National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

Biological Opinion

Agency:	Endangered Species Division of the Office of Protected Resources, National Marine Fisheries Service
Activities Considered:	Issuance of a Species Recovery Grant to the Cowlitz Indian Tribe Natural Resources Department (Award File NA10NMF4720373) to Conduct Research on Eulachon Smelt in Lower Columbia River Tributaries.
Consultation Conducted by:	Endangered Species Division of the Office of Protected Resources, National Marine Fisheries Service
Approved by:	
Date:	JUL 15 2010

Section 7(a)(2) of the Endangered Species Act (ESA), as amended requires each federal agency to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species (16 U.S.C. 1531 *et seq.*). When the action of a federal agency "may affect" a threatened or endangered species or critical habitat that has been designated for them, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the species that may be affected by the action. For the actions described in this document, NMFS' Office of Protected Resources – Endangered Species Division proposes to fund the Cowlitz Indian Tribe Natural Resources Department (CIT) to conduct research on the threatened southern distinct population segment (DPS) of eulachon smelt in lower Columbia River tributaries.

This document represents NMFS' biological opinion (Opinion) on the effects of the proposed action on threatened southern DPS of eulachon smelt. This Opinion, following formal consultation, has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.), as implemented by 50 CFR 402.14(d)-(j). It is based on our review of the environmental assessment (EA); the updated status review for eulachon; past and current research and population dynamics modeling efforts for this species; monitoring reports from prior research; monitoring reports from similar previous research; and reflects consideration of the best scientific and commercial data available.

Consultation History

On June 9, 2010, NMFS began pre-consultation work on this project.

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Consultation History
On June 9, 2010, NMFS began pre-consultation work on this project.

On June 14, 2010, NMFS received an EA from the Species Recovery Grants to Tribes Program and initiated formal consultation.

BIOLOGICAL OPINION

Description of the Proposed Action

The purpose of this proposed action is to provide financial assistance to support a program of scientific research within the Columbia River estuary/tributary system that will increase the basic state of eulachon knowledge. Specifically, the funded work would be used to 1) identify environmental factors influencing spawning run-timing and tributary selection; 2) identify spawning distribution in principle tributaries; 3) correlate spawning distribution with habitat quality factors; and 4) investigate egg mortality potentially caused by sedimentation.

The applicant would deploy plankton nets with flow meters in order to collect larval abundance samples and correct for flow volume. The locations and timing would be coordinated with the Washington Department of Fish and Wildlife ESA section 6 funded eulachon project and would occur from December to March in 2010, 2011, and 2012. Sample stations would likely occur every kilometer for an average of 10 stations up each tributary. At Grays and Kalama rivers theses distances would be shorter than 10 km and in the Cowlitz and Lewis rivers the distances would likely be 20-30 km upriver. Samples would be preserved in 95% ethanol (dilutes to approximately 50% alcohol during rinsing of sample into the bottle). Because of the difficulty identifying eulachon larvae in the field, Rose Bengal would be added to the samples in the laboratory to make the larvae more visible for identification and counting. As many as 10,000 larvae may be collected during these trawl surveys. The applicant would use spawning substrate frames (see Romano *et al*., 2001 for description) anchored overnight on the river bottom for at least two days following observations of adult eulachon presence to identify spawning areas. The overall expected catch would be less than 500 eulachon eggs based on maximum catch rates observed by Romano *et al*. (2001) during sampling conducted at sites in the mainstem Columbia River. Dip netting (dip nets would measure no more than 36 inches across the bag frame) would occur throughout the sampled area to identify fish presence. Approximately 500 adult eulachon may be captured using dip nets and killed for later biological analysis.

The researchers would investigate the impacts of egg burial using both extensive and intensive methods. The applicant would extensively investigate burial of eulachon eggs by taking cores samples of accreting sediments in the lower Cowlitz River (below the confluence of the Cowlitz and Toutle Rivers), in the weeks after adult eulachon have entered the Cowlitz River and spawned. The applicant would examine the core samples to identify the typical depth to which eulachon eggs may be buried by accreting sediments. Sediment accumulation rates may also be measured in the Cowlitz River with sediment traps, though sediment traps may not work optimally in a high-velocity river environment.

The CIT would intensively examine burial impacts to eggs by collecting mature, ripe male and female eulachon, collecting and fertilizing eggs, transferring eggs to incubation trays, verifying egg development, and then establishing experimental treatments by slowly burying developing eggs in varying depths of sediment. This work would be conducted at the USFWS Abernathy Fish Technology Center in Stella, Washington over three years. No more than 500 adult fish

(25-50 pounds) would be killed per year from Columbia River tributaries.

The CIT would characterize river substrate and water column factors throughout key spawning distribution areas to the upper physical limits of distribution in the six principal tributaries to the Lower Columbia River. Analysis factors would include, but are not limited to, substrate size and complexity (silt, sand, gravel, cobble, presence of large woody debris) or water quality (depth and velocity). If the opportunity presents itself, the applicant would also conduct video transects and/or sonar mapping from a boat. If significant correlations are observed, the quantity of suitable/optimal eulachon spawning habitat would be calculated and mapped.

The CIT proposes to identify, assemble and statistically evaluate sets of historic data to identify if any environmental factors (or combination thereof) strongly correlate with past initiation of spawning in the lower Columbia River estuary and associated tributaries. This development of a predictive model would use existing data-sets and would be conducted in an office setting.

Approach to the Assessment

NMFS approaches its section 7 analyses of research permits through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect physical, chemical, or biotic effects on listed species or on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in that spatial extent over time. The results of this step defines the *action area* for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (these represent our *response analyses*).

The final steps of our analyses — establishing the risks those responses pose to listed resources — are different for listed species and designated critical habitat (these represent our *risk analyses*). Our jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, or distinct population segments of vertebrate species. Because the continued existence of species depends on the fate of the populations that comprise them, the continued existence of these "species" depends on the fate of the populations that comprise them. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them; populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

Our risk analyses reflect these relationships between listed species and the populations that comprise them, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using changes in the individuals' "fitness" or an individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effects (responses that we identify during our response analyses) are likely to have consequences for the individual's fitness.

When individual listed plants or animals are likely to experience reductions in fitness (as defined in the preceding paragraph) in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individual's represent (see Stearns 1992). Reductions in at least one of these variables (or one of the variables we derive from them) is a *necessary* condition for reductions in a population's viability, which is itself a *necessary* condition for reductions in a species' viability. As a result, when listed plants or animals exposed to an action's effects are *not* expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (for example, see Stearns 1977, Brandon 1978, Mills and Beatty 1979, Stearns 1992, Anderson 2000). As a result, if we conclude that listed plants or animals are *not* likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in the fitness of individuals is a *necessary* condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always *sufficient* to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individual's represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of Listed Resources* sections of this opinion) as our point of reference. If we conclude that reductions in individual fitness are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always *sufficient* to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers distribution, estimates of extinction risk or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of the Species* section of this opinion) as our point of reference. Our final determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

To conduct these analyses, we relied on all of the evidence available to us. As discussed in the introduction to this biological opinion, this evidence consisted of the EA, the updated status review for eulachon, past and current research and population dynamics modeling efforts for this species, monitoring reports from prior research, and monitoring reports from similar previous research.

During this consultation, we conducted several electronic searches of the general scientific literature using *Biosis*, *Article First*, and *Aquatic Sciences and Fisheries Abstracts* search engines. We supplemented these searches with electronic searches of doctoral dissertations and master's theses. These searches focused on identifying recent information on the biology, ecology, distribution, status, and trends of the southern DPS eulachon, data; recent studies on the response of marine ecosystems and marine biota to shrimp trawls; and different methods for assessing risks of extinction.

We ranked the results of these searches based on the quality of their study design, sample sizes, level of scrutiny prior to and during publication, and study results. Carefully-designed field experiments (for example, experiments that control potentially confounding variables) are rated higher than field experiments that are not designed to control those variables. Carefully-designed field experiments are generally ranked higher than computer simulations. Studies that produce large sample sizes with small variances are generally ranked higher than studies with small sample sizes or large variances.

Action Area

The action area for this biological opinion is in tributary rivers to the lower Columbia River below RM 146. Research would occur in both Oregon and Washington. The principle research sites would include the lower portions of Grays River, Skamokawa River, Elochoman River, Cowlitz River, Kalama River, Lewis River and the Sandy River. Other rivers that may also be sampled include the Naselle River, Deep River, or parts of the Clatskanie River system.

Status of Listed Resources

NMFS has determined that the actions considered in this Opinion may affect the southern DPS of Pacific eulachon, listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.; ESA). The southern DPS of eulachon were listed on March 18, 2010 (75 FR 13012). A section 4(d) regulation including take prohibitions has not been promulgated. Critical habitat has not been designated for this species.

Upper Willamette River Steelhead evolutionarily significant unit (ESU), Lower Columbia River Steelhead ESU, and the Middle Columbia River ESU may be effected, but are not likely to be adversely affected. The use of plankton nets in tributaries would occur during the same limited window of exposure to the Upper Willamette River Steelhead ESU, Lower Columbia River Steelhead ESU, and the Middle Columbia River ESU, but impacts to these fish would be negligible. While steelhead could be caught in plankton nets, previous research using plankton nets has never captured a salmonids and the effects of this action on steelhead is discountable.

No green sturgeon are expected to be encountered with any of the gear types as the gear is not selective for them and the species are absent in the areas and times sampling takes place.

Southern DPS Pacific eulachon

Description of the Species. Based upon run timing, genetic distinctions, size at maturity, and ecological features of both oceanic and freshwater environments, the eulachon that spawn in rivers south of the Nass River of British Columbia to the Mad River of California have been separated into the southern DPS eulachon. In addition, the southern DPS may have a different mean number of vertebrae from northern DPS (Hart and McHugh 1944, McLean *et al.* 1999, Hay and McCarter 2000, McLean and Taylor 2001, Beacham *et al.* 2005).

Distribution. Eulachon are smelt native to eastern North Pacific waters from the Bering Sea to Monterey Bay, California, or from 61º N to 31º N (Hart and McHugh 1944, Eschmeyer *et al.* 1983, Minckley *et al.* 1986, Hay and McCarter 2000). The southern DPS of Pacific eulachon extends from the Nass River of British Columbia to the Mad River of California. However, the southern extent of their distribution has receded northward over the past several decades.

Growth and reproduction. Eulachon are semelparous and anadromous, spending most of their lives in marine environments before returning to freshwater to spawn once and die. Because larvae exit the freshwater systems almost immediately, they likely retain homing only to the estuarine system that their natal river drains to. Based upon this, the smallest stock unit is likely the estuary that natal streams drain (Hay and McCarter 2000, Beacham *et al.* 2005). Specific spawning rivers within the natal system are likely selected based upon environmental conditions at the time of return (Hay and Beacham 2005).

Adult eulachon have been observed in California's Humboldt Bay, Klamath, Mad, Russian, and Sacramento Rivers as well as Redwood Creek, the Umpqua and Rogue Rivers in Oregon, and Washington's Puget Sound, Hood Canal, Bear, Naselle, Nemah, Wynoochee, Quinault, Queets, and Nooksack Rivers (Odemar 1964, Moyle 1976, Minckley *et al.* 1986, Emmett *et al.* 1991, Jennings 1996, Wright 1999, Larson and Belchik 2000, Musick *et al.* 2000, WDFW and ODFW 2001). Spawning has been documented in the Elwha River and the Strait of Juan de Fuca, but sightings or spawning in these Oregon and Washington rivers is very limited or unknown (Wright 1999, Shaffer *et al.* 2007). For southern DPS eulachon, most spawning is believed to occur in the Columbia River and its tributaries (Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers), with less production from the Mad and Klamath Rivers, as well as sporadic production in other Oregon and Washington rivers (Emmett *et al.* 1991, Musick *et al.* 2000, WDFW and ODFW 2001). Eulachon from southern rivers generally spawn at a younger age than eulachon from more northern rivers (Clarke *et al.* 2007).

Spawn timing depends upon the river system involved (Willson *et al.* 2006). In the Columbia River and further south, spawning occurs from late January to May, although river entry occurs as early as December (Hay and McCarter 2000). The peak of eulachon runs in Washington State is from February through March. Fraser River spawning is significantly later, in April and May (Hay and McCarter 2000).

The timing of euchalon entry into spawning rivers is likely tied to water temperature and tidal cycles (Ricker *et al.* 1954, Bishop *et al.* 1989, WDFW and ODFW 2001, Lewis *et al.* 2002, Spangler 2002). Spawning normally occurs when water temperature is between 39º and 50º F. Adults may migrate up to 100 miles upstream to reach spawning grounds (Hart and McHugh 1944). Males tend to arrive on spawning grounds earlier than females and tend to stay longer, making them more susceptible to commercial and recreational fisheries (Hart and McHugh

1944). However, males outnumber females by a roughly 2:1 margin. Eulachon sperm is viable for only minutes and a key factor of eulachon spawning may be male grouping *en mass* to broadcast their sperm. Once milt reaches downstream females, each female releases 7,000 to 31,000 eggs (in the Columbia River) at which time fertilization occurs (WDFW and ODFW 2001). Females lay eggs over sand, course gravel, or detrital substrate. This reproductive strategy requires high eulachon density to ensure fertilization. Eggs attach to gravel or sand and incubate for 30 to 40 days after which larvae drift to estuaries and coastal marine waters (Wydoski and Whitney 1979) and after three to five years, migrate back to natal basins to spawn.

Eulachon generally die following spawning (Scott and Crossman 1973, Clarke *et al.* 2007). Maximum known lifespan is 9 years of age, but 20 to 30% of individuals live to 4 years and most individuals survive to 3 years of age, although spawning has been noted as early as 2 years of age (Wydoski and Whitney 1979, Barrett *et al.* 1984, Hugg 1996, Hay and McCarter 2000, WDFW and ODFW 2001). However, the age distribution of spawners varies between river and from year-to-year (Willson *et al.* 2006).

Habitat. Adult eulachon are found in coastal and offshore marine habitats possibly to 2,000 feet deep, but more frequently between 50 and 600 feet deep (Allen and Smith 1988, Hay and McCarter 2000, Willson *et al.* 2006). Following hatching in freshwater, larvae and juveniles become thoroughly mixed in coastal waters generally less than 50 feet deep and move deeper as they grow (Barraclough 1964, Hay and McCarter 2000).

Foraging. Larval and post larval eulachon prey upon phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and other eulachon larvae until they reach adult size (WDFW and ODFW 2001). At this time, the primary prey of eulachon are copepods and euphausiids, including *Thysanoessa* spp., unidentified malacostracans, and cumaceans (Smith and Saalfeld 1955, Barraclough 1964, Wydoski and Whitney 1979, Drake and Wilson 1991, Sturdevant *et al.* 1999, Hay and McCarter 2000).

Status and trends. The southern DPS of eulachon was listed as threatened on March 18, 2010 (75 FR 13012). It is threatened by decreased abundance, natural predation, commercial and recreational fishing pressure (directed and bycatch), and loss of habitat. Population decline is anticipated to continue as a result of climate change and bycatch in commercial shrimp fisheries. However, as highly fecund fish, eulachon have the ability to rebound quickly if given the opportunity, a feature that is likely necessary to withstand significant predation pressure and high mortality likely experienced by pelagic larvae (Bailey and Houde 1989).

Eulachon formerly experienced widespread, abundant runs and have been a staple of Native American diets for centuries along the northwest coast. However, such runs that were formerly present in several California rivers as late as the 1960s and 1970s (i.e., Klamath River, Mad River, and Redwood Creek) no longer occur (Larson and Belchik 2000). This decline likely began in the 1970s and continued until the last Klamath River run was observed in 1999 (Larson and Belchik 2000, Moyle 2002). Eulachon have not been identified in the Mad River and Redwood Creek since the mid-1990s, although sampling effort here may be low or non-existent (Moyle 2002).

Historically, the Columbia River system likely supported half of all southern DPS spawning abundance, but has declined precipitously since the early and mid 1990s (ODFW and WDFW 2007). Although regulations on commercial and recreational catches have been implemented throughout southern DPS freshwater range, commercial catch records suggest populations are a small fraction of their former abundance (an average of 998 metric tons from 1936 to 1992 compared to 91 metric tons annually from 1993 to present; ODFW and WDFW 2007).

No population estimate is available for southern DPS eulachon. For the purposes of this consultation, a very rough and conservative estimate of the population is based on commercial bycatch from 2001 through 2009. Pacific Decadal Oscillation is thought to have contributed to larger than normal runs in the 2001 and 2002 seasons resulting from optimal rearing conditions in 1998-2000 (Eulachon BRT 2010). The conditions have switched and are currently sub-optimal for eulachon rearing, and as a result, the eulachon runs are smaller. In 2001, Wilkins and Weinburg (2002) estimated the Columbia River eulachon population to be over 22 million fish (1,116,000 pounds). Also in 2001, commercial landings of Columbia River eulachon were measured to 313,100 pounds, which roughly equates to 6,224,652 eulachon or approximately 28% of the population (JCRMS 2007). In 2009, commercial landings were only 17,644 pounds, which roughly equates to 350,775 eulachon (WDFW 2009). Assuming a proportional ratio of commercial catch to overall population abundance, the Columbia River eulachon population may be approximately 1,250,000. This is a very conservative estimate for the Columbia River eulachon population because the proportion of the total population that can be captured as the size of the population decreases would likely decrease as well (as has been demonstrated by declines in CPUE from .253 kg/ha to .009 kg/ha), making it very unlikely that in 2009, 28% of the population was captured by the commercial fishery. Fishing restrictions were implemented in 1995 and the steep decline recently is thought to be linked to a decline in the stock (Bargmann *et al.* 2005).

Critical habitat. Critical habitat has not been designated for the southern DPS of eulachon.

Environmental Baseline

By regulation, environmental baselines for Opinions include the past and present impacts of all state, Federal, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation; and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of Pacific eulachon in the action area.

Although some information on the presence of species within the action area has been collected, the purpose of this project is to gather information on patterns of distribution or abundance of eulachon off the coast of Oregon and Washington. The following information summarizes the primary human and natural conditions within the action area that are believed to affect the status and trend of listed eulachon as well as their probable responses to these conditions.

Fisheries

Fisheries harvests are likely a major contributor to eulachon decline. The best available information for catches comes from the Columbia River, where catches have been as high as 5.7 million pounds per year, but averaged near 2 million pounds from 1938 to 1993 (Wydoski and Whitney 1979). Since 1993, catches have not exceeded 1 million pounds annually and the median catch has been 43,000 pounds, which represents a 97.7% reduction in catch, even when effort is accounted for (WDFW and ODFW 2001). Efforts to quantify fish that will be returning to the Columbia River to spawn in subsequent years have suggested significant variation in run size (100 metric tons to greater than 4,000 metric tons), but average less than 1,000 metric tons. Catch from sport fisheries is also high (Wydoski and Whitney 1979). Outside of the Columbia River, the next highest landing size has been in the Fraser River with catches nearly ten times smaller than in the Columbia (Hay *et al.* 2003). Bycatch from shrimp trawling along U.S. and Canadian coasts has also been high, composing up to 28% of the total catch by weight, triggering periodic closures of the fishery in some years (Hay and McCarter 2000, DFO 2008).

Global Warming

Changing ocean conditions, caused by global climate change, in the Pacific Northwest present an unclear, yet potentially severe threat to eulachon survival and recovery. Increases in ocean temperatures have already occurred and will likely continue to impact eulachon and their habitats. For example, changes in climate along the entire Pacific Coast and within the Columbia River basin will further change hydrologic patterns and ultimately pose challenges to eulachon spawning because of decreased snowpack, increased peak flows, decreased base flow, and increased water temperatures (Morrison *et al.* 2002). In the marine environment, eulachon rely upon cool or cold ocean regions and the invertebrate communities therein (Willson *et al.* 2006). As with El Niño and La Niña events, warming ocean temperatures will likely alter these communities, making it more difficult for eulachon and their larvae to locate or capture prey (Roemmich and McGowan 1995, Zamon and Welch 2005). Warmer waters could also allow for the northward expansion of eulachon predator and competitor ranges, increasing an already high predation pressure on the species (Rexstad and Pikitch 1986, McFarlane *et al.* 2000, Phillips *et al.* 2007).

Dams and Dredging

Construction projects have also had a negative impact on eulachon stocks. Dams, such as the Bonneville Dam, have blocked eulachon from moving into former spawning habitat (Smith and Saalfeld 1955). Such damming projects also alter sedimentation, river substrate, and flow dynamics that eulachon have evolved with. Impounding water tends to raise its temperature, which is problematic for spawning eulachon (NMFS 2008). Sediment retention structures, constructed to limit sediment transport downstream, have been correlated with reduced eulachon runs in subsequent years (Lou Reebs, pers. comm. *in* 74 FR 10857). Dredging activities likely destroy eggs and remove the benthic substrates they rely upon.

Effects of the Proposed Action

In this section of the Opinion, we assess the probable direct and indirect effects of funding the proposed procedures on eulachon in the action area. We also summarize the results of studies that have examined the direct and indirect effects of each sampling procedure on eulachon. We rely on these summaries of the literature to determine how individual eulachon are likely to respond upon being exposed to a particular sampling procedure. Based on this body of information, we then assess the risks these proposed activities pose, first to particular eulachon populations, then to the southern DPS.

The specific stressors associated with the proposed project are harassment, capture, and mortality of pre- and post-spawn adults and capture and mortality of larvae in plankton net tows. The following sections provide specific details of the stressors and summarize the available data on the responses of individuals that have been exposed to the sampling design.

Adult Spawner Sampling

Each year of the research proposal, adult eulachon will be sampled from tributaries to the Columbia River in coordination with the research being conducted by Oregon and Washington. If the states are not working in the Grays, Skamokawa, Elochoman, Cowlitz, Kalama, Lewis and Sandy Rivers, then the CIT will study them. Additionally, adult eulachon will be targeted in less common spawning tributaries such as Naselle River, Deep River, or parts of the Clatskanie River system, again in coordination with Oregon and Washington. Traditionally, local fishermen would target these large, synchronized adult runs with large dip nets, which is the same method the researchers will use to collect these eulachon. Adult sampling will take place every year to fish presence. Sampling will begin in December to target the earliest part of the mainstem Columbia River run and will continue through March to target the post spawn fish at the end of the run. As a result of these efforts, as many as 500 adult eulachon will be removed from the Grays, Skamokawa, Elochoman, Cowlitz, Kalama, Lewis and Sandy, Naselle, Deep, and Clatskanie Rivers every year for the three years of proposed research.

Plankton Net Tows and Substrate Frames

An important aspect of understanding eulachon reproduction and population fluctuations is monitoring egg and larval production. All of the samples collected by both plankton tows and substrate nets will result in complete mortality of the sample specimens. There will be no sub-lethal effects associated with these procedures.

In the past 14 years of reproduction monitoring, each one minute tow has captured an average of 76 eulachon larvae, and using this catch rate, NMFS expects no more than 10,000 larvae to be lethally captured during sampling. Eggs will also be collected using substrate frames and based on previous efforts identified by Romano *et al.* (2001), NMFS expects approximately 500 eulachon eggs will be captured and removed from the system during these surveys.

Integration and Synthesis of Effects

Eulachon are naturally prey to many different predatory species. As such, they have a reproductive strategy that has developed to produce many offspring, suffering massive casualties throughout their lives, and the few survivors reproduce to sustain the population. Eulachon take between three and five years to reach maturity before migrating back to fresh water to spawn (WDFW and ODFW 2001). As the population declines, each fish that reaches adulthood is increasingly important. Given that eulachon congregate before broadcast spawning both sperm and eggs, the more adults that are in the spawning location when spawning occurs, the better the chances of having more eggs released and having a higher proportion of those eggs get fertilized. The proposed research plans to lethally remove as many as 500 adult eulachon from Columbia River tributaries every year for three years in coordination with the states of Oregon and Washington. A very conservative population estimate of 1.25 million juvenile and adult eulachon are from the Columbia River, and these 500 fish would make up only 0.04% of the population. With a life history favoring short lives and high fecundity, eulachon are able to withstand the removal of large proportions of their population. The loss of 0.04% of the population should be quickly replaced by the adults who reach the spawning grounds and successfully reproduce.

In addition to sampling the adults, plankton net tows and substrate nets will be used to capture eggs and early life stages of eulachon from the Columbia River system. Approximately 10,000 larvae and 500 eggs will be killed every year to monitor the hatching cycle and overall reproductive success of the previous year. Each female eulachon from the Columbia River produces between 7,000 and 31,000 eggs (WDFW and ODFW 2001). Eulachon produce so many eggs that the probability of each egg surviving is less than 5% and in some cases less than 1% (Willson *et al.* 2006). Those eggs that do hatch and become larvae suffer high natural mortality rates as prey for many animals that feed on the pelagic larvae as they drift towards estuaries (Bailey and Houde 1989). The ecological consequences of removing up to 500 eggs and 10,000 larvae from as many as 10 different rivers over a four month period would be insignificant compared to the rates of predation and natural mortality.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, NMFS searched for information on future State, tribal, local, or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of business journals, trade journals, and newspapers using *First Search*, Google, and other electronic search engines. Those searches produced no evidence of future private action in the action area that would not require federal authorization or funding and is reasonably certain to occur.

Conclusion

After reviewing the current status of the threatened southern DPS of Pacific eulachon, the environmental baseline for the action area, the effects of the proposed research activities, and the cumulative effects, it is NMFS' Opinion that the proposal to fund this research is not likely to jeopardize the continued existence of the southern DPS of Pacific eulachon. Critical habitat has not been designated in the proposed action area, so no critical habitat would be affected by the proposed action.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Take

The southern DPS of Pacific eulachon is listed as threatened under the ESA and take is not prohibited by a rule promulgated under section 4(d) of the ESA. NMFS does not expect any other listed species to be taken incidentally to this research.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The following conservation recommendation would provide information for future consultations that may affect eulachon and other Columbia River species as well as reduce harassment related to research activities:

1. *Spawning substrate frames* should be monitored and bycatch reported to NMFS in an annual report.

REINITIATION NOTICE

This concludes formal consultation on the Cowlitz Tribes proposal to survey eulachon populations in the coastal waters of Washington and Oregon. As provided in 50 CFR '402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, PR3 must immediately request reinitiation of section 7 consultation.

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