American Beauties: Flagfin Shiners (*Pteronotropis*) of the Southeastern U.S.

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Of the 300-plus minnow species native to North America, few are more coveted by aquarists—and more confounding—than the flagfin shiners of the genus *Pteronotropis*.[1]

Flagfin shiners are coveted because they are among the most spectacularly colorful and decorated minnows in North America (if not the world). Take the bluenose shiner, the gaudiest member of the genus. It's the "jewel of the Southeast," enthused B. G. Granier (1998). "If any of our native fishes were to be placed in a color competition against exotic tropical species," wrote NANFA legend Gerald C. Corcoran, "the one with the best chance of winning would have to be the bluenose shiner" (Corcoran, 1980).

Flagfin shiners are confounding because they can be frustratingly difficult to locate in the wild. Although widely distributed throughout the Atlantic and Gulf coastal plains of the southern U.S. from South Carolina to Texas, *Pteronotropis* do not reveal their whereabouts easily. Many a hobbyist have embarked on Holy Grail-like quests to locate *Pteronotropis* only to return home with their skin burned, their legs eaten by mosquitoes, and their coolers empty. Those fortunate to locate *Pteronotropis* on a regular basis often keep their collecting spots a secret. Longtime NANFA member, former *American Currents* editor, and *Pteronotropis* connoisseur Dick Stober confessed to having "some sort of complex" believing that the bluenose shiner—the most elusive *Pteronotropis*—would forever escape his net (Stober, 1976).

Three factors help explain the elusiveness of the genus: 1) *Pteronotropis* often occur in nearly inaccessible, snag-filled, backwater creeks and small rivers that are difficult to sample.[2] In Florida, for example, bluenose shiners often occur in water that's too deep for minnow seines and dipnets (Watson, 1990).[3] 2) Juveniles and non-breeding males are easily mistaken for less colorful, less desirable, species. What experienced collectors have learned the hard way is that some of the plain, unassuming minnows they threw back were the very minnows they were after! 3) *Pteronotropis*, like many other fishes with distinct habitat preferences, *are* uncommon, and are becoming more uncommon, as their habitats are modified or destroyed. (More on this below.)

I'm not about to reveal secret *Pteronotropis* collecting spots. That's for you to discover (and keep secret) on your own. After all, the hunt of the chase is one of the most enduring aspects of the native fish hobby! However, I will reveal some of the latest biological discoveries regarding these minnows, and how to properly maintain and spawn them in the aquarium.

Compared to minnows from more northern climes, *Pteronotropis* are fairly easy to keep. They can withstand warmer temperatures than most other U.S. minnows, and as such are one of the few local fishes than can be mixed with

[1] The taxonomy of *Pteronotropis* is in a state of flux. Genetic analyses of bluehead shiner (*P. hubbsi*) and bluenose shiner (*P. welaka*) show that they are not related to other members of the genus (Simons et al., 2000) and may warrant separate generic status. In addition, some recent taxonomic papers refer to *Pteronotropis* as a subgenus of the speciose shiner genus *Notropis* (e.g., Suttkus and Mettee, 2001; Suttkus et al., 2003).

[2] The inaccessibility of *Pteronotropis* habitat also explains why the various forms of *P. hypselopterus* have eluded taxonomic recognition for so long (Suttkus and Mettee, 2001).

[3] Granier (1998) presented an unconfirmed report of bluenose shiner being observed while scuba diving in a Florida spring at depth of 30 feet.

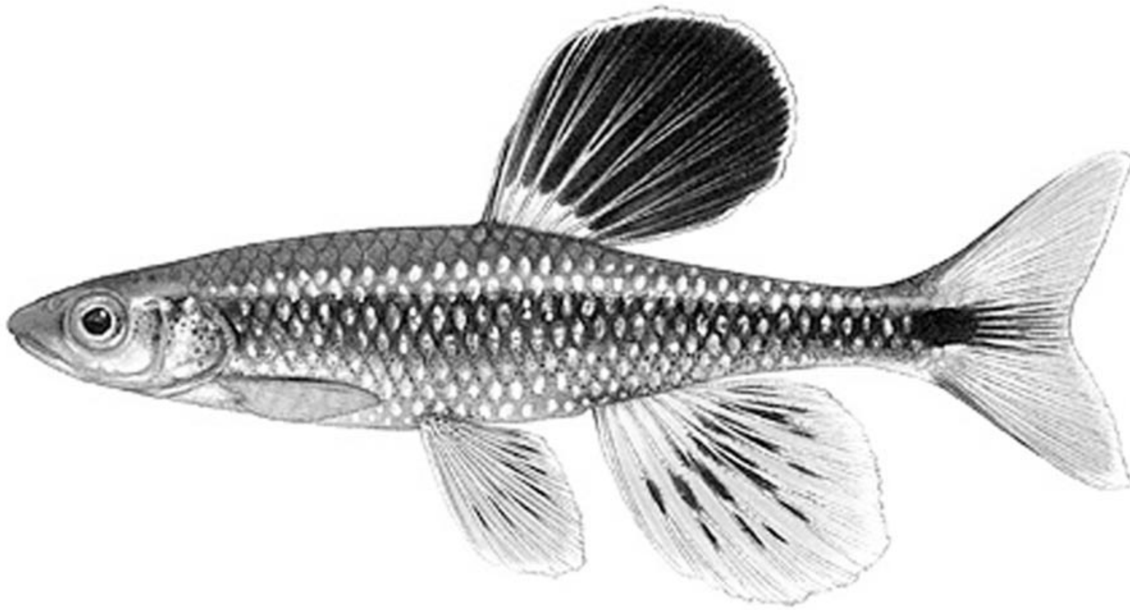

Fig. 1.
Bluenose shiner, *Pteronotropis welaka*, nuptial male. Illustration © Joseph R. Tomelleri.

tropicals (although purists would cringe at the thought!). *Pteronotropis* are peaceful with other fishes of the same size and temperament and readily accept standard aquarium fare. Males usually color up during the spawning season, but unless you coax them to spawn and successfully raise their eggs, you will only get to see their beautiful battle dress once, maybe twice if you're lucky, before they expire. Propagating these minnows, or receiving captive-born progeny from other aquarists, is far more preferable than continually raiding their ever-declining habitat.

The Bluenose Shiner, *Pteronotropis welaka*

Bluenose shiner—or simply welaka, as connoisseurs like to call it—is the "poster minnow" of the native fish hobby and a true cult item among devotees. It's found in dark, weedy streams in Gulf Coast drainages from the Apalachicola River in Georgia and Florida to the Pearl River in Mississippi and Louisiana. A former stronghold of the species was within Florida's St. Johns drainage, for which it is named: *welaka*, a Native American name for the St. Johns River, means "chain-of-lakes." Unfortunately, the St. Johns population has all but disappeared (Gilbert, 1992).

The precise habitat preferences of the bluenose shiner have been somewhat of a mystery over the years, and appear variable. "It inhabits weedy streams with beds of dark fetid mire," wrote naturalist Fannye A. Cook in 1959. Mettee et al. (1996) found breeding individuals to be more common deep within mats of vegetation and small individuals more common along the periphery. Bluenose shiner dart to the surface to take insects (Granier, 1998), but are also known to be herbivorous (McLane, 1955).

It's the breeding male of the species that receives all the oohs and aahs. They develop a flaglike dorsal fin (hence the moniker "flagfin" as applied to the genus), enlarged anal and pelvic fins, and a large forked caudal fin (Fig. 1). The dorsal fin is black with bright yellow lines, while the anal and pelvic fins are an unexpected and delightfully bright yellow, highlighted with thin streaks of black. When the dorsal and anal fins are fully flared—which happens when competing males confront each other in a *Betta*-like territorial display—they each form almost perfect circles. As impressive as these fins are, the male's most outstanding feature has to be its cerulean nose, with the blue extending from the upper lip and head to just behind the eyes. Females lack the elaborate finnage and colors of the male, although a spot of blue pigment can sometimes be found on the tip of the snout. Juveniles are often mistaken for other black-striped minnows, particularly the ironcolor shiner (*Notropis chalybeus*). One way to distinguish juvenile *P. welaka* is to look closely at the base of the caudal fin; you should see a dark spot bordered by areas of white, creating a "halo effect" around the spot.

During the spawning season, three types of male *P. welaka* are believed to be present: initial, transitional and terminal males (Fletcher, 1999). Initial males are smaller, with less-rounded fins, less overall color, and no blue on the head.

Terminal males are more colorful and larger, with broadly rounded fins. Transitional males are intermediate in size, fin shape and color. Interestingly, transitional males allocate a lesser proportion of their mass to reproduction. This suggests that male bluenose shiners sacrifice some of their reproductive energy in order to display their most ornate colors and finnage. All terminal males pass through the initial male phase, but it's unclear whether all initial males eventually become terminal.[4]

A fairly recent (1999) discovery concerning the bluenose shiner is that it's a nest associate of longear sunfish (*Lepomis megalotis*).[5] Nest association occurs when fish of one species (the associate) spawn in a nest guarded by a breeding male of another species (the host).[6] The benefits of this arrangement to the associates are clear. Why expend the energy to build a nest when plenty of other suitable nests are available for "rent"? And why worry about protecting your young when a bigger, meaner fish will unknowingly, "adopt" your eggs and babies? Usually, both hosts and associates benefit from the arrangement; when more eggs or fry are in the nest, the risk of losing them to other predators is spread out between the two species. Unfortunately for longear sunfish and other potential hosts, the bluenose shiner can be a predator, too. In an example of "parasitic nest association," bluenose shiner will sometimes raid the host's nest, eating the sunfish's bigger eggs while occasionally ingesting some of their own (Johnston and Knight, 1999). The only other parasitic nest associate known among North American minnows is the dusky shiner (*Notropis cummingsae*) (Fletcher, 1993). So individual is this behavior that some researchers recommend investigating whether bluenose shiner and dusky shiner are related (Simons et al., 2000).

[4] Not everyone agrees that Fletcher's data fully supports the notion that *P. welaka* has three types of males. One criticism is that Fletcher's data suffers from small sample size and from not having a sample that includes the entire breeding season (C. Johnston, pers. comm.).

[5] Although researchers did not observe the spawning act, *P. welaka* eggs and fry were subsequently removed from these nests, confirming that the minnow is a nest associate (Johnston and Knight, 1999).

[6] Some 35 species of minnows have been documented spawning over the nests of larger fishes, including other minnows. In addition to *P. welaka*, at least 10 species are known to spawn in the nests of sunfishes: bluehead shiner (*P. hubbsi*, see text), redfin shiner (*Lythrurus umbratilis*), rosefin shiner (*L. ardens*), pretty shiner (*L. bellus*), common shiner (*Luxilus cornutus*), red shiner (*Cyprinella lutrensis*), Topeka shiner (*Notropis topeka*), taillight shiner (*N. maculatus*), dusky shiner (*N. cummingsae*), and golden shiner (*Notemigonus crysoleucas*). The last-named species also spawns over nests of the predatory bowfin (*Amia calva*).

The $64,000 question facing aquarists who wish to raise bluenose shiners is: Are they obligate or facultative sunfish nest associates? This is a biologist's way of describing whether a certain life history trait is biologically essential for survival (obligate) or just something that occurs under some environmental conditions but not others (facultative). In other words, do bluenose shiners need sunfish nests (or reasonable facsimiles thereof) to breed in captivity? Based on the few reports of captive spawnings available, probably not. In fact, evidence collected from other nest-associating minnows indicate that maybe it's not the nest that gets bluenose shiners "in the mood," but the odor of sunfish milt and ovarian fluid.[7]

One of the first (if not *the* first) reported spawnings of *P. welaka* was published in an early issue of *American Currents*. Anthony Terceira (1975) reports placing two pairs of *P. welaka* into a 15-gallon aquarium with "natural gravel," a thick cover of water sprite, and one corner densely planted with foxtail. An airstone was "bubbling at a rather fast rate in the middle of the tank to provide maximum circulation of the water." Within two weeks the shiners had spawned and "scattered their eggs throughout the dense cover . . .". Although it's possible that Terceira's shiners spawned in the plants, it's also possible they spawned over the gravel and that the eggs were disbursed into the dense cover by the "rather fast" bubbling of the airstone. Terceira removed the parents and raised the fry on infusoria. After six days they became free-swimming and were fed paramecium and newly hatched brine shrimp.

Granier (1998) reports *P. welaka* "scattering eggs all over the substrate of the tank." Tank conditions emulated those in the wild—soft water, pH 6.4 to 7.0, water temperature 10-25.5°C (50-78°F)—and live foods help get adults into spawning condition. Not reported in that article are two potentially significant observations: Immediately after spawning the shiners assumed a nose-down position and quickly ate their eggs, and attempts to spawn them in bare-bottom tanks failed (B.G. Granier, pers. comm.).

The most detailed protocol for spawning the species comes from the book *American Aquarium Fishes*. Place 10-15 individuals into a 29-gallon tank with slight current, plants (or some other structure) around the sides, and an open middle area covered with coarse gravel or pebbles. Feed the fish on

[7] One study showed that redfin shiner (*Lyrthurus umbratilis*), a nest associate of the green sunfish (*Lepomis cyanellus*), was not attracted to the nest per se, but to the odor of the milt and ovarian fluid of the sunfish (Hunter and Hasler, 1965). It's possible that *P. welaka* is attracted to the same—a great topic of investigation for the serious aquarist-naturalist.

live foods for eight weeks, then lower the temperature to 18°C (65°F). Move the females to another aquarium and continue to feed them live foods. After another eight weeks of conditioning, return the females to the tank with the males and slightly reduce the current. Spawning should take place within a few hours. Turn off filters since the eggs are easily scattered into the current and drift throughout the tank. Remove the parents and begin conditioning them for several more rounds of spawning. Eggs hatch in 2-4 days, depending on the temperature. Eggs may also be collected in spawning mops or pebble- or marble-filled spawning trays for hatching in separate nursery aquaria. Keep turbulence to a minimum as it interferes with feeding. Feed the fry rotifers, infusoria, and green water; switch to daphnia and ostracods after two weeks. Brine shrimp nauplii are not readily accepted (Goldstein et al., 2000).

The Bluehead Shiner, *Pteronotropis hubbsi*

The bluehead shiner is similar to the bluenose shiner, but differs in having a more rounded body and, among breeding males, smaller dorsal fins (some with a trace of orange), less olive-yellow to cream-gold anal and pelvic fins, and an area of powder blue with green iridescence only on the top of the head. Females are conspicuously drab but also develop blue heads during the breeding season. *P. hubbsi* males lack a transitional phase, moving directly from terminal to initial males (Fletcher and Burr, 1992).[8] Initial males are smaller than terminal males and possess the species' characteristic blue patch on the head. Terminal males are larger in size, have more greatly expanded finnage, and possess only a faded blue spot or no spot at all. They also develop vertical bars on their sides, which may serve to exaggerate their apparent body depth (Fletcher, 1999).

The bluehead shiner is a widely distributed species found in the Red, Ouachita, and Atchafalaya River systems west of the Mississippi River in Texas, Oklahoma, Arkansas, and Louisiana. A relict population was in Wolf Lake in southwestern Illinois, approximately 440 km (273 mi) away from the nearest known population in Arkansas (Fletcher and Burr, 1992); it presumably was extirpated in the 1970s when two railroad tank cars derailed into the lake, spilling toxic fluid that caused a massive fish kill (Smith, 1979).

Like the bluenose shiner, the bluehead shiner is a nest associate. This was confirmed in a Louisiana bayou during the month of May, when male blueheads were seen defending a territory in a cavity between buttressing roots of a bald cypress tree (Fletcher and Burr, 1992). When eggs were removed from the cavity and hatched in the aquarium, two species emerged, the bluehead shiner and the warmouth (*Lepomis gulosus*). The shiners were actively defending their nests, but only before, during, and immediately after egg deposition. Shiners were never observed defending their fry, a task, it seems, they delegate to the warmouth. Bluehead shiners are apparently not obligate nest associates, since larvae have been found among woody plant roots where warmouth nests were not present.

Terminal males are one year older than initial males, and are more aggressive and dominant (Fletcher and Burr, 1992). They spend much of their time chasing females and defending their territory against other terminal males in a series of ritualistic displays, including head butting (but not biting), swimming side-by-side with flared fins, and spinning head-to-tail in tight circles. The more colorful initial males are not territorial, but occasionally "sneak" into terminal male territory, presumably to spawn while the larger males battle it out. Researchers hypothesize that the initial male's more intense colors function as a signal to terminal males that they are non-territorial, thus avoiding potential harassment and harm by the larger fish. Initial males outnumber terminal males by a ratio of 6:1, suggesting that few individuals survive the extra year it takes to transition from secondary to terminal phase.

The adaptive significance of the bluehead shiner's unusual life history has not been explained. Also unexplained is how one can find literally thousands of individuals in breeding condition one week, but find none the week before or after. The bluehead shiner is either highly migratory species, or a massive die-off of males occurs some time after spawning and nesting is complete (Fletcher and Burr, 1992).

The bluehead shiner's spawning behavior can be seen in the aquarium by following the same protocol described for the bluenose shiner above. Outdoor spawning is also possible. Aquarist David M. Schleser (pers. comm.) reports spawning bluehead shiners in 800-gallon, bare-bottomed fiberglass ponds each stocked with a pair of pumpkinseed sunfish (*Lepomis gibbosus*). In previous years, bluehead shiners placed into ponds without sunfish colored up but did not spawn. In laboratory studies, Fletcher and Burr (1992) raised *P. hubbsi* larvae on plankton collected from a pond.

[8] Initial male bluehead shiners were originally called secondary males, but the terminology changed when researchers realized that the latter term was already in use to describe fishes with hermaphroditic males that had previously been females (Fletcher, 1999).

The Flagfin Shiner, *Pteronotropis signipinnis*

The seven other species of *Pteronotropis* are deep-bodied minnows with bright orange, red, and blue colors on the body and fins. Although the fins of breeding males become greatly enlarged, the dorsal fin does not form a nearly round shape when fully flared as in *P. welaka* and *P. hubbsi*. Nor do their heads or snouts turn blue. Nevertheless, breeding males are all spectacularly colored minnows, with perhaps the flagfin shiner (*P. signipinnis*) being the most gaudy (Fig. 2). On nuptial males, the pectoral and pelvic fins are mostly yellow. The dorsal, anal, and caudal fins are yellow close to the body, warming to a brilliant red-orange towards the outer margins. The body is pearl-colored, with an iridescent rose-violet band—above a wider black band—stretching from the tail through the upper half of the eye into the snout.

The flagfin shiner is probably the easiest species in the genus to locate and collect. They're found in small, clear, spring-fed streams along the coastal plain from the Apalachicola River drainage in Florida to the Pearl River drainage in Mississippi and Alabama. Specimens may be collected as they form small schools feeding near the surface, lounging in the shade of a bridge or culvert, or congregating in pools. Tabb (2004) reported a novel collecting technique. Instead of trudging up- or downstream to locate a pool where the shiners like to congregate, he simply dug out a small pool at an easily accessible location in the stream. A few days later, the manmade pool was filled with flagfin shiners.

Flagfin shiner spawning has been observed in the aquarium (see below), but not in the wild, mainly because reproduction takes place in extremely shallow and highly vegetated riffles. Since spawning in fast riffles can be tricky, spawning in thick vegetation allows males and females to clasp more easily (Albanese, 2000). (In the aquarium, males corner females against the glass during spawning.) The dense mats of plant roots, plant detritus, and stems of living plants in vegetated riffles provide crevice-like areas where males may more easily clasp females and then spawn. In addition, dense vegetation may also decrease the chances of the eggs being eaten, especially by the parents.

Several aquarists report success breeding the flagfin shiner. Albanese (2000) placed 2-4 adults of unknown sex into each of four 10-gallon aquaria containing water from the Mississippi stream where they had been caught, sand-gravel substrate, and a few plants. The shiners were fed stream invertebrates, frozen bloodworms, and flake food. Imitating seasonal changes in stream conditions, the temperature was

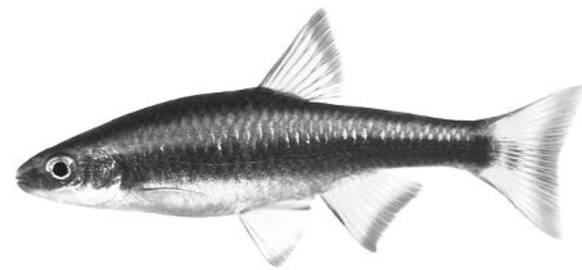

Fig. 2.
Flagfin shiner, *Pteronotropis signipinnis*, male.
Photograph by Howard Jelks.
Courtesy: USGS/Florida Integrated Science Center.

gradually raised from 17°C to 22°C (63°F to 72°F) over the course of a month. Lights were on for 10 hours a day. Prespawning behavior consisted of the male chasing the female and nudging his head against her abdomen, usually near the vent. The female responded by fleeing. Sometimes the male quivered when he got close to his potential mate, shuddering his body from side to side while swimming. Spawning always occurred along one of the sides or in the corner of the aquarium. During spawning the male wrapped his caudal fin around the female's body near her anal fin. Eggs were released all at once and quickly sank. Several times both parents consumed almost all of the eggs before they hit the bottom. Pairs produced multiple clutches, with at least four days between spawnings.

Stober (1977) spawned *P. signipinnis* in soft, slightly acid (6.5-7.0 pH) water. Tabb (2004) reported success at 7.0 pH with a hardness of 6 or 7. In fact, Tabb suggested that lowering the hardness through partial water changes—1/6 daily using distilled water—may be an important spawning cue in that it simulates the drop of hardness that occurs in the wild after spring rains. Tabb spawned his flagfins in a 30-gallon aquarium designed to simulate both the runs and pools found in flagfin habitat. The left side of the tank, where the filter was located, was unplanted and lit (the run); the right was dark and planted with *Anacharis* (the pool). The filter outflow was directed straight across the back wall of the tank, about halfway down from the top. A leaching piece of driftwood was used to add tannins to the water (blackwater extract should also work). The flagfins—two males and five females—spawned at the front of the tank (similar to that reported by Albanese), away from the current. Like Albanese, Tabb conditioned his fishes on live food, and gradually increased temperature and photo-period to simulate the onset of spring. Tabb started at 15.5°C (60°F) and began increasing the light by 15 minutes a day until the tank was lit for 11 hours daily. Then he raised water temperature a degree a day until water temperature reached 23°C (73°F), when spawning began. Fry took green water and aufwuchs scraped from the leaves of pond plants.

"Flagfins are breeding machines," wrote Bob Muller, the chairman of NANFA's Breeder's Award Program (2003). Muller's initial success with the species began when he placed seven wild-caught males and three females into a 15-gallon tank. When he raised the water temperature from 17°C (62°F) to 22°C (72°F), the flagfins started spawning—over gravel placed underneath the outflow of a Whisper power filter —and never stopped as long as a temperature of 22-24.5°C (72-76°F) was maintained. Eggs hatched in three days at 24°C (75°F). Fry ate green water until they were free-swimming, at which time they began eating APR (artificial protozoa and rotifer). After a week the fry took brine shrimp nauplii.

The Sailfin Shiner Complex, *Pteronotropis* cf. *hypselopterus*

The sailfin shiner has been admired by aquarium hobbyists since the beginning of the hobby. William T. Innes praised the shiner's beauty in his classic *Exotic Aquarium Fishes*, but noted how the fish's home-grown status was a turn-off for some fishkeepers. "It has more than once been used as the medium of a practical joke on some seasoned fancier of exotic fishes," Innes wrote. "When it is shown [to] him as a 'new importation from Timbuctoo,' or elsewhere, he is thrilled by its beauty, and must have it at any price. His ardor soon cools when informed that it is a home product" (Innes, 1948).[9] Socolof (1996) reprints a 1927 advertisement in which a Florida tropical fish wholesaler is selling "*Notropis metallicus*" for $1.50 a pair or $6 a dozen.

The sailfin shiner has a moderately deep body with olive-yellow to olive-orange caudal and anal fins. Along the side is a lateral band that usually intensifies to form a round, black spot at the base of the caudal fin. The species prefers riffles and flowing pools along the Gulf Coast plain from the Mobile Bay drainage of Alabama to the lower Choctawhatchee River and St. Andrews Bay drainages of Florida.

Sailfin shiner larvae share a common trait with juvenile gars and bowfin—they adhere to rocks, gravel and other submerged objects by secreting an elastic glue from pores located on their heads (Fletcher and Wilkins, 1999). Adhesion helps the larvae maintain their position in flowing water, avoid predators (since sedentary larvae may be more cryptic), and conserve energy for growth and development. It's believed to be the first report of adhesive offspring among North American minnows, although master aquarist Ray Katula (1993) noticed an identical behavior in captive-born *P. euryzonus* some years earlier. Wild sailfin shiner graze on aufwuchs and take emergent insects (especially midges) as they sink through the water column (J. J. Hoover, pers. comm.).

Like flagfin shiner, sailfin shiner will reach spawning condition on traditional aquarium fare. Stober (1975) reports placing one male and two females into a 20-liter aquarium with soft (25 ppm), alkaline (pH 8.2) water kept at 24°C (76°F). Spawning occurred several weeks later. Eggs appeared to be semi-adhesive; most were scattered all over the gravel, some in the plants. Hatching took place in three days. The parents ate some of the fry.

Four species formerly classified as *P. hypselopterus* have recently been recognized as distinct (Suttkus and Mettee, 2001; Suttkus et al., 2003). The orangetail shiner (*P. merlini*) has a very deep body with bright orange coloration on its caudal fin and most of its anal fin. It's restricted to the Choctawhatchee and Pea Rivers (just above their confluence) in Alabama. The Apalachee shiner (*P. grandipinnis*) has a deeper body than *P. hypselopterus* and a distinct black spot on its tail that is smaller than its eye and deeper than it is long. It's found in the Apalachicola River drainage in Georgia, Florida and southeast Alabama. The lowland shiner (*P. stonei*) inhabits large and small streams in the Coastal Plain and lower Piedmont from the Pee Dee River in South Carolina to the Satilla River in southern Georgia. It differs from its geographically close relative *P. grandipinnis* in having little, if any, black pigment on its tail, and lacking the greatly elevated dorsal and anal fins of nuptial males. The metallic shiner (*P. metallicus*) occurs in southern Georgia and northern Florida, east of the Apalachicola River drainage. Nuptial males differ from *P. stonei* in fin pigmentation; for example, the anterior tip of the dorsal fin in both species is pale, but contains an overlay of light brown on the distal tip in *P. metallicus*. The adult males of *P. stonei*, *P. grandipinnis* and *P. metallicus* are readily distinguished by the size and shape of their dorsal fins (Fig. 3).

The Broadstripe Shiner, *Pteronotropis euryzonus*

Broadstripe shiners are commonly found in tannin-stained blackwaters in lower tributaries of the Chattahoochee

[9] Innes also noted that the fish is not easily captured, foreshadowing the cult status that *Pteronotropis* would later hold for many native fish connoisseurs.

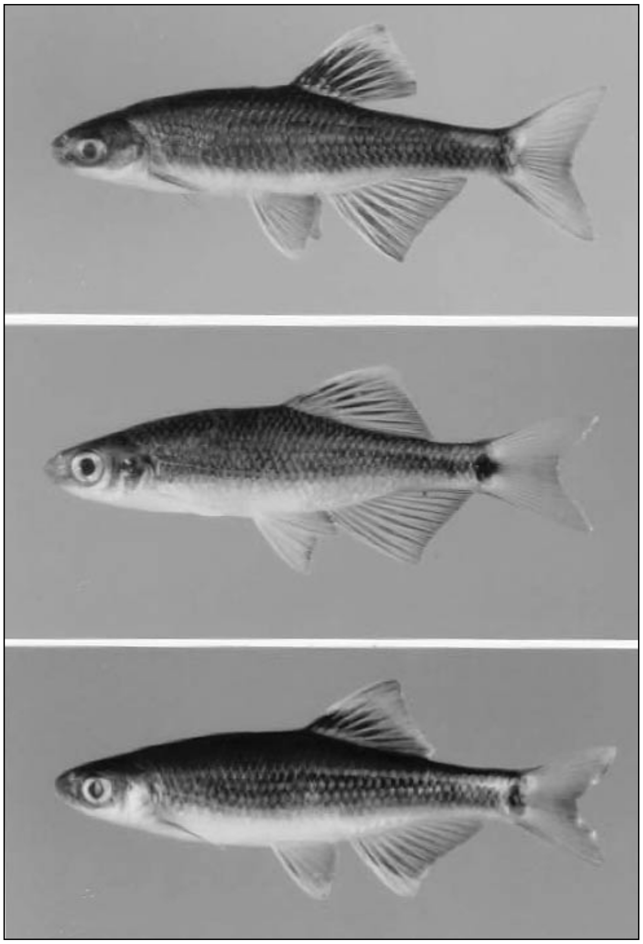

Fig. 3.
Top: Lowland shiner, *Pteronotropis stonei*, adult male, Beaver Dam Creek, Little Lynches River, trib. to Lynches River, trib. to Pee Dee River, Camden, Kenshaw Co., SC. Middle: Apalachee shiner, *Pteronotropis grandipinnis*, adult male, Chokee Creek, trib. to Flint River, Leesburg, Lee Co., GA. Bottom: Metallic shiner, *Pteronotropis metallicus*, adult male, Big Creek, trib. to Telogia Creek, trib. to Ochlockonee River, FL. Note the differences in size and shape of the dorsal fins. Photos by Brady A. Porter; reproduced from Suttkus et al. (2003) with the permission of the American Philosophical Society.

River drainage in Alabama and Georgia. As its name suggest, the species is characterized by a broad horizontal stripe that varies from black to metallic. Above this stripe is a thinner stripe of bright orange. Two red-orange spots grace the caudal peduncle. The species is similar to the sailfin shiner, but less slender and more colorful, with less elongated dorsal and anal fins.

Katula (1993) reported getting broadstripe shiner into breeding condition on flake food alone with the following protocol: Separate males and females for several weeks in 5- to 20-gallon aquariums with moderate water flow and a pH of 7.0-7.8. Add the males after making a 25% water change, slowly raising the temperature to 25.5°C (78°F). Provide spawning mops or thick java moss to catch the eggs and to help prevent the parents from eating them. If moving eggs to a nursery tank, be sure to only use water from the spawning tank. Eggs hatch in 5-7 days. According to Katula, fry blend in with their surroundings, and attach themselves to vertical surfaces, presumably by elastic glue from pores located on their heads, as described for *P. hypselopterus* above. After five days the fry began swimming on their own, and started feeding on infusoria or microworms. At 10 days of age, they're big enough to eat newly hatched brine shrimp. Females become sexually mature in six months, males in eight.

A Few Words About Conservation

The population status of most *Pteronotropis* species appear to be stable and do not warrant specific management or protection measures at this time. The status of the two most beautiful and coveted *Pteronotropis* species, however, *welaka* and *hubbsi*, are frail and declining, largely due to the destruction of swampland habitat from channelization, dredging, clear-cutting, topsoil runoff, and farming. Indeed, the prominent absence of *P. hubbsi* between Illinois and the lowlands of Missouri and northeastern Arkansas can be attributed to the conversion of cypress swamps into farmland (Fletcher and Burr, 1992). In addition, the limited and fractured distributions of *welaka* and *hubbsi*, as well as the short lifespan of adults and the over-zealousness of some collectors, makes populations vulnerable to catastrophic destruction. Bluenose shiner should not be collected in Georgia and Florida, where they are protected. Similar protections are afforded the bluehead shiner in Illinois, Iowa, Texas, and Arkansas.

Efforts to reintroduce *P. hubbsi* into Wolf Lake in Illinois, where the species has not been seen since the 1970s, failed. The reasons for the failure are not known, but may be due to the fact that broodstock came from Louisiana and Texas where the winters are not as severe as they are in southern Illinois (B. M. Burr, pers. comm.).

The Twilight Fish Conservancy, a group of snorkelers, divers, and aquarium hobbyists in Florida, has been granted permission from the Florida Fish and Wildlife Conservation Commission to collect limited numbers of *P. welaka* for captive propagation and reintroduction into suitable habitat. To date they've had one successful spawning, but the parents ate most of the eggs before workers noticed that spawning had occurred (D. Gallagher, pers. comm.). Perhaps other groups of dedicated aquarists and naturalists in other states can come together to help protect bluenose shiner habitat, and possibly aid in reintroduction efforts.

The bluenose shiner—and all members of the sailfin shiner genus *Pteronotropis*—are simply too beautiful to lose.

Acknowledgments

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