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 Protected Species Conservation and Recovery Grant to the Yurok Tribe (Award File NA10NMF4720374) to Conduct Research on Eulachon Smelt in northern California.
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 of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) 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. 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, 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 Yurok Tribal Fishery Program (YTFP) to conduct research on the threatened southern distinct population segment (DPS) of eulachon smelt in northwestern California.

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, 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.

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

BIOLOGICAL OPINION

Description of the Proposed Action

Up to 100 pre-spawned adult eulachon per year would be sampled from the Klamath River, Redwood Creek and Mad River (up to 300 per year total for all three systems). A small fin clip would be taken from the pre-spawned adults for genetic analysis and the fish would be visually sexed (McCarter and Hay 2003) and immediately released. This sampling protocol would take no more than 5 minutes. If 100 pre-spawned adults are not captured, sampling will continue and whole post-spawned fish would also be collected for genetics, age composition via otolith analysis, and sex ratio through visual examination. Sampling of adult eulachon in the Klamath River, Mad River, and Redwood Creek would occur from January through April in 2011, 2012, and 2013. Sampling would occur approximately 3 days per week for 8 hours per day at sampling locations yet to be determined but below river mile 30 in the Klamath. In the Mad River, sampling would occur 1 time per week for 8 hours at sampling locations yet to be determined but generally in the tidally influenced portion of the river (lower 5 miles). In Redwood Creek sampling would occur 1 times per week for 8 hours at 1 station located in Redwood Creek estuary (lower 3 miles of Redwood Creek). The adult eulachon would be collected using a combination of seine nets or dip nets (measuring no more than 36 inches across the bag frame). Sampling would be stratified by depth, distance from shore, and time of day. Some night sampling would occur as winter conditions and safety allow. If eulachon are found the applicant would design and conduct spawning stock biomass (SSB) estimate planktonic surveys using the methods described in Hay (2002, 2003).

If eulachon in significant numbers are found in the Klamath Basin, the applicant is proposing the use of the daily egg production method (DEPM) (Parker 1985, Jackson and Cheng 2001) to develop a robust SSB estimate for eulachon smelt. One minute plankton tows would be conducted near the top, middle, and bottom of a station along a transect position. The major Klamath River transect is located at approximately river mile 4, near the Highway 101 bridge. The transect position (perpendicular to the river flow) would have at least one station near each shoreline and one in the middle of the channel, for a total of three stations. Up to 90 tows would be made each year, 9 per week for approximately 10 weeks, dependent upon the duration of the eulachon larvae outmigration period. It is estimated that fewer than 5,000 eulachon larvae would be captured per year, although actual numbers could be far lower. A General Oceanic flow meter, mounted on the net frame, would be used to determine the volume filtered during sampling. Samples would be preserved in 95% ethanol (dilutes to approximately 50% alcohol during rinsing of sample into the bottle). In the laboratory, Rose Bengal would be added to make the larvae more visible for counting. The larval count data would be combined with daily river discharge and eulachon fecundity data to determine an estimate of SSB. The lower Klamath River discharge data would be derived from U.S. Geological Survey (USGS) river discharge data.

Additional plankton net sampling to document eulachon larvae presence in Redwood Creek and Mad River would occur during January-April 2011-2013. Estimated numbers of plankton net sets by river per year are 10 each in Redwood Creek and Mad River. Plankton net sets in both Mad River and Redwood Creek would take place in the lower tidally-influenced portion of the river; generally below river mile 5 in Mad River and river mile 1 in Redwood Creek. While the

potential larval density in these locations is unknown, it is expected to be low. The take from these secondary study areas would likely be less than a 600 larvae per year.

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 the mainstem lower Klamath River, Mad River, and Redwood Creek in northwest California.

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 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.

Southern Oregon/Northern California Coast coho salmon, California Coastal Chinook salmon, and Northern California Coast steelhead are all present in the action area and juveniles could be captured in plankton nets. NMFS has determined these species may be affected, but are not likely to be adversely affected by this project because in previous sampling no juvenile salmonids have been encountered.

No green sturgeon are expected to be encountered with any of the gear types as the gear is not selective for them.

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.* 1983a, 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) are thought to 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).

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.

Very little is known about the presence of Pacific eulachon within the action area. The purpose of this project is to gather information on patterns of distribution or abundance of eulachon in northern California rivers. The following information summarizes the primary human and natural phenomena in northern California that are believed to affect the status and trend of listed eulachon as well as their probable responses to these phenomena.

Fisheries

There are currently no harvest regulations for eulachon in the Klamath River, Mad River, or Redwood Creek. However, eulachon abundance has declined so dramatically in these rivers that there is little, if any, fishing effort for eulachon. In the Pacific Ocean, eulachon can be harvested year-round using any method otherwise authorized to harvest food fish in the open ocean.

Bycatch of eulachon in commercial marine fisheries poses a moderate threat to eulachon in Oregon and Washington and California. In the past, protection of forage fishes has not been a priority when developing ways to reduce shrimp fishing bycatch. Eulachon are particularly vulnerable to capture in shrimp fisheries in the United States and Canada as the marine areas occupied by shrimp and eulachon often overlap. In Oregon, the bycatch of various species of smelt (including eulachon) has been as high as 28 percent of the total catch of shrimp by weight (Hay and McCarter 2000, Hannah and Jones 2007).

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 along the northern California and southern Oregon coasts 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

Construction projects have also had a negative impact on eulachon stocks. Dams, such as the Iron Gate 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).

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 Klamath River, Mad River, and Redwood Creek. 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 capture and handling of mature adult eulachon, capture and mortality of post-spawn adult eulachon, and capture and mortality of larvae and eggs in plankton nets and sampling nets. 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 Capture and Genetic Samples

The Yurok tribe researchers will use seine nets and 36 inch diameter dip nets to capture adult Pacific eulachon during their spawning migration. As many as 100 adults will be captured from each of the Klamath River, Mad River, and Redwood Creek. All adults that are captured during their upstream migration or prior to spawning will receive a fin clip and be returned to the water to complete their spawning activities. From the time pre-spawn eulachon are captured, total handling and fin clip removal will not exceed five minutes. The process of capture and handling the fish is not expected to result in mortality or impact their spawning in any way. Fin clips are considered standard practice in fisheries science and are not thought to have any significant adverse effects (Wasko *et al.* 2003).

If 100 eulachon are not captured from each river during the upstream migration, researchers will continue to monitor Klamath and Mad Rivers and Redwood Creek for eulachon. Any post-spawn fish that are captured will be collected. Post-spawn adult eulachon will receive genetic fin clips the same as the pre-spawn fish. Additionally, the otoliths will be removed to determine the reproductive age of eulachon. The reproductive age of northern California eulachon appears to be younger than eulachon from farther north (Clarke *et al.* 2007), but very few fish have been captured from northern California in the past 20 years (Larson and Belchik 2000, Moyle 2002). Researchers will also visually inspect post-spawn fish to determine the sex ratio of spawning fish. Eulachon are considered semelparous and die after spawning, so the removal of up to 100 dying adults from each river will not have an adverse affect on the population.

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 Klamath River, Mad River, and Redwood Creek, there have been no recent attempts to document spawning behavior or spawning success. Larson and Belchik (2000) believe eulachon may have been extirpated from northern California rivers. In that case, there will be no eggs or larvae captured. However, if there is still a remnant population of eulachon, there is a chance for successful reproduction. Substrate frames will allow researchers to document the successful fertilization of eggs and plankton net tows will document the successful hatching of those eggs.

The eulachon population in northern California rivers, if existent, is likely extremely depressed. Plankton tows will last one minute and three tows will be made each week at three different stations for a total of nine tows each week over 10 weeks. This effort will amount to a one square meter net moving through the Klamath River for a total of 90 minutes over a 10 week period, which would ultimately capture a very small fraction of the entire drifting larval

population. If a uniform density of larval eulachon were expected during the entire sampling period, this sampling strategy would sample one square meter of the entire river for 0.09% of the time the larval fish are drifting downstream. Likewise, the substrate nets being set up in the Mad River and Redwood Creek would be set an out at a time, about four times per day, one day each week for 10 weeks sampling a small portion of both waterways for brief times, which would result in a very small fraction of the entire larval population being captured.

Most fish eggs and larvae are very small and difficult to differentiate from other captured eggs and larvae, so the most accurate means of identification is to preserve the entire sample for analysis in a laboratory. Plankton net tows and substrate frames will collect individual eggs and larvae to then be stored in alcohol. While the eulachon population in northern California rivers is unknown, the sampling strategy will only sample a very small proportion of the waterways. Any larval eulachon that are captured will come from several samples of small proportions of the entire river through months of sampling. Any collection of larval fish obviously carries a cost, but eulachon eggs and larvae have high natural mortality rates in some many months exceeding 50% (Hay *et al.* 2002). If there is any mortality of eggs and larvae, it should be minimal and provide the added benefit of documenting spawning and developing a spawning stock biomass (SBB), which is essential for management agencies to develop eulachon recovery strategies for northern California rivers.

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.

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 will not kill any pre-spawn adult eulachon from Klamath River, Mad River, or Redwood Creek. The population in these areas is unknown and to best protect any remaining spawning populations, no mortality is acceptable. Post-spawn adults die shortly after spawning and any post-spawn adults that are captured can be removed safely without an adverse effect to any remaining population in the northern California rivers. This sampling strategy

would pose no threat to the spawning potential of any adult eulachon encountered in these rivers.

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 Klamath River, Mad River, and Redwood Creek. Based on the samplind strategy that will target a small portion of the river for short periods of time over 10 weeks, NMFS does not expect the Yurok Tribe to capture 0.1% of the larval population. 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 less than 0.1% of larvae from each river would be insignificant compared to the rates of predation and natural mortality.

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 Act 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 recommendations would provide information for future consultations that may affect eulachon 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 States of Oregon and Washington's proposal to survey eulachon populations in their coastal waters. 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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