

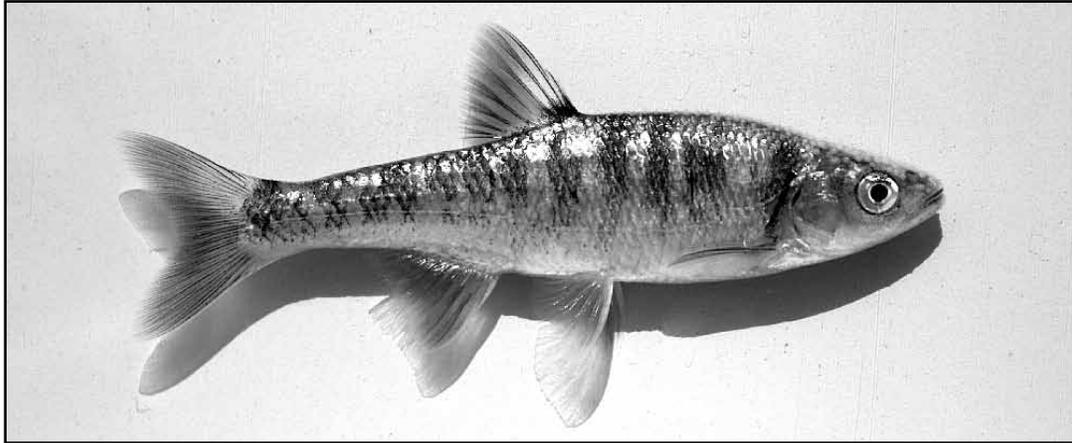
Breeding Minnows

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Fig. 1

Scarletfin Shiner (*Lythrus fasciolaris*)

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The minnows (family Cyprinidae) make up a quarter of all freshwater fishes. With about 50 genera and almost 300 species, the United States and Canada have 13 percent of the world's 2,400 minnow species. Among them are some spectacularly gaudy species equal to any tropical tetra, and as easy to breed.

Minnows can be seined in riffles, runs, and pools, underneath overhanging banks, and in the largest rivers and smallest creeks. Most male minnows only color up during spring breeding and during breeding they may scatter eggs over gravel (like danios) or vegetation (like tetras). A few insert eggs into crevices (like Tanganyikan killies) or beneath rocks, and still others construct a cichlid-type nest in the sand or gravel.

Most minnows do well in single-species groups in 20-gallon tanks with canister or trickling filtration, water changes, powerheads for current, a pebble substrate with rocks. They do well on a diet of flakes, bloodworms, brine shrimp, white worms, grindal worms, blackworms, and/or Daphnia. Most cannot tolerate heat, and some require a chiller.

I'll be looking at the diverse breeding behaviors of minnows and explaining how to breed them in an aquarium. I'll cover egg scatterers, saucer nesters, pit builders, egg clusterers, crevice spawners, and gravel-mound builders.

Egg Scatterer

The first group I'll look at are the egg scatterers or broadcasters. This group may breed over clumps of dense vegetation (*Nitella*, *Vesicularia*) or over gravel. They produce sticky or non-sticky eggs; stickiness keeps eggs from falling into silt or washing away in current. Minnows with non-sticky eggs often spawn near the bottom, their eggs falling into interstices between pebbles that protect them from currents and predators; some spawn in dense vegetation which serves the same function.

Threatened Taxa

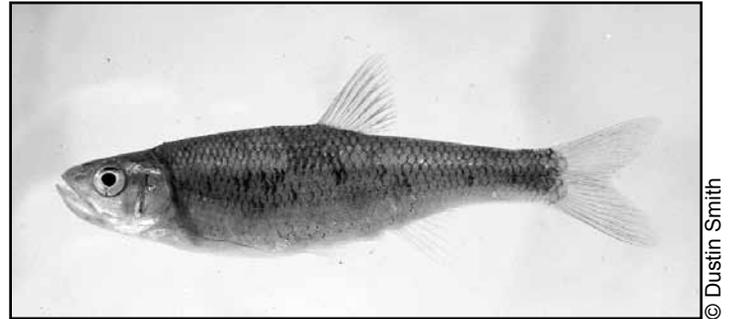
A number of minnows are either state or federally protected because of dwindling populations as desertification grows and isolated habitats dwindle. A few are threatened by exotics such as the Rudd and Bitterling from Europe, the Goldfish and the Grass, Bighead and Silver carps from Asia, and the Common Carp from Asia via Europe. More are depleted because of sportfish and bait introductions. Equally egregious is the loss of rivers wrought by power generation and potable water supply, replacing free-running streams with artificial lakes in which riverine fishes cannot survive. Contact your state game and fish agency for the laws governing collection and possession of wild native fishes in your state.

The largest genus of minnows is *Notropis*, which are mostly 2 to 4-inch long, peaceful community tank fish. Some are red or orange during the breeding season, especially those of the subgenus *Hydrophlox*. These fish live in the smallest streams where they are easily collected. Many of the prettiest only spawn on the nests of larger minnows, such as *Luxilus*, *Nocomis*, *Camptostoma*, or *Semotilus*, in nature. We are still learning which can be induced to breed in aquaria without their host nest-builders.

To try breeding them in an aquarium, separate the sexes, and feed them live foods while keeping them cool and on an 8 to 10 hour light cycle for a month. Then place them together in a larger tank with large gravel or pebbles. Raise the temperature 5 degrees, and increase the light cycle to 12 to 16 hours. Spawning starts in a few days with flashing undulations by the males, fin erection, operculum flaring, and color intensification. Non-adhesive eggs are scattered above the gravel or in thick bushy plants. After spawning, remove the adults. The eggs hatch within five days, and the fry need rotifers, ciliates, or other infusoria as a first food.

Pteronotropis was split out of *Notropis* for a few primarily Gulf coast minnows with a broad, blue-black band on the flank and brilliant yellow or blue colors in the males. In the Bluehead Shiner (*P. hubbsi*) two types of males occur: the socially dominant and large terminal males, which defend breeding territories, and the smaller, younger, secondary males, which dart into breeding territories to fertilize what eggs they can (sneaky males). They live in blackwater swamps and oxbow lakes, often in clumps of hornwort, in deep pools with scattered lilies, and sand and mud bottoms. From April through June, eggs are scattered in Warmouth nests or among plant roots. The more colorful, smaller secondary males dart into the nest apparently to spawn when the terminal male is distracted. Provide yours with a 29-gallon high aquarium with moderate current and plants, leaving the middle unobstructed and the bottom covered with pebbles. Feed them only live foods. Eggs are scattered, so turn off all filters. Remove the adults. The fry take rotifers, infusoria, and green water. After two weeks provide Ceriodaphnia and ostracods; *Artemia* nauplii are not readily accepted. You can also use spawning mops on the bottom, then move the mops to aerated gallon jars until the eggs hatch; or you can use a pebble or marble-filled spawning tray, which can then be transferred to a 10- or 20-gallon aquarium for hatching. In all cases, there should be no turbulence in the fry aquarium, as it interferes with feeding.

Gila contains western, egg-scattering chubs with fine scales and sometimes oddly shaped heads. Most are plain olive with a hazy line along the flank, but a few are colorful. The smaller chubs may spawn in aquaria. Place the males in a 30-gallon aquarium with gravel, large rocks, and current from a powerhead. The females should be in a separate bare aquarium. Keep all fish at 55 to 58° F, and feed them insect



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Fig. 2
Rosyside Dace (*Clinostomus funduloides*)

larvae. In six weeks add the females and raise the temperature slowly to 65° F. Spawning begins within three weeks. Turn off the filters and remove the adults. The eggs will hatch within 96 hours. The fry require rotifers and ciliates. (Editor's note: All members of this genus are either state or federally listed species.)

Clinostomus, with just two species, is an eastern genus related to *Gila*. Both the Redside and Rosyside daces are greenish black with blue, violet, purple and green highlights above, and white below. The nuptial male develops specialized sensory scales on his body and an orange-red flush along the side. They live in pools of clear, high gradient, hard bottom streams, feeding on aquatic invertebrates. In nature, both species broadcast eggs over nests of chubs and other minnows, but will breed by themselves in their own tank using the methods described above for *Notropis*. The fry require rotifers and ciliates.

Rhinichthys contains the speckled daces, long-nosed minnows with a tiny barbel at the corner of the jaws, an inferior mouth below the elongate snout (the generic name means "nose fish"), and a bridge of tissue preventing the jaw from being protruded. Most are dark above, silvery below, with a prominent dark band in between. In addition, the (usually upper) body is often heavily marked with black dots. Most are egg-broadcasters, but one species may use the nest of another minnow as a spawning site, and at least one species is an egg-clumper.

Hemitemia contains only *Hemitemia flammea*, the Flame Chub. The nuptial male has orange red on the belly and fin bases. It is rare everywhere throughout its range in Alabama, Georgia, and Tennessee where it can be found in densely vegetated springs. It feeds on bloodworms, isopods, worms, snails, and algae. The Flame Chub breeds mostly in February and March, and is probably a plant spawner demanding high water quality.

Chrosomus eos, the Northern Redbelly Dace ranges from Canada to New York and the upper Missouri River in lakes, ponds, bogs, and creeks. Nuptial males have brilliant red bellies. In nature it eats algae, zooplankton, and aquatic insect larvae. It scatters non-adhesive eggs over vegetation. It is also bred in bait ponds with flowing water over mats of algae. The eggs hatch in nine days at 75° F. It hybridizes with *C.*

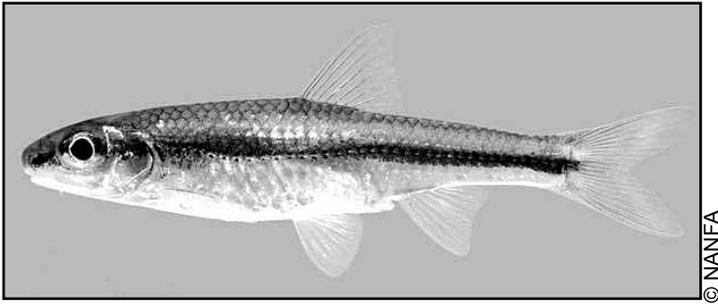


Fig. 3
Bigeye Chub (*Hybopsis amblops*)

neogaeus to form a self-perpetuating false species of diploids and triploids resembling the Amazon molly phenomenon in southern Texas. Sometimes found in feeder fish shipments, the Northern Redbelly Dace should be given open space and adjacent dense vegetation for spawning. The male becomes red from the upper jaw along the entire flank. He drives the female into plants, where they quiver, tetra-style, dropping eggs. More easily bred and temperature tolerant is *Chrosomus erythrogaster*, the Southern Redbelly Dace, which occurs throughout the eastern states in cool and clear upland, streams with permanent strong flow, and gravel or rock bottoms. It spawns on riffles, or optionally on the nests of other minnows. You can breed them in a 20-gallon aquarium with current from powerheads. Feed vegetable flakes supplemented with blackworms, brine shrimp, and bloodworms. Use a plastic shoe box with gravel or pebbles as a spawning site. Collect eggs for a week by leaving the box in the adult tank. Then move the box to a separate rearing aquarium before they hatch, providing only sponge filtration. The large fry take *Artemia nauplii* as a first food, but larger spawns will be raised if also provided green water.

Hybopsis are chub-like minnows with a long rounded snout and underslung mouth, eight anal rays, and usually barbels at the corner of the jaws. They live in clear upland streams with sand, rock, or rubble bottoms. They feed on aquatic invertebrates among rocks and vegetation. The eggs are scattered in vegetation. Most species are dull in coloration, but two can be pretty. *Hybopsis hypsinotus*, the Highback Chub and *Hybopsis rubrifrons*, the Rosyface Chub have a wide purple-black band along the flank and pink-tinged fins. The nuptial male is dark above, dusky with purple iridescence on the side, and a red belly. The upper jaw and nose are red, fins dark red, and there is a gold line above the dark side stripe. They sometimes spawn over chub nests, but in captivity they spawn freely over gravel. Provide them a sand, gravel, and rocky bottom, some current, and a diet rich with brine shrimp, bloodworms, and blackworms. Separate the sexes in spring for two weeks before bringing them together for spawning.

Luxilus have elongated scales in the front of the body; origin of the dorsal fin is directly over the origin of the pelvic fins; and there are nine anal fin rays. The nuptial male has prominent hooked tubercles on his

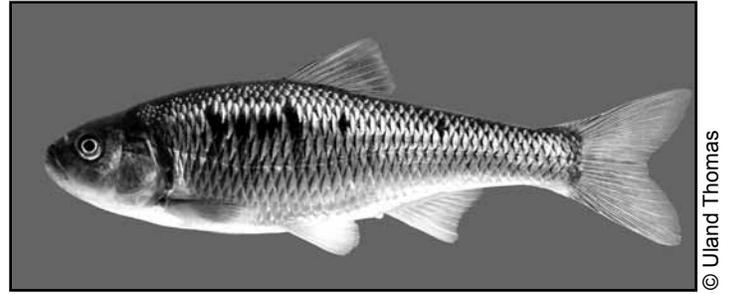


Fig. 4
Common Shiner (*Luxilus cornutus*)

snout. These mostly large minnows require 20- to 50-gallon aquaria for a group of six. Most are broadcasters, some spawning over the pits of chubs. Three groups are distinguishable: (a) Striped, Common, White, and Crescent shiners are silver with pink overtones. They are characteristic of moderately sloped, medium-sized sandy bottom rivers of Piedmont and foothill regions; (b) Warpaint and Bandfin shiners have black bands behind the gill cover and black on the dorsal fin, and prefer upper Piedmont slopes with stronger flows; (c) Bleeding, Cardinal, and Dusky stripe shiners have black bands on the flank, red heads and tails, and occur in small, upland headwater streams with rocky or gravel bottoms. Care and breeding are similar for all of these. Provide an inch deep pebble or large gravel bottom, no rocks or plants, vigorous aeration, and moderate current. Cool water is important for conditioning. They spawn when the temperature is increased from 60 to 70° F over a period of a month. In the wild, some species may spawn in depressions constructed by pit-building fishes. In captivity, any depression is used as a spawning site, or they may broadcast eggs over coarse pea gravel or pebbles with no depressions apparent or necessary. They spawn just above the bottom for several hours over a few days. Adults should be removed after spawning or after several days of bright nuptial coloration and flashing are observed. The eggs in the gravel and pebble spaces hatch in five to eight days. Feed the thin newly hatched fry rotifers, ciliates, algae, or finely crushed dry food. After a week, the fry hover just above the bottom.

Lythrurus can be distinguished from the *Luxilus* by smaller nape and upper body scales, a dorsal fin origin well behind the pelvic fin origin, and usually ten or eleven anal fin rays rather than nine. They tend to be lowland fishes found in oxbows, sluggish rivers, and blackwater streams. They feed on insects, crustaceans, and some vegetation. Some species use the nests of minnows or sunfishes to spawn over, but in general they broadcast over gravel at 55 to 80° F, depending on which region of the country they occur.

Saucer Nesters

The only saucer nester is *Agosia chrysogaster*, the Longfin Dace of Arizona, New Mexico, and Mexico. The most widely distributed desert fish, it tolerates high temperatures and low oxygen in pools and can even survive in damp algae when the stream has dried out. It is omnivorous and breeds year round. On soft bottoms, the males swirl out pits through their nuptial activity, but they do not move gravel or sand with their lips, nor remain with the nests. These one to two inch deep by eight inch diameter pits have a half inch high rim around the edge, and are clustered tightly together, often overlapping at their rims. When the female enters the pit, one or two males move alongside her and clasp while pushing her downward, forcing her partly into the sand. Eggs are buried in the pit and walls and hatch in a few days. Provide them a large, low aquarium with a sand bottom for a group of a dozen. Feed flakes, cooked vegetables, bloodworms, and brine shrimp. Aquarium breeding has not been reported, but probably has not been attempted as the fish is common and not colorful.

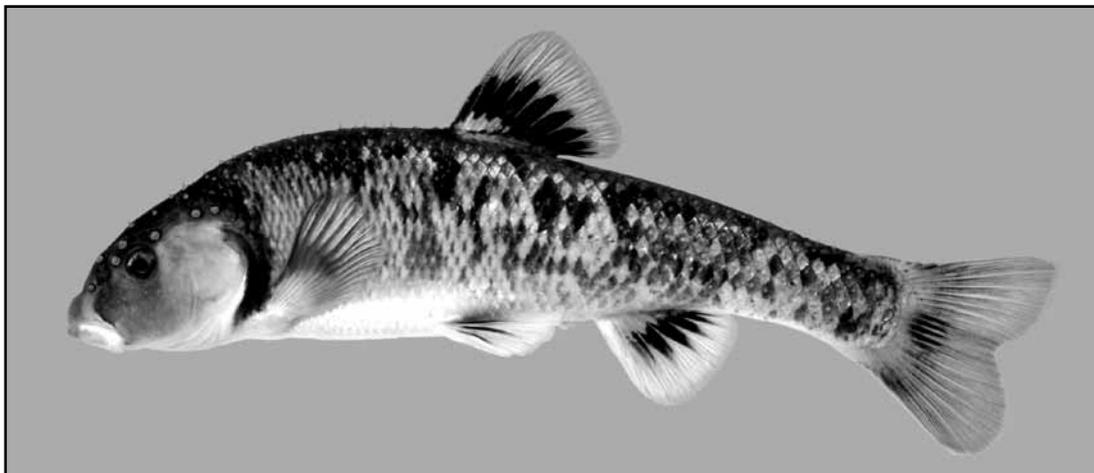
Pit-Builders

Campostoma, appropriately called stonerollers, are the only pit-builders. They are large, with a protruding snout and a hard ridge on the lower jaw. The male often has breeding tubercles on the head. He digs a four to eight inch circular pit just above a pool, pushing gravel with his snout and picking up pebbles and small stones with his mouth and moving them outside of the pit. A male may build, take over, and defend more than one pit, chasing away conspecific males, but ignoring other minnows which parasitize these pits for spawning. Stonerollers spawn above the pit, the eggs sinking into the pebble interstices where they are prevented from washing downstream and protected from predation, but

near the surface and able to get oxygen. Stonerollers prefer clear, rocky upland streams with strong flow, where they graze on algae and detritus. Males may nest near other males or not depending on the species. Females enter a pit and are rushed by males in a frenzy. Canister and trickling filtration and a large (40-gallon long) aquarium are recommended. They adapt to Spirulina algae-based flake foods and frozen adult *Artemia*, but often waste away in captivity. Large, difficult, and not particularly beautiful, why keep them at all? Stoneroller nests may be required to breed other cuckoo-like minnows which only spawn in the nests of nesting minnows or not at all.

Egg Clusterers

Eggs are clustered in a single layer on the undersurface of a cave roof and guarded by the territorial male. Two genera of minnows are egg clusters: *Pimephales*, and the closely related *Opsopoeodus*. *Pimephales* contains fathead minnow species, all of which hybridize. Nuptial males have vertical black and white patterns which provide shadow and light, which provides camouflage in caves. They also have nuptial tubercles on the snout and chin used to excite the females, and modified nape scales forming a cushion-like pad (hence the term fathead) used to brush the eggs on the roof of the nest. The common Fathead Minnow (*P. promelas*) is hatchery reared as a bait minnow. All fatheads live in small rocky creeks and rivers, in clear water over various bottoms, but not among plants. These omnivores are prolific egg-clusterers, producing 40 to 400 eggs per spawn; a nest (usually the underside of a flat rock forming a cave) sometimes containing up to 5,000 eggs. The male displays as the female nears, both bend into an S-shape, and a single egg is emitted during clasping, then swatted against the cave roof by the female's tail, where it adheres. The male rubs the eggs with snout and nape, protecting them from infection and predation. Seine wild fish or purchase bait fish



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Fig. 5
Central Stoneroller (*Campostoma anomalum*)

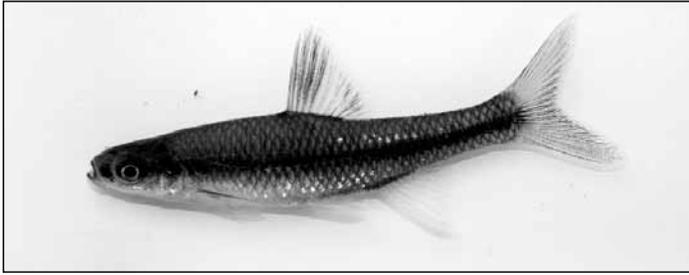


Fig. 6

Pugnose Minnow (*Opsopoeodus emiliae*)

(tuffies) from bait-and-tackle shops or the domestic orange strain of feeder fish (ruby reds) from pet stores. A bare 10-gallon aquarium with floss filter outside and sponge filter inside is suitable for one male and four females. You can use halves of 4-inch diameter PVC pipe as spawning caves, but flat rocks (slate) work fine. Provide at least 16 hours light. Most spawning is in the morning. Examine the cave every day, as eggs can hatch in 3 days. Egg clusters are incubated in a gallon jar with aeration. Fry are easily raised on *Artemia* nauplii and powdered flake food. *Opsopoeodus emiliae*, the Pugnose Minnow, breeds the same way. It is common from Canada to the Gulf coast. Males display in front of their caves by flaring their fins and gill covers, trying to drive the females inside. They deposit one to five eggs until 30 to 120 are spawned, but several females may spawn in the same nest. Eggs hatch in three to six days, and fry require rotifers, ciliates, *Ceriodaphnia*, small copepods, ostracods, vinegar eels, or microworms, later graduating to *Artemia* nauplii.

Crevice Spawners

North American crevice spawners are *Cyprinella* and *Hesperoleucas*. Crevice spawners seek tight locations into which they insert eggs, the crevices protecting them from siltation, washing away downcurrent and, to some extent, predation. Crevice spawning is more advanced than broadcasting but less than nesting. Crevice spawners neither construct nor defend nests, utilizing whatever cracks are available.

Cyprinella contains 30 United States and Mexican species. Their silvery flank scales are higher than they are wide, and they have a dark mark on the chin; there are barbels in the corner of the jaw in three species. Nuptial males have breeding tubercles on the snout and top of the head, white tips on the unpaired fins, and rich suffusions of red, orange, yellow, blue, or green on the body and sometimes the fins. They produce sounds during nuptial activity. *Cyprinella* can be found over pebbles and rocks in runs, riffles, pools, and sometimes lakes. They spawn several times during the warm months (fractional spawning) rather than all at once. In aquaria, they spawn year round on spawning mops, over marbles on a bare bottom, or in the cracks among piled stones. An excellent substratum is the pleated filter cartridge used in

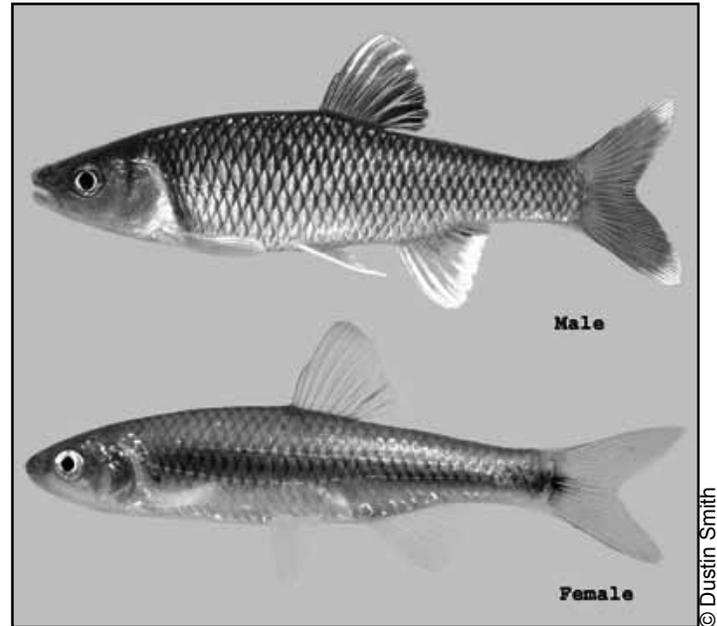


Fig. 7

Satinfin Shiner (*Cyprinella analostana*)

canister filters for diatomaceous earth filtration. Automobile air filters are not good because the metal screens are toxic and the pleats are too close together. *Cyprinella* require live food to bring them into breeding condition.

Cyprinella analostana, the Satinfin Shiner, ranges the Atlantic slope from Lake Ontario drainages southward into South Carolina, on gravelly runs and riffles of creeks and rivers, sometimes in lakes. Schools forage on small insects and crustaceans. Keep them in groups in a 10-gallon tank or larger. Maintain them on flakes, but condition them for spawning with live blackworms and frozen adult brine shrimp. They will breed continuously on a pleated aquarium filter cartridge, the adhesive eggs deposited just inside the crevices. Adults should be removed if the fish spawn on stacked rocks or among plants. If mops are used, pick out the yellow to colorless eggs with your fingers for incubation in shallow dishes with a drop of acriflavine. If a filter cartridge is used, remove it to a gallon jar with strong aeration and acriflavine. The elongate, glass-like fry appear in three to four days at 68° F and rest on the bottom the first several days. They need rotifers, protozoa, green water, or infusoria for two to three weeks, with *Artemia* nauplii or vinegar eels offered the second week. Growth is slow, even on live baby brine shrimp, but accelerates after 1 inch when they start feeding on live *Daphnia*. They will take powdered flake food at a half inch, but whole flakes should be deferred until they are one inch long.

Cyprinella lutrensis, the Red Shiner, ranges from Minnesota to the Gulf coast in creeks and small rivers over sand, rock, and gravel, in runs and pools. It spawns in rock and log crevices, at the base of plants, among algal masses, and elsewhere. This plasticity in spawning sites,

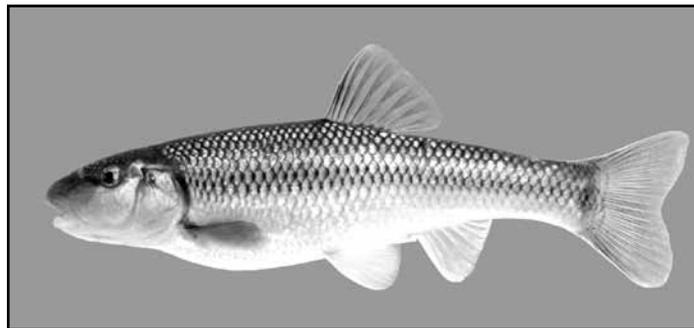
catholic feeding habits, tolerance of turbid to clear, fast or slow, warm to cold waters, and wide use as a baitfish accounts for its wide distribution and threat to other native fishes. Thirty years ago they were popularized in the United States as “African fire barbs.” Red Shiners have been spawned in aquaria utilizing Java moss, stones piled to provide crevices, spawning mops, and pleated canister filter cartridges. A 10-gallon aquarium is sufficient for six fish. They spawn readily with canister filter cartridges, and eggs hatch in a week. The fry on the bottom won’t swim for a few days. After hatching, move the fry into a 5-gallon aquarium with aeration, and feed green water, rotifers, infusoria, ciliates, Liquifry, or APR. After two weeks they take *Artemia* nauplii.

One of my favorites is *Cyprinella pyrrhomelas*, the Fieryblack Shiner. Provide them with pleated canister filter cartridges in a large tank. Feed heavily. Spawning will begin after two weeks. Eggs are deposited within the pleats and the fry, large for *Cyprinella*, hatch in ten days and swim immediately. Feed the fry vinegar eels for one to two days in the gallon jar, then move the contents and cartridge into a 10-gallon or larger aquarium with a sponge filter, and begin feeding *Artemia* nauplii. Another possible crevice spawner is *Hesperoleucus symmetricus*, the California Roach. Both sexes develop orange red blotches on the chin, gill cover, and at the base of the anal fin. It is an omnivore and eats algae, detritus, crustaceans, aquatic insect larvae, and even baby lampreys. It spawns in flowing, shallow, rock bottom areas, laying its adhesive eggs in rock crevices or even among plants.

Gravel-mound Builders

Thick lips and highly modified, distinctly lobed, lower jaws with bony plates identify the two species of *Exoglossum*. The male piles up stones, pebbles, or gravel near a bank or sunken log in an area of gentle current. The rocks or pebbles are the same size, some of which are stolen from other minnow mounds. The finished nest sometimes is topped with snail shells. The flat-topped mounds can be six inches high and 18 inches wide. They spawn heading into the current, the male and female clasping close to the gravel, the yellow eggs drifting back into the mound where they are covered by the male with more gravel. The young hatch and leave the gravel in a few days, but they remain at the mound a few days before dispersing. Cutlip Minnows collected during the breeding season have spawned in a six foot trough with three inches of pea gravel and a strong current. A shallow, half-filled 125-gallon aquarium with three inches of pea gravel or pebbles should induce nesting. Use trickling filtration to maintain good water quality and at least a 1,000 gph powerhead for current. The parents should be removed after spawning and the filter turned off, or the eggs removed to a separate aquarium for rearing.

The river chubs of the genus *Nocomis* are large, big-headed



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Fig. 8

Hornyhead Chub (*Nocomis biguttatus*)

minnows with dark-edged scales and prominent breeding tubercles on the head of the nuptial male. They all have a barbel at the angle of the jaws, eight dorsal fin rays, seven anal fin rays, and a dorsal fin origin slightly ahead of the pelvic fin origin. The larger, territorial males construct a pit, and they fill it with carefully selected pebbles or gravel to create a mound. A spawning pit or trough (sometimes more than one) is constructed atop the mound. After the spawning clasp and release of eggs into this high pit, the eggs are covered with a mound of gravel. This mound-building behavior is important because other minnows use *Nocomis* nests as spawning sites, a few species requiring those nests for their own survival. A 55-gallon plus aquarium is required for a male and two females. Two inches of pea gravel and river stones should be topped with closely spaced, large, flat rocks, leaving a clearing where the male might construct a pit and mound. Use canister or trickling filtration, and powerheads for current. Feed them frozen brine shrimp and bloodworms supplemented with chopped earthworms. *Nocomis* have not yet been spawned by aquarists, but a large aquarium (125 gallons) might yield success. The Hornyhead Chub (*Nocomis biguttatus*) is typical of the genus. It occurs in clear streams with gravel, as well as small rivers. Its diet is half plant and half insects. It spawns when temperatures reach 65° F. The male builds a nest of stones and pebbles in shallow water below a riffle, and the mound eventually reaches upward until the nest is one half to 1.5 feet below the surface. Stones often as large as the male’s head are carried in the jaws or pushed with the powerful blunt snout. The height of the nest is determined by the number of spawnings. Later spawnings result in layers of eggs placed on an ever higher mound. Many other minnows swarm and spawn on the chub nest.

These minnows exhibit an interesting variety of spawning techniques. If you’re ready to spawn some of these fascinating species, give them a try. 



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Fig. 1
Lowland Shiner



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Fig. 2
Smoky Dace



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Fig. 3
Broadstripe Shiner



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Fig. 3
Redfin Shiner



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Fig. 5
Largescale Stoneroller



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Fig. 6
Bluntnose Minnow



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Fig. 7
Rosyside Dace



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Fig. 8
Red Shiner