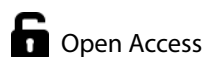


A Review of Food and Feeding Habits, Reproductive Biology of *Osteobrama cotio* (Hamilton, 1822)

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Abstract

Osteobrama cotio (Hamilton, 1822) is known 'Cotio' a tropical, benthopelagic, freshwater species under the family Cyprinidae. It is distributed in Bangladesh, India, Pakistan, and Nepal in Asia, and its presence in Myanmar is questionable. As per IUCN Red List Status, it is categorized as Least Concern (LC), but the species categorized as Endangered (EN) in Bangladesh. In India, *O. cotio* is distributed in Assam (Brahmaputra drainage), Bihar, Manipur (Barak-Brahmaputra drainage), Madhya Pradesh, Punjab, Uttar Pradesh, West Bengal and can grow to a maximum length of 15.0 cm. In the juvenile stages it is mainly fed on phytoplankton, and in growing and adult stages on zooplankton, insects, and detritus. The species is monsoon spawners and breeds during the month of May-July. Being a small indigenous fish, it provides nutritional supplements to a large section of economically backward populations. In this prelude, the present review is aimed to provide detailed information on *O. cotio* that might be useful to know the species, its potential importance, and suitable conservation measures that may be carried out accordingly.

1. Introduction

Osteobrama cotio of the family Cyprinidae is known as minnows, a tropical, benthopelagic, freshwater species (Baensch and Riehl, 1995). Once they matured occur in ditches, lakes, ponds, rivers, and possibly useful as larvicide (Menon, 1999; Talwar and Jhingran, 1991). In India a total of 9 species of the genus *Osteobrama* is available, 4 are native and 5 are endemic (Talwar and Jhingran, 1991; Froese and Pauly, 2020). Out of the nine species, *Osteobrama belangeri* are extinct in the wild (Vishwanath, 2010) whereas *O. neilli* are no longer found in the type locality due to rapid sampling (Ali and Raghavan, 2011). Being a small indigenous fish, it provides nutritional supplements to a large section of economically backward populations. *Osteobrama cotio* is one of the prime nutrient-rich small indigenous fishes that contain about 31 mg dehydroretinol, and 22 mg retinol per 100 mg fresh edible tissue within a 2.7 to 3.0 g of fish (Zafri and Ahmed, 1981).

The fish are mainly consumed in fresh conditions in the rural areas adjacent to the riverine sides where the fish being caught of the Brahmaputra, Barak, and lower stretches of river Teesta (Kumar and Goswami, 2013).

2. Synonyms

Cyprinus cotio (Hamilton, 1822)

Article History

RECEIVED in 18th September 2020

RECEIVED in revised form 14th November 2020

ACCEPTED in final form 15th November 2020

Leuciscus cotio (Hamilton, 1822)

Osteobrama cotio cotio (Hamilton, 1822)

Rohtee cotio (Hamilton, 1822)

Abramis cotis (Hamilton, 1822)

Abramis gangeticus (Swainson, 1839)

Leuciscus gangeticus Swainson, 1839

Common name: Cotio (English)

Bangladesh: Chela, Dhela, Ketu

India: Hafo (Assamese); Gila Khani, Hafo, Cotio (West Bengal); Bhongi (Marathi); Patta Kunji (Tamil)

Nepal: Gurda

3. Morphological Characters

The morphological characters are well documented by Talwar and Jhingran (1991), and Vishwanath and Shantakumar (2007).

Fin formula: D. iii, 8; P. i, 13; V. i, 9; A. iii, 31; C. 19.

The species bears 66 lateral line scales, a distinct spot on the dorsal-fin base, 14 scale rows between the dorsal fin base and lateral line, scales small and irregularly arranged, caudal peduncle shorter than its height (Figure 1). Body usually



Figure 1: A fully matured *O. cotio* collected from the inland open water body

very deep with laterally compressed, dorsal profile steep with a hump on the back, eyes comparatively large, snout blunt, scales small and irregularly arranged, 27 pre-dorsal scales (Vishwanath and Shantakumar, 2007). The pectoral fin touches the pelvic fin base and later almost touches the anal fin base, anal fin elongated with 31 branched rays, inserted well behind the dorsal fin. Body depth 42.9% (39.3-44.9 %) of standard length (SL), pre-pelvic length 40.09% (37.4-42.2 %) of SL, pre-anal length 55.2% (52.3-58.2 %) of SL, and length of the anal fin 37.7% (36.4-38.6 %) of SL.

Head length was reported 35.7% SL and 27.8% TL, head height was 42.9% SL and 33.3% TL, and eye 24% HL (Rahman, 1989).

3.1 Colour of Live Specimen

Live specimen colour as reported by Talwar and Jhingran (1991), bright silvery darker on the mid-dorsal line, and a conspicuous black blotch to the dorsal fin base.

3.2 Maximum Length

The maximum length was reported as 15 cm (Talwar and Jhingran, 1991), 10 cm (Bhuiyan, 1964), 10.8 cm (Rahman, 1989 and 2005).

4. Distribution

4.1 Global Distribution

It is distributed in Bangladesh, India, Pakistan, and Nepal in Asia, and its presence in Myanmar is questionable (Rahman, 1989; Talwar and Jhingran, 1991; Shrestha, 1994) (Figure 2).



Figure 2: Global distribution of *O. cotio* (Source: FishBase, Froese and Pauly, 2020)

4.2 Local Distribution

In India, *O. cotio* is distributed in Assam (Brahmaputra drainage), Bihar, Manipur (Barak- Brahmaputra drainage), Madhya Pradesh, Punjab, Uttar Pradesh, West Bengal.

5. Food and Feeding Habits

Alikunhi (1957) in his study stated that *O. cotio* largely feeds on zooplankton at all stages of their life. Besides, they also feed on phytoplankton (including filamentous algae), detritus, mud, small quantities of insects and worms. The feeding intensity of *O. cotio* from the pond conditions of Assam was found to be high, as most of the guts were found to be full or $\frac{3}{4}$ full (Parameswaran *et al.*, 1971). The specimens within the length of 21 mm were found predominantly feeds on phytoplankton (85.0%), zooplankton (9.4%), and rest by detritus. The specimens measuring more than 21 mm were found mainly feeds on zooplankton (45.7%), phytoplankton (8.4%), small aquatic insects (4.7%), worms (2.3%), and organic debris and mud (38.9%). While studying the food and feeding habits of *O. cotio* (*Rohtee cotio*), Ali *et al.* (1984) mentioned that debris was by far the most dominant food items in the gut content of the species both in the percentage of occurrences and percentage of total points followed by Cladocera, Rotifera, insects, higher plants, Bacillariophyceae, Chlorophyceae, and Cyanophyceae. Chandra and Haq (1986) also reported that *O. cotio* preferred mainly algae, zooplankton and debris from the Bangladesh water bodies.

It is a surface dweller fish and mostly feeds on algae, protozoan, crustaceans, and aquatic insects (Shafi and Quddus, 1982). Shafiqul (2000) worked out on the food and feeding habits of 'Dhela' (*Osteobrama cotio cotio*) from the Bangladesh water and found that Chlorophyceae (60.47%) followed by Bacillariophyceae (17.57%) were the main food items. Recently, Rafin *et al.* (2019) studied the food and feeding habits of *O. cotio* from Bangladesh waters and reported that it is an omnivorous column feeder and mainly feeds on phytoplankton, followed by zooplankton and benthos. The percentage of food composition varied from Bacillariophyceae (12.90%), Chlorophyceae (63.82%), Cyanophyceae (11.32%), Euglenophyceae (8.13%), Rhodophyceae (1.57%), Rotifera (1.43%) and Benthos (0.83%) (Table 1).

6. Reproduction

6.1 Sexual Dimorphism

Males and females specimens of *O. cotio* could only be distinguished during the breeding seasons with some external morphological features. The female specimens attain larger compared to the males. The distinguishing characters of males and females as per Parameswaran *et al.* (1971) provided in Table 2.

6.2 Gonadal Maturity Stages

Hussain *et al.* (2003) described the structure of the gonad of

Table 1: Food items found in gut contents of *O. cotio* (Rafin et al., 2019)

Major food groups	Genera status of each group
Bacillariophyceae	<i>Actinella, Cyclotella, Fragillaria, Navicula, Nitzschia, Surirella and Tabellaria</i>
Chlorophyceae	<i>Actinestrum, Ankistrodesmus, Chlorella, Cosmarium, Closterium, Gonatozygon, Pediestrum, Pleurococcus, Scenedesmus, Sticococcus, Tetradon, Ulothrix and Volvox</i>
Cyanophyceae	<i>Anabaena, Aphanizomenon, Aphanotheca, Mycrocystis, Oscillatoria and Spirulina</i>
Euglenophyceae	<i>Euglena and Phacus</i>
Rhodophyceae	<i>Hildenbrandia</i>
Rotifera	<i>Notholca</i>
Benthos	Unidentified

Table 2: Distinguishing characters of males and females of *O. cotio*

Character	Male	Female
Size	Smaller	Larger
Pigmentation on the back	Dark	Grey
Pectoral fins	Yellow	Pale yellow
Ventral fins	Brownish-yellow	Pale yellow
Outer margin of dorsal fin	Darker	Lighter
Anal fin	Has minute black spots, more concentrate on margin	Black spots not so numerous

O. cotio and observed that the gonad of *O. cotio* was bilobed, and in mature condition was found occupying a large part of the abdominal cavity. In general, the lobes were unequal and elongated. The middle portion of the ovary was boarder than the anterior and posterior regions. In the fully matured ovary, the eggs were fully ripe and yellowish with plenty of yolks. In the mature ovaries, three types of eggs were encountered, immature, maturing, and fully matured. The ovaries were found to change their shape, size, and colour, and other morphological features in different stages of maturity in different months.

6.3 Sex Ratio

Sex ratio between males to females was found to be 1:1.0434 of the specimens collected from Assam water bodies (Parameswaran et al., 1971).

6.4 Fecundity

Limited works have been done on the estimation of fecundity

on *O. cotio* in different regions. The fecundity of *O. cotio* varied from 3,006 to 10,970 of the fish collected from Assam waters (Parameswaran et al., 1971). The number of ova per gram weight of the ovary ranged from 3,796-4,664 and the number of ova per gram body weight ranged from 514 to 599 with an average of 553.5. Further, they have mentioned that the ripe ovary is golden yellow and the ova diameter ranged from 0.629-0.731 mm. Hussain et al. (2003) estimated the fecundity of the species from Bangladesh waters and observed that the absolute fecundity was varied from 512 to 6849 of the species size ranged from 2.20-5.7 cm, and weight 1.12-7.1 g, respectively.

6.5 Spawning Season

Parameswaran et al. (1971) observed that the breeding season of *O. cotio* rearing in pond conditions of Assam was found to start from late April or early May and extend till the end of July. Hussain et al. (2003) studied the fecundity and gonadosomatic index of *O. cotio* from the Bangladesh waters and found that the species breeds during monsoon months of early June to extend until September with peak spawning season between June to July. Euphrasia and Kurup (2008) studied the maturity and spawning behaviours of a threatened endemic *Osteobrama bakeri* (Day) and reported that the species breeds twice in river Periyar, Kerala, during April-June and October-November. In another species of *Osteobrama*, like *O. belangeri* is a seasonal and riverine spawner and normally spawns during June-July (Shashikumar, 1991; Devi, 1993; Das et al., 2017). The fish attains sexual maturity in 2+ years when it weighs 200-250 g. *Osteobrama belangeri* was found to be breed in riverine conditions during the southwest monsoon but does not breed in confined water without hormonal injections (Behera et al., 2010).

7. Conservation Status

As per IUCN Red List Status (IUCN, 2020), *O. cotio* is categorized as Least Concern (LC), but it is categorized as an Endangered (EN) in Bangladesh (IUCN Bangladesh, 2000). In several parts of the country, the species population is reported to be in decline from natural water resources (Kumar and Goswami, 2013). The causes for declining of the species are overexploitation, loss of habitat, human interference, climate change, pollution, siltation, etc. but the primary reason was found to be overfishing. Knowledge of certain biological aspects of these minnows will be useful to conserve this species in natural habitats and food and feeding behaviors along with reproductive traits will help while aquaculture practices will be performed utilizing this species.

8. Conclusion

Osteobrama cotio is found to be a high nutrient-rich small indigenous species and well distributed in Bangladesh, India, Pakistan, and Nepal. The food and feeding habits indicated that it is an omnivorous column feeder species and mainly feeds on phytoplankton, followed by zooplankton and

benthos. *Osteobrama cotio* is a monsoon breeder and the spawning season extends from June to September with a peak between June to July. Being smaller in size, fecundity is found reasonably fair in numbers. Due to overexploitation, habitat loss, etc. the species is gradually disappearing from the natural water bodies. Therefore, necessary initiatives must be taken to regenerate the species in the natural environment as well as to promote in pond aquaculture systems with standardized breeding techniques.

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