Current Status of the Bridle Shiner, *Notropis bifrenatus*

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The story of the bridle shiner (*Notropis bifrenatus*) is starting to sound like that of the passenger pigeon. A bird once so abundant its migrations blocked the sun, it was harvested to extinction in a mere 50 years. The bridle shiner was once so common that it was used as bait. Recently, the bridle shiner seems to have gone into a steep and swift decline. In a recent article on the status of the bridle shiner in Pennsylvania, Criswell (2002) stated, "None of our other native fishes has plunged in numbers from such abundance to its present rarity, and it may soon be a footnote in Pennsylvania ichthyology." It is reports such as these that are beginning to worry biologists.

Natural History

The bridle shiner is a small, slow-swimming, gregarious, minnow. It inhabits lakes and slow-moving streams in the Lake Ontario-St. Lawrence drainage, and Atlantic Slope drainages from southern Maine to South Carolina. It relies on clear water and submerged aquatic vegetation for feeding, spawning and protection (Jenkins and Burkhead, 1994). The bridle shiner is a sight feeder with a diet consisting mainly of aquatic insects and other invertebrates (Harrington, 1948). Spawning occurs from late spring to mid-summer just under the surface of the water above aquatic vegetation (Harrington, 1947).

Identification

The bridle shiner rarely exceeds 50 mm standard length (Jenkins and Burkhead, 1994). It has a straw colored dorsum, light-colored venter and a prominent lateral band on both sides extending from the caudal fin to the tip of the snout. It can be distinguished from similar looking "blackline" shiners (e.g., ironcolor shiner) by the presence of pigment on the upper lip, absence of pigment on the lower lip and the continuity of the lateral band.

Status

Most states and provinces that I attempted to obtain information from had a paucity of recent data with which to determine the status of the bridle shiner. In addition, many of the Natural Heritage rankings[1] are based on older data sets and appear outdated. The data that is available, however, suggests a recent decline in bridle shiner populations, particularly in the southern portion of its range.

Canada Natural Heritage ranking = S2 "Imperiled" (Ontario), S4 "Apparently Secure" (Quebec)

Holm et al. (2001) recently reviewed the status of the bridle shiner in Canada. Many populations have not been surveyed since the 1960s and their status is unclear. Most recently surveyed populations showed evidence of decline, particularly in Quebec. Despite a handful of stable populations, the authors recommended the bridle shiner be given "vulnerable" status in Canada.

Maine Natural Heritage ranking = S2 "Imperiled"

Maine's department of Inland Fisheries and Wildlife

[1] The Natural Heritage program is a network of independent heritage programs that collects and maintains data on species of the western hemisphere. Rankings are from NatureServe Explorer (2001).

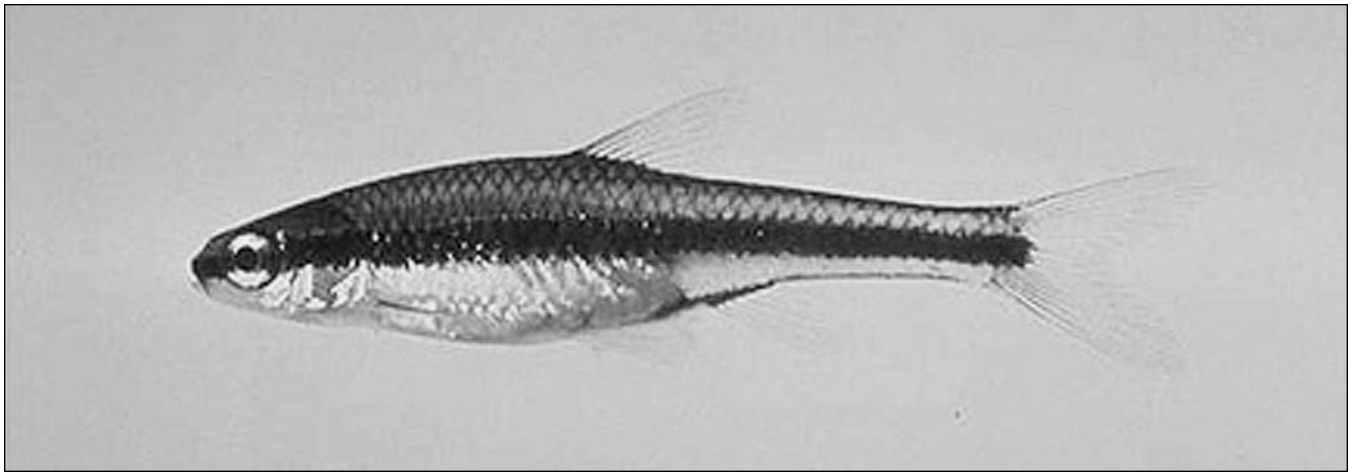

Fig. 1.
Bridle shiner, *Notropis bifrenatus*. Courtesy: The Virtual Aquarium of Virginia Tech (www.cnr.vt.edu/fish).

has identified the bridle shiner in seven lakes (Tim Obrey, pers. comm.). The most recent known collection from these lakes was in 1976. One specimen was collected on Mount Desert Island during the early 1990s (Doering et al., 1995), but it is believed to be a bait-bucket introduction since the bridle shiner is native to southwestern Maine (Stone et al., 2001).

New Hampshire Natural Heritage ranking = S4 "Apparently Secure"

The bridle shiner seems to be doing well in New Hampshire. The state's Department of Environmental Services has collected the bridle shiner in six stream locations between 1998 and 2001 (Michael Racine, pers. comm.).

Vermont Natural Heritage ranking = S1 "Critically Imperiled"

The bridle shiner can still be found in several streams of the Lake Champlain basin, but there is little data for the Connecticut and Hudson River drainages. There are unconfirmed collections of the bridle shiner in the Lake Memphremagog drainage (Mark Ferguson, pers. comm.).

Massachusetts Natural Heritage ranking = S? ("Unknown")

There is recent evidence of the decline of the bridle shiner in Massachusetts. A 1993 study designed to look for the bridle shiner found them in only nine of the 36 lakes that it had been historically present. The sampling of eight additional lakes turned up no specimens (M. Chandler, unpublished data in Whittier et al., 1997).

Rhode Island Natural Heritage ranking = S5 "Secure"

I could find no data to confirm or dispute this listing.

Connecticut Natural Heritage ranking = S3 "Vulnerable"

Recent surveys (1987-1995) by Connecticut's Department of Environmental Protection found bridle shiners in 15 of the 99 lakes (Jacobs and O'Donnell, 1996) and eight of the 978 stream segments (Hagstrom et al., 1995) surveyed. The authors of the stream survey noted that previous data showed a more widespread distribution than that of their survey.

New York Natural Heritage ranking = S5 "Secure"

The bridle shiner is still relatively common in north and central New York. Its range in the western portion of the state seems to be shrinking and there have been few recent records in Long Island, Hudson, Susquehanna, or Delaware River drainages. However, a lack of directed sampling efforts in these drainages makes the status of the bridle shiner difficult to assess (Doug Carlson, pers. comm.).

Pennsylvania Natural Heritage ranking = S1 "Critically Imperiled"

There is only one known extant bridle shiner population in the state. Unfortunately, there is a highway bypass project being planned in the immediate area of this population. Although safeguards are being put in place, possible sediment loads from the construction project are making Pennsylvania biologists nervous. In response to the recent decline and the vulnerability of the last known population, Penn State researchers have begun a captive breeding program with plans to reintroduce the bridle shiners in the future (Criswell, 2002). In 1999, the bridle shiner was given "Endangered" status by the Pennsylvania Fish and Boat Commission.

New Jersey Natural Heritage ranking = S4 "Apparently Secure"

The bridle shiner was historically widespread in lakes and streams throughout New Jersey, with the exception of acidic Pine Barren waters (unpub. data, N.J. Fish and Wildlife). Since 1995 there have been only two confirmed collections. However, current efforts to expand the state's stream and lake monitoring programs may reveal additional populations.

Delaware Natural Heritage ranking = SU "Unrankable"

A museum specimen from 1956 is the only confirmed record of the bridle shiner in Delaware. There are records from surveys done between 1986 and 1991, but some of these may have been misidentifications (Craig Shirey, pers. comm.).

Maryland Natural Heritage ranking = SH "Possibly Extirpated"

There are no recent collections of the bridle shiner in Maryland despite an intensive stream sampling program. Consequently, Dr. Rich Raesly (Frostburg State University) and Paul Kazyak (Maryland Department of Natural Resources) have been contracted to determine if the bridle shiner is extirpated from Maryland (Rich Raesly, pers. comm.).

Virginia Natural Heritage ranking = S2 "Imperiled"

Virginia is one of the more intensively sampled states for nongame fishes. This intense sampling effort, along with a study of historical records, has led to the conclusion that the bridle shiner is extirpated from all but one drainage where it historically occurred (Jenkins and Burkhead, 1994).

North Carolina Natural Heritage ranking = SH "Possibly Extirpated"

In 2000 and 2001, the bridle shiner was collected in a small creek of the Neuse River drainage (Sarah Kopplin, pers. comm.). The only collection prior to this was in a different creek of the Neuse River drainage in 1960. Based on this data, the North Carolina Fish Scientific Advisory Committee has recommended "Endangered" status for the bridle shiner. The Non-game Advisory Board has yet to make a decision regarding the official listing.

South Carolina Natural Heritage ranking = S? ("Unknown")

The presence of the bridle shiner in South Carolina was confirmed in 1981 from collections in Lake Marion and Lake Moultrie (Jenkins and Burkhead, 1994). The current status of these populations is unknown.

Reasons for Decline

The bridle shiner may be the passenger pigeon of the aquatic world, but unlike the passenger pigeon the exact cause of its decline is unclear. A number of theories are plausible, including the introduction of non-native predators and plants, declines in water quality and declines in suitable habitat.

A recent analysis of the Environmental Protection Agency's EMAP data (Whittier et al., 1997) revealed an alarming reduction in the diversity of minnows in northeastern lakes, the primary habitat and range of the bridle shiner. The authors concluded that the introduction of nonnative predators (e.g., largemouth bass) throughout the region was a major factor in the loss of minnow species.

The quick spread of the introduced green sunfish (*Lepomis cyanellus*) in many areas of the northeast may also be contributing to the decline of the bridle shiner. The introduction of this aggressive species has been linked to local extinctions of native fishes in California (Moyle and Nichols, 1974) and North Carolina (Lemly, 1985).

The spread of invasive aquatic plant species may be augmenting the decline of the bridle shiner. The bridle shiner spawns between the water surface and the top of aquatic vegetation making invasive species that grow to the water surface (e.g., Eurasian watermilfoil) unsuitable for reproduction.

The bridle shiner's reliance on clear, slow-moving water and abundant aquatic vegetation for feeding, spawning, nurseries, and predator-avoidance makes it vulnerable to human-induced declines in water quality. Increases in sediment inputs may inhibit sight-feeding and impact the growth of aquatic vegetation. In addition, the volatile flows of hydrologically altered streams may be devastating to the frail, weak-swimming species Although many streams may recover from acute hydrologic alterations and sediment inputs, the frail, slow-swimming shiner may have difficulty recolonizing areas of suitable habitat.

The Need for Further Research

Despite declines in some bridle shiner populations and the widespread degradation of water quality and habitat, the actual status of the bridle shiner is uncertain. Frequently used sampling protocols (e.g., boat electrofishing at night) may

miss the small minnow in lakes and ponds. To further complicate matters, the habitat specificity of the bridle shiner may cause biologists to overlook the species in stream surveys designed to obtain representative samples of the entire fish assemblages. For example, the New Jersey population that I recently sampled is confined to an area of about 15 square meters. Had we started electrofishing slightly upstream, we would certainly have missed them. In order to determine the true status of the bridle shiner, sampling efforts need to target suitable habitats and use field gear (e.g., minnow traps, seines) conducive to collecting the species.

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