



Golden Shiner Culture: A Reference Profile¹

Andrew M. Lazur and Frank A. Chapman²

Species Account

Taxonomy and Distribution

Golden Shiners (*Notemigonus crysoleucas*) are bony fish in the order Cypriniformes and belong to the carp and minnow family Cyprinidae. Among this family are several other commercially important aquaculture species including the common carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), grass carp (*Ctenopharyngodon idella*), and fathead minnow (*Pimephales promelas*). Golden shiners have a deeply compressed body and are recognized by having a scaleless keel on the belly between the pelvic fins and anus. They have greenish-olive backs and sides with a silver and golden luster; hence the name *crysoleucas* from the Greek meaning gold and white. Golden shiners have a wide range distribution within North America. Native to the eastern United States, they are found south into Mexico and northward into Manitoba and Quebec, Canada. Golden shiners have been introduced west of the Rocky Mountains and are well established in California.

Life Cycle Characteristics

Golden shiners can survive in a wide variety of habitats and thrive in clear ponds with dense beds of submerged vegetation. They live in small schools close to shore, feeding primarily on midwater zooplankton and insects on the water surface. They are known to also feed on other small fish, molluscs, and filamentous algae.

Golden shiners grow fast and can reach 4" (10 cm) during their first year of life. Adults are commonly 3–8" long (8–20 cm), and females typically grow faster and are larger than males. Most golden shiners attain sexual maturity during their first or second year of life, however, some are known to spawn at 7–8 months of age. Their breeding season is prolonged, usually extending from March through October, with 4 to 5 spawning peaks per season. They spawn early in the morning when water temperatures reach 68–80°F (20–27°C). Spawning takes place over submerged vegetation where the females lay adhesive eggs. A female can deposit approximately 10,000–20,000 eggs which are 1.0–1.4 mm in diameter after fertilization. The eggs hatch in three to four days and larvae are about 3 mm in length. The larvae form schools just below the water surface and feed on small planktonic organisms. Predators on the young fish include insect larvae, other fish, and birds. Adult golden shiners may reach 1' (30.5 cm) in length and live for nine years.

Culture History

Golden shiners are raised primarily for bait, but they also are used as forage for largemouth bass, crappie, and in other game fish ponds. The wide use of golden shiners as bait fish has resulted in their commercial propagation throughout the southeastern United States. The majority of farm-raised golden shiners are produced in the Mississippi Delta Region. Arkansas accounts for approximately 80% of the total production with 21,000 ac (8,500 ha) in 1995.

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2. Andrew M. Lazur, assistant professor, and Frank A. Chapman, assistant professor, Department of Fisheries and Aquatic Sciences, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

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Other states where golden shiners are farmed include Alabama, Mississippi, Missouri, and Louisiana. Experiments conducted at the University of Florida's Mitchell Aquaculture Farm have demonstrated the feasibility of golden shiner production as a viable alternative aquaculture species in Florida.

Golden shiners are easily stressed when handled. Attempts to hybridize the species with its hardier European relative the rudd (*Scardinius erthrophthalmus*) have been made. However, at present, the rudd is prohibited in many states, and hybridization is not viewed as a viable option. Domestication of the golden shiner and improvements in production and handling techniques will likely contribute to the hardiness of shiners as a bait species.

Production Methods

Culture Practices

Golden shiners are raised in ponds. Large ponds of 10–20 ac (4–8 ha) are commonly used in Arkansas. Smaller ponds are preferred by farmers because of the increased ease of water quality management and higher fish yields. Ponds constructed with 6' (1.8 m) tall levees made of clay soils with 3:1 slopes and a water depth of 4–5' (1.25–1.52 m) are used for production. Ponds are usually supplied with well water, a drain and electricity for aerators. Because of the reproductive behavior of golden shiners, culture practices can be grouped into three methods:

- the wild or free spawning method,
- egg transfer method, and
- fry transfer method.

Stocking rates and yields vary among these three production methods.

Wild or Free Spawning Method—With this method, ponds are stocked at 20–40 lb/ac (22.4–44.8 kg/ha) of adult golden shiners. Fish are allowed to spawn on natural vegetation or artificial spawning mats. Eggs and fry remain in the broodstock pond throughout the growout period. Because the pond is flooded for a prolonged period before eggs hatch, the potential to establish populations of predacious insects and increase fish loss is high.

Egg Transfer Method—This is the most widely utilized production method. In this case, brood ponds are stocked with 400–500 lb/ac (448–560 kg/ha) of adult golden shiners. Spawning mats are added to the pond during the spawning season when water temperatures reach 70°F (21.1°C), typically April to June in north Florida. The number of mats placed in the pond varies with spawning activity, and it is important to use the minimum number necessary to ensure high use of each mat and to prevent unused mats from getting fouled with dirt and algae. Mats are placed level along the shore at 1–2" (2.5–5 cm) water depth. Mats with a significant covering of eggs are transferred in a hauling tank with aerated water from the brood pond to the growout pond which has been fertilized and flooded within 7–10 days. Approximately 100 mats with eggs are stocked per acre (247 mats/ha) in nursery ponds.

Fry Transfer Method—In this method, fry produced by either the wild spawning or egg transfer method are harvested and transferred to recently flooded growout ponds; 50,000–200,000 $\frac{3}{4}$ -inch (1.9-cm) fry are stocked per acre (123,500–494,000 fry/ha). Lower densities promote rapid growth and result in larger fish. This method can improve utilization of ponds and fish production potential.

All three methods require broodstock to spawn on either a natural or artificial substrate. Common natural substrates include grasses or Spanish moss assembled into flat 1' × 2' (0.3m × 0.6m) mats. Washable air conditioner filter material is the most common artificial spawning substrate used in the industry.

Water Requirements

Culture of golden shiners requires an adequate supply of good quality water. Well water is preferred because it is relatively free of chemical and biological contaminants compared to some surface water sources. If a surface water source is used, it should be analyzed for pesticides and other potentially toxic compounds. In addition, the water should be properly filtered to remove debris, insect and fish predators, and wild fish which may compete with the golden shiners. A fine mesh screen sock (250 micrometers or smaller) attached to the inlet pipe will filter eggs and larvae of most insects and fish.

Water is required both for the brood and production ponds and holding tanks that are used to grade and hold shiners prior to marketing. A minimum of 15 gallons per minute per surface acre (140 L/min/ha) is recommended for production ponds; a supply of 20–40 gal/min/ac

(187–374 L/min/ha). A water temperature of 68–72°F (20–22°C) is preferred for holding tanks. The water should be adequately aerated before entering tanks.

Feeding Practices

Golden shiners are omnivorous, capable of eating both small plant and animal life. Young fish feed actively on plankton and readily train on commercial diets. Prior to stocking fry or eggs, production ponds are refilled and fertilized with inorganic and organic fertilizers to stimulate plankton production.

Actual feeding management varies with the intensity of production. In an extensive, or low input, management production system, ponds are fertilized on a regular basis to keep healthy plankton populations allowing fish to feed solely on natural foods. Both organic and inorganic fertilizers can be used. Many farmers make an initial application of 500–1000 lbs/ac (560–893 kg/ha) of an organic fertilizer, such as cotton seed or soybean meal, combined with 1–2 gal/acre (9.4–18.7 L/ha) of liquid (10-34-0) inorganic fertilizer. Once an adequate bloom is established, the inorganic fertilizer is used to maintain the bloom for the remainder of the growout period (See IFAS Fact Sheet FA-17 for more information on fertilization of fish ponds). It is recommended to initially stimulate a moderately heavy algae bloom, 8–10" (20–25.5 cm) Secchi disk visibility, until fish reach one inch in length and before high water temperatures occur. For the remainder of the growout period, a 14" (36 cm) Secchi disk visibility is recommended to provide ample food and reduce risk of algae related oxygen problems.

Intensive production of golden shiners requires pond fertilizers and supplemental feeding with artificially formulated diets. A finely ground starter feed is used initially for fry; as fish grow, larger sized "grower" feeds are used. The starter diet is higher in protein than the grower diets, ranging from 38–46% protein. Grower diets are commercially available in a crumble form (coarsely ground pellets) or as small pellets, with protein content ranging from 26–32%.

Feed is usually broadcast over one length and width of the pond once a day. Feeding fish twice per day has been shown to improve fish yields. A satiation method of feeding, or feeding fish whatever they can eat in a prescribed time, is a common feeding practice. This enables farmers to more accurately determine proper feeding rate and minimize feed waste. High water temperature and dense algae blooms can limit the amount

of feed applied to ponds. Maximum daily feeding rates are 40–50 lb/ac (44.8–56 kg/ha).

Fish Yields

Yields with the wild or free spawning method can be significantly lower than the other methods in which eggs or fry are transferred to specially prepared and recently flooded nursery ponds. Yields ranging from 100–200 lbs/ac (122–224 kg/ha) in large ponds are common.

Fish yields with the egg transfer production method range from 400–1,000 lbs/ac (448–1,120 kg/ha) depending on pond size and feeding management practices. Production in small 0.5-acre (1-ha) ponds in north Florida have averaged 1,900 lb/ac (2,128 kg/ha).

Yields using the fry transfer method are similar to that of the egg transfer method. A potential advantage of the fry transfer method is production of a greater quantity of preferred fish sizes because of known stocking densities.

Regardless of the culture method, yields can vary due to the impact of poor water quality, inadequate feeding and losses to predators. In addition, the size of fish varies at harvest resulting in a percentage of fish not being of market size. Grading of golden shiners into the preferred market sizes is essential.

Marketing Considerations

Golden shiners are an extremely popular baitfish and are marketed throughout the United States. Marketing golden shiners can be complex, involving distinct seasonal demands and size preferences. In addition, intense competition exists and marketing success will require a commitment to consistent supply and service. Several characteristics of golden shiners including their relatively high sensitivity to handling stress and broad size range at harvest present marketing challenges. Careful attention to fish harvest and transport methods and use of state of the art holding and grading tank facilities is essential.

The market distribution system for golden shiners is comprised of primary and secondary distributors and finally retail bait shops. Primary distributors buy shiners from farmers and transport them throughout the country to secondary distributors and to a few retail shops. Secondary distributors buy from primary distributors and sell directly to retail outlets. In Florida, harvesters of

wild shiners also distribute large 6–10 inch (15–25 cm) golden shiners directly to bait shops.

In most cases, farmers sell golden shiners directly to primary or secondary distributors. Selling directly to bait shops can challenge farmers. The consistent supply of graded shiners required by retailers places extra demands on the farmer's time. In addition, many retailers buy other bait species from distributors and are therefore reluctant to buy from a farmer that does not have a product mix. Consistent customer service is a key element in successful marketing of golden shiners.

Sources of Information and Selected References

The environmental requirements of golden shiners are poorly understood, and information dealing with propagation of golden shiners is somewhat limited. General information for holding and raising baitfish can be obtained at your local extension office. More detailed information is available from the University of Arkansas, Auburn University and University of Florida.

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