Corrections and Updates to *American Aquarium Fishes*

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Editor's note: American Aquarium Fishes, *by Robert J. Goldstein with Rodney W. Harper and Richard Edwards, was recently published by Texas A&M University Press. The following errata and addenda were supplied by the senior author as building materials for a second edition. Readers are asked to send additional corrections and new information to Dr. Goldstein at the above address.*

Corrections

p. xiii. Fred (not Frec) Rohde
p. 17. Percichthyidae should now be Moronidae.
p. 52. delete second sentence under *Acipenser* (it refers to family, not genus).
p. 85. *simulus* should be *simus*; *tristis* should be *topeka*.
p. 105. add (*Alburnops*) to *N. boops*.
p. 106. add (*Alburnops*) to *N. xaenocephalus*.
p. 143. under *Iotichthys*, remove "harsh" (it's a spring).
p. 148. common name of *L. fasciolarus* is scarletfin shiner.
p. 149. common name of *L. alegnotus* is Warrior shiner.
p. 150. common name of *L. umbratilis* is western redfin shiner; *L. cyanocephalus* is now eastern redfin shiner.
p. 164. common name of *C. lepida* is plateau shiner.
p. 171. *Hesperoleucas* is congeneric with *Lavinia* (p. 154) according to Moyle (*Inland Fishes of California*, 2nd ed., in press). Some California roach spawn in crevices, but at least one population spawns over vegetation.
p. 187. under *N. lachneri*: Stoeckal should be spelled Stoeckel.
p. 198. The Olympic mudminnow occurs in the Chehalis River and vicinity on the Olympic Peninsula in Washington.
plate 33. correct spelling is *Ameiurus*.
p. 220. last line: reference is Granier, B.G. 1996. Keeping the broadstripe topminnow. *American Currents* Fall 1996: 7.
p. 231. last paragraph: complete citation is Shrode, J. B. 1975. Developmental temperature tolerance of a Death Valley pupfish (*Cyprinodon nevadensis*). *Physiological Zoology* 48: 378-389.
p. 235. *Megupsilon* is now protected in México. For a list of México's protected species, see http://www.conabio.gob.mx/diodiversidad/pecesnom.htm .
p. 238. change Goodiidae to Goodeidae.
p. 245. Atherinidae should now be Atherinopsidae.
p. 271. change *dolomieui* to *dolomieu*.
p. 329. photos labeled *E. squamiceps* from the Cumberland River are of *E. nigripinne* according to Larry Page. But Bill Roston says the fish is *E. squamiceps*.
p. 347. photo labeled *E. fonticola* is actually a repeat of the *E. squamiceps* photo from p. 329.

Updates

• [p. 53] *Acipenser transmontanus* in captivity matured earlier than wild fish; males matured at 4 years and females at 8 years, compared to 10-20 years in the wild. Accelerated maturity was attributed to higher holding temperatures, although high temperatures also impede spawning, indicating a dual gonadotropin system controlling reproduction. Although experimental evidence is lacking, it is probable that temperature affects maturity and photoperiod controls spawning in the wild. In general, after maturity males are capable of annual spawning, but females can spawn only once every other year (Doroshov et al., 1997).

• [p. 60] *Amia calva* (bowfin) active nests were occupied by spawning golden shiners (*Notemigonus crysoleucas*) in flooded grasses that had been cleared. The bowfin eggs were black and 2 mm in diameter (Katula and Page, 1998).

• [p. 63] *Cycleptus meridionalis*, the southeastern blue sucker, has been split out of *Cycleptus elongatus*, the blue sucker by Burr and Mayden (1999). The new species occupies Gulf slope drainages from the Mobile River basin of Alabama to the Pearl River drainage in Louisiana, while the blue sucker ranges throughout the Mississippi drainage and in other Gulf slope drainages westward to the Rio Grande. The population in the Rio Grande may prove to be still another new taxon. Although populations of Mississippi drainge blue sucker have been in decline, the southeastern blue sucker and the Rio Grande blue sucker have strongly reproducing populations in no immediate danger.

• [p. 65] A British Columbia group of *Catostomus catostomus* is now suspected to be a distinct taxon (McPhail and Taylor, 1999).

• [p. 70] The primitive razorback sucker (*Xyrauchen texanus*) has been around since at least the Pliocene, five million years ago, based on a fossil recently found in California (Hoetker and Gobalet, 1999).

• [p. 101] *Notropis cummingsae* stores lipids (fats) as a prerequisite to sexual maturation and breeding. The greater the quality and amount of food, the more lipids will be stored, leading to larger ovaries and a longer breeding season. Lipid storage in the fall is opportunistic and not required for overwintering survival (Schultz, 1999). The greater the food resource quality in the stream, the larger and more reproductively successful the shiners, and the earlier they reach reproductive status.

• [p. 112] The genus *Pteronotropis* appears to be monophyletic, but stronger data are needed than just cytochrome *b* DNA analyses. The two thin species with blue on the head or nose, *P. welaka* and *P. hubbsi*, are both nest associates of sunfish and probably arose from a common ancestor (Simons et al., 2000).

• [p. 113] *Pteronotropis welaka* occurs in clear, coastal streams of the Gulf slope and a disjunct population also occurs in the St. Johns River in Florida. Ovaries mature in April and are latent by September. The fish spawns in May, June and July, somewhat into August, over the nests of longear sunfish (*Lepomis megalotis*), with several males over a nest, males chasing one another and non-spawning females, and feeding on sunfish and minnow eggs and fry when the guarding male sunfish leaves the nest. There is only one form of nuptial male, but size, finnage, and blue coloration on the nose develop in stages, gradually. All larger, older males develop blue noses, and the sizes of the dorsal and anal fins increase with increasing body length and depth. Eggs are 1 mm, vs. 2 mm for the sunfish. Adults spawn in their second year and then die (Fletcher, 1999; Johnston and Knight, 1999).

• [p. 115] *Pteronotropis hypselopterus* pairs scatter adhesive eggs on artificial grass and on the bottom of 10-gallon aquaria. The chorion is adhesive on all surfaces. When the larvae hatch, they adhere to solid surfaces by a glue emitted from two pores on the head, ventral at first and then rotating dorsally. The adhesive materials enable the fry to complete larval development, absorbing yolk while the posterior swim bladder fills, the intestinal linings form, fins replace finfolds, and gills mature. When development is almost complete with but a small amount of yolk remaining, the anterior swim bladder fills, cement is no longer produced, and the larvae swim up into the current. Cement enables them to avoid silt and other anoxic areas. The currently congeneric *P. hubbsi* does not have cement glands (Fletcher and Wilkins, 1999).

• [p. 116] *Pteronotropis signipinnis* broadcasts eggs in vegetated shallows and uses a spawning clasp which may assist pressing the adhesive eggs onto vegetation above the bottom (Albanese, 2000). Fish were spawned in 10-gallon tanks planted with *Sparganium* in gravel and sand and fed flakes, frozen bloodworms, and live foods. Although spawning was not observed in the wild, evidence of spawning was noted in shallow vegetated riffle equivalents of their streams. No evidence of nest association with other fishes was found, although centrarchid nest association behavior has been reported for *P. welaka* and *P. hubbsi*.

• [p. 118] Chubs of the *Gila robusta* complex were reviewed, with *robusta*, *intermedia*, and *nigra* recognized as full species, although *nigra* arose through hybridization (Minckley and DeMarais, 2000).

• [p. 125] *Rhinichthys osculus* fed trout chow and flake food, maintained at 14 hours of light and 10 dark, and exposed to gradually elevated temperatures spawned at about 24°C/75°F. Gravid females were swollen and nuptial males developed darker-colored fins. Two or three days after placing in a spawning tank, a single female was chased by one or more males around the aquarium, and adhesive eggs were scattered mostly in crevices of tank corners and crevices in the gravel around standpipes of the undergravel filters. Males did not clean or defend spawning areas. Both sexes searched for and consumed spawned eggs not protected by a woven mat through which eggs could sink and remain protected from the foraging parents. The fry were free-swimming 8-10 days later and were easily raised on powdered flake food, liquid fry food, and *Artemia* nauplii. The first generation matured and spawned at almost two years of age (Kaya, 1991).

• [p. 142] *Macrhybopsis tetranema* of the *M. aestivalis* complex has been elevated to species rank (Eisenhour, 1999).

• [p. 161] A total of 30 species of *Cyprinella* include six restricted to México and three with barbels and previously in *Hybopsis*. DNA analyses indicate that *Cyprinella* originated in Atlantic and/or Gulf slope drainages, with derived (secondary) speciation in the southwest and Mississippi basin. One derived clade contains *spilotera*, *whipplei*, *venusta*, and southwestern *lutrensis*. Other *lutrensis* are unrelated, and the *lepida* group is not a single line (Broughton and Gold, 2000).

• [p. 176] Bluenose chub (*Nocomis leptocephalus*) spawned in the senior author's fish room in a low 40-gallon minnow community aquarium with pebbles, powerhead flow, trickle filtration, and fluorescent lights on a 12-hour photoperiod, and fed trout chow. The male constructed a mound which, when disturbed, was reconstructed on the other side of the aquarium in only a day. About 30 fry were recovered swimming in an upper corner of the community tank, ignored by the minnows. They were removed, fed *Artemia* nauplii, and attained almost two inches by four months of age (original).

• [p. 183] Burr and Stoeckel (1999) have produced the most comprehensive review of madtoms (*Noturus*) since Taylor's monograph 30 years previously. With 25 valid species, the madtoms are the successful sister group of the monophyletic flathead catfish with which it shares male nest guarding. Some species spawn several times a season and others spawn once before dying. All are small and short lived (annual to five years) except for the unusually large and long-lived stonecat, and all, except for the stonecat, produce an average of a hundred enormous eggs per season, mostly through multiple clutches. They spawn in dark caves in mussel shells, bottles and cans, and under logs, boards, and stones. They are most active at dawn and dusk, foraging mostly on stream insects but also on occasional crayfish or fish.

• [p. 190] Carolina madtoms spawned at the North Carolina Museum of Natural Sciences in Raleigh, with about a dozen yolk-sac fry discovered in a clam shell. Removed to a separate tank, they all survived and grew rapidly, attaining over two inches in length in less than a year, according to NCMNS' Patrick McMillan.

• [p. 209] *Rivulus marmoratus* occupies the upper intertidal mangrove habitat, which is subject to periods of hypoxia. It thrives where other fishes cannot survive because it is amphibious and can rely on atmospheric air to wet its gills when the water itself is toxic to other fishes (Dunson and Dunson, 1999). Under these conditions, it grows better than in habitats occupied by other fishes, as it does not have to compete for food.

• [p. 221] *Fundulus heteroclitus*, a true amphibious killifish, uses atmospheric air when it emerges from water to keep pace with its need for oxygen and need to eliminate carbon dioxide. Its oxygen uptake is much less in air than in water (Halpin and Martin, 1999). That might be due to lowered activity during emergence, or perhaps the fact that richness of oxygen in air (21%) takes less work.

• [p. 245] The family Atherinidae represents old world silversides, and all new world silversides are placed in the family Atherinopsidae (Beheregaray and Levy, 2000).

• [p. 252] *Pungitius pungitius occidentalis* is restored as the name of the North American nine-spined stickleback (Keivany and Nelson, 2000).

• [p. 253] Is *Elassoma* related to sticklebacks or to sunfishes? Recent DNA studies suggest the stickleback connection may be false, and that the pygmy sunfishes (Elassomatidae) are sister to a line that gave rise to the sunfishes (Centrarchidae) and striped bass and white perch (Moronidae). It's too soon to nail down relationships, in part because pygmy sunfishes have lost characters (e.g., the lateral line) commonly used to associate other groups (Jones and Quattro, 1999).

• [p. 259] *Cottus caeruleomentum*, the Blue Ridge sculpin from the Elk, Susquehanna, Bush, Patapsco, Patuxent, Potomac, Nanticoke, James and Roanoke rivers of the middle Atlantic Coast, is distinguised from the allopatric *C. bairdii* in having a straight rear edge of the dark caudal fin band on at least one side, whereas in *C. bairdii* the band has a central notch on both sides (Kinziger et al., 2000). [See p. 30.]

• [p. 263] Males of *Cottus pygmaeus*, now known as *C. paulus*, adopt the clutches of other males, a behavior known as allopaternal care, which is thought to make the guarding male more attractive to females (Johnston, 2000; Williams, 2000).

• [p. 285] Ray Wolff (1999) conditions dollar sunfish (*Lepomis marginatus*) by feeding earthworms from rich soil (but not manure), small fish and crustaceans, and crickets dusted with vitamins, twice a day. Place a group of two males and two to four females in a densely planted 30-75 gallon long tank with sand, driftwood, foam filtration, two 40-watt fluorescent lamps, and a temperature of 75-79°F. Provide frequent water changes. When a pair sets up housekeeping (the male builds a nest and begins fanning), remove all other fish. The female will develop a pattern of light and dark bars when ready to spawn. She should be removed after spawning. The male will care for the fry, which begin feeding on epiphytic infusoria on the plants. They'll also take *Artemia* nauplii right away, but should be moved to grow-out quarters such as a

pond, as the tank will be too small. The fish can also be bred by setting up a pair in side-by-side 10-gallon tanks. Place the female in the male's tank after he has dug a nest and begun fanning, and she has developed the barred pattern. The fish can be spawned repeatedly.

• [p. 285] A new classification of the family Percidae was offered by Choon et al. (1998) based on complete cytochrome *b* sequences for 21 percid species. The data suppport three subfamilies as follows: Etheostomatinae (*Ammocrypta*, *Crystallaria*, *Etheostoma* and *Percina*), Percinae (*Perca* and *Gymncephalus*), and Luciopercinae (*Stizostedion*, *Zingel*, and *Romanichthys*).

• [p. 287] *Crystallaria asprella* from the Elk River in West Virginia differs significantly from other populations by DNA analysis and should be protected (Wood and Raley, 2000).

• [p. 288] Near et al. (2000) investigated the assertion of Simons that *Ammocrypta* is a sister taxon of *Etheostoma* (*Ioa*). Their cytochrome *b* DNA evidence rejected this hypothesis.

• [p. 297] The blackside darter, *Percina maculata*, occurs in many river systems and varies considerably among drainages. However, the variation is insufficient for taxonomic divisions (Steinberg and Page, 1999).

• [p. 316] The Waccamaw darter is an annual, females depleting all lipid and most other reserves in spawning, and dying afterward. The related tesselated darter is relatively conservative, using a portion of reserves for spawning and living to breed again the next year (Schultz, 1999b).

• [p. 325] Porterfield et al. (1999) used total evidence analysis, a new kind of weighted statistical treatment, on fantail darters and provided insight on the recently separated species groups that arose from single lines within the subgenus *Catonotus*.

• [p. 331] *Etheostoma oophylax* is a member of the *Catonotus* group, characterized by egg mimics in the soft dorsal fin. Page and Knouft (2000) found mimics to increase in length but not width toward the peak of the presumed breeding season in mid-April and to atrophy thereafter. It is unclear whether egg mimics or eggs in the nest are more important to attracting females.

• [p. 342] *Etheostoma* (*Etheostoma*) *histrio* spawns in a manner similar to *Etheostoma* (*Ulocentra*) in selecting a high rock or plant well above the stream bed. The female selects the site by jabbing it with her nose one to three times, and then advances over that site for egg deposition concurrent with male mounting and ejaculation (Steinberg et al., 2000). Groups were spawned in 35- and 10-gallon aquaria with powerheads for current. Adults attached adhesive eggs to moss or algal clumps growing attached to rocks, and occasionally on the rock surface itself if surrounded by plant growth, but not on barren rocks. The fish then advanced to other sites, and no parental or territorial guarding occurred.

• *Etheostoma denoncourti* from the Duck River is meristically unique from other populations of this species and its sister species, *E. tippecanoe*, but in nuptial coloration, facial scalation and other important characters it is consistent with and should be regarded as a regional variant of *E. denoncourti* (Skelton and Etnier, 2000).

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Shiner Spawning Video Available

B.G. Granier has compiled a tape featuring home video of rainbow shiner spawning over the nest of a bluehead chub, and the captive spawning of this species in the tank of NANFA member David Jones (DE). The tape also shows redfin shiner in spawning colors congregating in an Arkansas backwater creek, and longear sunfish nests and bluenose shiner in a Louisiana creek. The VHS tape is $7.50 each (postpaid) and is perfect viewing for regional meetings or other fish gatherings. Mail a check to B.G. Granier, 608 Maureen Dr., Baker, LA 70714.