

Jacob Kirk

Ichthyology 4453

Literature Review of the Chain Pickerel



Esox niger

ABSTRACT

The Chain Pickerel *Esox niger* is the larger of the two pickerel species found in Mississippi. This predatory fish is characterized by an elongated body, homocercal tail, and an elongated snout with several sharp teeth. Other species within the family Esocidae similar in appearance to the Chain Pickerel include the Grass Pickerel *Esox americanus* and Northern Pike *Esox lucius*. Chain pickerel are solitary ambush predators that prefer to lie-in-wait for their prey and dart towards them at high speeds once in range. They prefer shallow, calm waters within the littoral zone with dense vegetation. Grass Pickerel have been known to hybridize with Chain Pickerel. These fish are considered an important game species and are quite common throughout most of their range.

CONTEXT AND CONTENT

Kingdom – Animalia

Family – Esocidae

Phylum – Chordata

Genus + Species – *Esox niger*

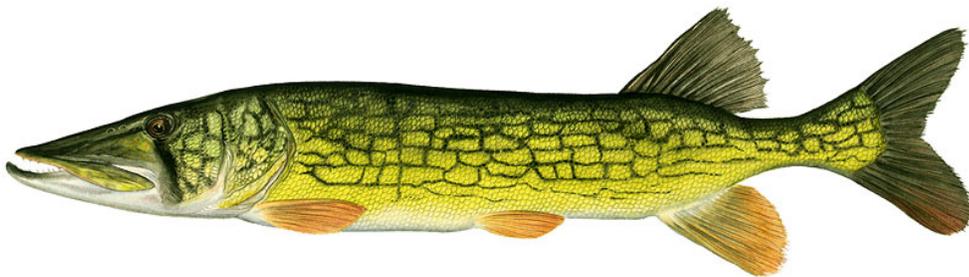
Class – Actinopterygii

Order – Escociformes

GENERAL CHARACTERISTICS

The Chain Pickerel is a member of the pike family and is very similar to Northern Pike and Grass Pickerel in body shape and structure (Ross 2001). Though not the largest in its family, the Chain Pickerel is the largest pike species found in the Southeastern United States (Ross 2001). *E. niger* is an elongate, moderately compressed fish with a large, terminal mouth and

well-developed teeth (Ross 2001). Much like other members within the family, its dorsal and anal fins are set far back, its pectoral and pelvic fins are set low on the body, and has a homocercal caudal fin (Ross 2001). Chain Pickerel have been known to live as long as 9 years, with an average lifespan of 3-5 years. They can reach lengths up to 787mm (31in) with an average weight between 4 and 5lbs (Ross 2001; Underhill 1949). The cheeks and operculum are both fully scaled. The snouts are usually dark in color with a prominent, dark vertical line below the eye while the fish itself ranges from green to dark green dorsally, with green or blue-green shading on the sides, and typically possesses creamy white coloration on the ventral side (Coffie 1998; Figure 1.). The biggest feature distinguishing the Chain Pickerel from other pikes is the network of chain-like markings on the sides from which its common name is derived (Coffie 1998). Chain Pickerel are a solitary fish, only exhibiting social behavior during spawning (Coffie 1998).



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Figure 1. Physical characteristics and coloration of *Esox niger*



Figure 2. Large terminal mouth and well-developed teeth.

DISTRIBUTION

Chain Pickerel are a freshwater fish of North America ranging from the Atlantic coastal plain on the east side of the Appalachian Mountains and all throughout the Southeastern United States (Ross 2001; Figure 3). They can be found north from Maine, south to Florida, west through the Gulf States to parts of Texas, and north in the Mississippi through eastern Kentucky and southwestern Missouri (Coffie 1998). Their range has recently extended further north into parts of Canada and their popularity as a game species has caused them to be introduced into Colorado, Nebraska, Minnesota, Indiana, Montana, Ohio, and Pennsylvania, and the Lake Erie drainage of New York (Coffie 1998). In Canada they can be found from Nova Scotia to New Brunswick and their westward expansion along gulf tributaries extends into the Pearl drainage (Ross 2001).

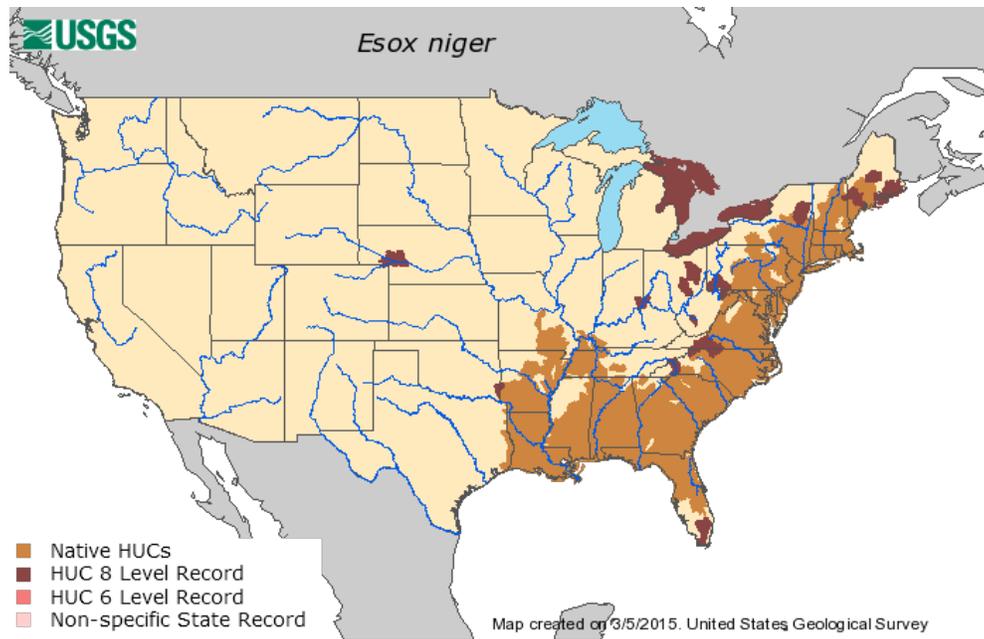


Figure 3. Map of Chain Pickerel distribution in the United States.

FAMILY AND ORDER

The family Esocidae is considered the pike and pickerel family and range from North America to Eurasia (Helfman 2014). Fish from the family Esocidae can be described as moderate to large piscivorous (fish-eating) fish, with large terminal mouths and dorsal and anal fins set far back on the body. They have strong teeth on both jaws, in addition to broad bands of cardiform teeth (numerous small, fine or coarse pointed teeth arranged in distinct rows) lining the roof of the mouth and tongue (Ross 2001). Considered ambush predators, they will feed on nearly anything resembling prey that comes nearby with their primary diet consisting of other fish (Ross 2001).

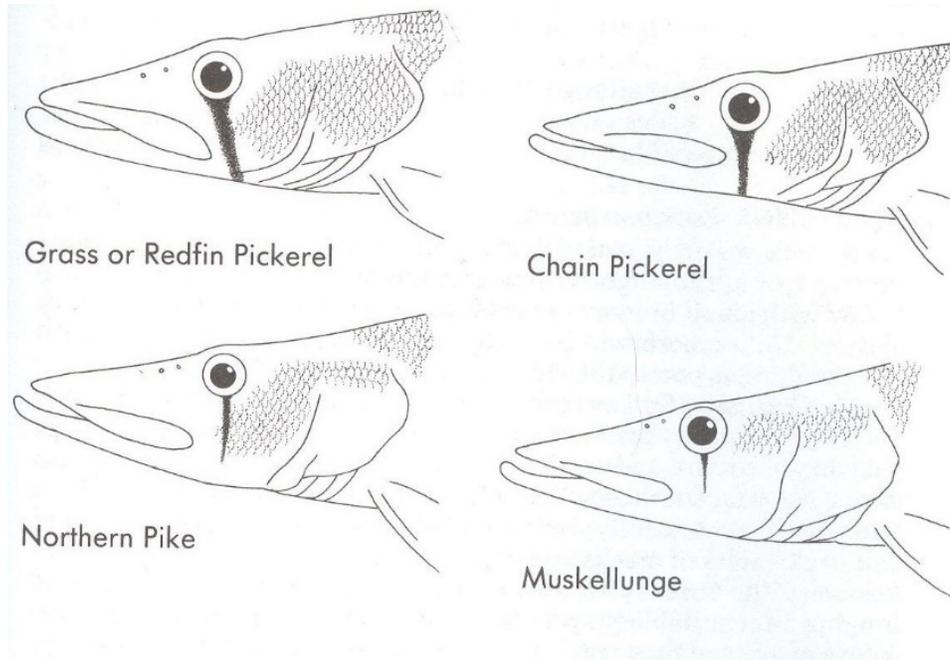


Figure 4. Comparison of the heads of different Esocids. Chain Pickerel distinguishing orbital characteristics include completely vertical bar and longer, slimmer snout as opposed to other species.

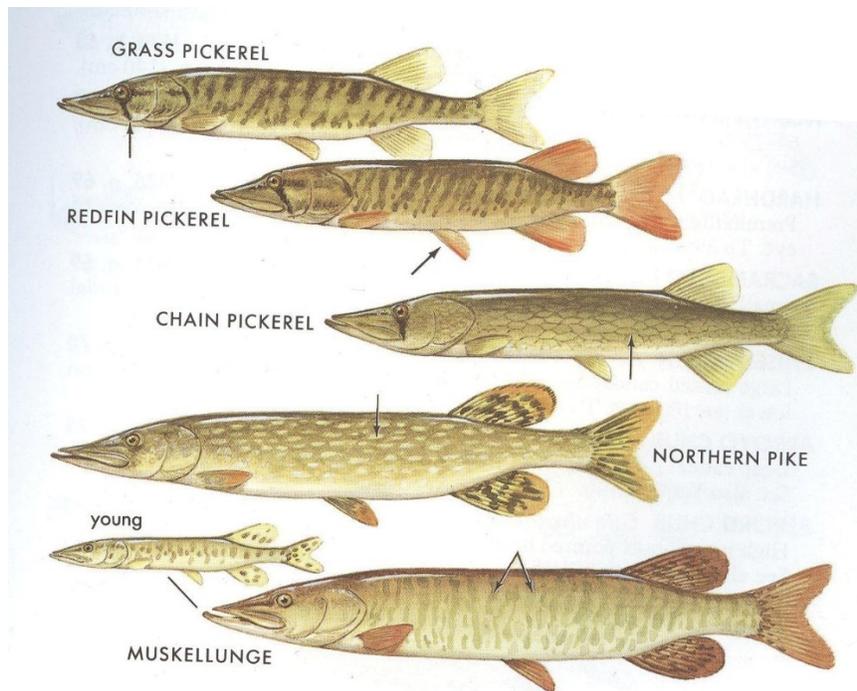


Figure 5. Differences in appearance of fish within Esocidae

The order Esociformes consist of two families and ten species of freshwater fish in which the maxillary bone is included in the gape but is toothless, and in which the median fins are located relatively far back on the body (Helfman 2014). The two families classified within this order include Escocidae (pikes, pickerels), and Umbridae (mudminnows, black fish). Their lineage can be traced back to the Cretaceous period. Esociformes has one of the most widespread natural east-west distributions of the fresh water fish and can be found scattered across North America, Europe, and Asia (Helfman 2014).

FORM AND FUNCTION

The body structure of the Chain Pickerel is designed to make it one of the fastest, deadliest predatory fish in its environment. The location of the dorsal and anal fin on the back end of the fish essentially doubles the area of the caudal fin. This characteristic drastically increases propulsion, providing the fish with very quick start-up speeds so they can ambush and capture prey (Ross 2001). In addition, the elongate, torpedo shaped bodies of the Chain Pickerel allows them to move quickly through the water with ease. Their large, terminal mouth, strong teeth, and several rows of cardiform teeth allow them to capture and grip prey very effectively (Ross 2001). The overall green coloration and chain-like pattern of the Chain Pickerel aids in concealing this ambush predator in weeds and vegetation (Coffie 1998), allowing the Chain Pickerel to remain hidden until their prey lurks too close for escape.

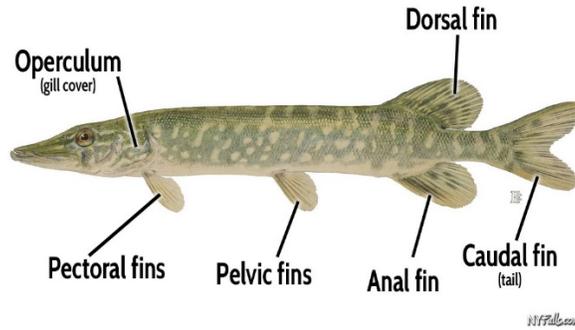


Figure 6. Pickerel body form

According to Ono (1980), proprioceptive nerve endings have recently been discovered along the locomotor muscles of pickerel. More work is currently being done to understand the specific functions of these nerve endings; however, there is evidence suggesting that these nerve endings allow the pickerel to go from high speeds when ambushing prey to abrupt stops with minimal disturbance of the water column (Ono 1980). Since pickerel are ambush predators, it is imperative they remain motionless so as not to alert any nearby prey to their presence. These nerve endings, coupled with the function of the pectoral fin in stabilization and maintaining of the correct orientation of the body, accomplish just this (Ono 1980).

ONTOGENY AND REPRODUCTION

Chain Pickerel spawn typically in late winter and early spring though the specific time is largely dependent on water temperature, with spawning initiated at roughly 15 degrees Celsius (Ross 2001). Spawning usually occurs during the day over areas of flooded vegetation such as flooded shores of lakes, streams, and ponds. A male and female will swim close to each other and from time to time, roll inward and flex their bodies to bring the vents together (Coffie 1998). Eggs and sperm are released at the same time and mixed by lashing of the tails. Once breeding is

complete, the adults abandon the eggs and go their separate ways; neither sex returns to guard the eggs and there is no form of ensuing parental care (Coffie 1998). The slightly adhesive eggs are gelatinous, measuring ~2mm in diameter, with most clutches numbering anywhere from 1200-1300 eggs depending on the size of the mother (Ross 2001). Since nests are not constructed, the eggs remain within the thick vegetation until they hatch 6-12 days later. After hatching, the larvae will then sink to the bottom during the day. At night, the larvae swim into the water column in order to attach themselves to vegetation by means of an adhesive gland located on the tip of their snout (Ross 2001).

Young Chain Pickerel begin feeding immediately once the yolk sac is fully absorbed (Underhill 1949). Juveniles feed on plankton and small invertebrates until they reach approximately 80 – 100mm, at which point they will then shift their diet to a variety of larger prey. Chain Pickerel tend to grow rapidly, reaching 102 – 127mm within the first year. Females tend to mature earlier, grow faster, live longer, and reach greater sizes than their male counterparts (Ross 2001). They will continue to grow throughout their lifetime with the average lifespan being around 3-5 years, reaching an average weight of approximately 4-5lbs (Ross 2001). They have been known to reach up to 787mm in length, however, growth rates can become limiting depending on available resources, water condition, vegetative cover, and population densities (Underhill 1949). Time of sexual maturity varies greatly based on regional factors; the average age of Chain Pickerel in the Southeast is around one year whereas the average age in the North may take anywhere from 2-4 years (Coffie 1998).

ECOLOGY

Chain Pickerel are considered to be ambush predators with a wide ranging diet. When young, they feed primarily on plankton, invertebrates, and other small fish (Ross 2001). Once grown, their diet ranges from other fish, large invertebrates, small reptiles including snakes, frogs, mice, and anything small enough to be eaten as they are gape limited predators. Primarily piscivores (preferred prey is other fish), there have been over 37 different fish species that have been regularly recorded as prey, including smaller Chain Pickerel (Coffie 1998). They are very opportunistic feeders and can swallow large prey as long as its body depth is less than or equal to that of the feeding Chain Pickerel (Ross 2001).

The Chain Pickerel serves as a top predator and is regarded as an important game species throughout much the United States (Coffie 1998). Often, the Chain Pickerel may fill the role of a keystone species by helping keep the plankton population stable by feeding on their predators such as insects and small bait fish (Helfman 2014). Not only does it keep populations of other fish species in check but it can occasionally become prey itself, providing another food source to other predatory fish. However, expansion into other territories brings the potential of adversely affecting the local biota through interference and competition with other species; particularly other piscivores in the fish community that have similar habitat requirements, such as Largemouth Bass, Walleye, and other native Esocids (Hoyle and Lake 2011). They may also have an effect on the local reptile and amphibian populations due to both species preferring areas of shallow water with plenty of vegetation, and taking into consideration the Chain Pickerel's predatory behavior.

BEHAVIOR

Chain Pickerel are a solitary species with spawning being the only time they socialize. Coffie (1998) observed that during the summer they have been known to establish and defend a defined territory, leaving it only to feed. They prefer shallow, sluggish waters near the shoreline with heavy vegetation (Coffie 1998). Though they can fully function metabolically and physically in temperatures as low as 5-15 degrees Celsius, they retain a preference to warmer waters; explaining their overall abundance in the Southeast as opposed to the colder waters of the North (Bailey 1991). Common bodies of water preferred by the Chain Pickerel include small, vegetated creeks, as well as large rivers and the shoreline of lakes (Ross 2001). Larger fish tend to move into shallow waters during the day and deeper water at night. They are typically sensitive to waters with a high pH and tend to prefer acidic water with a pH of around 3.8 (Coffie 1998).

Due to their affinity for submerged vegetation, well-structured bodies of water, and quiet flow, Chain Pickerel will readily move out of stream channels during times of flooding (Ross 2001). With this being said, they are not a fish known to exhibit any kind of regular migration pattern across a substantial range. However, they may occasionally migrate into more brackish waters during the winter time (Coffie 1998). Their northern distribution has increased in recent years into areas outside of their natural range due to human interaction. They have started making an appearance in several parts of Canada and continue to expand northward (Underhill 1949). The only potential physical barriers halting their recent expansion would be the vast open waters of Lake Ontario, the St. Lawrence River, and frigid northern waters all of which have qualities less desired by the Chain Pickerel (Underhill 1949).

As previously mentioned, Chain Pickerel are exceptional predators that prefer to ambush their prey rather than hunt it down. They will spend the majority of their day floating motionless within dense vegetation until suitable prey enters its range of vision (Underhill 1949). According to Ono (1980), it is for this reason they prefer calm, quiet waters to minimize the amount of potential disturbances within the water that could interfere with this tactic. Chain Pickerel, including other members of this family, have been described as 'mere machines for the assimilation of animal matter that lurk among plants in convenient corners whence they rush forth with arrow-like velocity' (Ono 1980). Once prey comes within sight, they will exhibit an S-posture which maximizes lunging performance prior to striking prey (Ono 1980).

GENETICS

All Pike and Pickerels are very similar to each other in form, function, and behavior. Of all the various Pickerels, however, the Grass/Redfin Pickerel, *Esox americanus*, is the most similar to the Chain Pickerel with the Northern Pike, *Esox lucius*, being a close second (Coffie 1998). Chain Pickerel have been known to readily breed with Grass/Redfin Pickerel and Northern Pike, producing hybrids (Figure 7). Though hybridization with Northern Pike is possible, the offspring are not fertile whereas hybrids formed through hybridization with Grass/Redfin Pickerel are fertile (Coffie 1998).



Figure 7. Example of a Pike-Pickerel Hybrid

CONSERVATION

In some areas of the United States, the Chain Pickerel is highly regarded as a sport fish and large numbers are taken annually (Coffie 1998). They are regularly stocked and can be caught on the same artificial lures offered to Largemouth Bass (Ross 2001). In some areas, they have even been introduced to control or reduce unwanted species (Coffie 1998). If managed properly, the stocking of this predatory fish may result in better balance in fish communities and improvement in the quality of fishing so long as it doesn't put a strain on resources if there are other predatory fish in the fishery (Underhill 1949). It is said the meat is of high quality in taste but is very bony. The species is widespread throughout its United States range and common where found with population statuses being completely secure. The only exception would be Kentucky where it is of special concern (Coffie 1998).

ACKNOWLEDGEMENTS

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REMARKS

Other common names of the Chain Pickerel include: Black Pike, Duckbilled Pike, Eastern Pickerel, Green Pike, and Jack. The Latin name of the species, *Esox niger*, can be broken down into two words with separate meanings: *Esox*, which is an old European name for Pike, and *niger*, which in Latin translates to dark or black (Ross 2001).

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FIGURES CITED

- Title Picture (<http://fishesoftexas.org/taxon/esox-niger/>)
- Figure 1 (<http://www.flickford.com>)
- Figure 2 (<https://www.flickr.com/photos/34486353@N07/4724880839/>)
- Figure 3 (<http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=681>)

- Figure 4 (http://basstardfishing.com/Identifying_The_Pike_Esox_Family.html)
- Figure 5 (http://basstardfishing.com/Identifying_The_Pike_Esox_Family.html)
- Figure 6 (<http://nyfalls.com/wildlife/fish/pike/>)
- Figure 7 (<https://anrweb.vt.gov/FWD/FWD/MasterAnglerSearch.aspx>)