EULACHON

TAXONOMY

Scientific name: *Thaleichthys pacificus* (Richardson, 1836)
Common name: Eulachon
Family: Osmeridae

Taxonomic comments:
See Begle (1991) for a classification and phylogeny of osmeroid fishes based on morphology. Common name eulachon is derived from the Chinook language, a synthetic trading language made of combined French, English and various Native American languages (Hay and McCarter 2000).

DESCRIPTION

Basic description: A small anadromous smelt.

General description:
Generally distinguished from other smelts by having the front of the dorsal fin begin well behind where the pelvic fin attaches to the body. Dorsally bluish to bluish black or brown, with fine black speckling; silvery white laterally and ventrally. Large pair of canine teeth on the vomer, 18-23 rays in the anal fin (Morrow 1980, Mecklenburg et al. 2002).

Length (cm): 25

Reproduction:
Spawns in the spring. Females produce 17,000- 40,000 eggs (Scott and Crossman 1973); average fecundity is around 25,000 eggs per female (Drake and Wilson 1991). Eggs incubate in sediment for 2-3 weeks, depending on water temperature, then hatch and larvae are carried downstream to the sea (Willson et al. 2003). Most adults die soon after spawning, may live 5 years. Generally semelparous, with sexual maturity reached at around age 3 or 4 (Hay and McCarter 2000, Willson et al. 2003). Spawning occurs at night, and males and females must synchronize activity closely because eulachon sperm remain viable for only a short time, possibly minutes (Hay and McCarter 2000, Willson et al. 2003). Spawning migration timing is variable and appears to be related to water temperature and the occurrence of high tides. Runs occur from February to June throughout species range, but generally occur in April or May; in some rivers more than one run occurs (Willson et al. 2003).

Ecology:
A valuable food source for many animals because of extremely high oil content (about 20%, or 4-5 times higher than most other fish of comparable size) (Payne et al. 1999 in Hay and McCarter 2000). Predators include sea birds and ducks, marine and terrestrial mammals, and humans (Lee et al. 1980, Willson et al. 2003). Predators often congregate at eulachon spawning runs. Used

historically and currently for an essential source of oil and food by Native Americans throughout their range (Drake and Wilson 1991). Called candlefish because a dried fish threaded with a wick will burn like a candle (Hay and McCarter 2000).

Migration:
Anadromous. Migrates short distances (maximum recorded 160 km) up coastal streams to spawn (Mecklenburg et al. 2002).

Food:
Eats crustaceans. Adults do not feed while in fresh water. Mainly a particulate feeder as opposed to a filter feeder, consuming primarily marine euphausiid crustaceans (*Thysanoessa* spp.; Hay and McCarter 2000). Young fish eat mostly copepod larvae, phytoplankton, copepods and other zooplankton, and smaller eulachon larvae; diet of juvenile fish consists of euphausiids, like adults (Morrow 1980).

Phenology:
Spawning migrations usually occur in April and May, often corresponding to high tides; spawning activity occurs at night (Willson et al. 2003).

Habitat:
Nearshore ocean bottom, coastal inlets. Adults live at moderate sea depths (commonly 20-200 m but have been recorded as deep as 625 m) in echo-sounding layer not far from shore; young apparently occur in deeper water (Lee et al. 1980, Page and Burr 1991, Willson et al. 2003). Spawns in coastal freshwater streams over bottoms of silt, sand, gravel, cobble or detritus but apparently prefer bar and riffle habitat containing sand or pea-gravel, seldom more than a few miles inland (Estes and Vincent-Lang 1984, Willson et al. 2003). Presence of spring freshets is a factor common to nearly all spawning streams or rivers; typically characteristic of rivers that drain large snowpacks or glaciers (Hay and McCarter 2000, Willson et al. 2003).

STATUS

Global rank: G5 (1996-09-13)
Global rank reasons:
Global rank reasons currently unavailable.

State rank: S3S4 (2004-08-20)
State rank reasons:
Overall distribution, abundance, and trends unknown. Apparent declines in the Gulf of Alaska and eastern Bering Sea during the last two decades; population status elsewhere unknown. An important prey species to marine birds, mammals, and fishes; concern regarding overfishing in subsistence and commercial fisheries, bycatch in trawl and shrimp fisheries, and habitat degradation.

DISTRIBUTION AND ABUNDANCE

Range:

Global range:

Found only in the eastern Pacific, from Monterey Bay, California, to Nushagak River and Pribilof Islands, Bering Sea, Alaska (Lee et al. 1980, Page and Burr 1991). Distribution coincides closely with coastal temperate rainforest, although there may not be a functional linkage (Hay and McCarter 2000). Historically spawned in the Sacramento River system and farther south along the California and Baja California coast but have been extirpated from those locations, occurring now only as far south as Monterey Bay (one record from this location) and in the Klamath River in California, rivers in Oregon and the Columbia River in Washington (Hay and McCarter 2000, Mecklenburg et al. 2000, Willson et al. 2003). In Alaska, seasonally abundant in most major drainages from Southeast Alaska west to Cook Inlet and become less abundant westward toward the Aleutian Islands and the Pribilof Islands in the Bering Sea (Fritz et al. 1993, Willson et al. 2003).

State range:

Seasonally abundant in most major drainages from Southeast Alaska west to Cook Inlet and become less abundant westward toward the Aleutian Islands and the Pribilof Islands in the Bering Sea (Fritz et al. 1993, Willson et al. 2003).

Abundance:

Global abundance:

Seasonally abundant in spawning rivers.

State abundance:

In Alaska, seasonally abundant from Southeast to Cook Inlet (Hay et al. 1997); abundance decreases from east to west toward the Aleutian Islands (Bartlett 1994). Relative abundance in the Bering Sea is highest between Unimak Island/end of the Alaska Peninsula and the Pribilof Islands (Anderson 2001 in Willson et al. 2003). Reported as widespread from trawl samples in the coastal fjords of northern southeast Alaska (Willson et al. 2003). Catch-per-unit-effort (CPUE) in the Gulf of Alaska varied almost cyclically between 1972 and 1997 from ~0.3 kg/km to ~1.9 kg/km (Anderson and Piatt 1999). However, catch data are not necessarily considered a reliable measure of population abundance or even presence/absence (NMFS 1999), nor are they available for species' entire range in the state.

Trends:

Global trend:

Highly variable or possibly cyclical run size makes trends in abundance hard to interpret (NMFS 1999). Nearly all runs in the southern part of their range (California to BC) have declined during the last 20 years (Hay and McCarter 2000). Commercial catches on the Fraser River have declined since the 1940s and 1950s (Hay et al. 1997). In 1994, sudden drastic declines were recorded in three large southern rivers, the Fraser, Columbia, and Klinaklini, resulting in the closure of major commercial fisheries on the Fraser and Columbia Rivers in the late 1990s (Hay and McCarter 2000, Willson et al. 2003). Due to continued low abundance, NMFS was petitioned to list the Columbia River populations as endangered or threatened under the Endangered Species Act (ESA) in 1999. Eulachon runs diminished over the last two decades in the Kitimat River, B.C., and became

chemically tainted as a result of industry and urbanization (Hay et al. 1997, Hay and McCarter 2000). Also see State trend comments below.

State trend:
In the Kodiak Island area, Alaska, eulachon peaked in abundance in 1981, then abruptly declined, and then again peaked in 1986 (Anderson et al. 1996). Since 1987, eulachon have remained at relatively low levels in trawl survey data (Anderson et al. 1996). Data from the Eastern Bering Sea also suggest that eulachon abundance steadily declined during the 1980s (Fritz et al. 1993). Native Alaskan subsistence users observed a decline in eulachon harvests in the Chilkat and Chilkoot rivers, Southeast Alaska, in the 1980s (Betts 1994).

EXISTING PROTECTION

Global protection:
In British Columbia, shrimp trawl fisheries are required to use bycatch reduction devices (BRDs) and to close shrimp fishing when bycatch limits of eulachon and other non-target species are reached, even if shrimp catch is below the allowable quota (Hay and McCarter 2000). In the U.S., the Magnuson-Stevens Act requires NMFS to reduce non-targeted bycatch in commercial fisheries, but currently there are few BRD requirements to shrimp fisheries in the Pacific Northwest. NMFS was petitioned to list Columbia River eulachon populations as a threatened or endangered species under the Endangered Species Act (ESA) in 1999, but did not approve the petition (U.S. Environmental Protection Agency 1999). The Washington Department of Fish and Wildlife Species of Concern list includes *T. pacificus* as a candidate species for state and federal listing as a threatened or endangered species as of June 2004 (Washington Department of Fish and Wildlife 2004).

State protection:
The Alaska Board of Fisheries with the Alaska Department of Fish and Game has not established seasons and/or limits, nor required subsistence permits for eulachon harvest by rural Alaska residents (Betts 1994, USFWS 2004).

CHALLENGES

Global challenges:
Threatened by overfishing in subsistence and commercial fisheries, continued/increased bycatch in commercial groundfish and shrimp fisheries, industry pollution of freshwater and marine habitats, human impact on spawning habitat (logging, dredging, diversions, etc.) and climate change (Hay and McCarter 2000).

Subsistence harvest is widespread throughout this species' range, is mostly unregulated, and could potentially slow recovery of declining populations. Bycatch of eulachon in commercial offshore groundfish and shrimp trawl fisheries may be substantial; shrimp trawling, especially, has increased in the last decade (Hay and McCarter 2000).

Threats to eulachon habitat include diversions/dams, logging, dredging and industrial pollution of streams and rivers, all of which may affect water volume, temperature and sediment levels in spawning habitat. Native communities in Southeast Alaska have noted declining eulachon harvests

and expressed concern about the effects of log rafting and pollution on fish habitat (Drake and Wilson 1991).

Recent changes in ocean climate, including increased surface water temperatures, have been recognized in the Gulf of Alaska and elsewhere in the species range, and have resulted in a general reorganization of fish communities in some areas (Anderson and Piatt 1999, Hay and McCarter 2000). High water temperatures can be lethal to cold-water acclimated fish. A study of 5°C-acclimated eulachon immersed in 11°C water for several days resulted in 50% mortality and spawning failure (Blahm and McConnel 1971 in Willson et al. 2003).

State challenges:
See Global challenges.

Recent changes in ocean climate, including increased surface water temperatures, have been recognized in the Gulf of Alaska and elsewhere in the species' range, and have resulted in a general reorganization of fish communities in some areas (Anderson and Piatt 1999, Hay and McCarter 2000). High water temperatures can be lethal to cold-water acclimated fish. A study of 5°C-acclimated eulachon immersed in 11°C water for several days resulted in 50% mortality and spawning failure (Blahm and McConnel 1971 in Willson et al. 2003).

RESEARCH AND INVENTORY NEEDS

Global research needs:
See State research needs below.

State research needs:
Basic research needed on species life history parameters including reproductive ecology and productivity, run-timing, seasonal movements, and habitat requirements. Genetic studies needed to differentiate population structure. Identify sources of mortality. Continued studies of the reorganization of fish communities in response to warming surface water temperatures are key.

Global inventory needs:
See State inventory needs below.

State inventory needs:
Species distribution in the state is incompletely known, needs study, including mapping of important spawning, wintering, and foraging areas. An accurate assessment of the Alaska population is needed. Develop a monitoring program to identify and track population trends. Monitor subsistence harvest and bycatch in commercial fisheries.

CONSERVATION AND MANAGEMENT NEEDS

Global conservation and management needs:
Continued protection of spawning habitat through restricted dredging and management of logging and industrial water pollution. Limit bycatch in commercial shrimp fisheries by conducting catch-monitoring assessments and mandating area closures when bycatch limits are reached. Also, require

use of fishery observers and selectivity devices which allow passive exit of bycatch species through escape panels (i.e., the Nordmore grid).

State conservation and management needs:
Monitor subsistence harvest.

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Acknowledgements

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