Adding knowledge to the seed production process of giant featherback (*Notopterus chitala*) in captivity

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Mature giant featherback broodstock.

Aquaculture in Asian countries is well recognised globally. It contributes to food security, rural livelihoods, employment and foreign exchange. Production has accelerated rapidly over the past two decades across Asia, using both native and exotic species. Yet many preferred native species remain neglected and have not reached commercial scale, despite strong market demand. A major reason is the lack of complete knowledge of their production processes.

Notopterus chitala, also known as chitala, clown knifefish or giant featherback, is one such species in South-East Asia. It is valued as a nutritious food fish and also as a sport fish. In carp ponds, it helps control weed fish, minnows and insects, so its inclusion in composite culture can add a useful secondary crop. The species prefers well-oxygenated water but can survive extended periods in low oxygen because it has an air-breathing organ. These traits make it a promising candidate for aquaculture diversification.

However, *N. chitala* is listed as Near Threatened/Endangered by the IUCN in parts of its range, likely due to overfishing, habitat degradation, pollution and other human pressures. It is therefore timely to compile and share practical knowledge from different groups on captive production. Improving access to seed will ease scarcity for farmers, and seed can also be ranched to reinforce wild populations.

This article provides information on breeding and seed-rearing management for chitala. The aim is to support expansion of chitala aquaculture to meet market demand while contributing to conservation of the species.

Biology of the species

N. chitala is a large, air-breathing freshwater fish found in rivers, reservoirs, ponds and tanks in South-East Asia. It prefers still waters with good oxygen levels, yet can tolerate low oxygen because of its accessory air-breathing organ. The body is silvery, with a slightly darker, banded dorsal side. The dorsal profile is arched, giving a humped appearance. The head is flattened with a terminal mouth bearing villiform teeth in both jaws, directed backwards. The dorsal fin is short, and the anal fin extends for about two-thirds of the body length.

The species is planktophagous in early life, then becomes predatory, feeding on crustaceans, insects, fish larvae and small fishes, which together form about 80% of gut contents. A U-shaped stomach allows ingestion of relatively large quantities of prey or feed.

Males mature in their second year, and females in the third. Fish of 2.0-2.5 kg (both sexes) are considered mature. Spawning in nature begins with the early monsoon. Both ovary and testes are single-lobed. The gonado-somatic index is about 2.0-2.5% in males and 5.0-6.0% in females. Fecundity is low, at roughly 8,000-18,000 eggs in females of 1.5-2.5 kg. Two egg size classes are present in the ovary during the pre-mature stage; as spawning approaches, the smaller oocytes decline and larger ones dominate. Water-hardened eggs are spongy and large, up to 5 mm.

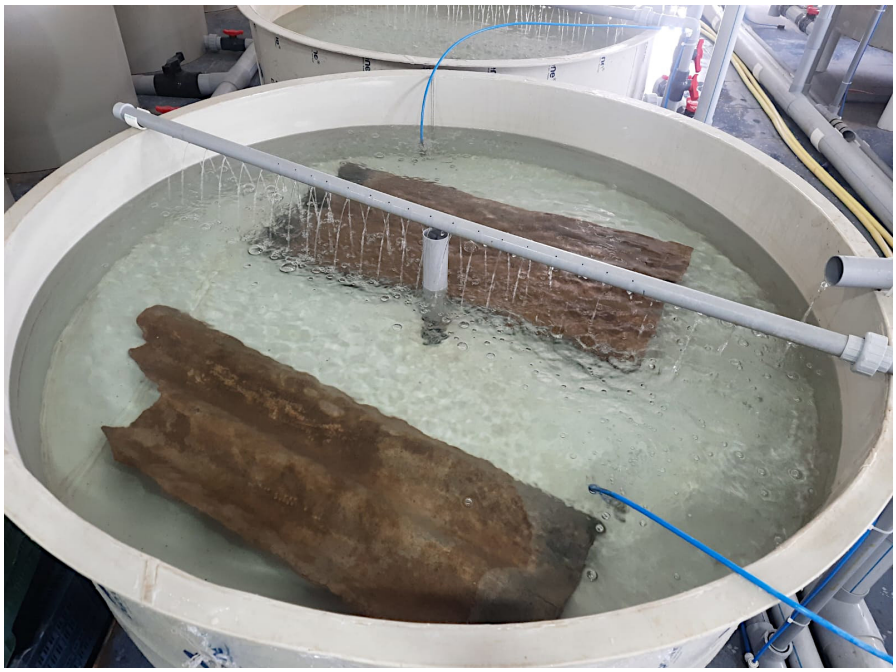
Wild populations show an isometric growth pattern. Growth is slow in the first year, with faster growth from the second year onwards. In captivity the species can add about 1 kg per year, and individuals of 8-10 kg are recorded in the wild.

Brood stock development

Brood fish of about three years of age or above 2 kg are expected to breed and are considered good brood stock. Juveniles can be reared in ponds to produce brood fish. Farmers also often collect large fish from the wild and rear them in ponds for seed production to shorten the time needed for brood development. Because chitala are predators, they rarely accept artificial feeds. Researchers recommend including more than 50% good-quality fishmeal in formulated feeds to improve acceptance.

A pond size of about 0.1 ha is suitable for rearing, providing ample space for activity. Some farmers suggest stocking 40-50 fish for breeding in 0.1 ha of water; others prefer lower numbers to reduce grazing/predation pressure on natural food in the pond. Farmers and researchers also rear mature chitala with carps in production ponds, as their feeding habits differ and competition for feed is limited.

Attached egg collected from pond.



Incubation of egg in flow-through system.

It is useful to release “weed fish” or species with frequent breeding in the pond. Naturally recruited fish can serve as live feed for chitala throughout the year. Tilapia may be added for this reason, as they breed often and their early fry can be eaten by chitala. However, uneaten tilapia may grow to early fingerling/fingerling stages, when their dorsal spines become strong and sharp, making them difficult for chitala to consume. Increasing tilapia populations can then become problematic due to higher grazing pressure on natural food resources. Using local species with frequent breeding as live feed is therefore often the best option to provide a regular food supply and maintain healthy brood stock.

Breeding the fish

Chitala is an air-breathing, monsoon-breeding fish that lays eggs in its habitat when conditions are suitable. After the first pre-monsoon showers, fish show signs of imminent spawning: twisting body movements at the surface become more frequent as egg release approaches. Males and females can be distinguished by the genital papilla: the male has a thin, conical papilla, whereas the female's is stout and broad. The testis is unilaterally placed, and the ovary is single-lobed.

There is little literature on induced breeding, apart from a few reports of eggs adhering to mosquito netting. In nature, however, the species lays eggs profusely on hard substrata within preferred habitats. Farmers exploit this behaviour by providing hard materials, such as broken asbestos sheets, car tyres, bricks or stones, and wooden planks, in brood ponds. Before laying, fish clean the pond bottom around the chosen substratum; this can indicate imminent spawning. In our observations, eggs were attached to asbestos sheets within a few days.

Regular checking (once or twice weekly) is needed to detect egg laying; more frequent disturbance can disrupt spawning or reduce egg numbers. The species is low-fecund. Egg counts on asbestos sheets in several instances ranged from 300 to 1,100 per provided substratum. Because spawning occurred in a pond, it was difficult to confirm how many females participated. We observed egg deposition until mid-August, with fertilisation above 80% during this period. Spawning later than mid-August yielded more unfertilised eggs, probably due to poorer spermiation by males.

Egg-laden substrata can be transported to the hatchery for incubation. A flow-through water supply is essential to ensure adequate oxygen and gentle current during embryonic development. Freshly laid eggs are off-white to slightly yellowish/brownish; viable eggs retain this colour. Eggs that turn fully white or gradually shrink are unfertilised. Water-hardened eggs are spongy and large, measuring 4-6 mm in diameter and weighing 65-70 mg. Incubation usually exceeds 6-7 days. Hatching is asynchronous: complete hatch-out may take 3-4 days as embryos drop from the chorion. Hatching is likely within 1-2 days once surface venation is visible on the eggs, reflecting blood vessels of the developed embryo; feeble embryonic movements can also be seen under a microscope at this stage.

Hatchlings are collected daily by siphoning until hatching is complete and are then transferred to rearing tanks for further nursing.

Haul of yolk sac larvae.

5 day yolk bearing larvae.

Nursing the larvae

Newly hatched larvae show limited movement because of the large yolk sac. Hatchlings are 12-15 mm in length, 40-45 mg in weight, and the yolk sac measures about 5-7 mm. Yolk absorption takes more than one week. The larvae are negatively phototactic even during the yolk-sac stage, so shelter should be provided. Without cover they tend to congregate in one or two spots in the rearing tank.

Good water quality is essential. Debris and uneaten feed should be removed with regular water replenishment. The larvae are very sensitive to low dissolved oxygen and to ammonia accumulation; prolonged exposure leads to sluggish movement and poor feed acceptance. Daily aeration and partial water exchange greatly reduce these problems. They are also sensitive to handling stress. Stress can be caused inadvertently during tank cleaning or by strong inflow currents when refilling; both should be avoided.

Low rearing density improves performance: 3-4 larvae/L typically yields survival ≥ 70%. Over 25-30 days of larval rearing, they usually reach 0.2-0.4 g. Live feeds such as Tubifex larvae, Artemia nauplii and mixed live zooplankton are well suited at the start. Mixed zooplankton collected from ponds should be sieved before feeding. Live items persist in the tank water and provide food throughout the day. Growth

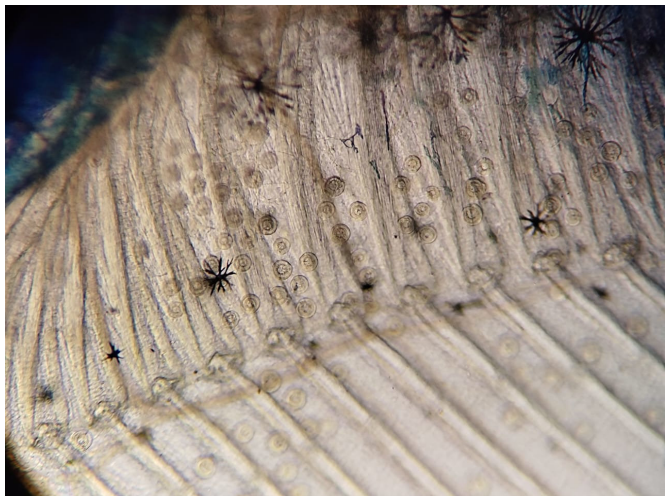
Group of fry after indoor rearing.

Haul of N. chitala fingerlings.

and survival are often better with *Tubifex* and *Artemia* than with zooplankton alone. *Tubifex* should be finely chopped, as longer worms are difficult to ingest; larvae will also nip at bunches of *Tubifex*.

A compound feed containing 40-50% high-quality fishmeal, offered as a soft dough, is accepted by 14-15-day-old larvae. Gradual weaning from live feeds to the compound feed is

Juveniles of chital from tank culture.



View of trichodina infection in larvae.

recommended as best practice. Some farmers also feed larvae/fry with live carp larvae or low-cost seed of other fish species.

Fingerling production

Fry of 20-25 days are well suited for rearing in fingerling tanks or small earthen ponds. Prepare rearing units as for carp nurseries, manuring to promote plankton production before stocking. Plankton and other live organisms generated by manuring provide natural food alongside a regular compound feed. As with larval diets, the compound feed should include high-quality fishmeal as a major ingredient. The fishy odour increases acceptance in this predatory species. Feed should be crumbled during the first 3-4 weeks of rearing. Provide shelters in the tanks, which the fish use as hiding places. Filamentous algae often develop in shallow water; remove them to allow free movement.

Good growth is obtained by stocking about 100-150 fry in a 16 m² tank. Over 6-8 weeks, fish typically reach 12-13 cm in length and 6-7 g in weight. Seed of this size is suitable for grow-out. With further rearing in tanks, fingerlings can reach 18-24 g and 16-19 cm over an additional 4-5 months.

Health management

During larval rearing we encountered and confirmed *Trichodina* infection. Fish appeared healthy at first, but at 13-15 days old showed unusual swimming behaviour and then died after 2-3 days. Mortality was never mass, but occurred in phases. We concluded that pond-collected plankton was the source. When we stopped feeding plankton to other batches of newly hatched larvae, mortality did not occur during nursing. Care is therefore needed when offering pond-collected plankton to larvae.