewer, 1.0–5.9 million, 6.0–12.9 million, 13.0–20.4 million, and 20.5 million pounds of fish or larger.

The following represents an example of the use of this indicator for the 2023 season. The States would average the 2020–2022 run size estimates of 3.8 million, 9 million, and 18.3 million pounds, respectively (found in Table A-6). This gives a P1 value of 10.4 million pounds for 2023. This value would then be compared to the blocked ranges for the P1 value, which would place this value within the range of 6.0–12.9 million pounds of fish. Therefore, evaluation of the P1 indicator determines that the 2023 season would start in Harvest Phase 1, 2, or 3. The Harvest Phase selection is further narrowed by the use of the P2 and P3 pre-season harvest indicators.

P2: Trend in run-size over previous two years.

P2 represents the second pre-season harvest indicator and is used to evaluate the trend of abundance using past data. P2 is calculated by assessing the difference in the run size over the past two years and evaluating if the resulting value is positive or negative. This short time frame of two years is necessary to use due to the short cyclical nature of Eulachon abundance and the rapidity at which change can happen. The use of this recent trend data serves as a check on the P1 harvest indicator, which has the potential to over- or under-estimate the in-season abundance and provides a method to increase or decrease the harvest rate based on recently observed runs sizes.

The following represents an example of the use of this indicator for the 2023 season. The States would calculate the difference of the 2021 and 2022 run sizes of 9 million and 18.3 million

pounds, respectively (found in Table A-6). The resulting value of +9.3 million indicates an increasing trend in run sizes over the previous two years. To build off the previous example, the evaluation of the P2 indicator for the 2023 season would further narrow the Harvest Phase selection to either Harvest Phase 2 or 3. The final step of narrowing the Harvest Phase selection is decided by the P3 pre-season harvest indicator.

P3: Trend in forecasted run abundance.

P3 represents the third pre-season indicator and is used to evaluate the predicted trend of abundance for the upcoming season using forecasted data.

Due to data limitations, a qualitative forecast has been developed for Eulachon using environmental and biological indices which are summarized into two primary phases of the Eulachon life cycle, the freshwater phase and ocean phase. Freshwater indices include the Columbia River temperatures, river flow anomalies, estuary water particle residence time, and the Columbia River plume volume. Ocean indices include those found within the “stoplight chart” developed annually by NMFS (<https://www.fisheries.noaa.gov/content/ocean-conditions-indicators-trends>). The use of these freshwater and marine indicators is supported by statistical analyses conducted by Sharma et al. (2017) and Montgomery (2020). Sharma et al. (2017) found decreased abundances correlated with increases in Sea Surface Temperature (SST) and increased survival and abundance correlated with the timing of the spring transition of larvae to the marine environment, the magnitude of the upwelling, and reductions in SST. Montgomery (2020) identified large-scale oceanic drivers, such as the status of the Pacific Decadal Oscillation (PDO), and bottom-up biological indicators, like copepod biomass, are important to eulachon abundance. Where available additional indices considered may also include coastal shelf hypoxia, Pink Shrimp trawl fishery bycatch of Eulachon, and the abundance metrics of other forage fish species (i.e., herring, sardine, and anchovy).

Although a majority of fish return at 3-years, it is common to see fish ranging from 2–5 years within a spawning run. Therefore, these cohort survival factors are compared across the brood years that make up the spawning run and the forecasted contribution of each brood year is assessed (Table 2). The States will evaluate the forecasted contribution of each brood year and determine if a positive (increasing abundance) or negative (decreasing abundance) is projected for the upcoming season. In the event of a neutral forecast or if managers are unable to determine a forecast, The States will assume a negative forecasted trend as a precautionary approach.

Table 2. An example of the summary of factors used to forecast the Columbia River Eulachon adult return in 2023.

Brood Year	Age at Spawn	Cohort Survival Factors		Forecasted Contribution
		Freshwater Phase	Ocean Phase	
2018	5	+	+	+
2019	4	+	+	+
2020	3	0	+	+
2021	2	-	+	0

Table 2 above represents an example of the use of this indicator for the 2023 season. Freshwater conditions during the egg and larval period, before entry to the marine environment, make up the Freshwater Phase. In this example, the fish making up the two-year old cohort (2021 brood year) may have experienced lower survival rates during this freshwater phase of their life cycle. This cohort experienced warmer riverine temperatures and a lower river flow rate during their larval stage, which is hypothesized to cause these tiny larvae to burn through yolk-reserves prior to ocean entry where first feeding is thought to initiate. In-river flow rates were slightly positive during the outmigration period for the three-year old cohort, therefore the slightly elevated water temperatures experienced during their outmigration period are thought to be less detrimental to survival. The four- and five-year old cohorts experienced improved freshwater conditions (including a large Columbia River plume volume and low particle residence time) and a higher likelihood of dispersal into the marine environment.

The marine conditions experienced by fish after ocean entry, but before the fish re-enter freshwater to spawn, make up the Ocean Phase. Many of the indices from within the marine environment were positive over the past few years, including PDO, SST, and Copepod Richness. Therefore, all brood years considered were ranked with a positive survival factor during the ocean phase of their life cycle and fish from these brood years were likely to experience relatively high survival rates within the marine environment. Additionally, fish from the 2018–2020 Brood Years have already been observed during the 2021 and 2022 spawning runs, providing further evidence for the forecasted contribution. The States conclude that the 2023 season is likely to show a mildly positive trend in the adult Eulachon run size.

To continue building off the previous example, the evaluation of the P3 indicator for the 2023 season narrows the final selection to Harvest Phase 3. In this Harvest Phase, managers would start the season targeting a 6% harvest rate and use information from the following section to inform commercial and recreational season setting as well as any in-season changes to the harvest phase selection.

Commercial and Recreational Season Setting

At the onset of the season, the selection of Harvest Phase determines the allowable limits on open areas and period for commercial and recreational fisheries (Table 3). Regulation of in-season bag limits, allowable gear types, and final selection of fishing periods and areas are at the discretion of The States.

Table 3. Summary of the allowable open fishing periods and areas for commercial (top table) and recreational (bottom table) fisheries in the Columbia River and tributaries, dependent upon the Harvest Phase set at the onset of the season.

Commercial Harvest Fisheries

Harvest Phase	Open Periods	Open Areas
0	--	--
1	up to 10 open periods, up to 12 hrs per period	Mainstem Columbia River
2	up to 20 open periods, up to 12 hrs per period	Mainstem Columbia River
3	up to 45 open periods, up to 18 hrs per period	Mainstem Columbia River
4	up to 60 open periods, up to 24 hrs per period	Mainstem Columbia River and Tributaries

Recreational Harvest Fisheries

Harvest Phase	Open Periods	Open Areas
0	--	--
1	--	--
2	up to 3 open periods, up to 6 hrs per period	Cowlitz River, WA or Sandy River, OR
3	up to 5 open periods, up to 10 hrs per period	Cowlitz River, WA or Sandy River, OR
4	up to 15 open periods, up to 10 hrs per period	Mainstem Columbia River and Tributaries

Commercial Fishery Recommendations:

To aid in monitoring the run size throughout the season, it is recommended that commercial periods span the entire season. During years with limited commercial harvest opportunity, managers are encouraged to target fishing periods from February to early March, when the peak run is mostly likely to occur. During years that start in a higher Harvest Phase, managers may consider opening commercial fisheries earlier in January to aid in collecting early-season run data and extending through May to collect late-season run data.

It is recommended that seasons are set using a 12 -hour minimum window to enable commercial fishers to target a useable tide for capturing smelt. If inadequate hours are provided, fishers will avoid fishing on days without an appropriate tide and limit the collection of monitoring data. Specific tidal choice may vary by fisher and river mile.

During phases in which commercial fishing opportunity exists, the data collected during the commercial fishery may be used as an in-season upgrade or downgrade harvest trigger,

changing the Harvest Phase and subsequent allowable harvest opportunities. The in-season Harvest Triggers are described in more detail in the section below.

Recreational Fishery Recommendations:

During phases in which recreational fishing opportunity is allowed, it is recommended that open periods on the Cowlitz River are set only after commercial landings reach a minimum daily CPUE of 200 pounds per delivery for at least one period to ensure adequate harvest opportunity exists. In the absence of adequate commercial landings data and for recreational fishing opportunity in the Sandy River, managers may use their discretion to set recreational fishing periods.

In just a few hours of fishing opportunity, tens of thousands of recreational anglers may dip smelt along the banks of the Cowlitz River. Due to the magnitude of this fishery, it is recommended that managers work closely with Cowlitz County, WDFW customer service, WDFW enforcement, and the WDFW Region 5 Director, Fish Program Manager, and District Fish Biologist to coordinate season setting, enforcing regulations, and operating an effective creel survey. At any phase less than the highest Harvest Phase, it is recommended that recreational openers are not set on back-to-back days and are only open during daylight hours to maintain orderly fisheries and stay within the target harvest rate. Additionally, it is recommended that managers regulate a set bag limit and the use of individual containers.

Harvest Phase 0:

Harvest Phase 0 is assigned to a season in which all indicators point to a very poor return of adult Eulachon and the in-season run size is likely to land below 1 million pounds of fish for the Columbia River (Table 1). No commercial or recreational fishing opportunity would be allowable for the duration of a season starting in this phase (Table 3). There is also no opportunity to upgrade or downgrade the Harvest Phase for a season starting in this phase. In Harvest Phase 0, the only allowable take by The States would be associated with research and monitoring activities, which is necessary for evaluating and documenting the run size.

Harvest Phase 1:

Harvest Phase 1 is assigned to a season in which the in-season run size is likely to land below the low target abundance of 5.9 million pounds of fish for the Columbia River (Table 1). During this phase, a 2% harvest rate would allow for minimal commercial fishing opportunity (up to 10 open periods, up to 12 hrs per period, with fishing allowable in the Mainstem Columbia River), which is considered one of the primary monitoring tools for evaluating run-size in-season (Table 3). While in Harvest Phase 1, there are no allowable recreational fisheries.

Harvest Phase 2:

Harvest Phase 2 is assigned when the in-season run size is likely to land above the low target abundance of 5.9 million pounds of fish but is unlikely to near the high target abundance of 20.5 million pounds of fish for the Columbia River (Table 1). During this phase, a 4% harvest rate would allow for limited commercial fishing opportunity (up to 20 open periods, up to 12 hrs per period, with fishing allowable in the Mainstem Columbia River) and limited recreational fishing opportunity (up to 3 open periods, up to 6 hrs per period, with fishing allowable in the Cowlitz River, WA, and/or the Sandy River, OR; Table 3).

Harvest Phase 3:

Harvest Phase 3 is assigned to a season in which the in-season run size is likely to land well above the low target abundance of 5.9 million pounds of fish but below the high target abundance of 20.5 million pounds of fish for the Columbia River (Table 1). During this phase, a 6% harvest rate would allow for increased commercial fishing opportunity (up to 45 open periods, up to 18 hrs per period, with fishing allowable in the Mainstem Columbia River) and increased recreational fishing opportunity (up to 5 open periods, up to 10 hrs per period, with fishing allowable in the Cowlitz River, WA or the Sandy River, OR; Table 3).

Harvest Phase 4:

Harvest Phase 4 is assigned to a season in which the in-season run size is likely to exceed the high target abundance of 20.5 million pounds of fish for the Columbia River (Table 1). During this phase, a 10% harvest rate would allow for the least restrictive commercial fishing opportunity (up to 60 open periods, up to 24 hrs per period, with fishing allowable in the Mainstem Columbia River and all other tributaries within the management area) and the least restrictive recreational fishing opportunity (up to 15 open periods, up to 10 hrs per period, with fishing allowable in the Mainstem Columbia River and all other tributaries within the management area; Table 3).

In-Season Harvest Triggers

After the onset of the season, it may become apparent that the actual Eulachon adult run-size is different than originally projected, and an adjustment to the Harvest Phase in-season may be needed. The fishery may be upgraded or downgraded more than once per season, depending on whether the appropriate criteria are met to trigger a change in Harvest Phase. The sections below outline in-season triggers, which may be easily identified by managers to justify an upgrade or downgrade in the Harvest Phase and any subsequent changes in the allowable commercial and recreational harvest opportunities (Table 4).

Table 4. In-season management triggers to upgrade (top) and downgrade (bottom) the Harvest Phase. Management triggers are based on CPUE data collected in the mainstem commercial fishery; however, this table may be updated to incorporate CPUE data from a standardized test fishery, should one ever be developed.

<i>In-Season Management: Upgrade Triggers</i>		
Starting Harvest Phase	Ending Harvest Phase	Management Trigger
0	1	<i>No data available for upgrade</i>
1	2	Daily CPUE >250 lbs for 1 period
2	3	Daily CPUE >400 lbs for 3 open periods
3	4	Daily CPUE >1000 lbs for 5 open periods

<i>In-Season Management: Downgrade Triggers</i>		
Starting Harvest Phase	Ending Harvest Phase	Management Trigger
1	0	<i>Unnecessary due to low catches</i>
2 or 3	1	Rolling CPUE <50 after February 25
3 or 4	2	Rolling CPUE <250 after March 1

As noted in Table 4, in-season changes to the Harvest Phase may only occur at a Harvest Phase 1 or higher. In Harvest Phase 0, with no commercial fishing opportunities comes no in-season monitoring data available to trigger an in-season change. The potential to monitor during a closed commercial fishery season may change if a standardized test fishery were to be implemented for in-season monitoring. Conversely, in Harvest Phase 1, if commercial fisheries are reporting extremely low catches, then a downgrade to Harvest Phase 0 is unnecessary as the fishery will regulate itself with low catches.

Upgrade Harvest Triggers

In the event that a spawning run is larger than initially expected, the list of in-season management upgrade triggers (Table 4) outline conditions that will allow managers to upgrade the Harvest Phase in-season. A Harvest Phase upgrade would increase the target harvest rate and may affect the total number of allowable open periods and areas for commercial and recreational fisheries.

The following represents an example of the use of this upgrade trigger. If it is determined that a season will start in Harvest Phase 1, a recreational fishery would not be initially allowed. However, The States could set up to 10 commercial fishing periods. When at least 250 pounds per delivery were harvested in at least one open commercial fishing period, this would trigger an upgrade to Harvest Phase 2. Under Harvest Phase 2, it is allowable for managers to then set up to three total recreational fishing periods on the Cowlitz River, WA, and/or Sandy River, OR.

Additionally, under Harvest Phase 2, it is allowable for managers to extend the total number of commercial fishing periods up to 20.

Downgrade Harvest Triggers

In the event that a spawning run is smaller than initially predicted, the list of in-season management downgrade triggers (Table 4) outline conditions that will allow managers to downgrade the Harvest Phase in-season. A Harvest Phase downgrade would decrease the target harvest rate and may affect the total number of allowable open periods and areas for commercial and recreational fisheries. If adjusted to Harvest Phase 1, this downgrade may eliminate recreational fishing opportunity for the season.

The following represents an example of the use of this downgrade trigger. If it is determined that a season will start in Harvest Phase 3, managers may plan to adopt up to 45 open periods for commercial fishing and up to 5 open periods for recreational fishing. However, if the rolling CPUE of the commercial fishery is not at least 50 pounds per delivery by February 25, then the run may not be sufficient to support ongoing fishing opportunity. This would trigger a downgrade to Harvest Phase 1. Under Harvest Phase 1, it is allowable for managers to cancel plans for recreational fishing opportunities and make plans to rescind any commercial harvest periods beyond 10 total open periods.

It should be noted that the dates used for these triggers represent the typical run-timing of Eulachon for current fisheries; however, these dates or management approach may need to be changed in the future as climate change impacts to run timing are better understood.

Likelihood of managing within the Harvest Phases

To evaluate the potential of the various Harvest Phases occurring, the pre-season indicators were considered, and an initial Harvest Phase assigned to every year since 2014 (Table 5). In that time, Harvest Phases 0 through 3 would have been assigned to start the season at least one time, with Harvest Phases 2 and 3 assigned to start the season in three years each. Harvest Phase 4, which allowed for the highest harvest rate of 10%, was not achieved during this period. However, this harvest phase is included in the event that the population rebounds to a status that can support higher harvest levels in the future.

Table 5. An exercise to evaluate the occurrence of Harvest Phase assignments for recent run-years in the Columbia River, assuming they had been managed under this management plan.

Year	Run Size			Harvest	
	(in millions)	P1	P2	P3	Phase
2011	3.3				
2012	3.2				
2013	9.6		-0.1		
2014	16.6	5.4	6.4	1	2
2015	11.4	9.8	7.0	1	3
2016	5.1	12.5	-5.2	-1	1
2017	1.6	11.0	-6.3	-1	1
2018	0.4	6.0	-3.5	-1	0
2019	4.2	2.4	-1.2	-1	0
2020	3.8	2.1	3.8	1	2
2021	9	2.8	-0.4	1	1
2022	18.3	5.7	5.2	1	2

To evaluate a recent example of the harvest triggers, the 2022 season was examined to determine if and when a harvest trigger would occur if managed under this plan (Table 6). In 2022, the harvest trigger to upgrade the fishery would have occurred on February 25, 2022. This trigger would have expanded the harvest rate to 6% and allowed The States to set additional commercial and recreational fishing opportunities in-season.

Table 6. An example of the changes in Harvest Phase throughout the 2022 season if that season had been managed following this management plan. The highlighted row indicates the timing of an upgrade to the Harvest Phase, triggered by the occurrence of the daily

Open Periods	Daily Pounds	Vessels	Daily CPUE	Rolling CPUE	Harvest Phase
1/26/2022	0	0	0	0	2
1/28/2022	0	0	0	0	2
1/31/2022	0	0	0	0	2
2/2/2022	0	0	0	0	2
2/4/2022	0	0	0	0	2
2/7/2022	0	0	0	0	2
2/9/2022	0	0	0	0	2
2/11/2022	0	0	0	0	2
2/14/2022	0	0	0	0	2
2/16/2022	0	0	0	0	2
2/18/2022	1062	3	354	354	2
2/21/2022	3920	6	653.3	554	2
2/23/2022	5684	4	1421	820	2
2/25/2022	3631	4	907.8	841	3
2/28/2022	1730	2	865	844	3
3/2/2022	3157	2	1578.5	914	3
3/4/2022	2937	2	1468.5	962	3
3/7/2022	2327	3	775.7	940	3
3/9/2022	2245	2	1122.5	953	3
3/11/2022	565	1	565	940	3
3/14/2022	140	1	140	913	3
3/16/2022	0	0	0	913	3
3/18/2022	0	0	0	913	3

SECTION 4: EFFECTS ON ESA-LISTED SPECIES

ESA Recovery - Eulachon

On March 18, 2010, the southern DPS of Eulachon were listed as threatened under the United States ESA (75 FR 13012). Critical habitat was designated for the southern DPS on October 20, 2011 (76 FR 65324), while protective regulations via section 4(d) of the ESA have not yet been promulgated. As of completion of the 2022 5-year review, the listing status of Eulachon remains unchanged; however, NMFS included the development of recovery abundance targets which were considered and incorporated within the development of this plan (Table 7; NMFS 2022).

Table 7. The demographic recovery criteria for the Columbia River subpopulation, as presented in the 2022 5-year Review: Summary and Evaluation of Eulachon, Southern DPS (NMFS 2022).

Demographic Recovery Criteria for the Columbia River Subpopulation
229,500,000 spawners 24 out of 30 years, and 66,500,000 spawners for 6 out of 30 years
PLUS – presence/absence surveys in the Cowlitz River with presence 27 out of 30 years
PLUS - presence/absence surveys in the Grays River with presence 21 out of 30 years
PLUS - presence/absence surveys in the Sandy River with presence 10 out of 30 years
PLUS - presence/absence surveys in the Lewis River with presence 15 out of 30 years

Take Coverage – Eulachon Harvest

The direct effects from harvest to ESA-listed Eulachon will be within the quantified harvest constraints as described in Section 3.

Take Coverage – Eulachon Research and Monitoring

The direct effects from research and monitoring will be within the following constraints. Additional detail regarding existing monitoring efforts is described in more detail in Section 2.

Eulachon Eggs/Larvae: handle/remove up to 50,000 Eulachon eggs and larvae annually

Eulachon Adults: handle/remove up to 1,000 adult Eulachon annually

Take Coverage - Other Species

Other adult ESA species that may be present in the management area, such as Green Sturgeon, Chinook Salmon, Coho Salmon, Chum Salmon, Sockeye Salmon, and steelhead, are not likely to be encountered in these fisheries due to the timing and the use of selective gear types. The species most likely to be encountered throughout the spring fisheries are natural-origin or hatchery-reared juvenile Chinook Salmon, Coho Salmon, Chum Salmon, and steelhead with very low handle and very few to no mortalities expected. The States developed the associated take coverage found in Table 8, based on the above assumptions of low to no encounters of the listed species.

Table 8. Annual take coverage for all Eulachon activities, including research, monitoring, and commercial and recreational fisheries.

Species	ESA-Listing Status	Life stage	Encounters	Mortalities	Justification
Salmonid, spp.	--	Juvenile	100	5	Minimal temporal overlap.
Snake River Sockeye	Endangered	Adult	1	1	Low abundance and no temporal overlap.
Upper Columbia Spring Chinook Salmon	Endangered	Adult	5	1	Minimal temporal overlap.
Columbia River Chum Salmon	Threatened	Adult	5	1	Minimal temporal overlap.
Columbia River Coho Salmon	Threatened	Adult	5	1	Minimal temporal overlap.
Green Sturgeon, Southern DPS	Threatened	Sub-adult/Adult	1	1	No temporal overlap.
Lower Columbia River Fall Chinook Salmon	Threatened	Adult	1	1	No temporal overlap.
Lower Columbia River Spring Chinook Salmon	Threatened	Adult	5	1	Minimal temporal overlap.
Lower Columbia River Steelhead	Threatened	Adult	5	1	Minimal temporal overlap.
Middle Columbia River Steelhead	Threatened	Adult	5	1	Minimal temporal overlap.
Snake River Fall Chinook Salmon	Threatened	Adult	1	1	No temporal overlap.
Snake River Spring Chinook Salmon	Threatened	Adult	5	1	Minimal temporal overlap.
Snake River Steelhead	Threatened	Adult	1	1	No temporal overlap.
Snake River Summer Chinook Salmon	Threatened	Adult	1	1	No temporal overlap.
Upper Columbia Steelhead	Threatened	Adult	1	1	No temporal overlap.
Upper Willamette Spring Chinook Salmon	Threatened	Adult	5	1	Minimal temporal overlap.
Upper Willamette Steelhead	Threatened	Adult	5	1	Minimal temporal overlap.

SECTION 5: COMMUNICATION AND COORDINATION

Harvest

The States consider communication and coordination between harvest entities and NMFS to be an essential component of this plan. In this context, a harvest entity is any state or tribal entity that has authorized or participated in the harvest of Eulachon within the management area for the purpose of recreational, commercial, ceremonial, or subsistence purposes. As such, The States recommend an annual coordination meeting between harvest entities to establish pre-season harvest expectations and to facilitate in-season and post-season communication of harvest. Additionally, The States recommend the development of a harvest reporting tool by NMFS to track in-season harvest of all harvest entities and to determine when the target harvest rate has been met.

Enforcement

Non-treaty commercial and recreational fishery regulations are enforced by the WDFW Enforcement Program and the Oregon State Police (OSP). The WDFW Enforcement Program’s general-authority for commissioned fish police officers is to provide protection for the state’s fish and wildlife habitats and species, prevent and manage human/wildlife contacts, and conduct outreach and education activities for both the citizens and resource users of Washington State. The mission and responsibilities of the Enforcement Program originate with statutes promulgated in several titles of the Revised Code of Washington (RCW) and Washington Administrative Code (WAC). Primary among these is RCW Title 77 - Fish and Wildlife, and Title 10 - Criminal Procedure.

Commissioned WDFW Fish and Wildlife Officers (FWOs) stationed in six regions throughout the state work with a variety of state and federal agencies to enforce all fish and wildlife laws, general authority laws, and WDFW rules. FWOs hold commissions with the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration’s Office of Law Enforcement (NOAA-OLE), and therefore have jurisdiction over specific federal violations. The most important of these are the Endangered Species Act (ESA) and the Lacey Act. Officers work joint patrols and coordinate with these federal agencies as well as with the United States Coast Guard (USCG), United States Forest Service (USFS), Federal Bureau of Investigation (FBI), Bureau of Land Management (BLM), tribal police, and the Department of Homeland Security (DHS).

We anticipate WDFW and OSP enforcement activity will continue similar to recent years for the duration of this plan. Outreach and education will continue to complement enforcement to improve compliance with fishing regulations and contribute to achieving the biological objectives of the plan.

ACKNOWLEDGEMENTS

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APPENDIX A: Additional Figures and Tables

Table A-1. Mainstem Columbia River commercial smelt seasons, 1960–2022 (ODFW and WDFW 2023).

Year	Season	Fishery Level ¹	Weekly Period	Days Open
1960–1964	Jan. 1 – Dec. 31	--	12 PM Sat – 12 AM Wed	~255
1965–1966	Jan. 1 – Dec. 31	--	12 PM Sat – 12 AM Wed	~307
1967–1977	Jan. 1 – Dec. 31	--	12 PM Sat – 12 AM Wed	~255
1978–1984	Jan. 1 – Dec. 31	--	7 days/week	365
1985	Jan. 1 – Dec. 31	--	7 d/wk (upstream of Cowlitz R. 2/22–3/1)	365
1986–1994	Dec. 1 – Mar. 31	--	7 days/week	121
1994/1995	Dec. 7 – Jan. 7	--	7 days/week	38
	Jan. 7 – Mar. 31	--	8 PM Sat – 8 AM Wed	48
1995/1996	Dec. 1 – Feb. 2	--	7 days/week	64
	Feb. 3 – Mar. 31	--	Noon Mon – 6 PM Fri	32
1996/1997	Dec. 1 – Jan. 27	--	7 days/week	58
	Jan. 30 – Feb. 21	--	6 AM Thu – 6 PM Fri	8
1997/1998	Dec. 1 – Dec. 31	--	7 days/week	31
	Jan. 2 – Feb. 13	--	6 AM – 6 PM Mon & Fri	13
1998/1999	Dec. 1 – Dec. 23	--	7 days/week	23
	Dec. 30 – Feb. 10	--	7 AM – 7 PM Wed	7
	Jan. 31, Feb. 7, & Feb. 18	--	7 AM – 7 PM	3
1999/2000	Dec 1 – Dec 26	--	7 days/week	26
	Dec. 29 Feb. 23	--	7 AM – 7 PM Wed	9
2000/2001	Dec 1 – Dec 31	--	7 days/week, 24 hrs/day	31
	Jan. 3 – Mar. 7	One	3 AM – 9 PM Wed	10
	Mar. 12 – Mar. 31	Two (3/06)	3 AM – 9 PM Mon & Wed	6
2001/2002	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 2 – Jan. 31	Two	3 AM – 9 PM Sun & Wed	9
	Feb. 1 – Mar. 31	Two (1/31)	3 AM – 9 PM Sun, Wed & Fri	26
2002/2003	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1– Mar. 31	Three	3 AM – 9 PM Sun, Tues, Thurs, & Fri	51
2003/2004	Dec. 1– Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 21	Three	3 AM – 9 PM Sun, Tues, Thurs, & Fri	34
	Mar. 22– Mar. 31	Two (3/18)	3 AM – 9 PM Fri, & Sun	2
2004/2005	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1– Feb. 23	Two	3 AM – 9 PM Mon, & Thurs	15
	Feb. 24 – Mar. 31	One (2/23)	3 AM – 9 PM Thurs	6
2005/2006	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 2	One	7 AM – 4 PM Mon, & Thurs	20
	Mar. 7	One (3/08)	7 AM – 4 PM Mon	1
	Mar. 13 – Mar. 31	One (3/08)	7 AM – 4 PM Mon & Thurs	6
2006/2007	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 31	One	7 AM – 4 PM Mon, & Thurs	20
	Mar. 11	One (3/05)	7 AM – 4 PM Sun	1
	Mar. 15– Mar. 31	One (3/05)	7 AM – 4 PM Mon & Thurs	5
2007/2008	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 31	One	7 AM – 4 PM Mon & Thurs	26
2008/2009	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 31	One	7 AM – 2 PM Mon & Thurs	26
2009/2010	Dec. 1 – Dec. 31	--	7 days/week, 24 hrs/day	31
	Jan. 1 – Mar. 31	One	7 AM – 2 PM Mon & Thurs	25
2011–2013	Closed	--	--	0
2014	Feb. 10 – Mar. 6	< One	7 AM – 2 PM Mon & Thurs	8
2015	Feb. 2 – Feb. 26	< One	7 AM – 2 PM Mon & Thurs	8
2016	Feb. 1 – Feb. 25	< One	7 AM – 2 PM Mon & Thurs	8
2017	Feb. 2 – Feb. 27	< One	7 AM – 2 PM Mon & Thurs	8
2018	Feb. 1 – Feb. 26	< One	7 AM – 2 PM Mon & Thurs	8
2019	Closed	--	--	0
2020	Feb. 3 – Feb. 27	< One	5 AM – 5 PM Mon & Thurs	8
2021	Jan. 28 – Mar. 11	< One	5 AM – 5 PM Mon & Thurs	13
2022	Jan. 26 – Mar. 28	< One	5 AM – 5 PM Mon, Wed, & Fri	27

¹ Fishery levels are described in the Joint State Eulachon Management Plan.

² Commercial fisheries were closed December 2010 through 2013, following the ESA listing of Eulachon as a threatened species, and again in 2019 due to projected low run abundance.

Table A-2. Washington and Oregon tributary commercial smelt seasons, 2002–20221 (ODFW and WDFW 2023).

Year	Cowlitz River ²	Kalama River ³	Lewis River ⁴	Oregon Rivers
2002	<u>1/02–1/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Wed – 6 AM Thu <u>2/01–2/25:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu <u>2/26–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu, and 6 PM Thu – 6 AM Fri	<u>2/05–2/25:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu <u>2/26–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu, and 6 PM Thu – 6 AM Fri	<u>2/05–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu <u>2/26–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and Wed – 6 AM Thu, and 6 PM Thu – 6 AM Fri	24-hours daily
2003	<u>1/01–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and 6 PM Wed – 6 AM Thu	<u>1/01–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and 6 PM Wed – 6 AM Thu	<u>1/01–3/31:</u> 6 PM Sun – 6 AM Mon, and 6 PM Tue – 6 AM Wed, and 6 PM Wed – 6 AM Thu	24-hours daily
2004	<u>1/01–3/17:</u> 6 PM Sun – 6 PM Tue and 6 PM Wed – 6 PM Fri <u>3/18–3/31:</u> 6 PM Sun – 6 AM Mon and 6 PM Wed – 6 AM Thu	<u>1/01–3/17:</u> 6 PM Sun – 6 PM Tue and 6 PM Wed – 6 PM Fri <u>3/18–3/31:</u> 6 PM Sun – 6 AM Mon and 6 PM Wed – 6 AM Thu	<u>1/01–3/17:</u> 6 PM Sun – 6 PM Tue and 6 PM Wed – 6 PM Fri <u>3/18–3/31:</u> 6 PM Sun – 6 AM Mon and 6 PM Wed – 6 AM Thu	24-hours daily
2005	<u>1/01–2/22:</u> 6 PM Sun – 6 AM Mon and 6 PM Wed – 6 AM Thu <u>2/23–3/31:</u> 6 PM Wed – 6 AM Thu	Closed	<u>1/01–2/22:</u> 6 PM Sun – 6 AM Mon and 6 PM Wed – 6 AM Thu <u>2/23–3/31:</u> 6 PM Wed – 6 AM Thu	24-hours daily
2006	<u>1/01–3/31:</u> 6 PM – 11:59 PM Sun and Wed	Closed	Closed	24-hours daily
2007	<u>1/01–3/31:</u> 6 PM – 11:59 PM, Sun and Wed	Closed	Closed	24-hours daily
2009	<u>1/01–3/31</u> 6AM – 10:PM, Saturdays:	Closed	Closed	24-hours daily
2010	<u>2/03–2/28</u> 7 PM – 10 PM Sun and Wed	Closed	Closed	24-hours daily through November
2011–2022 ⁵	Closed	Closed	Closed	Closed

¹ Washington tributaries not listed were closed by emergency regulation during this period. All tributary commercial fisheries are restricted to dip net gear.

² Area restricted to downstream of Peterson’s Eddy (approximately River Mile [RM] 8.0).

³ Area restricted to downstream of Modrow Bridge (RM 2.9).

⁴ Area restricted to the mainstem and North Fork downstream from the overhead powerlines near Eagle Island (approximately RM 11.5).

⁵ Tributary commercial fisheries were closed effective December 2010, following the ESA listing of Eulachon as a threatened species. These fisheries have not been re-established since closing.

Table A-3. Columbia River and tributary commercial Eulachon landings (in thousands of pounds), 1938–2022 (ODFW and WDFW 2023).

Year (s)		Columbia River ¹	Grays River	Cowlitz River	Kalama River	Lewis River	Sandy River	Total
1938-1949	Range	200-1,000	0-59	1-3,000	0-77	0-2,000	0-1,400	1,000-5,700
	Average	610	18	1,400	13	300	300	3,000
1950-1959	Range	400-1,300	0-16	0-2,000	0-44	0-900	0-500	1,300-2,600
	Average	800	3	700	11	200	100	1,800
1960-1969	Range	100-800	0-53	1,000	0-0	0-82	0-0	800-1,500
	Average	700	10	600	0	8	0	1,100
1970-1979	Range	900	0-6	100	0-300	0-900	0-800	500-3,200
	Average	300	1	1,400	4	100	100	2,000
1980-1989	Range	53-500	0-35	100-3,700	0-8	0-2,700	0-300	500-3,800
	Average	200	4	2,500	1	600	59	2,400
1990-1999	Range	0.2-37	0.0	0-3,673	0-67	0-22	0.0	9-3,674
	Average	13	0.0	1,029	7	2	0.0	1,051
2000-2009	Range	0.1-159	0.0	0-464	0.0	0-529	0-23	0.2-1083
	Average	37	0	102	0	102	2	244
2010		3.6	0.0	0.0	0.0	0.0	0.0	3.6
2011-2013 ²		--	--	--	--	--	--	--
2014		18.6	0.0	0.0	0.0	0.0	0.0	18.6
2015		16.5	0.0	0.0	0.0	0.0	0.0	16.5
2016		4.8	0.0	0.0	0.0	0.0	0.0	4.8
2017		5.0	0.0	0.0	0.0	0.0	0.0	5.0
2018		0.1	0.0	0.0	0.0	0.0	0.0	0.1
2019 ²		--	--	--	--	--	--	--
2020		10.3	0.0	0.0	0.0	0.0	0.0	10.3
2021		11.0	0.0	0.0	0.0	0.0	0.0	11.0
2022		27.4	0.0	0.0	0.0	0.0	0.0	27.4

¹ Season totals may contain landings from previous December.² Commercial fisheries were closed December 2010 through 2013, following the ESA listing of Eulachon as a threatened species, and again in 2019 due to projected low run abundance.

Table A-4. Eulachon catch-per-unit-effort (CPUE) and landings in Columbia River commercial fisheries, 1990–2022 (ODFW and WDFW 2023).

Year	CPUE's by Calendar Week								Season Totals	
	5	6	7	8	9	10	11	12	CPUE	Pounds ²
1990	0	0	0	0	0	0	--	--	709	6,381
1991	0	107	685	0	0	940	--	--	389	5,841
1992	344	232	290	0	0	50	--	--	203	2,644
1993	18	0	224	1,731	2,274	3,100	--	--	1,843	33,172
1994	0	0	0	0	35	109	--	--	59	235
1995	216	250	67	0	137	35	--	--	180	7,612
1996	122	0	445	59	150	20	--	--	95	7,208
1997	161	216	672	214	0	0	--	--	304	37,069
1998	94	30	17	0	0	0	--	--	134	11,866
1999	143	183	297	110	0	0	--	--	172	20,834
2000	371	123	330	241	37	0	--	--	211	31,042
2001	0	520	1,604	2,322	3,875	2,194	--	--	2,033	158,809
2002	1,401	2,014	106	0	2,057	7,320	--	--	1,920	57,980
2003	445	581	778	4,350	2,216	2,486	--	--	1,132	66,875
2004	34	693	368	47	21	153	--	--	548	15,431
2005	25	28	0	0	0	0	--	--	27	108
2006	194	209	14	0	0	0	--	--	157	13,099
2007	0	0	0	209	163	39	--	--	153	8,702
2008	0	63	210	58	1	0	--	--	133	11,381
2009	34	3	65	50	45	47	--	--	101	5,539
2010	43	22	7	3	0	0	--	--	96	3,539
2011-13 ³	--	--	--	--	--	--	--	--	--	--
2014	--	--	0	32	631	200	--	--	453	18,558
2015	--	76	534	469	61	--	--	--	435	16,546
2016	--	146	225	148	36	--	--	--	166	4,822
2017	1	0	258	121	53	--	--	--	167	5,019
2018	51	8	0	0	0	--	--	--	37	110
2019 ³	--	--	--	--	--	--	--	--	--	--
2020	--	198	402	261	81	--	--	--	250	10,255
2021	30	5	41	6	576	224	6	--	323	10,997
2022	0	0	0	354	945	1,304	856	140	913	27,398

¹ CPUE = pounds per delivery.² May include landings from previous December.³ Commercial fisheries were closed December 2010 through 2013, following the ESA listing of Eulachon as a threatened species, and again in 2019 due to projected low run abundance.

Table A-5. Lower Columbia River mainstem and tributary recreational smelt seasons, 1960–2022 (ODFW and WDFW 2003; ODFW and WDFW 2023).

Year	Season Structure
1960–1996	The Columbia River and tributaries open seven days per week the entire year (Washington: 20-lbs daily limit; Oregon: 25-lbs daily limit).
1997	The Columbia River and Oregon tributaries open seven days per week the entire year (Washington: 20-lbs daily limit; Oregon: 25-lbs daily limit). Washington tributaries closed effective February 28.
1998	The Columbia River and Oregon tributaries open seven days per week the entire year (Washington: 10-lbs daily limit; Oregon: 25-lbs daily limit). Washington tributaries closed effective February 2.
1999	The Columbia River and Oregon tributaries open seven days per week the entire year (Washington: 20-lbs daily limit; Oregon: 25-lbs daily limit). Washington tributaries were open on Wednesdays and Saturdays from January 2 through February 13.
2000	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year. The Cowlitz River was open on Fridays and Saturdays from January 1 through February 26. The Washington portion of the Columbia River and all other Washington tributaries were closed the entire year.
2001	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year and the Washington portion of the Columbia River was open seven days per week from February 24 through March 31. The Cowlitz River was open on Saturdays from January 6 through March 6. All Washington tributaries, including the Cowlitz River, were open on Saturdays, Sundays, and Wednesdays from March 7 to March 18, and Saturdays, Sundays, Mondays, and Wednesdays from March 19 through March 31.
2002	The Columbia River and Oregon tributaries open seven days per week the entire year. Washington tributaries open Saturdays, Sundays, and Wednesday from 6 AM to 10 PM during January 1–February 25, 2002. Washington tributaries open seven days per week from 6 AM to 10 PM during February 26–March 31, 2002.
2003	The Columbia River and Oregon tributaries open seven days per week the entire year. Washington tributaries open seven days per week from 6 AM to 10 PM during January 1–March 31, 2003.
2004	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year (25-lbs. daily limit), and the Washington portion of the Columbia River was open seven days per week during January 1–March 31, 2004 (20-lbs. daily limit). Washington tributaries were open seven days per week from 6 AM to 10 PM during January 1–March 19, 2004, and on Wednesdays and Saturdays from 6 AM to 10 PM during March 19–31, 2004 (20-lbs. daily limit).
2005	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year (25-lbs. daily limit), and the Washington portion of the Columbia River was open seven days per week during January 1–March 31, 2005 (25-lbs. daily limit). Washington tributaries (Grays River, Cowlitz River, Kalama River, and Lewis River) were open on Tuesdays and Saturdays from 6 AM to 10 PM during January 1–February 23, 2005 (10-lbs. daily limit), and in the Cowlitz River only, on Saturdays from 6 AM to 10 PM during February 26–March 31, 2005 (10-lbs. daily limit).
2006–2009	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year (25-lbs. daily limit), and the Washington portion of the Columbia River was open seven days per week during January 1– March 31 (25-lbs. daily limit). Washington tributaries were closed with the exception of the Cowlitz River, which was open on Saturdays only, from 6 AM to 10 PM, during January 1–March 31 (10-lbs. daily limit).
2010	The Oregon portion of the Columbia River and Oregon tributaries open seven days per week the entire year (10-lbs. daily limit), and the Washington portion of the Columbia River was open seven days per week during January 1–March 31 (10-lbs. daily limit). Washington tributaries were closed with the exception of the Cowlitz River, which was open on Saturdays only from 7 AM to 3 PM, during February (10-lbs. daily limit).

Table continued next page.

Continuation of Table A-5. Lower Columbia River mainstem and tributary recreational smelt seasons, 1960–2022 (ODFW and WDFW 2003; ODFW and WDFW 2023).

2011–2013 ¹	Closed
2014	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open on Saturdays (6 AM–noon) during February 8 – March 8 (10-lbs. daily limit) and the Sandy River on the Oregon shore, which was open on Saturdays (6 AM–noon) during March 1–22 (10-lbs. daily limit).
2015	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 6 AM–noon on Saturday February 7 and 14 (10-lbs. daily limit) and the Sandy River on the Oregon shore, which was open 6 AM–noon on Saturday March 7 and Sunday March 15 (10-lbs. daily limit).
2016	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 7 AM–1PM on Saturday February 6 (10-lbs. daily limit).
2017	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 8 AM–1 PM on Saturday February 25 (10-lbs. daily limit).
2018–2019 ¹	Closed
2020	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 8 AM–1 PM on Saturday February 14 and Wednesday February 26 (10-lbs. daily limit).
2021	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 8 AM–1 PM on Tuesday March 2 (10-lbs. daily limit).
2022	Columbia River closed. All tributaries closed except the Cowlitz River on the Washington shore, which was open 8 AM–1 PM on Saturday March 5 (10-lbs. daily limit).

¹ Recreational fisheries were closed December 2010 through 2013, following the ESA listing of Eulachon as a threatened species, and again in 2018 and 2019 due to projected low run abundance.

Table A-6. Eulachon run size and estimated harvest in Columbia River commercial, sport, and tribal fisheries, 2011–2022 (ODFW and WDFW 2023).

Year	Weeks sampled for SSB	Run size (SSB plus harvest in pounds) ¹	Harvest (pounds)				
			Commercial		Sport	Tribal	Combined
			Mainstem	Tributary			
2011	19	3,300,000	--	--	--	--	0
2012	25	3,200,000	--	--	--	--	0
2013	29	9,600,000	--	--	--	7,470	7,470
2014	22	16,600,000	18,560	--	203,880	6,970	229,410
2015	33	11,400,000	16,550	--	290,770	10,400	317,720
2016	25	5,100,000	4,820	--	141,050	8,560	154,430
2017	18	1,600,000	5,019	--	541	1,900	7,531
2018	13	400,000	110	--	--	--	110
2019	16	4,205,000	--	--	--	23,660	23,660
2020	10	-- ²	10,255	--	35,040	23,900	69,195
2021	17	9,000,000	10,997	--	91,250	55,940	158,187
2022	19	18,300,000	27,398	--	169,543	27,385	224,326

¹ Rounded to the nearest 100,000 pounds.

² The 2020 SSB estimate is incomplete due to truncated sampling during March

Table A-7. Eulachon larval sampling densities in the lower Columbia River and select tributaries, 1999–2021(ODFW and WDFW 2023).

Year	Catch (eggs and larvae per cubic meter) ²						
	Mainstem Columbia	Cowlitz River	Grays River	Elochoman River	Kalama River	Lewis River	Sandy River
1999	0.7	0.2	0.6	0.8	0.4	0.0	0.1
2000	1.3	41.6	25.7	3.5	0.1	0.2	0.1
2001	42.1	192.0	24.4	0.0	5.5	17.6	N/S
2002	28.2	283.0	N/S	N/S	0.5	0.6	N/S
2003	12.3	1.4	N/S	24.5	N/S	36.2	0.1
2004	3.5	0.9	20.4	N/S	N/S	N/S	N/S
2005	0.3	N/S	0.6	N/S	N/S	N/S	N/S
2006	0.7	0.1	0.0	N/S	N/S	N/S	N/S
2007	0.7	2.8	N/S	N/S	N/S	0.3	N/S
2008	1.1	6.2	44.0	3.3	N/S	<0.1	N/S
2009	2.3	0.1	0.2	N/S	N/S	0.5	N/S
2010	1.0	4.2	178.9	N/S	N/S	0.9	N/S
2011	6.0	29.1	0.2	2.0	0.4	<0.1 ³	N/C
2012	5.9	N/C ⁴	1.6	N/S	N/S	N/S	N/S
2013	20.3	N/C ⁴	1.4	N/S	N/S	N/S	N/S
2014	49.0	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2015	32.5	N/C ⁴	13.4	N/S	N/S	N/S	N/S
2016	13.8	N/C ⁴	48.7	N/S	N/S	N/S	N/S
2017	2.8	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2018	1.1	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2019	15.9	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2020	13.1	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2021	43.0	N/C ⁴	N/S	N/S	N/S	N/S	N/S
2022	47.1	N/C ⁴	N/S	N/S	N/S	N/S	N/S

¹ Inter-annual comparisons of abundance are tentative as sampling has not been systematic from year to year. Mainstem Columbia R. data since 2003 includes multiple collections at Price Island and Clifton Channel sites.

² N/S = not sampled. N/C = larval density not calculated, but some larvae collected.

³ Average density observed by the Cowlitz Tribe Natural Resources staff was 28 larvae per cubic meter.

⁴ Average density observed by the Cowlitz Tribe Natural Resources staff, but unavailable.

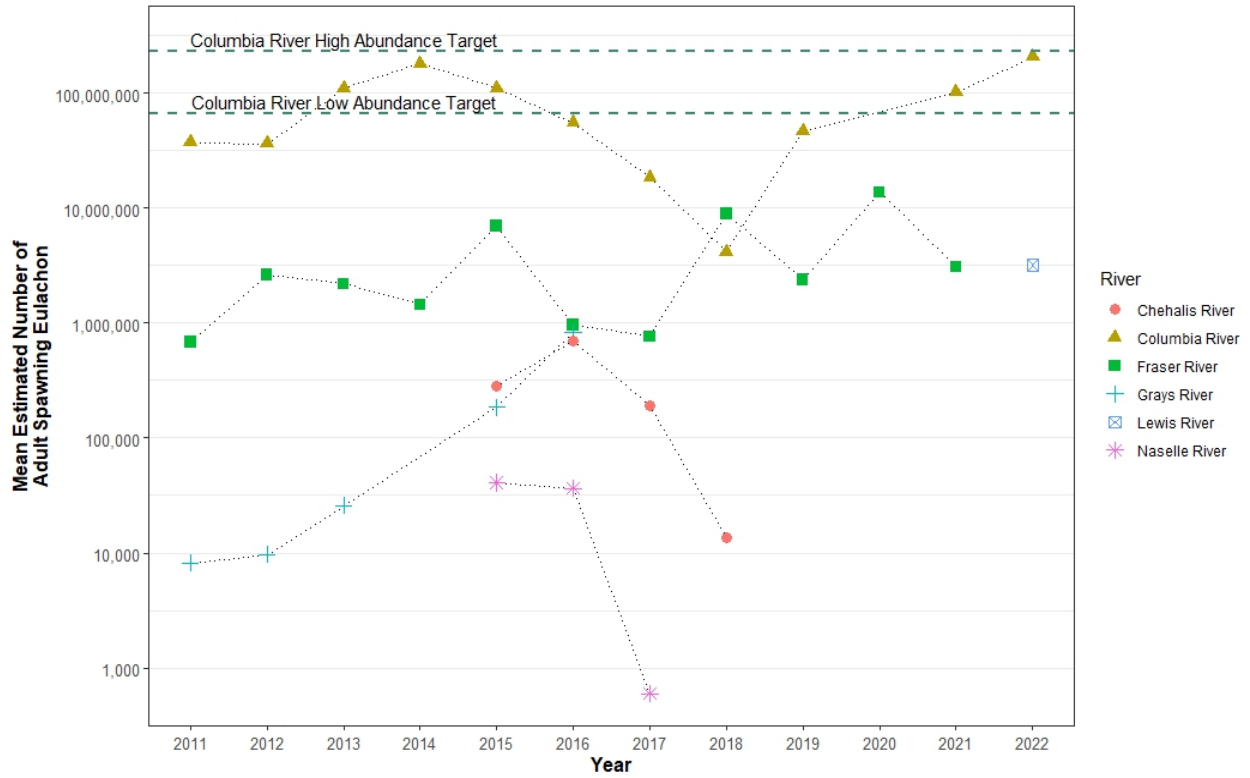


Figure A-1. The estimated number of Eulachon spawning in the Columbia, Fraser, Chehalis, Naselle, and Grays rivers in 2011–2022. Estimates are calculated by multiplying the annual Spawning Stock Biomass (SSB) total weight by a standard 11.16 fish per pound. Estimates for the Fraser River derived from data provided by the Canadian Department of Fisheries and Oceans (DFO). The Fraser River estimate for 2022 was not finalized at the time of this publication. No estimate for the Columbia River is available for 2020 due to truncated sampling (ODFW and WDFW 2023).