Dated: March 9, 2009.

**Karen A. Cook,**

*General Counsel.*

[FR Doc. E9–5446 Filed 3–12–09; 8:45 am]

**BILLING CODE 4310–4R–P**

## DEPARTMENT OF COMMERCE

## National Oceanic and Atmospheric Administration

## 50 CFR Part 223

**[Docket No. 080229343–81352–02]**

**RIN 0648–XF87**

# Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for Southern Distinct Population Segment of Eulachon

**AGENCY:** National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

**ACTION:** Proposed rule; 12–month petition finding; request for comments.

**SUMMARY:** We, the NMFS, have completed a review of the status of the Pacific eulachon (*Thaleichthys pacificus*; hereafter ''eulachon'') under the Endangered Species Act (ESA) in response to a petition submitted by the Cowlitz Indian Tribe to list eulachon as a threatened or endangered species. After reviewing the best scientific and commercial information available, we have determined that the species is comprised of two or more distinct population segments (DPSs) that qualify as species under the ESA. Moreover, after evaluating threats facing the species, and considering efforts being made to protect eulachon, we have determined that the southern DPS is likely to become endangered within the foreseeable future throughout all of its range. We propose to list it as threatened under the ESA. The southern DPS of eulachon consists of populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California. Within the range of the southern DPS, major production areas or ''core populations'' for this species include the Columbia and Fraser rivers and may have historically included the Klamath River. We solicit information to inform the development of the final listing rule.

Any protective regulations determined to be necessary and advisable for the conservation of the southern DPS of eulachon under ESA section 4(d) will be proposed in a subsequent **Federal Register** notice. We solicit information to inform the development of proposed protective regulations and designation of critical habitat in the event the DPS is listed. If the proposed listing is finalized, a recovery plan will also be prepared and implemented for the southern DPS.

**DATES:** Comments on this proposal must be received by May 12, 2009. A public hearing will be held promptly if any person so requests by April 27, 2009. Notice of the location and time of any such hearing will be published in the **Federal Register** not less than 15 days before the hearing is held.

**ADDRESSES:** You may submit comments identified by 0648–XF87 by any of the following methods:

- Electronic Submissions: Federal e-Rulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.
- Mail: Submit written comments to Chief, Protected Resources Division, Northwest Region, National Marine Fisheries Service, 1201 NE Lloyd Blvd., Suite 1100, Portland, OR 97232.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.regulations.gov* without change. All Personal Identifying Information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information. We will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, WordPerfect, or Adobe PDF file formats only. The eulachon petition, status review, and other reference materials regarding this determination can be obtained via the Internet at: *http://www.nwr.noaa.gov/* or by submitting a request to the Assistant Regional Administrator, Protected Resources Division, Northwest Region, NMFS, 1201 NE Lloyd Blvd., Suite 1100, Portland, OR 97232.

**FOR FURTHER INFORMATION CONTACT:** Eric Murray, NMFS, Northwest Region (503) 231–2378; or Dwayne Meadows, NMFS, Office of Protected Resources (301) 713–1401.

**SUPPLEMENTARY INFORMATION:**

## Background

On July 16, 1999, we received a petition from Mr. Sam Wright of Olympia, Washington, to list and designate critical habitat for Columbia River populations of eulachon. On November 29, 1999, we determined that, while the petition indicated that eulachon catches had recently declined in the Columbia River basin, it did not present substantial scientific information indicating that the petitioned action may be warranted (64 FR 66601). That finding was based on observations that the species is likely more abundant than commercial landings indicate and, based on life history attributes (e.g., the species' high fecundity and short life span) and assumptions from catch data and anecdotal reports, has a demonstrated ability to rebound from periods of low abundance. Additionally, the petition did not provide sufficient information regarding the distinctness of eulachon populations in the Columbia River relative to the other populations in the species' range.

On November 8, 2007, we received a petition from the Cowlitz Indian Tribe requesting that we list the eulachon that spawn south of the U.S./Washington-Canada border as threatened or endangered under the ESA. In contrast to our 1999 review, we concluded there was sufficient information showing that eulachon may warrant delineation into DPSs and that eulachon in the petitioned portion of the species' range had substantially declined in abundance. On March 12, 2008, we determined that the petition presented substantial information indicating that the petitioned action may be warranted, and we requested information to assist with a status review to determine if eulachon warranted listing under the ESA (73 FR 13185).

## ESA Statutory Provisions

The ESA defines species to include subspecies or a DPS of any vertebrate species which interbreeds when mature (16 U.S.C. 1532(16)). The U.S. Fish and Wildlife Service (FWS) and NMFS have adopted a joint policy describing what constitutes a DPS of a taxonomic species (61 FR 4722; February 7, 1996). The joint DPS policy identifies two criteria for making DPS determinations: (1) the population must be discrete in relation to the remainder of the taxon (species or subspecies) to which it belongs; and (2) the population must be significant to the remainder of the taxon to which it belongs.

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) ''it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation''; or (2) ''it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D)'' of the ESA.

If a population segment is found to be discrete under one or both of the above conditions, its biological and ecological significance to the taxon to which it belongs is evaluated. This consideration may include, but is not limited to: (1) ''persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that the loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; and (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.''

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532 (6) and (20)). The statute requires us to determine whether any species is endangered or threatened because of any of the following factors: the present or threatened destruction of its habitat, overexploitation, disease or predation, the inadequacy of existing regulatory mechanisms, or any other natural or manmade factors (16 U.S.C. 1533). We are to make this determination based solely on the best available scientific and commercial information after conducting a review of the status of the species and taking into account any efforts being made by states or foreign governments to protect the species.

**Status Review**

To conduct the status review, we formed a Biological Review Team (BRT) comprised of Federal scientists from our Northwest, Southwest, and Alaska Fisheries Science Centers, the FWS, and the U.S. Forest Service. We asked the BRT to review the best available scientific and commercial information to determine whether eulachon warrant delineation into DPSs, using the criteria in the joint DPS policy. We then asked the BRT to assess the level of extinction risk facing the species, describing their confidence that the species is at high risk, moderate risk, or neither. We described a species with high risk as one that is at or near a level of abundance, productivity, and/or spatial structure that places its persistence in question. We described a species at moderate risk as one that exhibits a trajectory indicating that it is more likely than not to be at a high level of extinction risk in the foreseeable future, with the appropriate time horizon depending on the nature of the threats facing the species and the species' life history characteristics. In evaluating the extinction risk, we asked the BRT to describe the threats facing the species, according to the statutory factors listed under section 4(a)(1) of the ESA. The draft report of the BRT deliberations (Gustafson *et al.*, 2008) (hereafter ''status report'') thoroughly describes eulachon biology and natural history, and assesses demographic risks, threats, limiting factors, and overall extinction risk. The key background information and findings of the draft status report are summarized below.

*Biology and Life History of Eulachon*

The biology of eulachon is described in detail in the draft status report and in Willson *et al.* (2006), and is summarized below. Eulachon are a member of the osmerid family (smelts), and no subspecies have been identified. The following section presents biology and life history information gathered from throughout the range of eulachon, though much of the research on eulachon has occurred in Alaska and British Columbia. A later section focuses on information specific to the southern DPS of eulachon.

*Spawning Range*

Eulachon (also called Columbia River smelt, candlefish, or hooligan) are endemic to the northeastern Pacific Ocean, ranging from northern California to southwest and south-central Alaska and into the southeastern Bering Sea. In the portion of the species' range that lies south of the U.S./Washington-Canada border, most eulachon production originates in the Columbia River Basin (Figure 1). Within the Columbia River Basin, the major and most consistent spawning runs return to the mainstem of the Columbia River (from just upstream of the estuary, river mile (RM) 25, to immediately downstream of Bonneville Dam, RM 146) and in the Cowlitz River. Periodic spawning also occurs in the Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers (tributaries to the Columbia River) (Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW), 2001). Other river basins in the lower 48 United States where spawning runs of eulachon have been documented include the Klamath River in northern California and infrequently in some, but not all, coastal rivers

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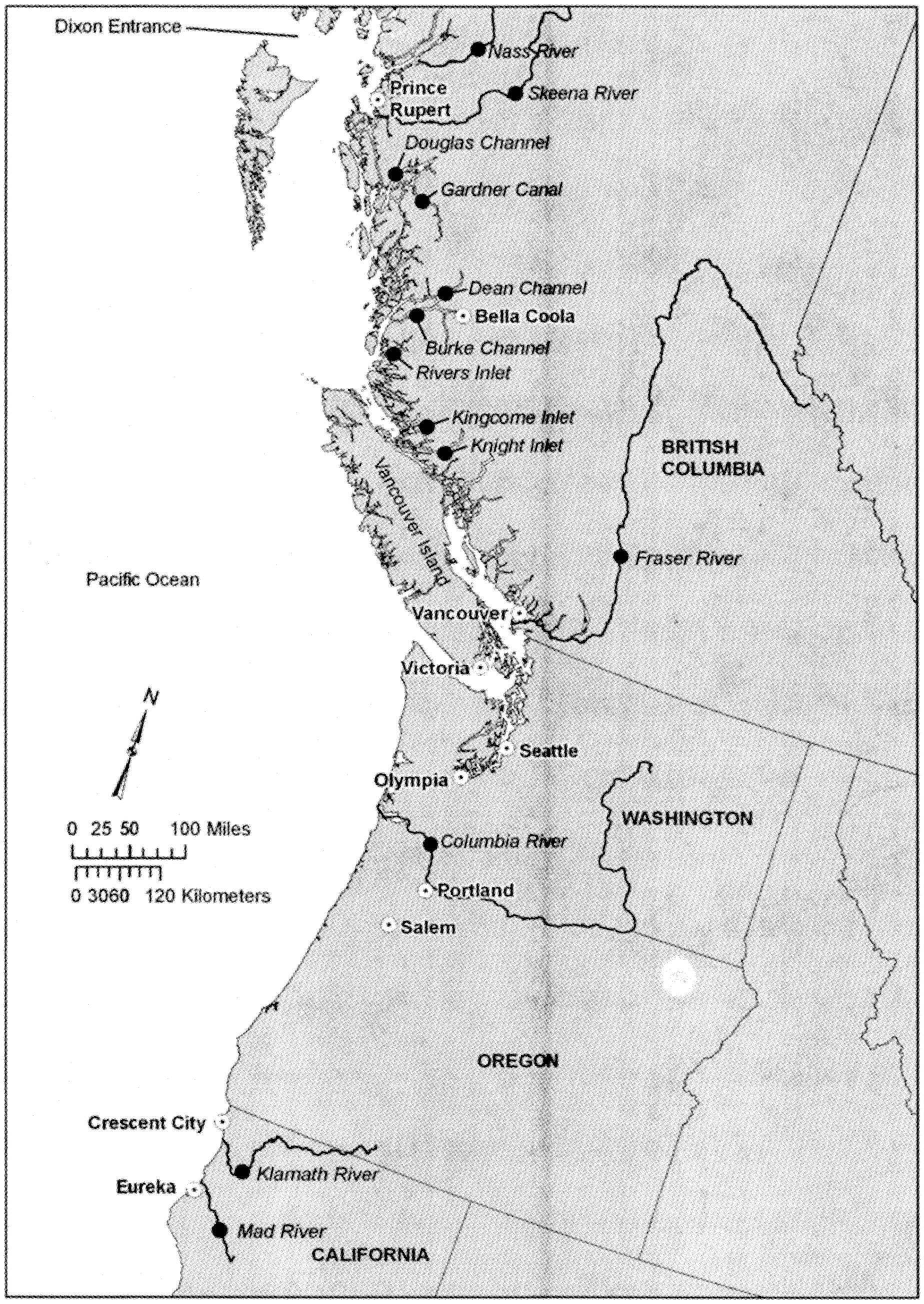
**Figure 1. Rivers, channels and inlets referred to in the eulachon status review.**

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in northern California, Oregon and Washington (Emmett *et al.*, 1991, Willson *et al.*, 2006). Major production areas in Canada are the Fraser and Nass rivers (Willson *et al.*, 2006). Numerous other river systems in central British Columbia and Alaska have consistent yearly runs of eulachon and historically supported significant levels of harvest (Willson *et al.*, 2006; Gustafson *et al.*, 2008). Many sources note that runs occasionally occur in many other rivers and streams, although these tend to be erratic, appearing in some years but not others, and appearing only rarely in some river systems (Hay and McCarter, 2000; Willson *et al.*, 2006).

*Spawning Behavior*

Eulachon typically spend 3–5 years in saltwater before returning to fresh water to spawn from late winter through early summer. Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt (Hay and McCarter, 2000). Spawning typically occurs at night. Willson *et al.* (2006) concluded that the age distribution of eulachon in a spawning run probably varies among rivers and also varies between sexes in some years, and among years in the same river system. Males typically outnumber females by 2:1 or more. Spawning occurs at temperatures from 4° to 10° C in the Columbia River and tributaries (ODFW and WDFW, 2001) and from 0° to 2° C in the Nass River (Langer *et al.*, 1977) over sand, coarse gravel, or detrital substrates. The sexes must synchronize their activities closely, unlike some other group spawners such as herring, because eulachon sperm remain viable for only a short time, perhaps only minutes (Hay and McCarter, 2000). Some researchers report that males lie next to, beside, or on top of females in riffles (Lewis *et al.*, 2002). Langer *et al.* (1977) report that males congregate upstream of groups of females, releasing milt simultaneously, and females lay eggs as the milt drifts over them. Eggs are fertilized in the water column, sink, and adhere to the river bottom typically in areas of gravel and coarse sand. Most eulachon adults die after spawning.

In many rivers, spawning is limited to the part of the river that is influenced by tides (Lewis *et al.*, 2002), but some exceptions exist. In the Berners Bay system of Alaska, the greatest abundance of eulachon was observed in tidally-influenced reaches, but some fish ascended well beyond the tidal influence (Willson *et al.*, 2006). Eulachon once ascended more than 160 km in the Columbia River system. There is some evidence that water velocity greater than 0.4 m/s begins to limit the upstream movements of eulachon (Lewis *et al.*, 2002).

Entry into the spawning rivers appears to be related to water temperature and the occurrence of high tides (Ricker *et al.*, 1954; Smith and Saalfeld, 1955; Spangler, 2002). Spawning occurs in January, February, and March in the Columbia River, and April and May in the Fraser River. Eulachon runs in central and northern British Columbia typically occur in late February and March or late March and early April. Attempts to characterize eulachon run timing are complicated further by marked annual variation in timing. Willson *et al.* (2006) give several examples of spawning run timing varying by a month or more in rivers in British Columbia and Alaska.

Although spawning generally occurs at temperatures from 4° to 7° C in the Cowlitz River (Smith and Saalfeld, 1955), peak eulachon runs occurred at noticeably colder temperatures (between 0° and 2° C) in the Nass River. The Nass River run is also earlier than the eulachon run that occurs at warmer temperatures in the Fraser River (Langer *et al.*, 1977).

*Early Life History and Maturation*

Eulachon eggs are approximately 1 mm in diameter, averaging about 43 mg in weight; however, in the Fraser River population egg weight varied from 10 mg in fish measuring 120 mm in length to almost 30 mg in fish of 180–190 mm standard length (Hay and McCarter, 2000). Eggs are enclosed in a double membrane; after fertilization in the water, the outer membrane breaks and turns inside out, creating a sticky stalk which helps anchor the eggs to sand grains and small gravel (Hart and McHugh, 1944; Hay and McCarter, 2000). Eulachon eggs hatch in 20–40 days, with incubation time dependent on water temperature. Shortly after hatching, the larvae are carried downstream and dispersed by estuarine and ocean currents. Similar to salmon, juvenile eulachon are thought to imprint on the chemical signature of their natal (birth) river basins. However, juvenile eulachon spend less time in freshwater environments than do juvenile salmon, and researchers believe that this short freshwater residence time may cause returning eulachon to stray more from their birth spawning sites than salmon (Hay and McCarter, 2000).

After leaving estuarine rearing areas, juvenile eulachon move from shallow nearshore areas to deeper areas over the continental shelf. Larvae and young juveniles become widely distributed in coastal waters, with fish found mostly at depths up to 15 m (Hay and McCarter, 2000) but sometimes as deep as 182 m (Barraclough, 1964). There is currently little information available about eulachon movements in nearshore marine areas and the open ocean. Willson *et al.* (2006) summarized the results of surveys showing concentrations of pre-spawning adult eulachon off Vancouver Island, in the Bering Sea, in the Gulf of Alaska, in Prince William Sound, and in the Coastal Fjords of Southeast Alaska. The amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

*Prey*

Eulachon feed on zooplankton, chiefly eating crustaceans such as copepods and euphausiids, including *Thysanoessa* spp. (Barraclough, 1964; Hay and McCarter, 2000), unidentified malacostracans (Sturdevant *et al.*, 1999), and cumaceans (Smith and Saalfeld, 1955). Eulachon larvae and post-larvae eat phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and eulachon larvae (WDFW and ODFW, 2001). Adults and juveniles commonly forage at moderate depths (15 to 182 m) in inshore waters (Hay and McCarter, 2000).

*Predators*

Eulachon are very high in lipids, and, due to their availability during spawning runs, they are an important part of the Pacific coastal food web. They have numerous avian predators such as harlequin ducks, pigeon guillemots, common murres, mergansers, cormorants, gulls, and eagles. Marine mammals such as baleen whales, orcas, dolphins, pinnipeds, and beluga whales are known to feed on eulachon. During spawning runs, bears and wolves have been observed consuming eulachon. Fishes that prey on eulachon include white sturgeon, spiny dogfish, sablefish, salmon sharks, arrowtooth flounder, salmon, Dolly Varden, Pacific halibut, and Pacific cod. In particular, eulachon and their eggs seem to provide a significant food source for white sturgeon in the Columbia and Fraser Rivers.

*Age and Length*

It is difficult to compare eulachon body lengths among reports because researchers have used different length measures (i.e., standard, fork, and total length) and these must be standardized for across-population comparisons (Buchheister and Wilson, 2005). As expected, both length and body mass increase with age. Eulachon on the Twentymile River averaged about 180–200 mm and 40–58 g at age 2, to 220–225 mm and 80–90 g at age 5. At age 3, the most common age of spawners, fork length averaged about 200–215 mm and body mass averaged about 60–65 g (estimated from Spangler, 2002). For the Fraser River population, fork-length distribution was as follows: age 0+ fish were about 20–50 mm, age 1+ about 50–80 mm, age 2+ about 75–105 mm, age 3+ about 105–135 mm, and age 4+ about 135–160 mm (estimated by Willson *et al.*, 2006, from Barraclough, 1964). Eulachon in the Kemano, Kitimat, Nass, Stikine, and Columbia rivers have similar distributions of size-at-age, but the increase in size-at-age is small for both sexes (10 mm from age 3 to 4 and 4 mm from age 4 to 5; Lewis *et al.*, 2002).

*DPS Delineation*

Evidence that the BRT found informative for determining whether southern populations of eulachon may be discrete from northern populations of eulachon included differences in: spawning characteristics; size- and age-at-maturity of eulachon between northern and southern rivers in the species' range; ecological features of both the oceanic and freshwater environments occupied by eulachon; and genetic characteristics.

Spawning Characteristics

Eulachon generally spawn in rivers that are glacier-or snowmelt-fed and have a pronounced peak freshet in spring. Some researchers hypothesize that the rapid flushing of eggs and larvae out of the spawning river reach by these freshets may result in eulachon imprinting and homing to the larger local estuary rather than to individual spawning rivers (Hay and McCarter, 2000). Thus, the estuary has been invoked as the likely geographic population unit for eulachon (Hay and McCarter, 2000; Hay and Beacham, 2005).

Variation in spawn timing among rivers has also been cited as indicative of local adaptation in eulachon (Hay and McCarter, 2000), although the wide overlap in spawn timing among rivers makes it difficult to discern distinctive patterns in this trait. These differences in spawn timing result in some populations spawning when water temperatures are as low as 0–2° C, and sometimes under ice (e.g., in the Nass River; Langer *et al.*, 1977), whereas other populations experience spawning temperatures of from 4–7° C (e.g., in the Cowlitz River; (Smith and Saalfield, 1955)). In general, eulachon spawn earlier in southern portions of their range than in rivers to the north. River-entry and spawning begin as early as December and January in the Columbia River Basin and as late as June in central Alaska. However, eulachon have been known to spawn as early as January in rivers of the Copper River Delta of Alaska and as late as May in northern California. The general spawn timing pattern is reversed along the coast of British Columbia where the earliest spawning occurs in the Nass River in the far north in February to early March, and the latest spawning occurs in the Fraser River in April and May in the far south.

Size and Age-at-Maturity

Coastwide, there appears to be an increase in both mean length and weight of eulachon at maturity with an increase in latitude. Mean eulachon fork length and weight at maturity range from about 215 mm and 70 g in the Twentymile River in Alaska to 175 mm and 37 g in the Columbia River. This pattern is typical of many vertebrate poikilotherms (i.e., cold-blooded animals), for which higher rearing temperatures result in reduced size at a given stage of development (Lindsey, 1966; Atkinson, 1994; Stout *et al.*, 2001a).

Age determination of eulachon has been difficult to validate and estimates of age based on otolith increments may not be accurate (Ricker *et al.* 1954, Hay and McCarter 2000). Most studies based on otolith increments conclude that some eulachon spawn at age–2 through age–5, but most spawn at age–2, age–3 or age–4 (Barraclough, 1964; Langer *et al.*, 1977; Hay and McCarter, 2000; Willson *et al.*, 2006). Recently, Clarke *et al.* (2007) developed a method to estimate eulachon age at spawning from analysis of variations in barium and calcium in the otoliths. This study indicated that age structure of spawners in the southern areas may be limited to one or at most two year classes (Clarke *et al.*, 2007). According to Clarke *et al.* (2007), the number of peaks in the Barium to Calcium ratio observed in eulachon otoliths increased with increasing latitude, suggesting that the age at maturity is older for northern populations.

Ecological Boundaries

The fidelity with which eulachon return to their natal river, estuary, or inlet implies some association between a specific population and its freshwater and/or estuarine environment. Differences in life-history strategies among eulachon populations may have arisen, in part, in response to selective pressures of different freshwater/estuarine environments. If the boundaries of distinct freshwater or estuarine habitats coincide with differences in life histories, it would suggest a certain degree of local adaptation. The BRT looked at the characteristics of the terrestrial and marine environments occupied by eulachon to assist in evaluating potential DPS structure.

The BRT used the Environmental Protection Agency ecoregion designations (Omernik, 1987) to evaluate potential eulachon DPS structure based on freshwater distribution. These ecoregions have been used in past ESA status reviews and recovery plans to identify DPSs and population structure of Pacific salmon and other marine fishes (e.g., Good *et al.*, 2005). The historical distribution of eulachon in Washington, Oregon, and California corresponds closely with the Coastal Range Ecoregion as defined in Omernik (1987). Extending from the Olympic Peninsula through the Coast Range proper and down to the Klamath Mountains and the San Francisco Bay area, this region is influenced by medium to high rainfall levels because of the interaction between marine weather systems and the mountainous nature of the region. Topographically, the region averages about 500 m in elevation, with mountain tops under 1,200 m in elevation. The region is heavily forested, primarily with Sitka spruce, western hemlock, and western red cedar. Streams occupied by eulachon within this region generally follow two distinct annual flow patterns: (1) Streams draining coastal watersheds, where winter rain storms are common, have high flow periods coinciding with these storms; (2) streams draining more interior areas, such as the Columbia and Cowlitz Rivers, have a distinct spring freshet period coinciding with snow melt. Eulachon production is highest in these latter systems.

The BRT also used Environment Canada's (2008) established system of ecozones and ecoregions to help assess eulachon DPS boundaries in Canada. Their ''Ecozones'' are approximately the same size as the ecoregions defined by Omernik (1987), while their ecoregions are considerably smaller. All rivers that support regular runs of eulachon in British Columbia are within the Pacific Maritime Ecozone, which consists of 14 ecoregions. The Lower Mainland, Pacific Ranges, and Coastal Gap ecoregions contain rivers supporting regular runs of eulachon as defined in Hay and McCarter (2000) and Hay (2002). The Lower Mainland Ecoregion is dominated by the Fraser River and includes the Fraser River valley. Mean annual precipitation in the Fraser River Valley ranges from 200 cm in the Cascade foothills to 85 cm at the river's mouth. Mean summer and winter air temperatures in this region are 15° C and 3.5° C, respectively. Douglas fir dominates native forest stands while other common tree species include red alder, Pacific madrone, western red cedar and western hemlock. The Pacific Ranges Ecoregion extends from the southern extent of the steeply sloping irregular Coast Mountains at the US border to Bella Coola in the north. These mountains range from sea level to as high as 4000 m. Many rivers in this region originate in expansive ice-fields, and numerous glaciers extend into the lowlands. Mean summer and winter air temperatures in this region are 13.5° C and -1° C, respectively. Mean annual precipitation in this ecoregion ranges from 340 cm at high elevations to 150 cm at sea level. The coastal forest zone is dominated by stands of western red cedar, western hemlock, and Pacific silver fir; and by Douglas fir and western hemlock in drier sites. The Coastal Gap Ecoregion extends from Dean Channel north to the border between British Columbia and Alaska and is bounded by the taller Pacific Ranges to the south and the Boundary Ranges to the north. The low-relief mountains in this ecoregion consist of the Kitimat Ranges, which rarely reach higher than 2400 m. Mean summer and winter air temperatures in this region are 13° C and -0.5° C, respectively. This ecoregion has the highest mean annual precipitation in British Columbia, ranging from 200 cm on the coast to over 450 cm at high elevations. Forests are dominated by western red cedar, yellow cedar, and western hemlock. Some Sitka spruce and shore pine are also present with red alder being common on disturbed sites.

The Nass Basin Ecoregion contains two rivers, the Nass and the Skeena, which also support regular runs of eulachon. The Nass Basin Ecoregion lies between the interior and coastal portions of the Coast Mountains in west-central British Columbia and is an area of low-relief composed of folded Jurassic and Cretaceous sediments that is almost encircled by mountains. Mean summer and winter air temperatures in this region are 11.5° C and -9.5° C, respectively. Mean annual precipitation ranges up to 250 cm at higher elevations to 150 cm in the lowlands. The moist montane zone is dominated by western red cedar and western hemlock, whereas forests in the subalpine zone contain subalpine fir, lodgepole pine, and Engelmann spruce.

The BRT also looked at ecological features of the ocean environment to evaluate potential eulachon DPS structure. Ware and McFarlane (1989) built upon previous descriptions of oceanic domains in the northeast Pacific Ocean by Dodimead *et al.* (1963) and Thomson (1981) to identify three principal fish production domains in the range of eulachon: (1) a Southern Coastal Upwelling Domain, (2) a Northern Coastal Downwelling Domain, and (3) a Central Subarctic Domain (the Alaskan Gyre). The boundary between the Coastal Upwelling Domain and Coastal Downwelling Domain occurs where the eastward flowing Subarctic Current (also called the North Pacific Current) bifurcates to form the north-flowing Alaska Current and the south-flowing California Current. This occurs in the vicinity of a Transitional Zone between the northern tip of Vancouver Island and the northern extent of the Queen Charlotte Islands (an archipelago off the northwest coast of British Columbia, Canada, just south of the Nass River outlet).

Similarly, Longhurst (2006) identifies an Alaska Downwelling Coastal Province and a California Current Province within the Pacific Coastal Biome in his delineation of ocean zones. Within Longhurst's (2006) Pacific Coastal Biome, ocean distribution of eulachon spans the Alaska Downwelling Coastal Province and the northern portion of the California Current Province. Longhurst (2006) also places the boundary between the Alaska Coastal Downwelling Province and the California Current Province where the eastward flowing Subarctic Current (also called the North Pacific Current) bifurcates.

Different modes of physical forcing and nutrient enrichment characterize these provinces. Eulachon occupying these different provinces likely experience different ocean conditions and selective pressures. In the Alaska Coastal Downwelling province, large amounts of precipitation and runoff from melting glaciers along the mountainous Alaskan coast provide the majority of freshwater input. In summer and fall, when runoff is at a maximum, waters in the fjord-like coastline and in this area are usually highly stratified in both temperature and salinity. Following the spring phytoplankton bloom, stratification in the top layers of the water column limits nutrient availability and leads to subsequent nutrient depletion. Occasional wind events lead to temporary local upwelling of nutrients and subsequent phytoplankton blooms. In general, water temperatures are lower in this province than the more southerly California Current Province.

In the California Current Province, seasonal wind driven upwelling is a dominate feature of this province. This process carries nutrients onshore where they are upwelled along the coast, leading to high primary production that lasts through much of the spring and summer. Nearshore upwelling also results in higher salinities and lower temperatures compared to offshore locations.

These two provinces are also characterized by distinct plankton communities: a boreal community in the Alaska Downwelling Province and a temperate community in the California Current Province. Food availability for eulachon differs in type and seasonal availability between provinces. It is likely that food availability highly influences eulachon behaviors such as seasonal movements.

### Genetics

The analysis of the geographical distribution of genetic variation is a powerful method for identifying discrete populations. In addition, such analysis can sometimes be used to estimate historical dispersals, equilibrium levels of migration (gene flow), and past isolation. Commonly used molecular genetic markers include protein variants (allozymes), microsatellite loci (variable numbers of short tandem repeats in nuclear DNA), and mitochondrial DNA (mtDNA).

The BRT reviewed three published genetic studies to consider evidence of population structure in eulachon. One of these studies (McLean *et al.*, 1999) used restriction fragment length polymorphism analysis to examine variation in mtDNA. Mitochondrial DNA studies are generally most useful for detecting deep divergence patterns of population structure, and may not be very powerful for detecting structure among closely related populations. The other studies (McLean and Taylor, 2001; Kaukinen *et al.*, 2004; Beacham *et al.*, 2005) analyzed microsatellite loci. Microsatellite DNA markers can potentially detect population structure on finer spatial and temporal scales than can other DNA or protein markers because of higher levels of polymorphism (diversity) found in microsatellite DNA (reflecting a high mutation rate).

McLean *et al.* (1999) examined mtDNA variation in 285 eulachon samples collected at 11 freshwater sites ranging from the Columbia River to Cook Inlet, Alaska, and also from 29 ocean-caught fish captured in the Bering Sea. They concluded that, overall, there was little genetic differentiation among eulachon collected from distinct freshwater locations throughout the eulachon range. The pattern of eulachon mtDNA variation does not indicate the existence of any highly divergent populations and is consistent with the hypothesis that eulachon dispersed from a single glacial formation and retreat event. However, McLean *et al.* (1999) did note an association of geographic distance with genetic differentiation among eulachon populations, and suggested this represented an emerging population subdivision throughout the range of the species.

In a later study, McLean and Taylor (2001) used five microsatellite loci to examine variation in the same set of populations as McLean *et al.* (1999). The populations in the Columbia and Cowlitz rivers were represented by 2 years of samples with a total sample size of 60 fish from each river. However, several populations were represented by very few samples, including just five fish from the three rivers in Gardner Canal and just 10 fish from the Fraser River. Results from a hierarchical analysis of molecular variance test were similar to those of the McLean *et al.* (1999) mtDNA study, with 0.85 percent of variation occurring among large regions and 3.75 percent among populations within regions. In contrast to the mtDNA analysis however, genetic distances among populations using these five microsatellite loci were not correlated with geographic distances. Overall, McLean and Taylor (2001) concluded that their microsatellite DNA results were mostly consistent with the mtDNA findings of McLean *et al.* (1999) and that both studies indicated that eulachon have some degree of population structure.

The most extensive genetic study of eulachon, in terms of sample size and number of loci examined, is that of Beacham *et al.* (2005). Beacham *et al.* (2005) examined microsatellite DNA variation in eulachon collected at 9 sites ranging from the Columbia River to Cook Inlet, Alaska, using the 14 loci developed in an earlier study by Kaukinen *et al.* (2004). Sample sizes per site ranged from 74 fish from the Columbia River to 421 from the Fraser River. Samples collected in multiple years were analyzed from populations in the Bella Coola and Kemano rivers (2 years of sampling) and also in the Nass River (3 years of sampling). Beacham *et al.* (2005) observed much greater microsatellite DNA diversity within populations than that reported by McLean and Taylor (2001), and all loci were highly polymorphic in all of the sampled populations. Significant genetic differentiation was observed among all comparisons of the nine populations in the study. A cluster analysis of genetic distances showed genetic affinities among the populations in the Fraser, Columbia, and Cowlitz rivers and also among the Kemano, Klinaklini, and Bella Coola rivers along the central British Columbia coast. In particular, there was evidence of a genetic discontinuity north of the Fraser River, with Fraser and Columbia/Cowlitz samples being approximately 3–6 times more divergent from samples further to the north than they were to each other. Similar to the mtDNA study of McLean *et al.* (1999), the authors also found that genetic differentiation among populations was correlated with geographic distances.

Beacham *et al.* (2005) found stronger evidence of population structure than the earlier genetic studies, and concluded that their results indicated that management of eulachon would be appropriately based at the level of the river drainage. In particular, the microsatellite DNA analysis showed that populations of eulachon in different rivers are genetically differentiated from each other at statistically significant levels. The authors suggested that the pattern of eulachon differentiation was similar to that typically found in marine fish, which is less than that observed in most salmon species.

Although Beacham *et al.* (2005) found clear evidence of genetic structure among eulachon populations, the authors also noted that important questions remained unresolved. The most important one in terms of identifying DPSs for eulachon is the relationship between temporal and geographic patterns of genetic variation. In particular, Beacham *et al.* (2005) found that year-to-year genetic variation within three British Columbia coastal river systems was similar to the level of variation among the rivers, which suggests that patterns among rivers may not be temporally stable. However, in the comparisons involving the Columbia River samples, the variation between the Columbia samples and one north-of-Fraser sample from the same year was approximately 5 times greater than a comparison within the Columbia from 2 different years.

When all genetic studies are considered, the BRT found modest genetic structure within eulachon, with the most obvious genetic break appearing to occur in southern British Columbia north of the Fraser River. This break indicates a degree of reproductive isolation between northern and southern populations, suggesting the two population segments are discrete.

*DPS Conclusions of the BRT*

Based on the foregoing, the BRT identified six possible DPS configurations or scenarios that could include eulachon that spawn in Washington, Oregon, and California rivers (i.e., the petitioned region). The geographic boundaries of possible DPSs considered in this evaluation were: (1) the entire biological species is the ''ESA species'' (i.e., there is no DPS structure within the species); (2) a DPS boundary near the Yakutat Forelands in Alaska such that eulachon in Southeast Alaska through Northern California consist of one DPS and eulachon further north and west consist of one or more additional DPS(s); (3) a DPS boundary just south of the Nass River/Dixon Entrance in British Columbia such that eulachon from south of the Nass River through Northern California consist of one DPS and eulachon from the Nass River and further north and west consist of one or more additional DPS(s); (4) a DPS boundary north of the Fraser River such that eulachon from the Fraser River through Northern California consist of one DPS and eulachon from the Fraser River and further north and west consist of one or more additional DPS(s); (5) a DPS boundary south of the Fraser River such that eulachon south of the US-Canada border consist of one DPS and eulachon from the Fraser River and further north and west consist of one or more additional DPS(s); (6) multiple DPSs of eulachon in Washington, Oregon and California and one or more additional DPSs throughout the remainder of the species' range.

Because of the paucity of quantitative population data, the BRT used structured decision making to guide its determination of DPS structure and boundaries. To allow for expressions of the level of uncertainty in identifying the boundaries of a discrete eulachon population, the BRT adopted a ''likelihood point'' method, often referred to as the ''FEMAT'' method because it is a variation of a method used by scientific teams evaluating management options under the Northwest Forest Plan (Forest Ecosystem Management and Assessment Team, 1993). In this approach, each BRT member distributed 10 ''likelihood points'' amongst these six DPS scenarios. This approach has been widely used by NMFS BRTs in previous DPS determinations (e.g., Pacific Salmon, Southern Resident Killer Whale). The BRT did not attempt to divide the entire species into DPSs, but rather focused on evaluating whether a DPS could be identified that contains eulachon that spawn in Washington, Oregon, and California, as discussed in the listing petition.

Scenario 1 (no DPS structure) received about 12 percent of the total likelihood points. Scenarios 2 (one DPS inclusive of eulachon in Southeast Alaska to Northern California) and 5 (one DPS south of the Fraser River) received no support by the BRT. There was also very little BRT support for multiple DPSs of eulachon in the conterminous United States; only 4 percent of the likelihood points were placed in scenario 6. All remaining likelihood points (84 percent) were distributed among scenarios supporting a DPS at a level larger than the petitioned unit of Washington, Oregon, and California but smaller than the entire biological species. Scenario 3 (one DPS south of the Nass River/Dixon Entrance) received over 57 percent of the total likelihood points. Scenario 4 (one DPS inclusive of eulachon in the Fraser River through California) received significant support with over 27 percent of all points placed in this scenario.

After reviewing these results, it was the majority opinion of the BRT that eulachon from Washington, Oregon, and California are not discrete from eulachon north of the U.S.-Canada boundary (as petitioned), but that eulachon south of the Nass River are discrete from eulachon in the Nass River and northward (Figure 1). This opinion is based on the evidence indicating that eulachon occurring in this area are discrete from eulachon occurring north of this area based on differences in spawning temperatures; length- and weight-at-maturity; ecological features of both the oceanic and freshwater environments occupied by eulachon; and the genetic results (particularly of Beacham *et al.* 2005).

This BRT determined the discrete population segment is significant to the species as a whole because it constitutes over half of the geographic range of the entire species' distribution and includes at least two of the major production areas (Columbia and Fraser rivers) for the entire species. Therefore, the loss of this DPS would result in a significant reduction in the species' overall distribution.

During the status review, the BRT did not evaluate potential DPS structure of eulachon populations occurring north of the Nass River. The BRT found, however, that northern populations are discrete from southern populations. We conclude that this discrete northern population segment (from the Nass River (inclusive) to Bristol Bay, Alaska) would also be significant to the taxon because it comprises a substantial portion of the range of the species and because the Alaska Downwelling Coastal Province (described above) represents a unique ecological setting for the taxon. We have not considered whether this northern population segment of eulachon might be further subdivided into more than one DPS. We refer to the DPS south of the Nass River as the southern DPS.

## Extinction Risk Assessment

### *Information Reviewed*

The BRT considered several types of information while evaluating the status of the southern DPS of eulachon. The available data types and their respective strengths and weaknesses are discussed in detail in the draft status report. Fishery-independent scientific assessments of the total number or biomass of spawning eulachon were only available for the Fraser River and from several other British Columbia rivers. In some areas, the only data available on eulachon abundance are derived from commercial or subsistence fisheries landings. Commercial landings were available from the Klamath, Columbia, Umpqua, Fraser, Kitimat, and Skeena rivers. Data from Canadian First Nations subsistence fisheries landings were available for the Fraser River and several other British Columbia coastal rivers. Recreational fisheries for eulachon have been poorly documented, even though the recreational catch may have been equal to the commercial catch on many rivers with eulachon runs. Some data are available for Fraser River recreational catches and the BRT considered this information. The BRT recognized that inferring population status from commercial, subsistence, or recreational fishery data can be problematic and considered this when drawing conclusions from fishery-dependant data.

Numerous ethnographic studies emphasize the nutritional and cultural importance of eulachon to coastal Indian tribes and First Nations. The BRT examined ethnographic sources that describe historical distributions and relative abundance of eulachon fisheries within the boundaries of the DPS. Many of the statements in these sources as to the historical distribution and abundance of eulachon consisted of traditional ecological knowledge or were anecdotal in nature. The BRT also examined a variety of both primary anecdotal sources (e.g., accounts of early explorers, surveyors, fur trappers, and settlers; and newspaper articles) and secondary anecdotal sources (e.g., agency fisheries reports and journal articles that cite personal communications) that describe historical distributions and relative abundance of eulachon within the boundaries of the DPS.

### Absolute Numbers

The absolute number of individuals in a population is important in assessing two aspects of extinction risk. For small populations that are stable or increasing, population size can be an indicator of whether the population can sustain itself into the future in the face of environmental fluctuations and small-population stochasticity. In addition to total numbers, the spatial and temporal distribution of adults is important in assessing risk to a species or DPS. At a minimum, adults need to be in the same place at the same time for reproduction to occur.

Several aspects of eulachon biology indicate that large aggregations of adult eulachon are necessary for maintenance of normal reproductive output. Eulachon are a short-lived, high-fecundity, high-mortality forage fish, and such species typically have large population sizes. Research from other marine fishes (Sadovy, 2001) suggests that there is likely a biological requirement for a critical threshold density of eulachon during spawning to ensure adequate synchronization of spawning, mate choice, gonadal sterol levels, and fertilization success. Since eulachon sperm may remain viable for only a short time, perhaps only minutes, sexes must synchronize spawning activities closely, unlike other fish such as Pacific herring (Hay and McCarter, 2000; Willson *et al.*, 2006). In most samples of spawning eulachon, males greatly outnumber females (although many factors may contribute to these observations) (Willson *et al.* 2006), and in some instances congregations of males have been observed simultaneously spawning upstream of females that laid eggs as milt drifted downstream (Langer *et al.*, 1977).

In addition, the genetically effective population size of eulachon may be much lower than the census size. Effective size is important because it determines the rate of inbreeding and the rate at which a population loses genetic variation. In marine species, under conditions of high fecundity and high mortality associated with pelagic larval development, local environmental conditions may lead to random "sweepstake recruitment" events where only a small minority of spawning individuals contribute to subsequent generations (Hedgecock, 1994), and this effect appears to be more pronounced in larger populations (Hauser and Carvalho, 2008).

### Historical Abundance and Carrying Capacity

Knowing the relationship of present abundance to present carrying capacity is important for evaluating the health of populations; but the fact that a population is near its current carrying capacity does not necessarily signify full health. A population near carrying capacity implies that short-term management may not be able to increase fish abundance.

The relationship of current abundance and habitat capacity to historical levels is another important consideration in evaluating risk. Knowledge of historical population conditions provides a perspective for understanding the conditions under which present populations evolved. Historical abundance also provides the basis for scaling long-term trends in populations. Comparison of present and past habitat capacity can also indicate long-term population trends and problems of population fragmentation. For eulachon, current and historical abundance data and information was available in the form of spawner biomass and/or total spawner counts, offshore juvenile eulachon biomass estimates, mean eulachon larval density, catch-per-unit-effort, commercial/recreational/subsistence fisheries landings, ethnographic studies, and anecdotal qualitative information.

Trends in Abundance

Short- and long-term trends in abundance are a primary indicator of risk. Trends may be calculated from a variety of quantitative data, which are discussed in detail in specific sections below. Interpretation of trends in terms of population sustainability is difficult for a variety of reasons: First, eulachon are harvested in fisheries, and shifting harvest goals or market conditions directly affect trends in spawning abundance and catch. Second, environmental fluctuations on short timescales affect trend estimates, especially for shorter trends and relatively short-lived species like eulachon.

Recent Events

A variety of factors, both natural and human-induced, affect the degree of risk facing eulachon populations. Because of time lags in these effects and variability in populations, recent changes in any of these factors may affect current risk without any apparent change in available population statistics. Thus, consideration of these effects must go beyond examination of recent abundance and trends. Yet forecasting future effects is rarely straightforward and usually involves qualitative evaluations based on informed professional judgment. Events affecting populations may include natural changes in the environment or human-induced changes, either beneficial or detrimental.

It is generally accepted that important shifts in ocean-atmosphere conditions occurred about 1977 and again in 1998 that affected North Pacific marine ecosystems. Several studies have described decadal-scale oscillations in North Pacific climatic and oceanic conditions (Mantua and Hare, 2002). These changes have been associated with recruitment patterns of several groundfish species and Pacific herring (McFarlane *et al.*, 2000). Increases in eulachon in the Columbia, Fraser, and Klinaklini rivers in 2001–2002 may be largely a result of the more favorable ocean conditions for eulachon survival during the transition from larvae to juvenile when these broods entered the ocean in 1998–2000.

At this time, we do not know whether recent shifts in climate/ocean conditions represent a long-term shift in conditions that will continue affecting populations into the future or short-term environmental fluctuations that can be expected to be reversed in the near future. Although recent conditions appear to be within the range of historic conditions under which eulachon populations have evolved, the risks associated with poor climate conditions may be exacerbated by human influence on these populations (Lawson, 1993).

*Distribution and Abundance*

Historically important spawning areas for eulachon south of the Nass River include the Klamath, Columbia, and Fraser Rivers, and numerous coastal rivers in British Columbia (Willson *et al.* 2006).

Klamath and other Northern California Rivers

There has been no long-term monitoring program targeting eulachon in California, making the assessment of historical abundance and abundance trends difficult (Gustafson *et al.*, 2008). Ethnographic studies, pioneer diaries, interviews with local fishers, personal observations and communications from managers, and newspaper accounts are therefore the best scientific and commercial information available that provide documentation of eulachon occurrence in the Klamath River and other rivers on the Northern California coast.

Hubbs (1925) and Schultz and DeLacy (1935), leading ichthyologists of their day, described the Klamath River in Northern California as the southern limit of the range of eulachon. More recent compilations state that large spawning aggregations of eulachon were reported to have once regularly occurred in the Klamath River (Fry 1979, Moyle *et al.*, 1995; Larson and Belchik 1998; Moyle 2002; Hamilton *et al.*, 2005) and on occasion in the Mad River (Moyle *et al.*, 1995; Moyle 2002) and Redwood Creek (Redwood Creek is located south of the Klamath River near the town of Orick, California) (Moyle *et al.*, 1995). In addition, Moyle *et al.* (1995) and Moyle (2002) stated that small numbers of eulachon have been reported from the Smith River (the Smith River is located just south of the Oregon/California border). California Department of Fish and Game's ''Status Report on Living Marine Resources'' document (Sweetnam *et al.*, 2001) stated that ''The principal spawning run [of eulachon] in California is in the Klamath River, but runs have also been recorded in the Mad and Smith Rivers and Redwood Creek.''

Eulachon have been occasionally reported from other freshwater streams of California. Jennings (1996) reported observations of adult eulachon in creeks tributary to Humboldt Bay, California in May of 1977. Although Minckley *et al.* (1986) indicate that eulachon were native to the Sacramento River and drainages within the south California Coastal to Baja California region, no verifying references or actual observations for these assertions were given. Recently, Vincik and Titus (2007) reported on the capture of a single mature male eulachon in a screw trap at RM 142 on the Sacramento River.

The California Academy of Sciences (CAS) ichthyology collection database lists eulachon specimens collected from the Klamath River in February 1916 and March 1947 and 1963, and in Redwood Creek in February 1955 (see CAS online collections database at *http://research.calacademy.org/research/Ichthyology/collection/index.asp*). A search of available online digital newspaper resources revealed an early account of eulachon in the Klamath River in a newspaper account in 1879 and runs large enough to be noted in local newspaper accounts occurred in the Klamath River in February 1919, March 1968, and April 1963 and 1969; in Redwood Creek in April 1963 and 1967; and in the Mad River in April 1963 (see draft BRT report Appendix B). An early memoir by a traveler surveying timber resources on the Klamath River reported eulachon being harvested (15–20 pounds in a single dipnet haul) by Yurok tribal members in the early 1890s (Pearsall, 1928).

Eulachon were of great cultural and subsistence importance to the Yurok Tribe on the Lower Klamath River (Trihey and Associates, 1996) and the Yurok People consider eulachon to be a Tribal Trust Species (Trihey and Associates, 1996; Larson and Belchik, 1998). Eulachon once supported popular recreational fisheries in Northern California rivers, but were never commercially important in California. The only reported commercial catch of eulachon in Northern California occurred in 1963 when a combined total of 25 metric tons (56,000 lbs) was landed from the Klamath River, the Mad River, and Redwood Creek (Odemar, 1964). Larson and Belchik (1998), report that eulachon have not been of commercial importance in the Klamath and are totally unstudied as to their run strengths.

Larson and Belchik (1998) also reported that according to accounts of Yurok Tribal elders, the last noticeable runs of eulachon were observed in the Klamath River in 1988 and 1989 by Tribal fishers. Most fishers interviewed perceived a decline in the mid to late 1970s, while about a fifth thought it was in the 1980s. A minority of those interviewed noticed declines in the 1950s and 1960s. Larson and Belchik (1998) further stated that ''in December 1988 and May 1989, a total of 44 eulachon were identified in outmigrant salmonid seining operations in and above the Klamath River estuary (CDFG unpublished seining data)'' and that only a single eulachon specimen (in 1996) was positively identified between 1991 and 1998 on the Klamath River. As detailed in Larson and Belchik (1998), the Yurok Tribal Fisheries Program spent over 119 hours of staff time from 5 February to 6 May 1996 sampling for eulachon in the lower Klamath River at five different sites, where eulachon had been noted in the past, without encountering a single eulachon. However, one eulachon was captured by a Yurok Tribal member near the mouth of the Klamath River in 1996 (Larson and Belchik, 1998). Sweetnam *et al.* (2001) stated that ''In recent years, eulachon numbers seem to have declined drastically; so they are now rare or absent from the Mad River and Redwood Creek and scarce in the Klamath River.'' They also stated that, ''the eulachon and its fishery have been largely ignored in the past'' in California. Sweetnam *et al.*, 2001 suggest the perceived lack of eulachon in the Klamath River, currently and in the recent past, represents a low point in a natural cycle, though they also admit that the declines may be due to human activities. In January 2007, six eulachon were reportedly caught by tribal fishermen on the Klamath River (Dave Hillemeier, Yurok Tribe, pers. comm.).

The BRT discussed several possible interpretations of the available information. In particular, the BRT discussed the possibility that, historically, runs of eulachon in the Klamath River were episodic and perhaps only occasionally large enough to be noticed. This interpretation, however, is inconsistent with the numerous anecdotal but independent reports of regular large runs. The BRT also considered the possibility that eulachon still occur in low but viable numbers in Northern California rivers but are not frequently observed because of the absence of a formal monitoring program, or that some eulachon may spawn in estuarine environments and are therefore not observed in the riverine environment. These interpretations are inconsistent with the following facts: state and tribal biologists are monitoring rivers where eulachon were historically reported but are not regularly finding eulachon; sizable spawning runs of eulachon attract large numbers of predators, which are readily observable and were historically well-reported (see above); and eulachon are not known to spawn in estuaries in large numbers.

After considering these possible interpretations of the available information, the BRT concluded that the explanation most consistent with the evidence is that Klamath River eulachon runs used to be regular and large enough to be readily noticeable and now are intermittent, small, and sporadic. In particular, various accounts written by California Department of Fish and Game personnel (Fry, 1979; Sweetnam *et al.*, 2001; CDFG, 2008), Yurok Tribal Fisheries Department personnel (Larson and Belchik, 1998), the National Resource Council's Committee on Endangered and Threatened Fishes in the Klamath River Basin (NRC, 2004), and available academic literature (Moyle *et al.*, 1995; Moyle, 2002; Hamilton *et al.*, 2005) describe accounts of the past occurrence of eulachon in the Klamath River and their subsequent decline. Based on the available information, the BRT was unable to estimate the historical abundance of eulachon in northern California, but found no reason to discount the veracity of these anecdotal sources, which span a period of approximately 100 years and are consistent in their description of noticeable runs of eulachon having once ascended the Klamath River.

Likewise, although the BRT was concerned about the absence of a contemporary monitoring program for eulachon, the available information strongly indicated that noticeable runs of eulachon are not currently spawning in Klamath River or other northern California rivers. In particular, the BRT thought it likely that if eulachon were returning in any substantial numbers it would be reported by local residents or those engaged in recreation, research, or management on rivers in Northern California. The BRT noted that large eulachon runs tend to attract the attention of fishers, and the previous runs on the Klamath River were readily noticeable (e.g., ''the fish moved up in huge swarms, followed by large flocks of feeding seabirds'' (Moyle, 2002)). The BRT therefore concluded that the available information was most reasonably interpreted as indicating that noticeable, regularly returning runs of eulachon used to be present in the Klamath River, but have been rare or sporadic for a period of several decades.

Although the BRT was reasonably confident that eulachon have declined substantially in Northern California, it is also clear that they have not been totally absent from this area in recent years. In particular, recent reports from Yurok Tribal fisheries biologists of a few eulachon being caught incidentally in other fisheries on the Klamath in 2007 indicates eulachon still enter the Klamath River on occasion in low numbers. We agree that the BRT's conclusions regarding eulachon presence and declines in the Klamath and other Northern California rivers are the most persuasive interpretation of the best available scientific and commercial information.

Columbia River

The Columbia River and its tributaries support the largest known eulachon run. Although direct estimates of adult spawning stock abundance are unavailable, records of commercial fishery landings begin in 1888 and continue as a nearly uninterrupted data set to the present time (Gustafson *et al.*, 2008). A large recreational dipnet fishery for which catch records are not maintained has taken place during the same time as the commercial fishery (WDFW and ODFW, 2001).

Although commercial eulachon landings do not provide a quantitative measure of spawning stock abundance, since they can be driven by market and environmental conditions as well as population abundance, the WDFW and ODFW Joint Columbia River Management Staff (JCRMS, 2007) has concluded that ''they do provide a useful measure of the relative annual run strength.'' In particular, State fisheries managers of Columbia River eulachon use commercial landings to judge whether population trends are upward, neutral, or downward (JCRMS, 2007). In their report, the BRT agreed with this use of commercial landings data.

The Columbia River, estimated to have historically represented fully half of the taxon's abundance, experienced a sudden decline in its commercial eulachon fishery landings in 1993–1994 (ODFW and WDFW, 2001; JCRMS, 2007). Commercial catch levels were consistently high (usually greater than 500 metric tons and often greater than 1,000 metric tons) for the three quarters of a century from about 1915 to 1992. In 1993, the catches declined greatly to 233 metric tons and declined further to an average of less than 40 metric tons between 1994 and 2000. From 2001 to 2004, the catches increased to an average of 266 metric tons, before falling to an average of less than 5 metric tons from 2005 to 2008 (JCRMS, 2007). Some of this pattern is due to fishery restrictions, which were in turn put in place due to sharp declines in apparent abundance. Persistent low returns and landings of eulachon in the Columbia River from 1993 to 2000 prompted the States of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity indicate a poor return is likely (WDFW and ODFW, 2001). The fishery has operated at the most conservative level allowed for in the Joint State Eulachon Management Plan since 2005 owing to the low level of returns during this time period (JCRMS, 2005; 2006; 2007). Based on these data and the interpretation of them described above, the BRT concluded that available catch and effort information indicate an abrupt decline in eulachon abundance in the early 1990's, with no evidence that the population has returned to its former level since then.

Fraser River

As in the Columbia River, a long-term data set for commercial landings dating back into the 1880s exists for the Fraser River in British Columbia. Between 1941 and 1996 commercial landings averaged about 83 metric tons, but ranged as high as 421 metric tons (Hay and McCarter, 2000). For much of this period the commercial fishery landings are not a good indicator of relative abundance, since landings were largely driven by market demand (Moody, 2008). Following a similar pattern to that of the Columbia River, eulachon abundance began to decline in 1993 to the point where the fishery was closed in 1997. This closure was also partially due to what the Canadian DFO perceived to be a lack of ability to control the fishery under the existing regulations (Hay *et al.*, 2002). Since then only minor commercial landings have been allowed in only two of the last ten years (2002 and 2004) (DFO, 2006). Due to poor returns, recreational and First Nation subsistence fisheries have also been suspended on the Fraser River since 2005.

In 1996, the Canadian Department of Fisheries and Oceans (DFO) began to estimate spawning stock abundance, independent of the fishery landings, using mean egg and larval plankton density and river discharge rates (gathered throughout a seven week outmigrant period at five locations) in combination with known relative fecundity (egg production per gram of female) and sex ratio. Over the three-generation time of approximately 10 years, the overall biomass of the Fraser River eulachon population has undergone a 92.5 percent decline (1998, 134 metric tons; 2008, 10 metric tons). The most recent population assessment of Fraser River eulachon by Fisheries and Oceans Canada (DFO, 2007) stated that ''despite limited directed fisheries in recent years, the Fraser River eulachon population remains at a precariously low level and has failed to recover from its collapse.'' Subsequent to this statement, spawner biomass for the 2008 eulachon run in the Fraser River was estimated at 10 metric tons (see draft BRT report citing data at *http://www-sci.pac.dfo-mpo.gc.ca/herring/herspawn/pages/river1__e.htm*), which equates to a maximum escapement of approximately 300,000 fish.

Coastal British Columbia Rivers

Other coastal rivers and inlets in British Columbia south of the Nass River with historically consistent eulachon runs include rivers in Knight (Klinaklini River), Kingcome (Kingcome River), and Rivers (Wannock, Chuckwalla, and Kilbella rivers) inlets; rivers flowing into Dean (Bella Coola, Dean, and Kimsquit rivers) and Douglas (Kitimat and Kildala rivers) channels; rivers flowing into Gardner Canal (Kemano, Kowesas, and Kitlope rivers); and the Skeena River (Hay and McCarter, 2000; Willson *et al.*, 2006). Spawner biomass (pounds or metric tons) and/or total spawner counts (numbers of adult fish) are available for the Klinaklini River (1995), Kingcome River (1997), Wannock/Kilbella rivers (2005–2006), Bella-Coola River (2001–2004), Kitimat River (1993–1996, 1998–2005), and Skeena River (1997). Many of these coastal rivers also have a long history of anecdotal reports of eulachon runs or sporadic records of First Nations' harvest. Some areas, such as the Kingcome and Knight Inlet, have spawning stock abundance estimates for a single year but no trends can be determined from these single data points. The BRT concluded that available catch records, the extensive ethnographic literature, and anecdotal information all indicate that eulachon were probably present in larger annual runs in the past and that current run sizes of eulachon appear inconsistent with the historic level of eulachon oil or ''grease'' production, which is extensively documented in the ethnographic literature (Macnair, 1971; Codere, 1990).

Hay and McCarter (2000) reported that annual runs of eulachon return on a regular basis to the Wannock, Chuckwalla, and Kilbella rivers in Rivers Inlet on the Central Coast of British Columbia. The spawning stock biomass of eulachon in Rivers Inlet was estimated using scientific survey methods in 2005 and 2006. In 2005, an estimated 2,700 adults returned to the Wannock River, based on the capture of only eleven adults during spawner abundance surveys (Burrows, 2005 as cited in Moody, 2008). An additional three adult eulachon were taken on the Kilbella River in 2005 (Burrows, 2005, as cited in Moody, 2008). Moody (2008) stated that this adult spawner survey was repeated in 2006 and although no adults were captured, an estimated 23,000 adult spawners returned. Some limited information is available for First Nation harvest in the 1960s and 1970s; Moody (2008) reported that catches were 1.81, 2.27, and 4.54 metric tons, in 1967, 1968, and 1971, respectively. The BRT determined that available recent estimates of spawning stock abundance, catch records, ethnographic literature (Hilton, 1990), and anecdotal information indicate that Rivers Inlet eulachon were present in larger annual runs in the past.

The Bella Coola, Dean, and Kimsquit rivers in Dean Channel support regular eulachon runs (Hay and McCarter, 2000). Moody (2007) reports relative abundance estimates, based on egg and larval surveys similar to those used on the Fraser River, for the Bella Coola River in 2001 (0.039 metric tons), 2002 (0045–0.050 metric tons), 2003 (.016 metric tons), and 2004 (0.0072 metric tons). Nuxalk First Nation subsistence fishery landings of eulachon from the Bella Coola River show an average catch of 18 metric tons between 1948 and 1984, with a low of 0.3 metric tons in 1960 and a high of nearly 70 metric tons in 1954, based on data available in Hay (2002). These data suggest that recent (2001–2004) spawner biomass in Bella Coola River is approximately two orders of magnitude less than the average First Nations eulachon landings were between 1948 and 1984. According to Moody (2007), it has been nine years since the last First Nations fishery occurred on the Bella Coola River.

The BRT concluded that that available spawning stock biomass data collected since 2001, catch records, extensive ethnographic literature, and anecdotal information indicates that Bella Coola River and Dean Channel eulachon in general were present in much larger annual runs in the past. In addition, the present run sizes of eulachon appear inconsistent with the historic level of grease production that is extensively documented in the ethnographic literature on the Nuxalk First Nations Peoples (Kennedy and Bouchard, 1990; Moody, 2008).

The Kitimat and Kildala rivers in Douglas Channel support regular eulachon runs (Hay and McCarter, 2000). Spawning stock biomass of eulachon in the Kitimat River was estimated using scientific survey methods in 1993 and First Nations fisheries landings are available for

1969–1972. Between 1969 and 1972, First Nations fisheries landings of eulachon ranged from 27.2 to 81.6 metric tons (Moody, 2008). The First Nations eulachon fishery reportedly came to an end in 1972 as pollution by industrial (pulp mill) and municipal effluent discharges made the eulachon unpalatable (Pederson *et al.*, 1995; Moody, 2008). Pederson *et al.* (1995) estimated a total spawning biomass in the Kitimat River of 22.6 metric tons or about 514,000 individual eulachon in 1993. According to Moody (2008), catch-per-unit-effort of eulachon on the Kitimat River, as presented in EcoMetrix (2006), declined from 50–60 fish per 24 hour gill net set in 1994–1996 to less than 2 eulachon per gill net set since 1998. According to EcoMetrix (2006, as cited in Moody, 2008), abundance of eulachon from 1994 to 1996 ranged between 527,000 and 440,000 individual spawners, and from 1998 to 2005 ranged between 13,600 and less than 1,000. Based on anecdotal information, Moody (2008) stated that the last strong run returned to the Kitimat River in 1991 and runs from 1992–1996 were estimated at half the size of 1991. The BRT concluded that given this information, Kitimat River, and Douglas Channel eulachon in general, were present in larger annual runs in the past and that present run size estimates of eulachon appear inconsistent with the historic level of grease production extensively documented in the ethnographic literature (Hamori-Torok, 1990).

The Kemano, Kowesas, and Kitlope rivers in Gardner Canal support regular runs of eulachon with the Kemano River being the primary production area. First Nations fisheries landings on the Kemano River are available for 1969–1973 and 1988–2007 (Moody, 2008). Rio Tinto Alcan operates a hydroelectric generation facility on the Kemano River and, as part of an environmental management plan, has funded monitoring of eulachon since 1988 (Lewis *et al.*, 2002). From 1988 to 1998, landings ranged from 20.6 to 93.0 metric tons (average of 57 metric tons)(Lewis *et al.*, 2002; Moody, 2008). However, according to Moody (2008), no run occurred in 1999. First Nations landings in the Kemano River were low from 2000 to 2002, but improved to between 60 and 80 metric tons in 2003 and 2004 (ALCAN, 2005; Moody, 2008); however, anecdotal information indicate that eulachon returns were not detected in the Kemano River in either 2005 or 2006 (ALCAN, 2006, 2007; EcoMetrix, 2006, as cited in Moody, 2008). Catch-per-unit-effort data showed similar trends to the First Nation fishery landings, with a sharp drop from about 2.5 metric tons per set in 1998 to less than 0.5 metric tons per set from 1999–2002, a rebound to between 0.5 and 1 metric tons per set in 2003–2004, and no fish caught in 2005–2007 (Lewis *et al.*, 2002; Moody, 2008)

The BRT concluded that available catch-per-unit-effort data collected since 1988, First Nations catch records, extensive ethnographic literature, and anecdotal information indicates that Kemano River, and Gardner Canal eulachon in general, were present in larger annual runs in the past and that present run sizes of eulachon appear inconsistent with the historic level of grease production that is well documented for this region in the ethnographic literature (Hamori-Torok, 1990).

The Skeena River and its tributaries have supported eulachon runs (Moody, 2008), but they reportedly were small, of short duration, and difficult to harvest because of the large size of the mainstem Skeena River (Stoffels, 2001; Moody, 2008). Lewis (1997) estimated the total spawning stock abundance of the Skeena River eulachon at only 3.0 metric tons in 1997. A small commercial eulachon fishery operated between 1924 and 1946 (landings ranged from 15.4 metric tons in 1924 to 0.9 metric tons in 1935) (Moody, 2008). However, total landings records (both commercial and subsistence) were as high as 100 metric tons at one time and averaged 27.5 metric tons from 1900–1941 (Canada Department of Marine and Fisheries, Annual Report, Fisheries (1900–1916); and Statistics Canada, Fisheries Statistics of Canada (1917–1941)). It is likely that demands of the local market have driven subsistence and past commercial fisheries statistics on the Skeena River, thus the BRT did not believe these data were a good index of abundance. Moody (2008) reported anecdotal information indicating that very few Skeena River eulachon were observed between 1997 and 1999, a good run occurred in 2005, and virtually no eulachon were observed in 2006 (Moody, 2008). Although unable to draw strong conclusions, the BRT concluded that available catch records and anecdotal information indicate that Skeena River eulachon were present in larger annual runs in the past that at one time supported a fishery. Although the current status of this population is unknown, the BRT concluded that anecdotal information indicates declines in abundance have occurred.

### *Demographic Risk Summary*

Eulachon in the southern DPS were assessed according to the four viability criteria of abundance, productivity, diversity, and spatial structure (including connectivity). These four parameters are universal indicators of species' viability, and individually and collectively function as reasonable predictors of extinction risk (McElhany *et al.*, 2000) that have been used extensively in extinction risk analysis for endangered species.

#### Abundance

The BRT was concerned that although eulachon are a relatively poorly monitored species, almost all of the available information indicates that the southern DPS of eulachon has experienced an abrupt decline in abundance throughout its range. The BRT was particularly concerned that two large spawning populations, in the Columbia and Fraser Rivers, have both declined to what appear to be historically low levels. The BRT was also concerned that there is very little monitoring data available for Northern California eulachon, but determined that the available information suggests that eulachon in Northern California experienced an abrupt decline several decades ago. The BRT was concerned that recent attempts to estimate actual spawner abundance in some rivers in B.C. that are known to have supported significant First Nations fisheries in the past have resulted in very low estimates of spawning stock.

In addition, the BRT was concerned that the current abundance of the many individual populations within the DPS may be sufficiently low to be an additional risk factor, even for populations (such as the Columbia and Fraser) where the absolute population size seems large compared to many other at-risk fish populations. Of relevance to this issue are recent reviews of extinction risk in marine fishes illustrating that forage fish are not immune to risk of extirpation at the population scale (Dulvy *et al.*, 2003; Reynolds *et al.*, 2005). Hutchings (2000; 2001a; 2001b) and others (Dulvy *et al.*, 2003; Mace and Hudson, 1999; Hutchings and Reynolds, 2004) cite empirical analyses indicating that marine fishes likely have similar extinction probabilities to those of non-marine taxa. In evaluating this issue, the BRT concluded that eulachon (and other similar forage fishes) (see Dulvy *et al.*, 2004) may be at significant risk at population sizes that are a fraction of their historical levels but are still large compared to what would be considered normal for other ESA listed species. The BRT believe that high eulachon minimum viable population sizes are necessary to: (1) ensure a critical threshold density of adult eulachon are available during breeding events for maintenance of normal reproductive processes, (2) produce enough offspring to counteract high in-river egg and larval mortality and planktonic larval mortality in the ocean, and (3) produce enough offspring to buffer against the variability of local environmental conditions which may lead to random ''sweepstake recruitment'' events where only a small minority of spawning individuals contribute to subsequent generations. In species with a life history pattern like eulachon, the genetically effective population size can be several orders of magnitude lower than the census size (Hedgecock, 1994; ICES, 2004). Based on the best available information summarized above, the minimum viable census sizes for spawning populations may therefore be on the order of 50,000 to 500,000 (Dulvy *et al.*, 2004). The BRT was concerned that in a number of sub-areas of the DPS (Klamath, Fraser River, Bella Coola River, Rivers Inlet, etc.) population sizes of eulachon are below what would be considered minimum viable population sizes for highly fecund, broadcast-spawning species.

Productivity

The BRT noted that variable year-class strength in marine fishes with pelagic larvae is dependent on survival of larvae prior to recruitment and is driven by match-mismatch of larvae and their planktonic food supply (Hjort, 1914; Lasker, 1975; Sinclair and Tremblay, 1984), oceanographic transport mechanisms (Parrish *et al.*, 1981), variable environmental ocean conditions (Shepherd *et al.*, 1984; McFarlane *et al.*, 2000), and predation (Bailey and Houde, 1989). If time of spawning does not coincide with river conditions conducive to successful fertilization and egg survival, and to the appearance of larval prey species in the oceanic environment, the result would be high rates of environmentally-driven egg and larval mortality. The BRT was concerned that there is evidence that climate change is leading to relatively rapid changes in both oceanic and freshwater environmental conditions that eulachon are unable to tolerate. Eulachon are basically a cold-water species and are adapted to feed on a northern suite of copepods in the ocean during the critical transition period from larvae to juvenile and much of their recent recruitment failure may be traced to mortality during this critical period. Recent studies show a shift in the suite of copepod species available to eulachon toward a more southerly species assemblage (Mackas *et al.*, 2001; 2007; Hooff and Peterson, 2006), contributing to a mismatch between eulachon life history and prey species. It is also likely that pelagic fish with their shorter life cycles may be less resilient to long-term climatic changes than longer-lived demersal species.

The ability of the Columbia River eulachon population to respond rapidly to the good ocean conditions of the late 1999–early 2002 period illustrates the species' resiliency, which the BRT viewed as providing the species with a buffer against future environmental perturbations. The productivity potential or intrinsic rate of increase of eulachon (Musick *et al.*, 2000), as indicated by life history characteristics such as low age-at-maturity, small body size, and planktonic larvae, was recognized by the BRT as likely conferring eulachon with some resilience to extinction as they retain the ability to rapidly respond to favorable ocean conditions.

Diversity

In terms of threats related to diversity, the BRT was concerned that not only are eulachon semelparous (spawn once and die) but if recent estimates of age structure in eulachon are correct (Clarke *et al.*, 2007), then spawning adults-particularly in southern areas such as the Columbia and Fraser rivers-may be limited to a single age class, which likely increases their vulnerability to perturbations and provides less of a buffer against year-class failure than species such as herring that spawn repeatedly and have variable ages at maturity. The BRT was also concerned about the apparently very low abundance of the Klamath River sub-population, which might be expected to have unique adaptations to conditions at the southernmost extent of the range, and about the potential loss of biocomplexity in Fraser River eulachon due to contraction of spawning locations, as documented by Higgins *et al.* (1987).

The BRT noted some positive signs including observations that eulachon continue to display variation in spawn timing, age-at-maturity, and spawning locations, and a high degree of biocomplexity (i.e., many spawning locations and spawn-timing variation) in the Columbia River, which may buffer this population from freshwater environmental perturbations.

Spatial Structure

The BRT also had concerns about risks related to spatial structure and distribution. In particular, because the major spawning populations within the DPS appear to have declined substantially, the BRT was concerned that if some formerly significant populations, such as the Klamath River, become extirpated, there would be less opportunity for successful re-colonization. In addition, the apparent decline of populations in Northern California may result in contraction of the southern portion of the DPS's range. The BRT also noted that several populations that used to support significant First Nations fisheries on the British Columbia coast have declined to very low levels (e.g., Bella Coola River and Wannock River). Positive signs for spatial structure and connectivity noted by the BRT include considerations that eulachon appear to have the potential to re-colonize some areas, given their apparent ability to stray from the natal spawning area, at least within rivers sharing the same estuary. In addition, the perceived historical spatial structure of the DPS, with the possible exception of the Klamath River, remains intact.

The BRT noted several recent events that appear likely to impact eulachon. Global patterns suggest the long-term trend is for a warmer, less productive ocean regime in the California Current and the Transitional Pacific. The recent decline in abundance or relative abundance of eulachon in many systems coupled with the probable disruption of metapopulation structure may make it more difficult for eulachon to adapt to warming ocean conditions. In addition, warming conditions have allowed both Pacific hake (Phillips *et al.*, 2007) and Pacific sardine (Emmett *et al.*, 2005) to expand their distributions to the north, increasing predation on eulachon by Pacific hake, and competition for food resources with both species. However, cold ocean conditions in 2008 suggest that this may have been a good year for eulachon recruitment. The BRT concluded that the net effects of these recent positive and negative events are likely to be negative.

*BRT Extinction Risk Assessment Conclusion*

The BRT was asked to use three categories of risk to describe the species' status – ''high risk'' of extinction; ''moderate risk'' of extinction; or ''not at risk'' of extinction. To allow individuals to express uncertainty in determining the overall level of extinction risk facing the species, the BRT adopted the ''likelihood point'' method referred to previously. The BRT's scores for overall risk to the southern DPS of eulachon, throughout all of its range, were heavily weighted to ''moderate risk,'' with this category receiving 60 percent of the likelihood points. The ''high risk'' category received 32 percent of the likelihood points, and the ''not at risk'' category received 8 percent of the points.

**Summary of Factors Affecting the Southern DPS of Eulachon**

As described above, Section 4(a)(1) of the ESA and NMFS's implementing regulations (50 CFR 424) state that we must determine whether a species is endangered or threatened because of any one or a combination of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or man-made factors affecting its continued existence. According to the BRT, the primary factors responsible for the decline of the southern DPS of eulachon are the destruction, modification, or curtailment of habitat and inadequacy of existing regulatory mechanisms. The following discussion briefly summarizes the BRT's findings regarding threats to the eulachon southern DPS. More details can be found in the draft BRT report (Gustafson *et al.*, 2008). For analytical purposes, the BRT identified and ranked threats for the four primary populations of this DPS: mainland British Columbia Rivers south of the Nass River, Fraser River, Columbia River, and Klamath River.

*The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range*

The BRT identified changes in ocean conditions due to climate change as the most significant threat to eulachon and their habitats. They ranked this as the most significant threat to all of the DPS populations. Marine, estuarine, and freshwater habitat in the Pacific Northwest has been influenced by climate change over the past 50–100 years, and this change is expected to continue into the future. Average annual Northwest air temperatures have increased by approximately 1oC since 1900, or about 50 percent more than the global average warming over the same period (see ISAB, 2007 for a recent review). The latest climate models project a warming of 0.1 to 0.6oC per decade over the next century (ISAB, 2007). Analyses of temperature trends for the U.S. part of the Pacific Northwest (Mote *et al.*, 1999); the maritime portions of Oregon, Washington, and British Columbia (Mote, 2003a); and the Puget Sound-Georgia Basin region (Mote, 2003b) have shown that air temperature increased 0.8 C, 0.9 C, and 1.5 C, in these respective regions during the twentieth century. Warming in each of these areas was substantially greater than the global average of 0.6 C (Mote, 2003b). This change in surface temperature has already modified, and is likely to continue to modify, freshwater, estuarine, and marine habitats of eulachon.

Climate change is likely to have significant effects on the large river systems that are essential to eulachon production. Ferrari *et al.* (2007) predict that the Fraser River will increase in temperature over the next century in all summer months with a maximum increase in August temperatures of 0.14oC per decade. Peak flows in the Fraser River may also shift during this timeframe (Morrison *et al.*, 2002), potentially altering the timing of freshets that coincide with eulachon spawning. It is uncertain whether eulachon would adjust spawn timing to account for shifts in peak flows. In the Columbia River, climate change is likely to result in decreased snowpack, increased peak flows, decreased base flow, and increased water temperatures (ISAB, 2007). As with the Fraser River, peak flows in the Columbia and its tributaries are likely to shift, possibly decoupling eulachon spawning and spring freshets.

Climate change could cause problems for the eulachon spawning in the other areas throughout the range of this DPS. In British Columbia, many of the coastal systems that support eulachon are fed by glaciers. The size of these glaciers and other glaciers at mid-latitude areas around the world has been decreasing (Meier *et al.*, 2003; Barry, 2005). It is uncertain what effect reduction in glacier size might have on the hydrology of these systems, but in most cases a shift in peak stream flow timing would occur. Mote (2003) reports that anticipated reductions in snowpack in the Georgia Basin/Puget Sound area are likely to alter hydrologic patterns, possibly reducing peak and/or base stream flows. Again, shifting stream flow patterns may cause problems for eulachon spawning.

Changes in the marine environment due to climate change are also likely to affect eulachon. Eulachon generally inhabit cool to cold ocean waters and feed on cold water assemblages of copepods and other marine invertebrates (Willson *et al.*, 2006). The consequences for Pacific zooplankton communities of warming trends in the high to mid-latitudes could be substantial, but their magnitude and trajectory are not yet known (Mackas *et al.*, 2007). Increases in ocean temperatures off the coast of the Pacific Northwest could alter the abundance and composition of copepod communities, thus reducing the amount of food available for eulachon, particularly larvae. Zamon and Welch (2005) reported these types of rapid shifts in zooplankton communities in the Northeast Pacific during recent El Nino-La Nina events. Warming ocean conditions may also lead to a general reduction in eulachon forage. For instance, Roemmich and McGowan (1995) noted an 80 percent reduction of macrozooplankton biomass off Southern California between 1951 and 1993. Warming ocean temperatures could also facilitate the northward expansion of warm-water eulachon predators and competitors for food resources, such as Pacific hake (Rexstad and Pikitch, 1986; McFarlane *et al.*, 2000; Phillips *et al.*, 2007).

Changes in the freshwater and marine environment due to climate change are likely to cause adverse effects on eulachon abundance, productivity, spatial distribution, and diversity. There is still a great deal of uncertainty associated with predicting specific changes in timing, location, and magnitude of future climate change. It is also likely that the intensity of climate change effects on eulachon will vary by geographic area.

The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath Rivers where hydropower generation and flood control are major activities, and a low to moderate risk for eulachon in the Fraser and mainland British Columbia rivers where dams are less common. Dams can slow or block eulachon migration. Dams and water divisions alter the natural hydrograph of river systems, in many cases reducing the magnitude of spring freshets with which eulachon have evolved. Dams can also impede or alter bedload movement, changing the composition of river substrates important to spawning eulachon.

Water quality degradation is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased water temperatures, potentially altering the water temperature during eulachon spawning periods (NMFS, 2008). Numerous chemical contaminants are also present in freshwater systems where eulachon spawn, but the exact effect these compounds may have on spawning and egg development is unknown (NMFS, 2008).

The BRT identified dredging as a low to moderate threat to eulachon in the Fraser and Columbia Rivers and a low severity threat for eulachon in mainland British Columbia rivers as less dredging for commercial shipping occurs in these areas. Dredging during eulachon spawning would be particularly detrimental, as eggs associated with benthic substrates are likely to be destroyed.

*Overutilization for Commercial, Recreational, Scientific or Educational Purposes*

Commercial harvest of eulachon in the Columbia and Fraser rivers was identified as a low to moderate threat. Current harvest levels are orders of magnitude lower than historic harvest levels, and a relatively small number of vessels operate in this fishery. No significant commercial fishing for eulachon occurs in the Klamath or British Columbia rivers north of the Fraser. The BRT ranked recreational and Tribal/First Nations harvest of eulachon as a very low to low severity threat to eulachon in all four DPS populations. It is likely that these harvests have a negligible effect on population abundance.

Commercial Fisheries

In Oregon, commercial fishing for eulachon is allowed in the Pacific Ocean, Columbia River, Sandy River, and Umpqua River. In the Pacific Ocean, eulachon can be harvested year-round using any method otherwise authorized to harvest food fish in the open ocean. In the Sandy River, commercial fishing with dip nets is allowed in a small portion of the lower river downstream from the U.S. Route 30 Alternate bridge at Troutdale Oregon, year-round, 7 days a week, 24 hours a day. The last large harvest of eulachon in the Sandy River occurred in 1985 (304,500 lb (138 metric tons)), with a moderate harvest occurring in 2003 (23,000 lb (10 metric tons)) (John North, ODFW, pers. comm.). In the Umpqua River, commercial fishing for eulachon is allowed year-round and 24 hours a day with dip nets and gill nets not more than 600 ft (183 m) in length and of a mesh size no more than 2 inches (51 mm). Those areas of the Umpqua River not closed to commercial fishing for shad (upstream from approximately river mile 21 (34 km)) are open for commercial eulachon fishing. However, commercial fishing for eulachon has not occurred for many years in the Umpqua River (John North, ODFW, pers. comm.). In the mainstem Columbia River, permissible commercial gear includes gill nets with a mesh size of no more than 2 inches (51 mm), dip nets having a bag frame no more than 36 inches (91 cm) in diameter, and small trawl nets (Oregon Administrative Rule 635–004–0075). In the past several years, the Columbia River commercial fishery has been open 7 days a week in December and 2 days a week from January 1–March 31. Commercial fishing in the Columbia River is now managed according to the joint ODFW and WDFW management plan for eulachon (ODFW and WDFW, 2001). Under this plan, three eulachon harvest levels can be authorized based on the strength of the prior years' parental run, resultant juvenile production estimates, and ocean productivity indices. Current effort in the Columbia River mainstem fishery is typically low (less than 10 vessels) (John North, ODFW, pers. comm.).

In Washington, year-round commercial fishing for eulachon is allowed in the Columbia and Cowlitz rivers. In the Columbia River, commercial fishing for eulachon is permitted during 9 hour periods on Mondays and Thursdays. In the Cowlitz River, commercial fishing is allowed for 6 hour periods on Sunday and Wednesday nights. The Canadian DFO did not authorize any commercial fishing for eulachon in 2008 due to low abundance. Historically, commercial fishing for eulachon occurred at low levels in the Fraser River (as compared to the Columbia River). DFO has only allowed a commercial harvest of eulachon in the Fraser River twice since 1997 (DFO, 2008).

Recreational Fishing

The states of Oregon and Washington have altered sport fishing regulations in the past due to declining eulachon abundance (WDFW and ODFW, 2001). During the eulachon run, the ODFW allows recreational fishers to capture 25 lb (11 kg) per day of eulachon, using a dip net. Each fisher must have his or her own container; the first 25 lbs (11 kg) of fish captured may be retained. No angling license is required to harvest eulachon in Oregon. The WDFW currently allows harvest of eulachon by dip netting on the Cowlitz River, from 6 a.m. to 10 p.m. on Saturdays from January 1st-March 31st. The daily limit on the Cowlitz River is 10 lb (4.5 kg) per person per day. In Washington, the mainstem Columbia River is open for eulachon harvest 24 hours per day, 7 days per week during the eulachon run, and the daily limit is 25 lb (11 kg) per person per day. Washington and Oregon developed a joint eulachon management plan in 2001 (WDFW and ODFW, 2001). The two states plan to continue authorizing eulachon sport fishing at various levels depending on predicted yearly eulachon abundance. Under the strictest proposed regulations, harvest would be limited to less than 10 percent of the run. If run sizes increase beyond current levels, the states would consider allowing additional harvest, but these more liberal harvest rates have not been specifically identified. In the State of California, the California Department of Fish and Game (CDFG) currently allows licensed recreational fishers to dipnet up to 25 lb (11 kg) of eulachon per day per person year-round (CDFG, 2008). However, in practice, little to no fishing is taking place because so few fish return each year. In 2008, the Canadian DFO did not authorize any recreational fishing for eulachon due to low abundance. In general, interest in recreational fishing for eulachon has decreased significantly due to the difficulty of harvesting these fish at their currently low abundance.

Tribal Subsistence Fishing

In the past, eulachon were an important food source for many Native American tribes and Canadian First Nations from northern California to Alaska. In more recent history, tribal members in the United States harvest eulachon under recreational fishing regulations. The Canadian DFO typically authorizes a small subsistence fishery for First Nation members, primarily in the Fraser River. Historically, members of the Yurok Tribe harvested eulachon in the Klamath River in California for subsistence purposes. The Yurok Tribe does not have a fishery management plan for eulachon at this time, and eulachon abundance levels on the Klamath are too low to support a fishery.

*Disease or Predation*

The BRT identified disease as a low risk to all four DPS populations of eulachon. Although Willson *et al.* (2006) identify common parasites of eulachon, the BRT did not present any information indicating that disease was a significant problem for this DPS.

Predation primarily from marine mammals, fishes, and birds was identified as a moderate threat to eulachon in the Fraser River and mainland British Columbia rivers and a low severity threat to eulachon in the Columbia and Klamath where there are fewer predators. Large numbers of predators commonly congregate at eulachon spawning runs (Willson *et al.*, 2006). Eulachon rely on high abundance and synchronized spawn timing to ensure that adequate numbers of male and female fish escape predators and reproduce successfully. At low eulachon abundance, predation at historic levels may jeopardize population viability.

*The Inadequacy of Existing Regulatory Mechanisms*

Bycatch

The BRT identified bycatch of eulachon in commercial fisheries as a moderate threat to all four populations. 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 (Hannah and Jones, 2007). In Canada, bycatch of eulachon in shrimp fisheries has been significant enough to cause the Canadian Department of Fisheries and Oceans to close the fishery in some years (DFO, 2008).

In 2000, we declared canary rockfish overfished, as recommended by the Pacific Fisheries Management Council. In response, the states of Oregon, Washington, and California enacted regulations to reduce canary rockfish bycatch that require bycatch reduction devices (BRDs) on trawl gear used in the ocean shrimp fishery. The BRDs were successful in reducing bycatch of all finfish species (Hannah and Jones, 2007). In Oregon, these devices have been shown to reduce the smelt (including eulachon) bycatch to between 0.25 and 1.69 percent of the total catch weight (Hannah and Jones, 2007).

The DFO sets bycatch limits for the Canadian shrimp fishery and the shrimp trawl industry in Canada adopted 100 percent use of BRDs in 2000. The DFO will implement further management actions if estimated eulachon bycatch meets or exceeds the identified level. Management actions that may be taken include: closure of the shrimp trawl fishery, closure of certain areas to shrimp trawling, or restricting trawling to beam trawlers, which have been found to have a lower impact on eulachon than otter trawlers.

Little is known about the degree of injury and mortality eulachon experience as they pass through BRDs. Suuronen *et al.* (1996a; 1996b) found that herring passing through mesh and rigid trawl net sorting devices (similar to BRDs) often die (mortality estimates ranging from 30–100 percent depending on herring size and season caught). Although eulachon bycatch rates in shrimp fisheries have declined significantly, it is not certain what percent of eulachon traveling through BRDs survive.

*Other Natural or Manmade Factors Affecting Its Continued Existence*

Natural events such as volcanic eruptions may cause significant local declines in eulachon abundance by causing catastrophic debris flows in rivers and drastically increasing fine sediments in benthic substrates. After the eruption of Mt. Helens in 1980, the Army Corps of Engineers constructed a sediment retention structure on the Toutle River. This structure was placed to prevent debris avalanches resulting from the eruption from moving downstream and causing navigation problems. Although the structure is designed to reduce the level of fine sediment traveling down the Toutle and into the Cowlitz River, there is some concern (as mentioned in the 2007 petition to list eulachon) that water released from the structure in the spring may contain high sediment levels that adversely affect eulachon spawning.

**Efforts Being Made to Protect Southern DPS Eulachon**

Section 4(b)(1)(A) of the ESA requires the Secretary of Commerce to take into account efforts being made to protect a species that has been petitioned for listing. Accordingly, we assessed conservation measures being taken to protect eulachon to determine whether they ameliorate this species' extinction risk (50 CFR 424.11(f)). In judging the efficacy of conservation efforts that have yet to be implemented or to show effectiveness, we consider the following: the substantive, protective, and conservation elements of such efforts; the degree of certainty that such efforts will reliably be implemented; the degree of certainty that such efforts will be effective in furthering the conservation of the species; and the presence of monitoring provisions that track the effectiveness of recovery efforts, and that inform iterative refinements to management as information is accrued (68 FR 15100; March 28, 2003).

Although no efforts specific to eulachon are currently being made to protect freshwater habitat in the United States, this species indirectly benefits from several Federal, state, and tribal regulatory and voluntary aquatic habitat improvement programs aimed at other species. Based on the available information on eulachon biology, the physical habitat features most likely to be important to eulachon reproduction in fresh water are water quantity, water quality (especially temperature), free passage, and substrate condition. Federal programs carried out under legislation such as the Federal Clean Water Act (CWA) of 1972 help to ensure that water quality is maintained or improved and that discharge of fill material into rivers and streams is regulated. Several sections of this law, such as section 404 (discharge of fill into wetlands), section 402 (discharge of pollutants into water bodies), and section 404(d) (designation of water quality limited streams and rivers) regulate activities that might degrade eulachon habitat. Although programs carried out under the CWA are well funded and enforcement of this law occurs, it is unlikely that programs are sufficient to fully protect eulachon habitat. Despite the existence and enforcement of this law, a significant percent of stream reaches in the range of Pacific eulachon do not meet current water quality standards.

Section 10 of the Rivers and Harbors Act prohibits placement of any structure in any navigable waterway of the United States without approval from the Army Corps of Engineers. Most or all freshwater eulachon habitat in the United States is considered to be navigable, and it is not expected that any additional major obstructions (i.e., dams) to eulachon migration would be authorized within their range in this area. Smaller structures such as weirs and fish traps intended for fishery management may be placed in some tributaries of the Columbia River (see: *http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Mitchell-Act-EIS.cfm* and NMFS, 2004; for more information).

In Canada, dredging is not allowed in the Fraser River during early March to June to protect spawning eulachon. We are not aware of any other specific measures taken to protect eulachon freshwater habitat in Canada.

State regulatory programs that protect eulachon habitat include wetland/waterway fill-removal programs such as those administered by the Oregon Department of State Lands and the Washington Department of Ecology. Similar to the Federal CWA, these programs regulate filling of wetlands and discharge of fill material that might adversely affect eulachon spawning habitats. In addition, the State of California protects water quality and associated beneficial uses through administration of the Porter-Cologne

Act, (similar to the Federal CWA), and implementation of CDFG 1602 regulations. In general, the described regulatory programs within these three states are aimed at protecting the important functions of riverine and wetland ecology, such as maintaining a properly functioning riparian plant community, storing groundwater, and preserving floodplain roughness. They are also aimed at reducing the discharge of fine sediments that might alter or degrade eulachon spawning substrates. It is thus reasonable to conclude that these laws will provide some protection to eulachon habitat.

The range of eulachon in the Pacific Northwest and California largely or completely overlaps with the range of several ESA-listed stocks of salmon and steelhead and green sturgeon. Although the habitat requirements of these fishes differ somewhat from eulachon, habitat protection generally focuses on the maintenance of aquatic habitat forming processes expected to benefit eulachon. In particular, the numerous ESA section 7 consultations carried out on Federal activities throughout the range of eulachon provide a level of habitat protection. The protective efforts for salmon and steelhead are described in detail in our proposed listing determinations for 27 species of West Coast salmon and steelhead (69 FR 33102; June 14, 2004). Efforts to protect green sturgeon are described in our proposed listing determination for this species (70 FR 17386; April 6, 2005).

The development and operation of the Federal Columbia River Power System (FCRPS) and Bureau of Reclamation irrigation projects in the Columbia River basin have altered the hydrology of this river system. We have worked with the Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation to develop mitigation measures to minimize the adverse effects of these projects on ESA-listed salmon and steelhead. On May 5, 2008, we issued final biological opinions on the operation of the FCRPS and Upper Snake River Irrigation Projects. The planned mitigation measures, including additional spring water spill and predator control programs, will benefit eulachon as well. Since eulachon are known to be plentiful in systems with a strong spring freshet, spilling additional water in the spring to increase survival of juvenile salmon and steelhead is likely to move the hydrograph of the Columbia River to a state more similar to that under which eulachon evolved. The Northern Pikeminnow Sport Reward Fishery should reduce predation levels in the Columbia River on all small fishes, including eulachon.

Throughout the eulachon's range in Oregon, Washington, and California, an array of Federal, state, tribal, and local entities carry out aquatic habitat restoration programs. These programs are generally intended to benefit other fish species such as salmon, steelhead, trout, etc. Eulachon also benefit from improvements in water quality and physical habitat attributes resulting from these projects. Although these programs are too numerous to list individually, some of the larger programs include the Bonneville Power Administration's Columbia Basin Fish and Wildlife Program, the Pacific Coast Salmon Recovery Fund, the Lower Columbia Fish Recovery Board, and the Oregon Watershed Enhancement Board. The Federal land managers, U.S. Forest Service, Bureau of Land Management, and National Park Service also carry out aquatic restoration projects in some watersheds where eulachon migrate and spawn. These agencies have been conducting restoration projects in these areas for many years and projects located in the lower reaches of rivers (where eulachon spawn) are likely to provide some benefit to eulachon habitat.

Marine waters of the United States are managed by state and Federal Governments. At this time, we do not know enough about eulachon use of near shore ocean habitats to determine the degree to which existing marine habitat management benefits eulachon.

**Proposed Determination**

Section 4(b)(1) of the ESA requires that the listing determination be based solely on the best scientific and commercial data available, after conducting a review of the status of the species and after taking into account those efforts, if any, being made by any state or foreign nation to protect and conserve the species. We have reviewed the petition, the report of the BRT (Gustafson *et al.*, 2008), co-manager comments, and other available published and unpublished information, and we have consulted with species experts and other individuals familiar with eulachon.

Based on this review, we conclude that eulachon populations spawning from the Skeena River in British Columbia south to the Mad River in Northern California meet the discreteness and significance criteria for a DPS (Gustafson *et al.*, 2008). Eulachon occurring in this area are discrete from eulachon occurring north of this area based on differences in spawning temperatures; length- and weight-at-maturity in the species' range; ecological features of both the oceanic and freshwater environments occupied by eulachon; and genetic characteristics. This group of fish is significant to the species as a whole because it constitutes over half of the geographic range of the entire species' distribution and includes two of the known major production areas (Columbia and Fraser rivers) and a third area that may have been historically a major production area (Klamath River). Although eulachon are currently rarely seen in the Klamath River, sampling in 2007 confirmed they are still present there in small numbers. The loss of this group of fish would create a significant reduction in the species' overall distribution.

Ongoing efforts to protect Pacific salmonids, as described in the previous section, are likely to also benefit Pacific eulachon habitat. Taken together, however, these efforts do not comprehensively address the threats to eulachon from climate change and bycatch in the shrimp fishery.

Based on the best scientific and commercial information available, including the draft BRT report, we propose that the southern DPS of eulachon is not presently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. Factors supporting a conclusion that the DPS is not presently in danger of extinction include: (1) two core spawning areas have sufficient numbers of eulachon to maintain spawning, at least at low levels; (2) as observed in the past (2001–2003), a reversion to favorable environmental ocean conditions could result in a rebound in abundance; and (3) the species likely strays at a moderate-to-high rate, so that in the presence of favorable environmental conditions re-building of depressed populations may occur.

Factors supporting a conclusion that the DPS is likely to become in danger of extinction in the foreseeable future include: (1) abundance in all surveyed populations, and in the two remaining core populations, is low and declining; and (2) the available information suggests that eulachon in Northern California experienced an abrupt decline several decades ago, and although still present at very low numbers, it is unknown if these represent a viable self-sustaining population, and (3) eulachon require minimum population sizes to achieve successful reproduction.

In sum, future declines in population abundance may occur as a result of climate change and continued bycatch in the shrimp fishery. These threats indicate that the southern DPS of eulachon is likely to become endangered in the foreseeable future. Therefore, NMFS proposes to list the southern DPS of eulachon as threatened.

### Take Prohibitions and Protective Regulations

Section 9 of the ESA prohibits certain activities that directly or indirectly affect endangered species. These 9(a) prohibitions apply to all individuals, organizations, and agencies subject to U.S. jurisdiction. In the case of threatened species, ESA section 4(d) requires the Secretary of Commerce to issue regulations necessary and appropriate for the conservation of the species. We have flexibility under section 4(d) to tailor protective regulations based on the needs of, and threats to, the species. The 4(d) protective regulations may prohibit, with respect to threatened species, some or all of the acts which section 9(a) of the ESA prohibits with respect to endangered species. We will evaluate protective regulations pursuant to section 4(d) for the southern DPS of eulachon and propose any considered necessary and advisable for conservation of the species in future rulemaking. In order to inform our consideration of appropriate protective regulations for southern DPS eulachon, we seek information from the public on the threats to this species and possible measures for its conservation.

### Other Protections

Section 7(a)(2) of the ESA and NMFS/FWS regulations require Federal agencies to confer with us on actions likely to jeopardize the continued existence of species proposed for listing or that result in the destruction or adverse modification of proposed critical habitat. If a proposed species is ultimately listed, Federal agencies must consult on any action they authorize, fund, or carry out if those actions may affect the listed species or its critical habitat. Examples of Federal actions that may affect the southern DPS of eulachon include: water diversions, hydropower operations, discharge of pollution from point sources, non-point source pollution, contaminated waste disposal, dredging, water quality standards, fishery management practices, and a variety of land management practices such as development, logging, and transportation management.

### Peer Review

In December 2004, the Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review establishing minimum peer review standards, a transparent process for public disclosure of peer review planning, and opportunities for public participation. The OMB Bulletin, implemented under the Information Quality Act (Public Law 106–554), is intended to enhance the quality and credibility of the Federal government's scientific information, and applies to influential or highly influential scientific information disseminated on or after June 16, 2005. To satisfy our requirements under the OMB Bulletin, we are obtaining independent peer review of the draft status review report, which supports this proposal to list the southern DPS of eulachon as threatened; all peer reviewer comments will be addressed prior to dissemination of the final report and publication of the final rule.

### Critical Habitat

Critical habitat is defined in section 3 of the ESA as: ''(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species'' (16 U.S.C. 1532(5)(A)). ''Conservation'' means the use of all methods and procedures needed to bring the species to the point at which listing under the ESA is no longer necessary (16 U.S.C. 1532(3)). Section 4(a)(3)(A) of the ESA requires that, to the maximum extent prudent and determinable, critical habitat be designated concurrently with the listing of a species (16 U.S.C. 1533(a)(3)(A)(i)). Designations of critical habitat must be based on the best scientific data available and must take into consideration the economic, national security, and other relevant impacts of specifying any particular area as critical habitat.

Once critical habitat is designated, section 7 of the ESA requires Federal agencies to ensure that they do not fund, authorize, or carry out any actions that are likely to destroy or adversely modify that habitat. This requirement is in addition to the section 7 requirement that Federal agencies ensure that their actions do not jeopardize the continued existence of listed species.

We are currently compiling information to prepare a critical habitat proposal for the southern DPS of eulachon, and in this document are seeking public input and information to assist in gathering and analyzing the best available scientific data to support a critical habitat designation. We will continue to meet with co-managers and other stakeholders to review this information and the overall designation process. We will then initiate rulemaking with the publication of a proposed designation of critical habitat in the **Federal Register**, opening a period for public comment and the opportunity for public hearings.

Joint NMFS/FWS regulations for listing endangered and threatened species and designating critical habitat at 50 CFR 424.12(2)(b) state that the agency ''shall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection.'' Pursuant to the regulations, such requirements include, but are not limited to the following: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally; (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. The regulations also state that the agency shall focus on the principal biological or physical constituent elements within the specific areas considered for designation. These primary constituent elements may include, but are not limited to: spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, geological formation, vegetation type, tide, and specific soil types.

In accordance with the Secretarial Order on American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act, we will coordinate with federally recognized American Indian Tribes on a Government-to-Government basis to determine how to make critical habitat assessments in areas that may impact Tribal trust resources. In accordance with our regulations at 50 CFR 424.13, we will consult as appropriate with affected states, interested persons and organizations, other affected Federal agencies, and, in cooperation with the Secretary of State, with the country or countries in which the species concerned are normally found or whose citizens harvest such species from the high seas.

**Public Comments Solicited**

To ensure that the final action resulting from this proposal will be as accurate and effective as possible, we solicit comments and suggestions from the public, other governmental agencies, the Government of Canada, the scientific community, industry, environmental groups, and any other interested parties. Comments are encouraged on this proposal (See **DATES** and **ADDRESSES**). Specifically, we are interested in information regarding: (1) eulachon spawning habitat within the range of the southern DPS that was present in the past, but may have been lost over time; (2) biological or other relevant data concerning any threats to the southern DPS of eulachon; (3) the range, distribution, and abundance of the southern DPS of eulachon; (4) current or planned activities within the range of the southern DPS of eulachon and their possible impact on this DPS; (5) recent observations or sampling of eulachon in Northern California rivers including but not limited to the Klamath River, Mad River, and Redwood Creek; and (6) efforts being made to protect the southern DPS of eulachon.

*Critical Habitat*

We also request quantitative evaluations describing the quality and extent of freshwater and marine habitats for juvenile and adult eulachon as well as information on areas that may qualify as critical habitat for the proposed southern DPS. Specific areas that include the physical and biological features essential to the conservation of the DPS, where such features may require special management considerations or protection, should be identified. We also solicit biological and economic information relevant to making a critical habitat designation for the southern DPS of eulachon. Although the range of this DPS extends into Canada, ESA implementing regulations at 50 CFR 424.12(h) specify that critical habitat shall not be designated within foreign countries or in other areas outside of United States jurisdiction. Therefore, we request information only on potential areas of critical habitat within the United States or waters within U.S. jurisdiction.

Section 4(b)(2) of the ESA requires the Secretary to consider the ''economic impact, impact on national security, and any other relevant impact,'' of designating a particular area as critical habitat. For this, section 4(b)(2) authorizes the Secretary to exclude from a critical habitat designation those particular areas where the Secretary finds that the benefits of exclusion outweigh the benefits of designation, unless excluding that area will result in extinction of the species. We seek information regarding the conservation benefits of designating areas in the Columbia River and its tributaries, the Klamath River, other coastal rivers in Washington, Oregon and California, and marine areas, as critical habitat. We also seek information on the economic benefit of excluding areas from the critical habitat designation, and the economic benefits of including an area as part of the critical habitat designation. In keeping with the guidance provided by the Office of Management and Budget (2000; 2003), we seek information that would allow us to monetize these effects to the extent possible, as well as information on qualitative impacts to economic values. We also seek information on impacts to national security and any other relevant impacts of designating critical habitat in these areas.

Data reviewed may include, but are not limited to: (1) scientific or commercial publications, (2) administrative reports, maps or other graphic materials, information received from experts, and (3) comments from interested parties. Comments and data particularly are sought concerning: (1) maps and specific information describing the amount, distribution, and use type (e.g., spawning, rearing, or migration) of eulachon habitat (both freshwater and marine), as well as any additional information on occupied and unoccupied habitat areas; (2) the reasons why any habitat should or should not be determined to be critical habitat as provided by sections 3(5)(A) and 4(b)(2) of the ESA; (3) information regarding the benefits of designating particular areas as critical habitat; (4) current or planned activities in the areas that might be proposed for designation and their possible impacts; (5) any foreseeable economic or other potential impacts resulting from designation, and in particular, any impacts on small entities; (6) whether specific unoccupied areas (e.g., areas where eulachon have been extirpated) may be essential to provide additional habitat areas for the conservation of this DPS; and (7) potential peer reviewers for a proposed critical habitat designation, including persons with biological and economic expertise relevant to the species, region, and designation of critical habitat. We seek information regarding critical habitat for the southern DPS of eulachon as soon as possible, but by no later than May 12, 2009.

**References**

A complete list of all references cited herein is available upon request (see **ADDRESSES** section).

**Classification**

*National Environmental Policy Act*

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in Pacific Legal Foundation v. Andrus, 675 F. 2d 825 (6th Cir. 1981), we have concluded that ESA listing actions are not subject to the environmental assessment requirements of the National Environmental Policy Act (See NOAA Administrative Order 216–6).

*Executive Order 12866, Regulatory Flexibility Act and Paperwork Reduction Act*

As noted in the Conference Report on the 1982 amendments to the ESA, economic impacts cannot be considered when assessing the status of a species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process. In addition, this proposed rule is exempt from review under Executive Order 12866. This proposed rule does not contain a collection-of-information requirement for the purposes of the Paperwork Reduction Act.

*Federalism*

In keeping with the intent of the Administration and Congress to provide continuing and meaningful dialogue on issues of mutual State and Federal interest, this proposed rule will be given to the relevant state agencies in each state in which the species is believed to occur, and those states will be invited to comment on this proposal. We have conferred with the states of Washington, Oregon, and California in the course of assessing the status of the southern DPS of eulachon, and considered, among other things, Federal, state and local conservation measures. As we proceed, we intend to continue engaging in informal and formal contacts with the states, and other affected local or regional entities, giving careful consideration to all written and oral comments received.

**List of Subjects in 50 CFR Part 223**

Endangered and threatened species, Exports, Imports, Transportation.

Dated: March 6, 2009.

**Samuel D. Rauch III,**

*Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.*

For the reasons set out in the preamble, 50 CFR part 223 is proposed to be amended as follows:

## PART 223—THREATENED MARINE AND ANADROMOUS SPECIES

1. The authority citation for part 223 continues to read as follows:

**Authority:** 16 U.S.C. 1531 1543; subpart B, § 223.201–202 also issued under 16 U.S.C. 1361 *et seq.*; 16 U.S.C. 5503(d) for § 223.206(d)(9) *et seq.*

2. In § 223.102, paragraph (c) is revised by adding and reserving paragraphs (c)(25) and (c)(26) and adding a new paragraph (c)(27) to read as follows:

**§ 223.102 Enumeration of threatened marine and anadromous species.**

(c) * * *

| Species[1] | | Where Listed | Citation(s) for listing determination(s) | Citation(s) for critical habitat designation(s) |
|---|---|---|---|---|
| Common name | Scientific name | | | |
| * * | * | * | * | * * |
| (27) eulachon - southern DPS | *Thaleichthys pacificus* | California, Oregon, Washington, and British Columbia. | [INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE] | [INSERT FR CITATION & DATE WHEN PUBLISHED AS A FINAL RULE] |

[FR Doc. E9–5403 Filed 3–12–09; 8:45 am]

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