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Etroplus suratensis (Bloch), the State Fish of Kerala

1. Introduction

Pearlspot, *Etroplus suratensis*, known locally as 'Karimeen' (figure 1), is the largest among Indian cichlids, a high-valued food fish endemic to peninsular India and Sri Lanka. The Vembanad lake in Kerala (Lat. 09°31′ and 09°41′ N and Long. 76°21′ and 76°26′ E), considered the heritage abode of this fish, supports a rich natural fishery for this species since long, although the annual landings have reduced to 200 tons (Padmakumar *et al.* 2002) from 1252 tons reported earlier (Samuel 1969).

Because of their wide salinity tolerance, omnivorous feeding habit and high market price in Kerala, pearlspot is considered ideal for commercial culture in brackish and freshwaters. This species has a unique breeding habit of nesting on submerged substratum on the lake bottom. Indiscriminate dredging of the lake bottom for lime shell deposits has been catastrophic to the natural breeding of pearlspot. With rapid expansion of backwater tourism, destruction of mangroves on the lake shore and land fringes, construction of saltwater exclusion barrage for rice farming, and several ecosystem alterations, the fish production in the Vembanad Lake is on rapid decline. Lack of required quantity of fish seed has been the most serious constraint for expansion of its culture.

2. Pond breeding of *Etroplus suratensis*

The fish attains maturity at the end of the first year, with sexual dimorphism perceptible only during the breeding season (Padmakumar *et al.* 2004a, b). Fecundity of pearlspot is low, varies from 500 to 7550 (Vijayaraghavan *et al.* 1981; Bindu 2006). Breeding of the fish in Vembanad Lake peaks during December–February and June–July (Krishnan and Diwan 1990). The presence of two peaks in gonadosomatic index and two distinct batches of eggs in the same ovary is corollary to its breeding habit. *E. suratensis* breeds throughout the year in ponds, with a peak during September (Bindu 2006). Breeding behaviour includes pairing, nest making, pit nursing and parental care. As a prelude to breeding, the male and female fish form a spawning pair (Padmakumar *et al.* 2004b). The breeding pair utilize any stationary solid objects (coconut leaves, husk, roots, stones, bricks, etc.) lying at the lake bottom, and along the shallow periphery of the water body, for attaching the eggs (figure 2). After the eggs (250 to 1573 eggs per brood) are laid by the female and are stuck to the substratum one by one, the male fish fertilizes them immediately. The process of egg laying and fertilization continues several times and the eggs are cemented closely without touching each other. Spawning is completed within 45 to 60 min (figure 3). The parents aerate the egg by rapidly fanning with their pectoral fins. The eggs hatch in 70–72 h, and the hatchlings are transferred by the parents to the breeding pit, which is prepared on the shallow pond bottom. Once the eggs are transferred, the female closely guard the pits. During this period, the parents continue fanning the pit with their fins to increase oxygenation required for the hatchlings sheltered in the pit. *E. suratensis* exhibits a prolonged parental care till the young ones attain a size of 30–40 mm. As the fish hardly eat during parental care, the growth rate of the mature fish is poor in pond rearing conditions.

Keywords. *Etroplus suratensis*; breeding; raceway; enclosure farming; sanctuary

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Figure 1. Pearlspot, *Etroplus suratensis*.

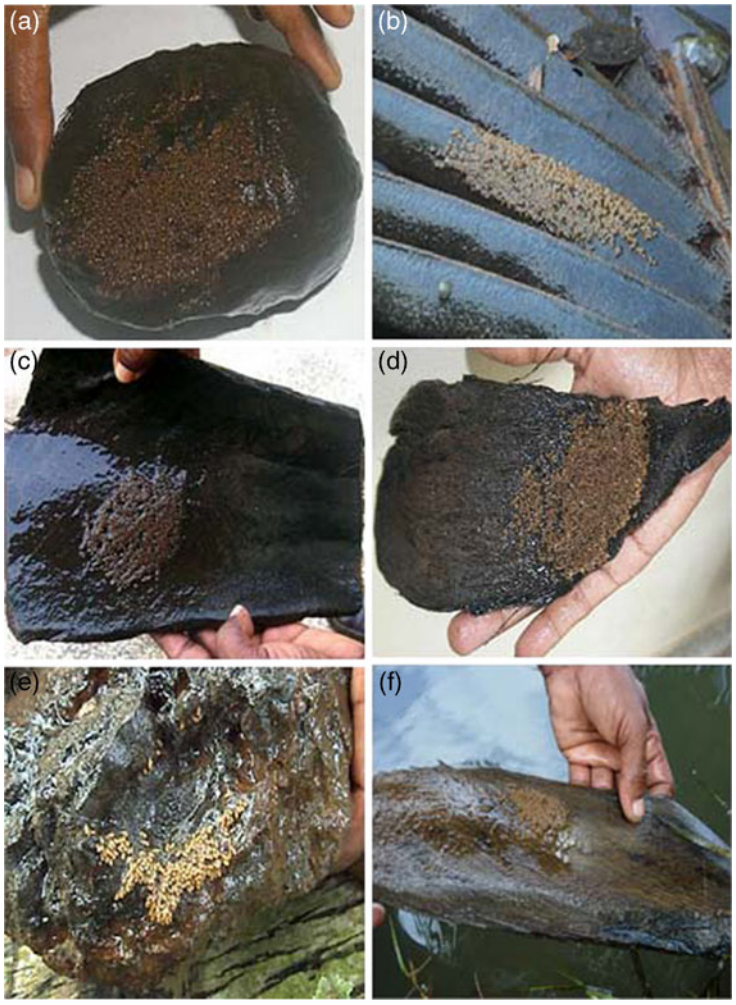

Figure 2. Attached eggs collected from the experimental pond.

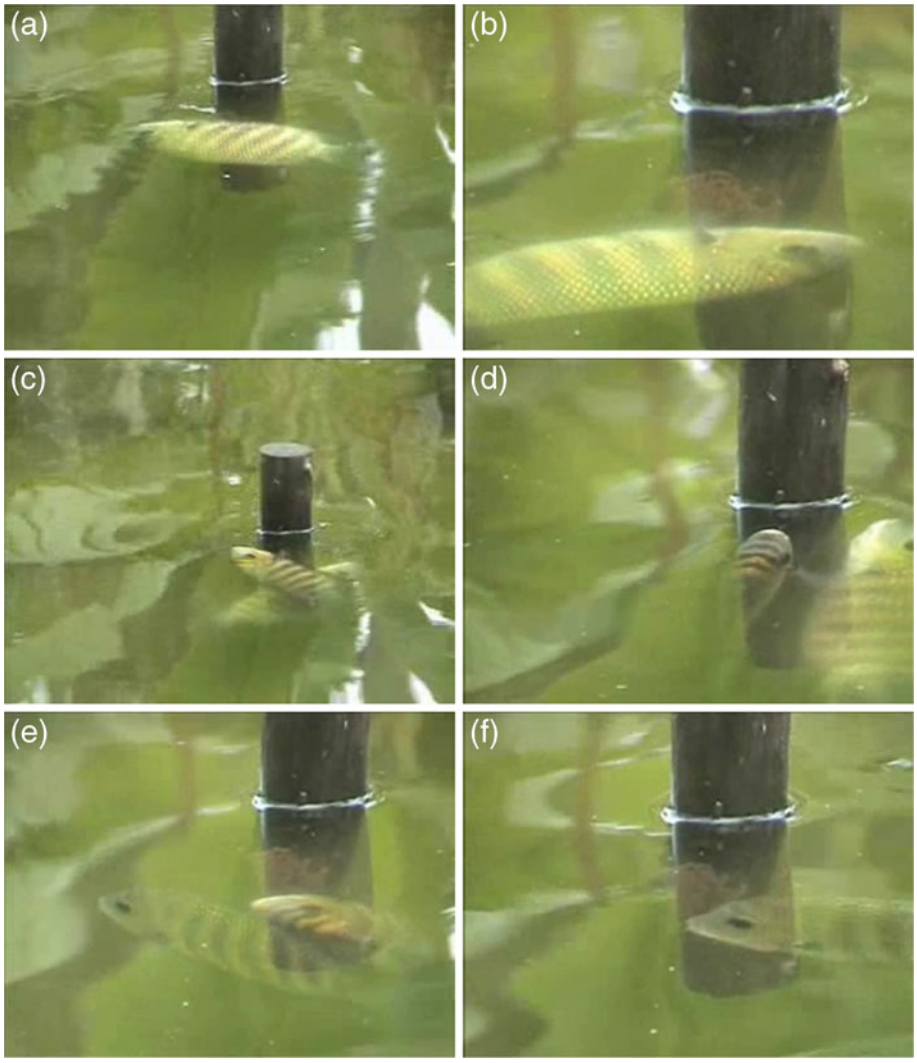

Figure 3. Different stages of breeding of *Etroplus suratensis* in the raceway tank: (**a**–**e**) Female placing eggs on the substratum and male fertilizing them; (**f**) parent fish guarding the eggs.

3. Tank breeding

These fishes are highly adapted to captive farming due to its ability to feed on a variety of natural foods. Pearlspots have an 'asynchronous' type of ovary which contain oocytes of all stages of development, enabling to spawn many times during a prolonged breeding season. Therefore environment simulation, rather than hormonal manipulation is employed for inducing captive breeding of pearlspots, in difference to fish species that exhibit syschronous/group synchronous gonadal development. Captive breeding was carried out in specialized raceways (70 m^2) by providing artificial substrates and breeding pits (figure 4). Appropriate water levels and a moderate water flow (5 cm/s^{-1}) were maintained. The raceway was stocked with brood fishes collected from the Vembanad Lake with 1 $pair/m^{-2}$. Over 50 nestings were obtained in a year. More than 75% of the nests were confined to shallow clear areas within the tank. Around 400–2000 eggs were laid per brood (figure 5) and over 95% survival was obtained in raceway breeding (Padmakumar *et al.* 2009a). The eggs are oblong in shape and are attached on the nesting object (figure 6). Over 80% of egg hatching is completed by 98 h after egg-laying, and the hatchling measures 4.5 mm in size. They are characterized by a transparent body and large pigmented eyes.

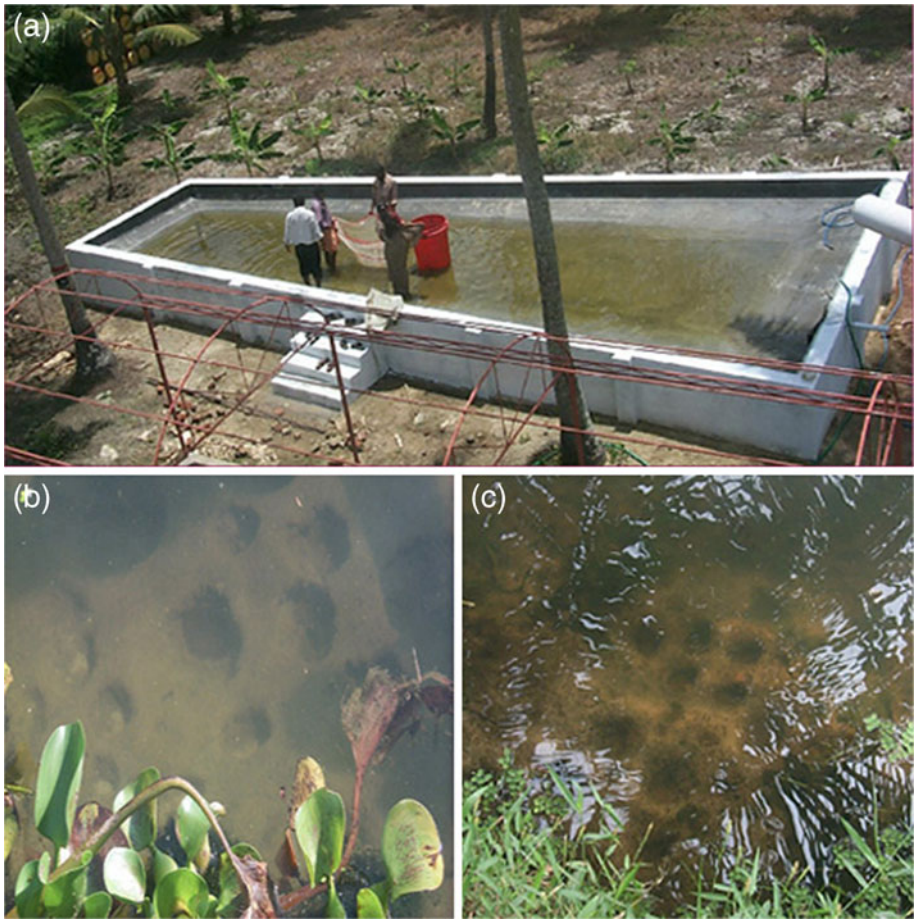

Figure 4. Artificial breeding of *Etroplus suratensis* in (**a**) raceway system, (**b**) breeding pits in the raceway and (**c**) pits in the experimental pond.

The yolk is absorbed by the sixth day and then the larvae, known as 'wrigglers', freely begin to move. In the tank breeding conditions, the hatchlings are fed on freshly hatched *Artemia nauplii*, which were observed to be the most effective live feed substitute. Parental care is continued until the fry become free living individuals. Rectangular tanks (5×3×1.5 m) with a water depth of 1 m were also suitable for its breeding. Studies conducted in tank breeding indicate that transparency of water is most essential for breeding, which also helps in feeding. This raceway breeding technique exploits the unique reproductive behaviour of the species.

4. Enclosure farming of pearlspot

Karimeen is a culinary delicacy, exploited extensively for the tourism industry in Kerala, and therefore, demands concerted attention to increase production. This fish is demonstrated to be a suitable candidate species for high-density cage culture (figure 7a). The production rate is 12 to 50 times higher in cages than in pond culture, where it attains only 120–130 g in 6 to 8 months (Thampy 1980). The high growth rate and biomass gain in open water cage farming is apparently due to total breeding exclusion in such enclosure systems. Pioneering studies on cage culture of pearlspot in Vembanad Lake by the Regional Agricultural Research Station (RARS), Kumarakom, has shown that average production is over 20 kg/m^3 in 6–7 months. The survival rates vary between 45% and 100% (Padmakumar *et al.* 2004a, b, 2009b). Karimeen is remarkable for its scrubbing behaviour and the fish cleans the mesh apertures effectively by feeding on the attached algae and periphyton growing on the cage mesh. These studies on enclosure farming

Figure 5. Eggs collected from the raceway tank.

demonstrate the immense potentials of cage farming of pearlspot in open waters as a cluster enterprise by women Self-Help Groups.

5. Protected habitats and engineered sanctuaries

By simulating the unique biological requirements of this species, a 'fish sanctuary', in an area of 10 ha, is established in open Vembanad Lake at Kumarakom, (figure 7b) for enhancing natural production. Natural breeding of fishes within the sanctuary is promoted by providing appropriate water depths for breeding and recruitment, through lake floor modifications and by providing a variety of

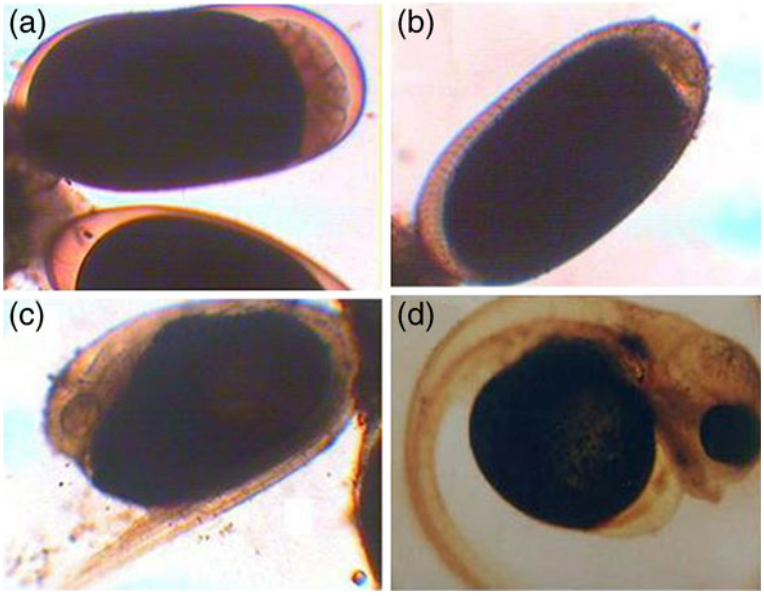

Figure 6. Early development in *Etroplus suratensis*: (**a**) 17 h, (**b**) 49.30 h, (**c**) 80.30 h hatching and (**d**) second day larva (scale bar 1 mm).

artificial nesting substrates (Padmakumar 2003). These substrates also function as fish aggregating devices and feeding surfaces with the growth of periphyton on them. All these structures simulate near natural breeding habitats in the open lake sanctuary. The sanctuary is cordoned off by fixing coconut wood piles at close intervals to obstruct fishing and operation of crafts and gears to the interior areas, thus hindering unauthorized fishing.

A perceptible increase in fish yield in lake areas nearer to the sanctuary during the succeeding years indicate that such attempts are most effective and practical for conservation of endemic fish species. With the increased availability of fish, the sanctuary zone in the lake has also become a favoured resting place for water birds and migratory species. While developing this engineered habitats, co-operation and support of the local fisher communities was ensured. In contrast to artificial ranching carried out for fishery enhancement on commercial considerations, fishery management by establishment of a network of sanctuaries of this kind in the lakes and water courses is the most effective method for stock enhancement. Needless to state that such interventions are of immense help for conservation of fish species such as pearlspot which have unique breeding requirements.

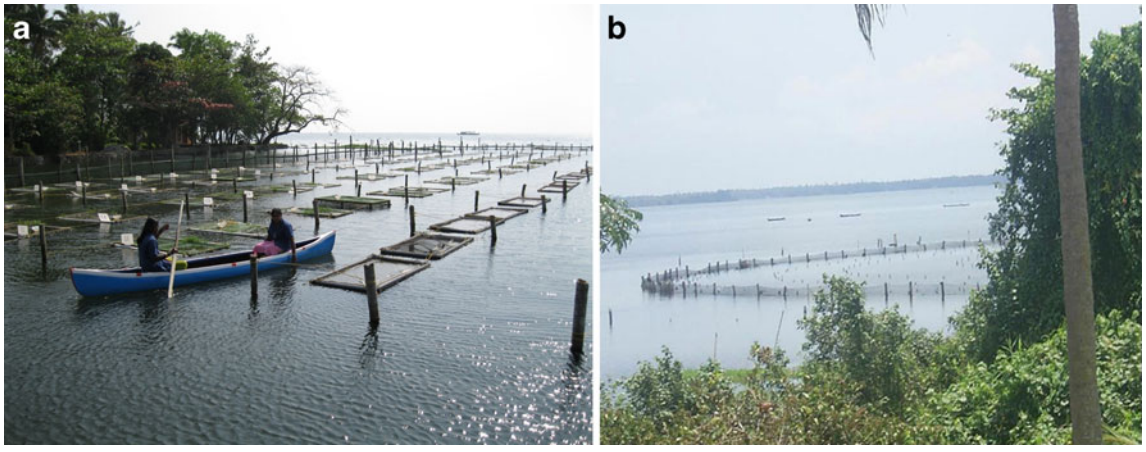

Figure 7. (**a**) Experimental cages and (**b**) sanctuary in Vembanad lake for *E. suratensis.*

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