

Evaluating the Status of Gars and Bowfin in Illinois

Gars (*Lepisosteidae*) and Bowfin (*Amia calva*) are among North America's most primitive predatory fishes, with records dating them over 100 million years. Primarily found in slow-moving riverine environments, these ancient fish have the ability to utilize their well-vascularized gas bladders to survive in low-oxygen environments where other animals cannot survive. Although the four species native to Illinois (Fig. 1) differ slightly in appearance, they all have elongated, cylindrical bodies and jaws full of razor-sharp teeth. These features help gars and Bowfin effectively target smaller forage fishes, which in turn helps stabilize freshwater ecosystems in Illinois.

Historically, gars and Bowfin have been unpopular with anglers because they were seen as a threat to more desirable

sport fish species. This perception led to eradication efforts unsupported by scientific evidence. However, in recent years recreational angling for gars and Bowfin has grown in popularity throughout Illinois. Despite the emerging interest in these fishes, Illinois currently does not have management plans for their populations. Population demographic information is needed to develop such plans, including size structure; growth and mortality rates; and estimates of population size. This fundamental information represents an emerging research need so fisheries managers can effectively provide and maintain a quality ancient sport fishery in Illinois.

Researchers in the Sport Fish Ecology Lab (SFEL) at the Illinois Natural History Survey (INHS), with the valuable assistance

from the Illinois Department of Natural Resources Division of Fisheries, the INHS Illinois River Biological Station, the INHS Population Monitoring Program (LTEF), Eastern Illinois University, the Missouri Department of Conservation, The Illinois Bowfishing Association, The Bowfishing Association of America, and The Tri-State Bowfishers, have embarked on a multi-year research effort to conduct population assessments, evaluate age and growth, and estimate population sizes of gar and Bowfin in Illinois. By means of collaborative sampling efforts, researchers have begun gathering data to evaluate the status of Longnose Gar (*Lepisosteus osseus*), Shortnose Gar (*L. platostomus*), Spotted Gar (*L. oculatus*) and Bowfin populations in the major river basins of Illinois.

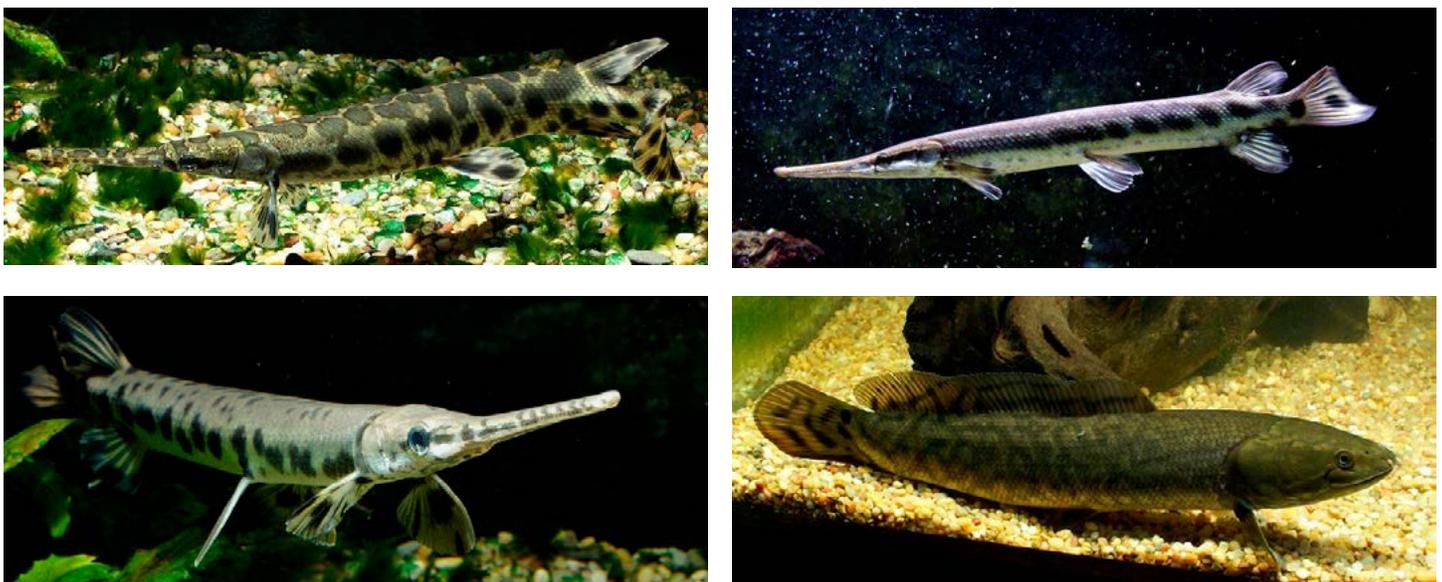
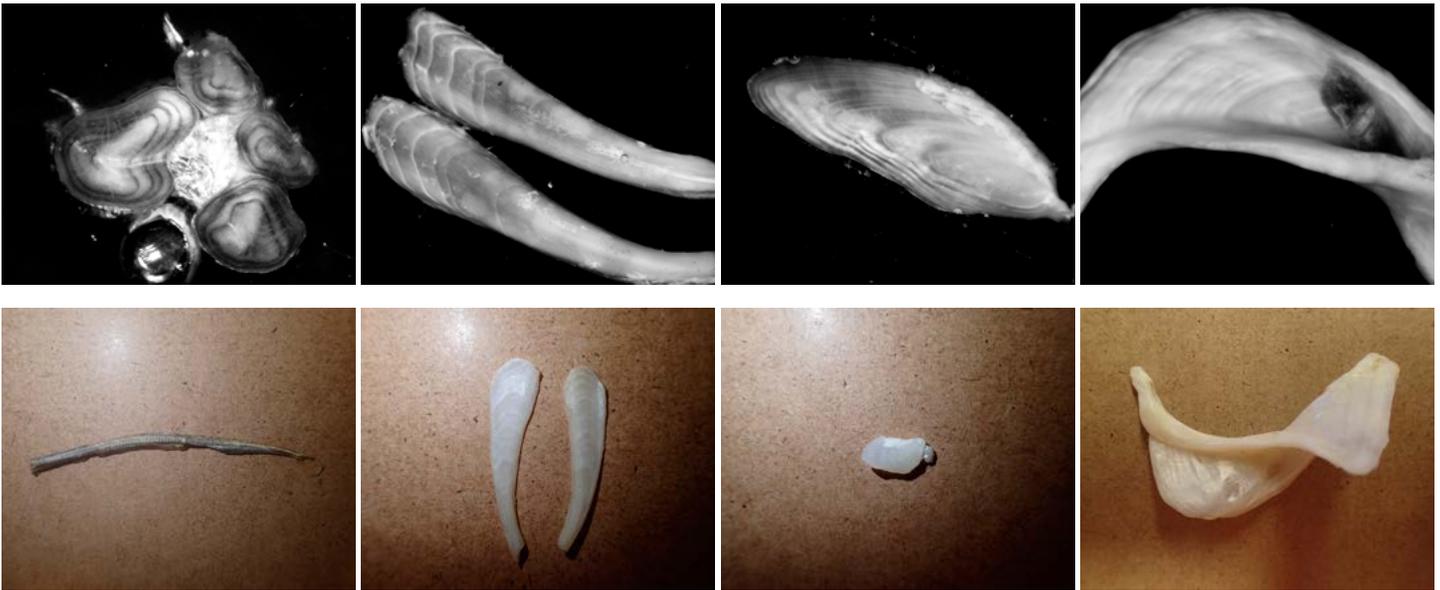


Figure 1. The Illinois native gars and Bowfin in aquaria. Top: Spotted Gar (*Lepisosteus oculatus*), Shortnose Gar (*Lepisosteus platostomus*); Bottom: Longnose Gar (*Lepisosteus osseus*) and Bowfin (*Amia calva*). Photos courtesy of Dr. Solomon David (Shedd Aquarium).



ABOVE: Figure 2.

(A) Top row from the left: a transverse cross-section of a pectoral fin ray, a set of branchiostegal rays, a longitudinal-section of a sagittal otolith, and a left cleithra as seen under a dissecting microscope while aging. Photos by Sarah King (INHS) using a DCM digital camera attached to a dissecting microscope.

(B) Bottom row from the left: a most-anterior pectoral fin ray, a set of branchiostegal rays, a sagittal otolith, and a left cleithra as seen by the naked eye after removal from fish and cleaning. Photos by Sarah Molinaro (INHS).

Researchers often estimate the age of a fish by examining the growth of a hard structure from the fish, such as a scale, otolith (ear bone), or fin ray. In the Midwest, fish grow faster during the summer than in the winter due to the seasonal changes of the environment. The “fast” and “slow” growth periods are reflected by a pattern of varying densities in the hard structures, and these patterns form rings called annuli. Much like the rings of a tree trunk, annuli can be counted to estimate the age of a fish (Fig. 2A). Interestingly, different hard structures vary in their precision and accuracy of age estimates depending on the species in question. Previous research shows that pectoral fin rays are useful to estimate ages of Bowfin. However, the literature is less certain for gars. Historically, researchers have used branchiostegal rays to estimate the age of gars, but very few studies have examined the utility of alternative nonlethal structures.

SFEL researchers collected over 390 gars to determine the ideal hard structure for estimating age—a critical piece of information needed to accurately determine population demographics. Individual fish were collected; hard structures were removed, processed, and aged independently by two readers. Age estimates of branchiostegal rays, cleithra, sagittal otoliths, and the most anterior pectoral fin rays were compared (Fig. 2B). The structures were evaluated by four criteria: ease of removal, ease of processing, lethality to the animal, and precision of age estimates among multiple readers. Our results suggest that both the branchiostegal rays and the anterior pectoral fin rays are useful for gar age estimation. However, pectoral fin rays have the added benefit of being nonlethal to collect, which may be more desirable when a population is of unknown conservation status.

Simultaneously, SFEL researchers initiated a mark-recapture study to compare age and growth demographics of each species among watersheds. To date, over 1,800 gar and Bowfin have been floy-tagged in the Wabash, Lower Illinois, Upper Illinois, Upper Mississippi-Meramec, and Kaskaskia watersheds. In time, these data will aid in estimation of population size and may help identify movement patterns within and among river basins. As the ancient sport fish studies progress, SFEL researchers will expand sampling efforts into other watersheds and continue to gather size and age data on all four species. Information from our studies will aid managers in the development of appropriate strategies to sustain quality gar and Bowfin fisheries in the waters of Illinois.

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