Magical role of live foods in boosting spawn survival of climbing perch: A success in the farmer's field

D. N. Chattopadhyay[1], S. Adhikari[1], B. N. Paul[1], R. N. Mandal[1], G. S. Saha[2], B. R. Pillai[2] and S. K. Swain[2]

*1. Regional Research Centre, ICAR-CIFA, Rahara, Kolkata, 700118, West Bengal, India; 2. ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar, 751002, India. *Corresponding author: rnmandal1964@gmail.com*

Human efforts continue to promote the aquaculture sector to meet the demand for protein rich foods from aquatic sources. The development of aquaculture emphasises the improvement of culture practices, diversification of aquaculture systems, and incorporation of more wild species into culture through their domestication. The climbing perch, *Anabas testudineus* (Bloch, 1792) is a preferred fish species with high market demand that was brought into culture practice in the recent past.

Climbing perch belongs to the family Anabantidae in the order Perciformes. It was treated as a monotypic genus *Anabas*, until another species *A. oligolepis* was known to us, which created a bit of confusion in regard to its distinctness from *Anabas testudineus*. *A. oligolepis* was later determined to have been first described as *A. cobojius* by Hamilton (1822) and is now accepted as a second species of the genus *Anabus*. The global population of *A. testudineus* is declining in many regions, but the substantial number of populations that exist assure the species remains unthreatened. Earlier, the species was treated as 'data deficient' on the IUCN Red List of Threatened Species, but later it was revised to 'least concern' on version 3.1 (Ahmed et al, 2020).

Habit, habitats and distribution

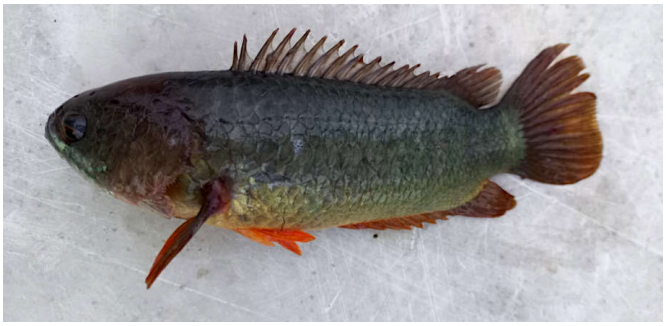
Habit

A. testudineus is an air breathing species which has an accessory air breathing organ situated above gills to facilitate the exchange of atmospheric air. This enables the species

Netting the broodstock.

A close view of harvested broodstock.

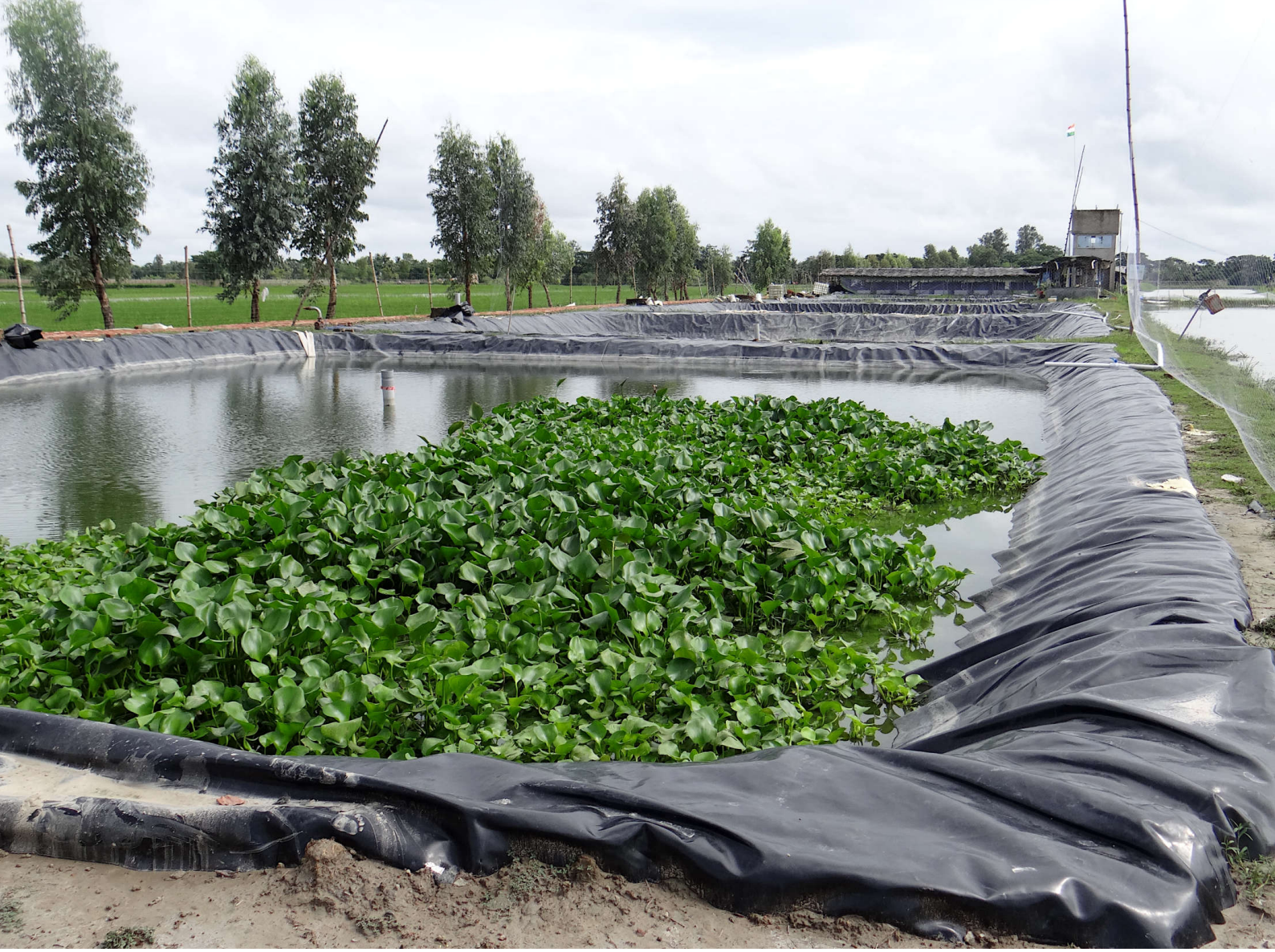
to withstand oxygen depleted conditions for a considerable period and enables the fish to migrate short distances overland to reach new habitats. The size and weight of adult males and females is usually in the range of 6.5-8.5 cm and 40-100 g, respectively. Adults may be 150 g in some cases. The species is migratory with movement usually taking place during the early monsoon months when showers start in June and July. *A. testudineus* prefers laying eggs in clean water and will search for preferred breeding ground in early rains so as to provide a suitable habitat for its progeny. Adults are omnivorous and will feed on large plankton, insects, invertebrates and small fish, but juveniles feed on plankton according to their capability at different ages. This species is a visual feeder and mainly feeds during the day; it prefers chasing prey, which seems to increase its appetite while feeding.



Above, below: Mature climbing perch.

Habitat

Climbing perch inhabit water bodies ranging from freshwater to brackish water, with diverse forms: Rivers, lakes, reservoirs, tanks, ponds, jheels, canals, karanjali, ditches, swamps, estuaries and low-lying water bodies. It also grows in paddy fields, flood plain lands and derelict water bodies, whether they be seasonal, annual or perennial. It can withstand sluggish flowing canals densely covered with aquatic plants, tolerate waters with high biological oxygen



Management of climbing perch broodstock in an earthen tank.

demand or polluted conditions, survive in turbid and stagnant water, and even remain alive buried in mud during the dry season. People commonly catch it from low-lying water bodies, swamps, and marshy lands which generally dry up during the summer months, but also catch this species during its migration at the eve of the rainy season.

Distribution

Climbing perch are dominant in the south Asia, comprising India, Bangladesh, Pakistan, Nepal, Sri Lanka and Bhutan. It also occurs in south-east Asia including Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, Indonesia, Brunei, and Singapore. It is found in southern China, and has been introduced to the Philippines.

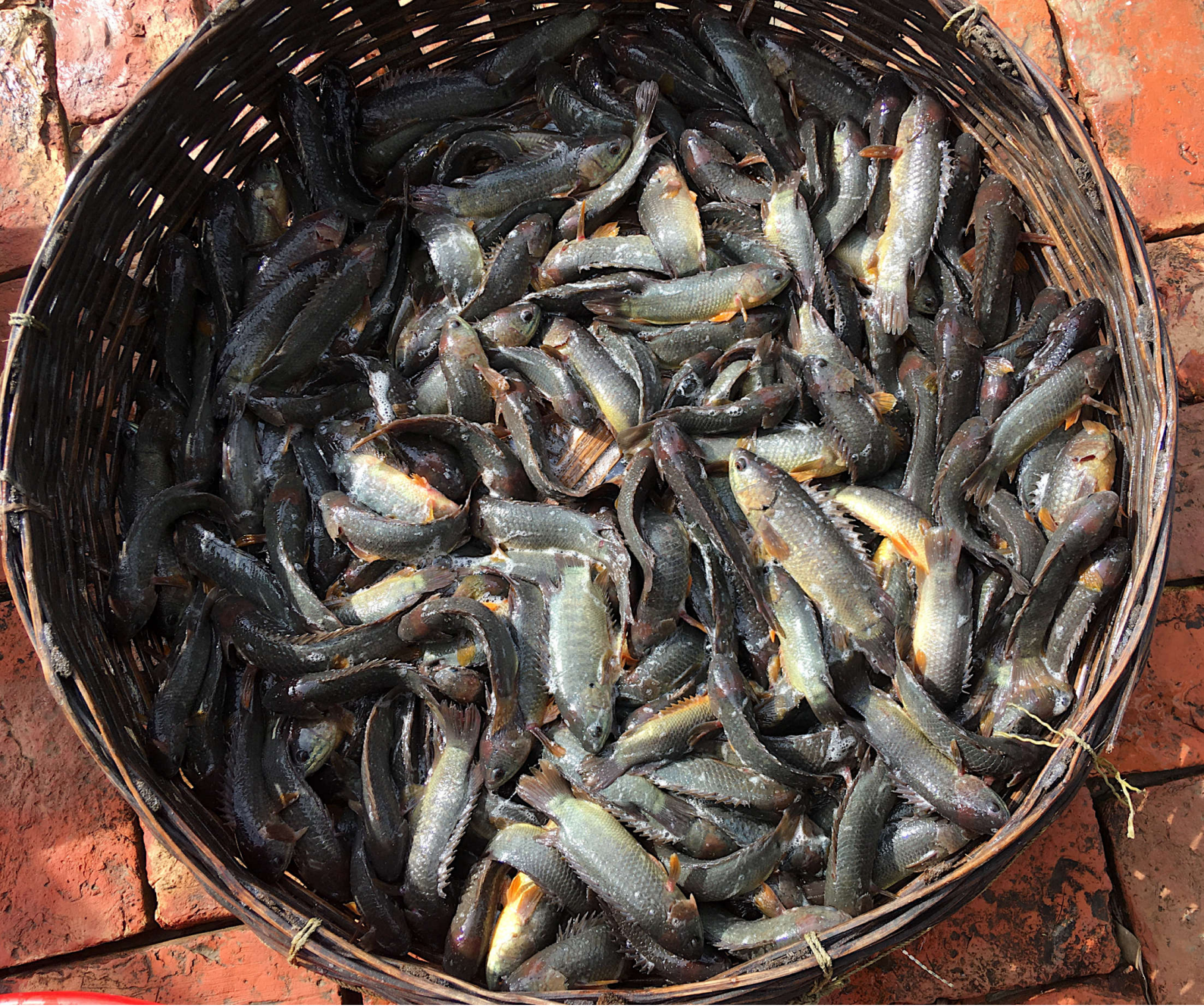
Medicinal importance and food value

Traditionally, people use *A. testudineus* as a food of medicinal importance. People who fall in sick due to stomach upset, intestinal disorder and repeated convulsions are advised to consume this species through traditional culinary preparation. Its muscle is soft and easily digestible and has a unique taste. It is a valuable source of docosahexaenoic acid (DHA), ecosapentaenoic acid (EPA) and several essential amino acids required for human brain development, and fat metabolism, essential for preventing diseases such as atherosclerosis, dementia, and Alzheimer's disease. Typical nutrient values of *A. testudineus* per 100 g are: Moisture, 70 g; protein (N × 6.25), 14.8 g; fat, 8.8 g; minerals, 2 g; carbohydrate, 4.4 g; energy, 156 kcal; calcium, 410 g; phosphorus, 390 g and vitamin c, 32 mg; vitamins A, D, E and K as 93.9, 43.12, 1.27 and 1.15 respectively. Climbing perch is highly valued for its unique flavour, and prolonged freshness.

Breeding

Broodstock management

Anabus broodstock are usually stocked from February onwards in selected ponds or in small tanks with suitable size ranges between 0.015- 0.02 ha, and water depth less than 0.7 m. They are conditioned under specific management strategies including daily feeding, water exchange, growth measurement, and disease surveillance. The broodstock are supplied with mixed plankton, along with high protein rich food purchased from the local market.



Broodstock are collected in a bamboo basket for selection of suitable fish.

Broodstock selection for breeding

As soon as broodstock develop a considerable size, they are examined through secondary sexual features to determine whether they are fully conditioned to take part in breeding. If they are found to be in suitable conditioned for breeding, the males and females are placed in separate tanks with slow showers falling into them for 3-4 hours. Then they are transferred to the breeding tray, and kept together in equal numbers.

Breeding in captivity

Selected broodstock are administered hormone injections: Females @1.0 ml/kg body weight and males @ 0.5 ml/kg body weight. Then both male and female broodstock were kept in the breeding tray with flowing water and aeration. After 7-8 hours, females release eggs. The fertilised eggs are put into a hatching chamber in which a running water flow is provided. Hatching occurs after 4 days. Then the difficult period of how to feed spawn begins.

Feeding spawn in captivity - critical to spawn survival

A farmer's struggle that urged in developing technology

Spawn survival of *A. testudineus* is a critical task. Not that everybody will succeed every time, but spawn mortality is a common phenomenon in captive culture. One has to know the secret of feeding spawn. What happened to farmer Saifulla Mandal of West Bengal is a learning point to others. Saifulla tried to breed fully conditioned and matured *A. testudineus* at captivity in his farm four or five times, but never succeeded in getting the spawn to survive. He is an expert farmer experienced in breeding and larval rearing of other fish species, but he never encountered such a difficult task, which left him feeling frustrated. In this juncture, he had interactions with Scientists of Regional Research centre, ICAR-CIFA, Rahara, West Bengal, India.

Development of 'fact query sheet' – a way to resolve the problems

Having listened to his difficulties, we suggested him to prepare a "fact query sheet' to note down all the facts related to spawn feeding.

Table 1: 'Fact Query Sheet' including facts and solutions.

Facts	Information
Fish species	*Anabus testudineus*
Character	Air breathing
Feeding behaviours	Carnivore
Sex	Male and female
Breeding time	Rainy season
Breeding behaviour	Fully migrant
Culture practice	Cultivable
Spawn age	4th -12th day
Spawn size	2,800 to 4,200µm*
Mouth aperture of spawn	290-623µm*
Probable prey	Plankton*
Suitable prey size	90-150µm*
Feeding condition	Visual feeder
Feeding behaviour	Chasing prey

**Information added by the Scientists, RRC, ICAR-CIFA, Rahara, Kolkata.*

With the prepared 'Fact Query Sheet', we understood that spawn would require those plankton which are less than 150µm and have motility to stimulate predation – a key point to emphasise. Prior to our suggestions, he had collected mixed plankton from his tanks/ponds prepared for plankton production, and supplied them to spawn from the 4th day onwards. When mixed planktons were supplied to spawn, the larger plankton with developed appendages could rupture the mouth of spawn – a probable incident might happen or larger planktons would feed on tiny spawn as prey. Both the facts might cause spawn mortality in despair. Having prepared the fact query sheet, he has been guided to carefully observe the following:

- Which size of plankton can enter into spawn mouth actively or passively, befitting with size of spawn mouth aperture through water movement?
- Whether spawn prefer to chase prey or wait for prey to move its nearby, then catch.
- Whether movement of prey stimulate spawn appetite to catch prey.

Having followed the suggestions, he observed the spawn behaviour and reported that spawn requires suitably sized plankton after 4 days in age. Simultaneously, we examined the length and mouth aperture of spawn aged in between from 4–12-day old samples which he supplied us. Length of spawn measured ranged from 2,800 to 4,200 µm, and mouth apertures corresponded to the range 290-623µm. With this range of mouth aperture, we suggested him to supply rotifer (*Brachionus calyciflorus*) – a zooplankton – suitable for spawn feeding. This suggestion brought a much-awaited success in achieving spawn survival and made him smile.

Acclimatisation of broodstock before breeding.

Collection of spawn from a rearing tank with a plankton net.

Spawn collected in an aluminimum plate.

Segregation of live foods – a technique easy to adopt

Saifulla methodically segregated a variety of plankton through plankton nets of different mesh sizes. He purchased a plankton net of around 150µm mesh size as a suitable one to sieve and collect desirable plankton to feed 4–12-day old spawn. After the 12th day, spawn were able to feed on mixed plankton of suitable size. In such practice, he collected a huge numbers of rotifer species with suitable size in the range of 90-150µm that could easily enter into the mouth of spawn. Further, the movement of rotifer stimulates spawn to chase them down and feed. Rotifer is also soft and easily digestible to spawn – the magical role it plays for spawn survival. Saifulla reported high spawn survival after following

Scientists of RRC, ICAR-CIFA, Rahara observing spawn maturity & survival with Saifulla Mandal, a progressive farmer.

our suggestions to feed spawn with rotifer. Scientists visited his farm to confirm the success of spawn survival that Saifulla achieved after implementing our technology.

Rotifer culture in outdoor tanks

In outdoor tanks, rotifer is cultured with green water that acts as a good source of food. Green water culture of rotifer with *Chlorella* is an ideal food for rotifer. *Chlorella*-fed rotifer supports spawn growth and development because *Chlorella* is an rich source of nutrients.

Scientists' advice to the farmer to achieve success

An essential intervention requires through interactions between scientists and farmers to establish technology that is viable in the farmers' field. What happened in Saifulla's farm is exemplary of exchange and coordination of ideas among aquaculture stakeholders and practitioners. Working together, farmers can improve their production using solutions that scientists have developed based on consultations with farmers concerning their conditions and difficulties. Success required farmers and scientists to exchange views and practical experiences from lab to land vis a vis land to lab.

Acknowledgement

Authors are grateful to the Director, ICAR-CIFA for his encouragement of farmers' interaction. Authors acknowledge Saifulla Mandal for his cordial invitation to visit his farm. We thank Mrs Bithilekha Mondal and Mr Knudal Pal for rotifer photography.

Reference

Ahmad, A.B., Hadiaty, R.K., de Alwis Goonatilake, S., Fernado, M. & Kotagama, O. 2019. *Anabas testudineus* (errata version published in 2020). The IUCN Red List of Threatened Species 2019: e.T166543A174787197. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T166543A174787197.en

Microscopic view of rotifers (Brachionus calyciflorus) suitable for feeding spawn.