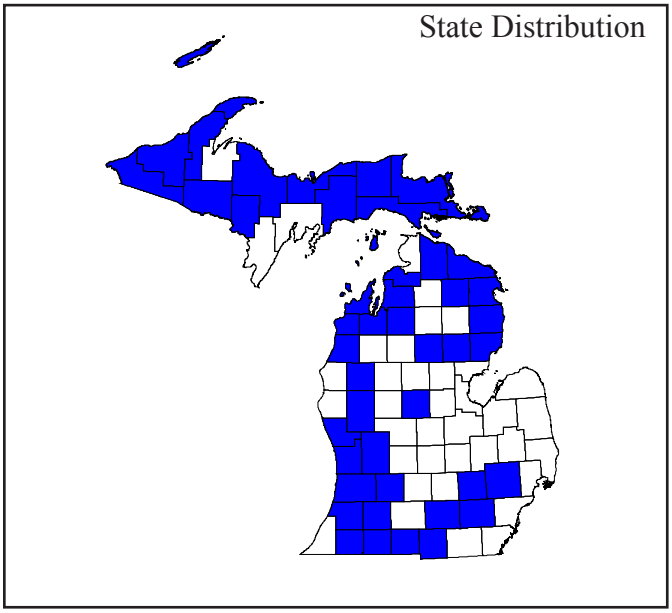
Coregonus artedi Lesuer — lake herring (cisco)



Best Survey Period

Status: State Threatened

Global and state rank: G5/S3

Family: Salmonidae (Salmon family)

Synonyms: Lake herring are also known as cisco and tulibee.

Total range: Lake herring have the widest distribution of the North American ciscos. They occur in the north-central and eastern parts of the United States and throughout Canada (Scott and Crossman 1998).

State distribution: Lake herring occur throughout Michigan and the Great Lakes. The majority of inland lake populations occur in southern Michigan from Oakland County southwest to Cass County in an area of moraine kettle lakes left by the Wisconsin glacier (Latta 1995). Their populations are very low in lakes Erie, Michigan, and Huron, and abundant only in Lake Superior (Todd and Smith 1992).

Recognition: The lake herring is an elongate fish, almost round in cross section, with an average length of 267 mm (Koelz 1929). They have moderate sized scales with fewer than 100 in the row above the lateral line (Bailey et al. 2004) and short dorsal fins with 9-11 rays (Becker 1983). Their lower jaw is equal to or shorter than the upper jaw and they have two flaps between the nostrils (Bailey et al. 2004). The number of gill rakers, ranging from 44 to 52, is one of the main characters distinguishing this species from other Coregonus species (Bailey et al. 2004). The *Coregonus* genus is quite variable and is recognized as having many subspecies (Evers 1994).

Best survey time/phenology: This species aggregates to spawn, and hence spawning season, which often occurs in late November or early December, is the best time for collection. They are often captured in gillnets, and sometimes trap nets and seines.

Habitat: Lake herring are a pelagic, cold-water, lake species. They often form large schools at depths of 9-91 m, and are most commonly found at depths ranging from 27-46 m (Wells 1968). They typically move into shallow waters in the winter to spawn and then move back to deeper waters, below the thermocline in spring (Scott and Crossman 1998). Of all the ciscos, they are most often found around inshore shoals and shallow water (Becker 1983). As young, their upper lethal water temperature is 26° C.

In inland lakes they rarely occur in waters with temperatures above 17-18° C. In Michigan, lake herring occur in inland lakes ranging from 20 to 19,000 acres, the majority of populations occurring in lakes larger than 100 acres (Latta 1995). They generally require deep lakes of at least 10 m (Becker 1983). These lakes are typically classified as hard water, oligotrophic lakes (Latta 1995).

Biology: Lake herring spawn in late November to mid-December and often arrive at spawning grounds when water temperatures are around 5-6° C. Spawning

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peaks when water temperatures fall below 4° C (Becker 1983). In inland lakes, spawning occurs in 1 to 3 m depths when ice begins to form around shores (Scott and Crossman 1998). In the Great Lakes spawning generally occurs in shallow waters (<20 m), but can occur at depths up to 64 m. Spawning has also been reported pelagically at 9-12 m below the water surface in much deeper water (Becker 1983, Scott and Crossman 1998). Generally, eggs are deposited at night over rocky substrates (Becker 1983). Lake herring have been noted jumping and splashing during spawning.

Fecundity or reproductive capacity is directly related to the size of the female (Evers 1994). Since eggs are released in winter, they are slow to develop and often hatch in late April or early May after spring breakup (Becker 1983, Scott and Crossman 1998). Fry can be found in shallow, protected bays until they are about 1 month old (Becker 1983). Lake herring mature between 1 and 4 years and can reach 13 years of age. The scales of this fish are easy to age especially ages 1 to 3 (Scott and Crossman 1998).

Lake herring are plankivores and feed mainly on algae, Cladocera, copepods, and *Mysis* but may also feed on mollusks, insect larvae, and small fish. Young typically need light to feed. Lake herring are a main food item for lake trout. Other predators include rainbow trout, northern pike, burbot, sea lamprey, yellow perch, and walleye (Scott and Crossman 1998). Many species predate upon lake herring eggs including brown bullheads, yellow perch, lake whitefish, mudpuppies, and other lake herring (Becker 1983).

Lake herring are susceptible to summer kills. Low oxygen levels in the hypolimnion may push this species into waters where temperatures are lethal (Becker 1983).

Movements: Lake herring are constant movers. They have been shown to do vertical diurnal movements to feed directly under the ice at night. They tend to live out their life within a few kilometers of their hatching site (Becker 1983). A tagging study in Lake Michigan found that individuals did not move greater than 81 km from the original tagging point (Smith and Van Oosten 1940).

Conservation and management: Historically lake herring have been one of the most important and productive commercial species in the Great Lakes (Becker 1983). Declines are attributed to over-exploitation, competition, and pollution. Smelt, alewife, and bloater have all been suggested as competitors of lake herring (Anderson and Smith 1971, Becker 1983). The greatest threat to lake herring populations of inland lakes is eutrophication (Becker 1983, Latta 1995). Enrichment of inland lakes causes oxygen depletion of deep waters and forces individuals to move into the upper strata where temperatures are unfavorable causing summer kills. Hence, lake herring are excellent indicators of eutrophication and global warming (Latta 1995).

Research needs: As of 1995 (Latta), the status of approximately 66% of lake herring populations were unknown. More survey effort is needed to determine locations and population status of this species, especially in inland lake populations. Mapping locations of spawning and rearing habitats in the Great Lakes is important to aid in protecting a critical life stage of development for this species. There is currently disagreement between experts on the recognition of subspecies of *Coregonus* genus. For example, Ives Lake Cisco (*Coregonus hubbsi*) are thought by some to be a subspecies of lake herring. Hence, research is needed in describing subspecies.

Selected references:

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