CHAPTER 4

BEHAVIOURAL PERSPECTIVES

Among the fishes, a remarkably wide range of biological adaptation to diverse habit has evolved. Fundamental work on fish behaviour has been a rapidly moving field. The behaviour of fishes intimately unique and efficient solutions to the problems raised by their three dimensional environment. A newly fertilized egg does not behave but an adult fish responds to its environment with repertoire of complex, adaptive behaviour pattern.

The different aspect of ethological perspectives of present test species is resting behaviour, locomotive behaviour, ingestive conation, aggressive or chasing behaviour, and procreatic demeanor.

4.1. Resting behaviour

The resting behaviour of the test species in a classic model of deceptive resemblance and exhibits extreme morphological specialization correlated with exceptionally well-developed predatory habits (Jhingran and Talwar 1991, Marshall, 1999).
The test species is observed mostly to remain at rest, camouflaged among the aquarium plants or among the pebbles at the floor of the aquarium. Both male and female display similar resting behaviour.

At the column level and among aquatic plants the test fish rests making an angle of $45^\circ - 60^\circ$ to the water surface either pointing upwards or downwards with rhythmic beating of the pectoral fins with sporadic movements of the rays of the dorsal fin while the spines are kept erect.

**Fin reciprocation**

- Dorsal - $0.8 - 0.9 (\bar{x} 0.9 \pm 1.7)$
- Pectoral - $0.9 - 1.6(\bar{x} 1.2 \pm 0.7)$
- Anal - $0.7 - 1.1(\bar{x} 0.9 \pm 0.5)$

### 4.2 Locomotive deportment

Fishes are adapted to moving through both still and flowing water. Both progressive and fluctuating movements of the water play a significant role in the lives of fishes. Fishes are adapted to moving through the water by various means and at various speeds.

Regarding mechanism of locomotion, three primary methods are employed by fish to produce forward movements in water.

The methods are

(i) Progressive movements are accomplished by means of bending the whole body as a wave, which passes along the body of the fish.

(ii) By vibratory movement of the fins.
(iii) By movement caused by the action of jets of water expelled from the gill opening. In teleost the three are interrelated and may all be used at different times.

Locomotion, only by means of fin movements takes place when slow process is desired but for rapid, swimming body movement is most important. During such activity the paired fins serve for balancing the body so that the fish remains in position and does not float with belly upwards. The dorsal and anal fins form dorsal and ventral keel which can be lowered or raised, according to need and give stability to the body. The trend of locomotive velocity in the present species is portrayed in Table 3.

Table 3. Locomotive velocity (mm/sec) in *Nandus nandus*.

<table>
<thead>
<tr>
<th>Normal Level</th>
<th>Velocity Direction in Male and Female</th>
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<tbody>
<tr>
<td></td>
<td>Forward Horizontal</td>
</tr>
<tr>
<td></td>
<td>MALE</td>
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<td>Level 0.4–1.2</td>
<td>0.4–1.2</td>
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The speed attained by fishes have always been the subject of much speculation, but unfortunately very little accurate data exists as to relative speed of different forms. Speed of travel in the studied fishes may be thought of as

(i) **Cruising speed**: Cruising speed is that which is involved in ordinary travel.
(ii) **Top speed**: Top speed involves maximum thrust for short duration especially in feeding and breeding. The data on these two speed are:

**Cruising speed (cm/sec)**: Male 2.8; Female 1.8.

**Top speed (cm/sec)**: Male 5.2; Female 3.6

(iii) **Drifting movement**: The test species mostly remains sedentary but it is seen occasionally to drift among the aquatic vegetation. Initially, it moves upward with rapid beating of the pectoral fin, after attaining column height, the test species is seen to move forward with continuous movement of the pectoral and the rays of the dorsal fin, keeping the dorsal spines erect.

### 4.3. Ingestive behaviour

The feeding behaviour of the test species is also precisely investigated in the aquaria. Reaction and responses of the fish under study towards their food elements introduced into the eco-system are visually analysed. With a patient manoeuvre to deduce the modus operandi of food capture, period of quiescence, change of equilibrium, operculum and fin movement, surfacing behaviour, postures of feeding actual mode of movement and other related changes of the fish. It is observed that the test species do not attack live food if not hungry. The species being nocturnal feeds during twilight and dawn.

In general, the first noticeable reaction immediate to the application of food is an initial state of excitation with rapid movement of pectoral fins. Initially the fish never responds immediately to the presence of food. After acclimatizing them, the fishes start feeding immediately after feed administration.

Fin reciprocation and the opercular movement of the test species is critically studied and expressed as frequency/sec is purported below.
Dorsal: 0.95 - 1.20 (x 1.09± 0.55); Pectoral: 1.22 - 1.30 (x 1.22 ± 0.61); Ventral: 0.80 - 1.05 (x 0.92 ± 0.46); Anal: 1.32 - 1.50 (x 1.41 ± 0.71) and Caudal: 0.60 - 0.75 (x 0.67 ± 0.34).

Opercular movement: 1.98 - 2.12 (x 2.04 ± 1.02)

The feeding activities commence with the fish opening the mouth and gulping the food elements. The species is found to feed mostly in the column zone. But after acclimatization, it is seen to execute at the surface level, the fish rests at the column zone making an angle of 50° to the water level with the beating of the pectoral fin, the dorsal spines are kept erect and the rays beat slowly. After gulping the fish quickly returns to its initial position and conveniently swallows the gulp with slow opercular movements and with rhythmic beating of the pectoral fin. On the other hand, the fish moves down for bottom feeding from the column at an angle of 60° and returning back to its initial position.

4.4. Agonistic mien

The competition for food, mating pattern and nesting space may result in aggressive behaviour pattern, primarily between members of the same species. When another fish approaches a fish too closely, its first response is often that of a defensive posture. The agonistic behaviour of the test fish is observed especially during, resting and feeding period. In the present investigation, the aggressive behaviour of the test species is observed and precisely purported in the following lines through schematic figures.

Aggressive behaviour towards a newly introduced fish has not been observed. The test species is solitary by nature and it has been observed that the newly introduced fish moves around the aquarium for 2 - 4 mins and settles in a resting phase.

Feeding period: Both male and female exhibit agonistic behaviour at the time of feeding. After feed application male-to-male, male to female and female-to-female
FIGURE 4. SCHEMATIC DIAGRAM SHOWING AGGRESSIVE BEHAVIOUR IN *NANDUS NANDUS* DURING FEEDING PERIOD
exhibit aggressive behaviour. It pushes the opponent at the mid-dorsal and post opercular region with its snout and engulfs the food. This trend has been elucidated in Figure 4.

Resting period: Aggressive behaviour during resting period is exhibited by test fish with larger size in an aquarium where four test species of different sizes were kept, of which all were females. The female, which is bigger in size, pushes the opponent either at the caudal region or at the post opercular region and rotates in a clockwise direction for 1 – 3 mins where by the opponent leaves the resting ground and the dominant one settles. The trend has been schematically depicted in Figure 3

4.5. Procreatic demeanor

Courtship: Before the actual courtship display, the male and female *Nandus nandus* (Ham) exhibit restlessness and frequently move at the base of the aquaria. Both male and female moves parallel to each other. The actual courtship display starts approximately 6 hrs. after inducing the pair. The male nudges the female with the snout and pushes the female upwards whereby the male bends down and brings its genital pore in proximity with the female’s genital pore enticing and interlocking the female with the pelvic and anal fin as in figure 6. Thereafter the male rubs the vent of the female vigorously for 0.5 – 1 min. The display continues for 3 to 4 hours whereby the female delivers eggs in several batches and the male sheds milts over the eggs, thereby fertilizing the eggs. After the display, both male and female settles down at the bottom of the aquaria with increased opercular movement (Figure 5).

Parental care: Parental care has not been shown by any of the parents towards the fertilized eggs.
FIGURE 3. SCHEMATIC DIAGRAM SHOWING AGGRESSIVE BEHAVIOUR IN *NANDUS NANDUS* DURING RESTING PERIOD
FIGURE 5. SCHEMATIC DIAGRAM SHOWING LINEAMENT OF PROCREATIC DEMEANOR