Species of Concern
NOAA National Marine Fisheries Service

Rainbow smelt
Osemerus mordax

Photo credit: J.F. Scarola.

KEY INFORMATION

Areas of Concern
Rivers and coastal areas of eastern North America from Labrador to New Jersey and on the west coast from Vancouver Island around Alaska to the Arctic Ocean.

Year Identified as "Species of Concern"
2004

Factors for Decline
- Acid precipitation
- Fishing
- Dams and blocked culverts
- Spawning habitat degradation

Conservation Designations
IUCN: Not Evaluated

Brief Species Description:
This is a small, slender, elongated fish averaging 6 to 8 inches (15 to 20 cm) in length. Sea-dwelling populations are **anadromous**, migrating to spawn in fresh water, while some populations are found entirely in fresh water. They naturally occur in the Northeast and around Alaska, but have been introduced into freshwater systems in the northeastern and central U.S. (Buckley 1989). Rainbow smelt usually remain close to shore and in shallow water, and some spend the entire year in the **estuaries** (Collette and Klein-MacPhee 2002). There is evidence of migrations in the sea, however, little is known about this part of the smelt life history (Collette and Klein-MacPhee 2002).

Spawning takes place in late winter/early spring in the southern portion of this species range and in mid-spring farther north. Spawning is believed to be triggered by photoperiod rather than water temperature (Collette and Klein-MacPhee 2002). A female smelt can produce 7,000 to over 75,000 eggs, depending on size (Collette and Klein-MacPhee 2002).

Smelt are voracious feeders of amphipods, mysids, euphausiids, shrimps, and marine worms; and as they grow, any small fishes that are available (Collette and Klein-MacPhee 2002). Smelt are a major prey item for striped bass, bluefish and a variety of birds. Mortality due to predation is quite high for this species: up to 72% of adult fish die annually (Rainbow Smelt general information, 2002). In addition, smelt are preyed upon by their own species (Collette and Klein-MacPhee 2002).

Summer habitat varies with water temperature. Smelt leave the harbors and estuaries of Massachusetts Bay for slightly deeper and cooler water during the summer (Collette and Klein-MacPhee 2002). Farther north, east of Penobscot Bay, they remain in harbors, bays, and river mouths all summer (Collette and Klein-MacPhee 2002). Smelt overwinter in nearshore waters prior to making their spawning runs.

Restored spawning habitat in North River, Salem, MA in 2002. Project funded by NOAA Community-Based Restoration program. Photo Credit; NOAA photo library.

Rationale for "Species of Concern" Listing:

Demographic and Genetic Diversity Concerns:

The area of concern for this species of concern is in the Northeast US (Figure 1). During the last 15 to 20 years there has been a region-wide trend in declining smelt populations in Massachusetts Bay (Chase and Childs 2001). The current status of rainbow smelt populations for the majority of the Gulf of Maine is not well known, especially east of the Kennebec drainage. Many inland populations appear to be declining, apparently due in part to the impacts of acid precipitation.

Factors for Decline:

Fishing and natural mortality rates of smelt are not known (Chase and Childs 2001). Collette and Klein-MacPhee (2002) note that enough smelt still remain to provide sport fishing for thousands of anglers; this applies equally to many locations along the coast of Maine and in Great Bay New Hampshire. In Maine, they are prized food fish harvested in three distinct fisheries. Fishermen use dip nets to catch them. In fall, a riverine and coastal bay hook and line fishery occurs (Maine DMR Recreational Fisheries Program, 2002). For over 100 years smelt have supported a successful commercial fishery and have been caught in sport fisheries. They are eagerly pursued along the coast and also during spawning migrations to rivers and estuaries (Collette and Klein-MacPhee 2002). Commercial landings peaked in 1966 at 162.8 mt with the majority being landed from Maine (115.6 mt). Landings declined over the next 22 years with a low in 1988 of 1.3 mt. In the early 1990s, landings increased slightly to a high of 27.1 mt in 1992. However, a declining trend has again been evident, and landings have averaged only 0.14 mt since 1998. In 2001, total U.S. landings were 0.1 mt with all fish reported as being landed from New Hampshire waters.

Chase and Childs (2001) note that fishing mortality is not suspected to be a major influence in smelt population dynamics in Massachusetts due to the absence of a commercial fishery and very little catch and effort involved in the sport fishery. Populations and fisheries are not assessed there (Brad Chase Massachusetts Division of Marine Fisheries, personal communication 2003). Other factors contributing to the declining trend in this species are not well identified. Two concerns identified for many rivers in Massachusetts Bay are structural impediments to spawning habitat (such as dams and blocked culverts), and chronic degradation of spawning habitat from stormwater inputs (Chase and Childs, 2001). Declines in anadromous smelt may also be due to damming and siltation (The smelt family Osmeridae, 2002).

Status Reviews/Research Underway:

In 2006, the states of Maine, New Hampshire and Massachusetts received a grant under NMFS's Proactive Conservation Program to conserve and restore wild populations of rainbow smelt, Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and non-DPS Atlantic salmon, (*Salmo salar*) within the U.S. Gulf of Maine watershed. This is a five year collaborative project to develop and implement a comprehensive and integrated multi-state conservation program. The goals of the project are to complete a comprehensive Gulf of Maine inventory for each species (including information on status and trends of each species and threats); develop a set of conservation and restoration strategies; and implement those strategies through collaborations with local, state and Federal governments, non-governmental organizations, and academia.

Data Deficiencies:
Accurate population estimates are unavailable throughout the majority of the species range. Also, the locations of many spawning areas have yet to be identified. The magnitude of existing threats such as habitat alteration, pollution, passage restrictions, and presence of non-native species is also unknown. Other threats such as exposure to disease or egg toxicity from periphyton mats may be having an unknown effect on this species. Conditions that cause stress (e.g., pollution) or reduce genetic variation (e.g., low populations) may increase susceptibility to disease, whereas crowding and cross-species contact can increase disease transmission (John Sowles, Maine Department of Marine Resources, personal communication 2006). However, very little is known about the pathology or exposure to disease organisms in rainbow smelt.

Existing Protections and Conservation Actions:
In Massachusetts the fishery is closed by regulation from March 15th to June 15th to protect spawning fish (Chase and Childs, 2001). Massachusetts has a monitoring program, which looks at spawning habitat. There have been a number of projects in recent years involving restoration of habitat (Brad Chase, MA Division of Marine Fisheries, personal communication 2003).

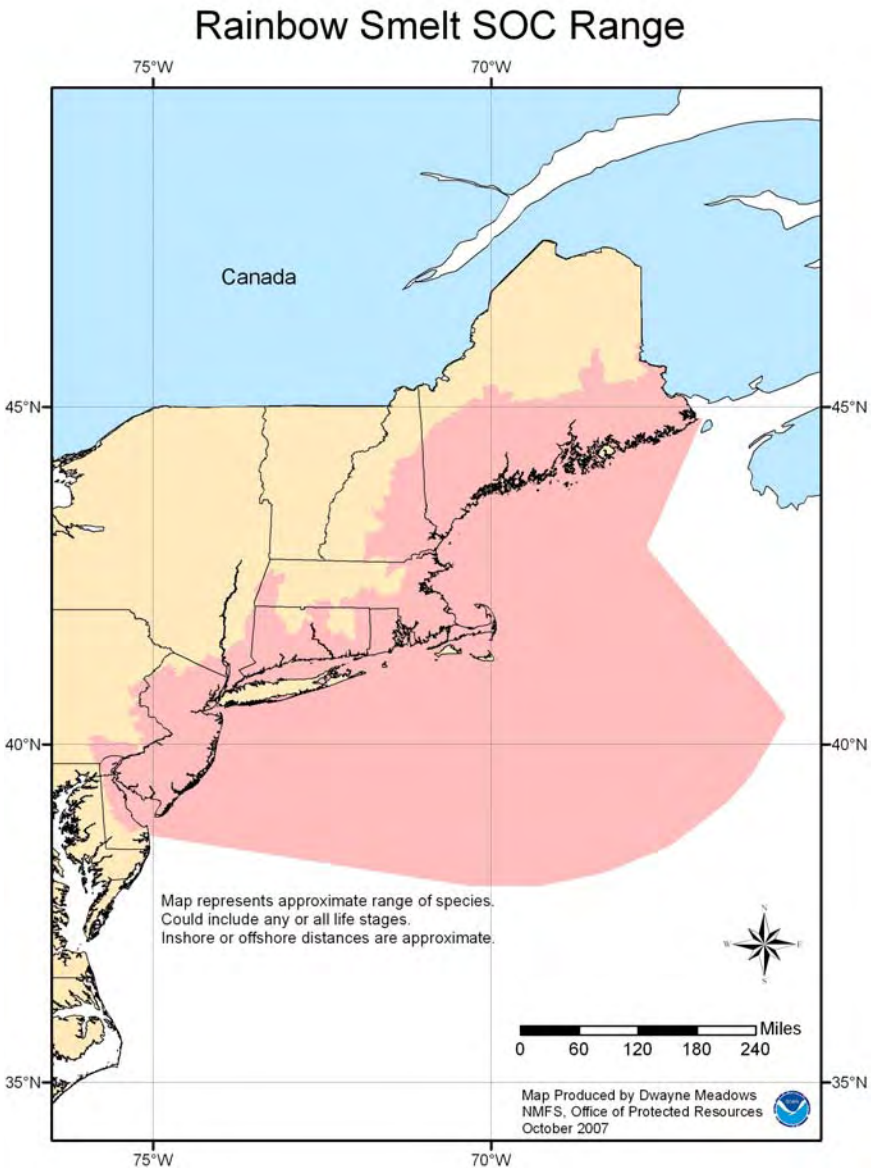

Figure 1. Range of the rainbow smelt species of concern.

References:
Buckley, J. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates. Rainbow smelt. USFWS Biol. Rept. U.S. Army Corps of Engineers. TR EL-82-4, 11 p.

Chase, B.C., and A.R. Childs. 2001. Rainbow Smelt (*Osmerus mordax*) Spawning Habitat in the Weymouth-Fore River. Massachusetts Division of Marine Fisheries Technical Report TR-5. 29 p.

Collette, B.B., and G. Klein-MacPhee. 2002. Atlantic halibut. In: B.B. Collette and G. Klein-MacPhee (eds). Bigelow and Schroeder's fishes of the Gulf of Maine. Smithsonian Inst Press, Washington, DC.

Maine Department of Marine Resources Recreational Fisheries Program: Do you know your catch? http://www.state.me.us/dmr/recreational/fishes/smeltrainbow.htm (23 July 2002).

Nova Scotia Department of Agriculture and Fisheries: Species Sheets: Inland Rainbow Smelt (*Osmerus mordax*). http://www.gov.ns.ca/nsaf/sportfishing/species/smel.htm (23 July 2002).

Rainbow Smelt general information. http://www.cptdave.com/rainbow-smelt.html (23 July 2002).

Smelt Family Osmeridae. http://www.sarep.cornell.edu/Sarep/fish/Osmeridae/osmeridae.html (23 July 2002).

The smelt family Osmeridae. http://collections.oeb.harvard.edu/Fish/ma_fish/ma_osme.htm. Original source: Hartel, K.E., et al. 1996. An annotated working list of inland fishes of Massachusetts. (23 July 2002).

Point(s) of contact for questions or further information:

For further information on this Species of Concern, or on the Species of Concern Program in general, please contact NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, (301) 713-1401, soc.list@noaa.gov; http://www.nmfs.noaa.gov/pr/species/concern/, or Kimberly Damon-Randall, NMFS, Northeast Region, One Blackburn Drive, Gloucester, MA 01930-2295, (978) 281-9328, x6535, Kimberly.Damon-Randall@noaa.gov.