Pallid Sturgeon, *Scaphirhynchus albus*

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Fig. 1: Artistic interpretation of *Scaphirhynchus albus*

Image provided by: fisheries.org
Abstract:

The Pallid Sturgeon *Scaphirhynchus albus* is a lesser-documented species of sturgeon that has a native range from the Missouri to the Mississippi river, preferring open, turbid channels. General characteristics of the Pallid Sturgeon include: light gray coloration, elongated and flat snout, fringed barbels, small eyes, armored and long caudal peduncle (Ross 2001). On average, Pallid Sturgeon account for 1 in every 300 river sturgeon caught in the Mississippi River. (Kallemyen et al. 1983). Due to their rarity and elusive nature, collecting life history and population abundance data on Pallid Sturgeon is a difficult task.

Content and Context:

Class Actinopterygii, Order Acipenseriformes, Family Acipenseridae, Genus Scaphirhynchus, Species *albus*. Pallid Sturgeon are colloquially known as: white hackleback, white shovelnose sturgeon, or white sturgeon. The Pallid Sturgeon has very similar characteristics and ecological niches to its close relative the Shovelnose Sturgeon (*Scaphirhynchus platorynchus*). For instance, both species are found in open, free-flowing rivers and tributaries in the Missouri and Mississippi Rivers. Both species have a similar diet of insects and fish, albeit the Pallid Sturgeon tends to be more piscivorous. In the larval stage, the two are indistinguishable until they reach a total length (front of snout to end of tail) of ~10 mm. At this point, the barbels can be used as an indicator for the two species. The inner and outer barbels for Shovelnose sturgeon are relatively similar in length. Pallid Sturgeon’s outer barbels tend to extend further than their inner barbels (Figure 2; Ross 2011). The striking similarities between Pallid Sturgeon and Shovelnose Sturgeon make differentiating the two species difficult.
Fig. 2: Phenetic differences between Pallid Sturgeon and Shovelnose Sturgeon, relative to their barbels.

Image provided by: http://fwp.mt.gov/.

**General Characteristics:**

Pallid Sturgeon have a cylindrical body, with a skeleton composed primarily of cartilage. The dorsal side is typically a brown/grayish hue, while the ventral side is white. Pallid Sturgeon have very small eyes relative to their size, and do not rely on vision as much as other fish species. The snout is elongated and flattened, with a protrusible, toothless mouth located on the ventral side of the head (Keenlyne and Jenkins 1993). Two sets of barbels are located underneath the snout, in front of the mouth. The outer barbels are typically longer than the inner barbels (Ross 2011). Pallid Sturgeon have a long, slender, almost completely armored caudal peduncle. Pallid Sturgeon have 13-14 gill rakers, 37-43 dorsal rays, and 24-28 anal rays. Spiracles are absent from the Pallid Sturgeon as well (Ross 2001). At maturity, Pallid Sturgeon are larger than
their relative, the Shovelnose Sturgeon (Ross 2011). By 13-14 years of age, most Pallid Sturgeon range from 29.5-35.4 in long, and can reach a weight of 68 lbs. (Ross 2001).

**Distribution:**

Pallid Sturgeon can be found in the Missouri and Mississippi rivers and tributaries (Keenlyne and Jenkins 1993; Figure 3). In Mississippi, Pallid sturgeon primarily occur within free-flowing rivers and tributaries close by (Killgore 2007a).
Form and Function:

Pallid Sturgeon are a member of the order Acipenseriformes, a group of primitive, ray-finned fishes. This order contains two extant families of fishes, the paddlefish and sturgeon. Pallid Sturgeon are very similar to its relative *S. platorynchus*, the shovelnose sturgeon. Pallid Sturgeon were described by Forbes and Richardson (1905). Initially, there was some controversy as to whether or not Pallid Sturgeon were a distinct species, or a sub-species of Shovelnose Sturgeon (Kallemeyn 1983). The two species not only share similar characteristics, such as form and function, but also similar life strategy and over-lapping ranges (Phelps 2010). During the larval stage, the two species are indistinguishable. Once they begin to mature, subtle differences in morphology begin to emerge that help scientists distinguish the two species. Outside of genetics, morphological differences are considered in order to help separate the two species. The coloration of the two is typically different, with the Pallid Sturgeon having a lighter color than the shovelnose. However, this cannot be used as a sole indicator. Barbel lengths of each species differ from one another. Outer barbels on the Pallid Sturgeon extend further than its inner barbels, where the barbels of the Shovelnose Sturgeon extend a uniform length. Pallid Sturgeon lack bony plates on their ventral side, whereas the bony plates are present in Shovelnose sturgeon. Shovelnose Sturgeon have only 30-36 dorsal rays. Only 18-23 anal rays are present on Shovelnose Sturgeon. (Kallemeyn 1983; Ross 2001). Unfortunately, these two species have the ability to hybridize, which only serves to complicate the issue of taxonomy (Figure 4.).
Ontogeny and Reproduction:

Pallid Sturgeon, like other sturgeon, are a long-lived species. Sexual maturity occurs in male Pallid Sturgeon by ages 3-4, when they attain a length of 533-584mm (Kallemeyn 1983). Sexual maturity for female Pallid Sturgeon is believed to occur between ages of 15-20 years old (Dyer and Sandoval 1993). In addition to being slow to mature, Pallid Sturgeon do not spawn annually. Male sturgeon have a 2-3 year interval between spawning, and female sturgeon have a 3-10 year interval between spawning (Dyer and Sandoval 1993). Although there is a lack of detailed information about the reproduction of Pallid Sturgeon, strong inferences can be made in relation to the Shovelnose Sturgeon, which has extremely similar morphological, physiological, and genetic characteristics to the Pallid Sturgeon. Pallid Sturgeon prefer shallower, slower
flowing river bends to reproduce. Habitat suitable for reproduction is common and not considered to be a limiting factor. Female sturgeon move upstream (10’s- 1000’s km) and spawn at the apex of their migration (DeLonay et al. 2009). Males migrate upstream as well, but choose several spawning locations along the way, and tend to be more sedentary (DeLonay et al. 2009). While the precise location of spawning for Pallid Sturgeon is still not well documented, it is believed that zones of convergent flow are preferred, in reference to other sturgeon species. Sturgeon eggs are adhesive, and sturgeons choose to utilize rock, gravel, and some sand substrates, but prefer rocky substrates (DeLonay et al. 2009). The reproductive cues for Pallid Sturgeon are believed to be: temperature, discharge, and day length. Temperature is the most highly suspected cue, due to the temperature correlating with proper zygote maturation and survival. This is noted by the fact that Pallid Sturgeon choose to spawn in the spring-early summer when the water is 14.2-20.8°C. However, it may simply be an internal, biological process that signifies the time for reproduction (DeLonay et al 2009). It is believed that the biggest hurdle for successful Pallid Sturgeon reproduction is the anthropological alteration of naturally flowing rivers (Dryer and Sandoval 1993). The creation of dams and the alteration of meandering rivers to stream-lined canals can disrupt and even inhibit Pallid Sturgeon from migrating to an acceptable spawning habitat. (DeLay et al 2009).

Ecology and Behavior:

Pallid Sturgeon utilize sandy or rocky, turbulent river bottoms along the Missouri and Mississippi rivers for their primary habitat (Dryer and Sandoval 1993). Including spawning, Pallid Sturgeons can have ranges varying from 10’s to 1000’s of kilometers (DeLonay et al. 2009). Pallid Sturgeon prefer depths ranging from 6-14 m deep, with water temperatures ranging from 0-30°C (32-86°F) (Dryer 1993; Herrala et al. 2014). The mean turbidity suitable for Pallid
Sturgeon is 0.6-1 m/s (Herrala et al. 2014). Sturgeons are a benthic or drift-feeding species, relying mainly on their sensitive barbels to navigate. The diet of the Pallid Sturgeon is composed of invertebrates (11-16%) and other fish (60-74%). It should be noted that once Pallid Sturgeons reach a FL (fork length) of 600-700, they are much more piscivorous than Shovelnose Sturgeon (Dryer 1993). The niche that Pallid Sturgeon utilize is very similar to that of its relative, the Shovelnose Sturgeon. This is an indicator that the two species may be competing for similar resources, depending on their life stage (Killgore, 2007b).

**Genetics:**

Genetic studies on the Pallid Sturgeon are few. However, in 2000, the mitochondrial DNA of 78 individual sturgeon (Pallid Sturgeon, Shovelnose Sturgeon, and Alabama Sturgeon) was sampled in order to help better understand the potential genetic differences or similarities between the three species. The study concluded that the genetic differences between species were relatively minimal, yet significant enough for the three to be considered their own species. The study also concluded that hybridization between Pallid Sturgeon and Shovelnose Sturgeon was far more common in the southern range (lower Mississippi River) as opposed to their ranges further north in the Missouri river (Campton 2000).

**Conservation:**

Pallid Sturgeon are less common than Shovelnose Sturgeon. Currently, Pallid Sturgeon are considered an endangered species. Primary causes for decline include: habitat loss, flow alteration by dams, accidental catch, pollution, and hybridization with Shovelnose Sturgeons (Kallemeyn 1983). Man-made alteration of natural rivers has reduced habitat that is essential for successful Pallid Sturgeon reproduction. Channelization of rivers causes a number of aquatic
changes, including: increased turbidity, decreased water clarity, altered water temperature regimes, increased depth, decrease in snags, and changes in sediment (substrate), as well as preventing flow into backwaters (Dryer and Sandoval 1993). Impoundment of rivers creates an impassible barrier that often prevents the highly migratory Pallid Sturgeon from reaching a suitable spawning location (Dryer and Sandoval 1993). These alterations are also likely for the increasing amount of hybridization (DeLonay et al 2009). If unable to migrate up-stream to find suitable habitat to spawn, Pallid Sturgeon will simply choose the most suitable spawning habitat available (Dryer 1993). Unable to find its own spawning habitat, Pallid Sturgeon are forced to share spawning space with the much more common Shovelnose Sturgeon, which can lead to unintentional hybridization (Dryer 1993).
Literature Cited:


Kallemeyn L. 1983. Status of the Pallid Sturgeon (Scaphirhyncus albus) Fisheries, Vol. 8, Issue 1

