

Review Article

Morphology, growth pattern, feeding and reproductive biology of *Mystus gulio* (Hamilton-Buchanan, 1822) (Siluriformes: Bagridae)

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Abstract: *Mystus gulio* is a euryhaline fish, occurring mostly in freshwater; it has also been found to thrive in backwaters of low salinity. It is a popular food fish due to its good taste and recently it has also been reported to be exported as indigenous ornamental fish from India. Number of workers earlier has studied morphology, age, growth pattern, food and feeding habit and reproductive biology of this fish species; but no such collective documentation on these aspects is available. With this view, the current review work has been made to document all available information along with noting down those which are lacking and will be beneficial for future fishery and management of this fish species.

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Introduction

Mystus gulio (Hamilton-Buchanan, 1822), commonly known as long whiskered catfish, is a euryhaline fish, occurring mostly in freshwater and has also been found to thrive in backwaters of low salinity (Pandian, 1966) (Fig. 1). Talwar and Jhingran (1991) have reported that this fish primarily inhabits brackish water and also enters and lives in fresh water. The adults occur mainly in larger water bodies (rivers and streams) with mud or clay substrates, and rarely found in smaller streams (Talwar and Jhingran, 1991). Shafi and Quddus (2001) have documented its availability in canals, beels, haors, oxbow lakes, rivers and estuaries of Bangladesh. *Mystus gulio* has been documented to be distributed in India, Bangladesh, Sri Lanka, Indonesia, Vietnam, Pakistan, Nepal, Java, Thailand, Malaysia and Myanmar (Day, 1878; Weber and de Beaufort, 1913; Smith and Schultz, 1945; Pethiyagoda, 1991; Talwar and Jhingran, 1991; Roberts, 1993; Jhingran, 1997; Kottelat, 2001; Senarathne and Pathiratne, 2007; Froese and Pauly, 2014). Recently it has also been reported from China

(Dong et al., 2012). This fish species is widely cultured in rice fields and brackish water areas of deltaic Bengal, where it forms a valuable culture fishery (Pantulu, 1961). It has good market demand as food fish due to its delicious taste (Haniffa, 2009; Begum et al., 2010) and recently has been documented to be exported as indigenous ornamental fish from India (Gupta and Banerjee, 2014).

Till date number of workers has documented information on its morphology, age and growth pattern, food and feeding habit and reproductive biology; but all are in scattered format. No consolidated review report is available on these aspects. Therefore, the present review has been conducted to accumulate all those available information along with documentation of the lacunae of information which will be beneficial to explore its future fishery and management.

Morphology

Day (1878) and Talwar and Jhingran (1991) have documented the morphological characters of



Figure 1. Long whiskered catfish, *Mystus gulio*.

M. gulio which are as follows: body elongated and compressed; body depth 3.8 to 4.1 times the standard length. Head depressed, its upper surface rough and granulated; occipital process triangular, rounded posteriorly, about 1.5 times longer than broad at its base, extending (in adults) to basal bone of dorsal fin; median longitudinal groove on head short, not very conspicuous, not reaching base of occipital process. Snout broad and slightly depressed; mouth terminal, upper jaw somewhat longer; teeth villiform in bands on jaws, vomerine tooth patch narrow, continuous and crescentic. Barbels four pairs; nasal shorter than the head, maxillary barbells extend posteriorly to end of pelvic fins, the external mandibular are longer than the head or than the internal ones. Dorsal spine strong, serrated on its inner edge; adipose fin small, inserted considerably behind rayed dorsal fin, pectoral fin does not reach the ventral, its spine is as long as the head excluding the snout, strong and denticulated internally, ventral fin arises on the vertical behind the last dorsal ray and does not reach the anal; caudal fin forked, upper caudal lobe the longer, lower one sometimes rounded. Colour bluish-brown on the head and back, becoming dull white beneath; fins usually black on their outer halves, maxillary barbells black, those from freshwater sometimes whitish or white tipped.

Age and growth pattern

No other workers except Pantulu (1961) have determined the age of *M. gulio* using pectoral spine. He has documented age wise variation in mean total length; mean total length of 47.42 mm, 87.66 mm, 109.33 mm, 130.00 mm and 158.67 mm, respectively, at the age of 1 to 5. No significant difference in mean total length at different ages between sexes has been reported. A proportional

relationship between spine radius and total length has also been reported by Pantulu (1961). Kaliyamurthy (1981) has reported positive allometric growth in *M. gulio*, which has later been supported by Dasgupta (1997); on contrary isometric growth pattern has been reported by Pantulu (1961) and Begum et al. (2008b).

Food and feeding habit

Pandian (1966) has documented that food of *M. gulio* consists mainly of crustaceans and insects; insect populations of *Chironomus* and *Micronecta* has been reported to constitute 40% of the total food items while crustaceans (copepods and cladocerans) have been reported to form 55% of the diet; rare occurrence of prawns and fishes has also been reported. On the other hand, Pantulu (1961) has reported high predation of *M. gulio* on prawns and small fishes (about 57% of the total annual food requirement) in Hooghly estuary. Debris, zooplanktons, zoobenthos, other benthic organisms, fish eggs and larvae have been documented in stomach content of juveniles and adults by Siddique (2007). Yusuf and Majumdar (1993) have reported *M. gulio* as omnivorous fish with inclination towards carnivore as animal foods cover 79% of the overall diet of this fish; among animal food, nauplius larvae and *Brachionus* sp. have been reported as main food items with higher frequency of occurrence. They also have reported bottom feeding habit for this fish species. David (1963) has reported small crustaceans forming the dominant food item over the entire study period along with presence of fish and vegetable matters like algae, diatoms etc. in the gut content. Kaliyamurthy and Rao (1972) have reported this species as carnivorous with high preference for amphipods, copepods and other crustacean; they have reported it as benthos feeder. Pasha (1964) earlier has also reported its bottom feeding habit. Tripathi (1996) has reported its insectivorous feeding habit.

Pandian (1966) has reported monthly variation in the amount of different food items in the stomachs of *M. gulio*. He also has reported low feeding activity

during pre-spawning period and marked rise of the same in the month following spawning. Pantulu (1961) and Begum et al. (2008a) have reported the same for *M. gulio* in Hooghly estuary and in Bangladesh, respectively. Monthly variation in amount of different food items in the stomachs has also been reported by Begum et al. (2008a).

Pandian (1966) has documented no remarkable change in the food progression with increasing size in *M. gulio*. Kaliyamurthy and Rao (1972) have reported variation in food preference in relation to size; small size fishes have been reported to prefer copepods, diatoms and amphipods while large size fishes prefer prawns, fish, hermit crab, polychaetes etc. Begum et al. (2008a) have observed difference in food preference in adult and juveniles of *M. gulio*; adult fishes have been reported to prefer insects and crustaceans, whereas the immature and juvenile fishes have been reported to consume diatoms, copepods, cladocerans and rotifers mostly.

Pantulu (1961), David (1963), Pandian (1966) and Kaliyamurthy and Rao (1972) have reported *M. gulio* as carnivorous fish whereas Begum et al. (2008a) have reported this fish species as an omnivorous fish as the diet covers a wide spectrum of food ranging from various types of plankton to invertebrates and plants. Begum et al. (2008a) stated that *M. gulio* exhibit overlapping in food and feeding habits to avoid inter and intra-specific competition for available food. Yusuf and Majumdar (1993) have pointed out its omnivorous diet with inclination towards carnivorous feeding habit.

Reproduction

Sexual dimorphism: Mookherjee et al. (1941) have reported the presence of genital papilla in male and its absence in female of *M. gulio*; later David (1963) and Begum et al. (2008b) have also supported this observation.

Sex ratio: Kaliyamurthy (1981) has reported female dominance over male in *M. gulio* population; later it has been supported by Islam et al. (2008); though Pantulu (1961) has reported no such significant variation from 1:1 (male: female) ratio in his studied

sample.

Minimum size at maturity: Pantulu (1961) has reported 6.2 cm as minimum size at maturity for *M. gulio* in Hooghly estuary while 7.9 cm, 8.2 cm and 5.4 cm has been documented as minimum size at maturity by David (1963), Jhingran and Natarajan (1969) and Kaliyamurthy (1981), respectively.

Fecundity: The fecundity of *M. gulio* to be ranged from 1,285 to 24,768 with an average of 4,754 (Kaliyamurthy, 1981). Fecundity range of 12,074-21,437 and 425-18,199 have been documented by Sarker et al. (2002) and Dasgupta (2002), respectively. Islam et al. (2008) has reported the fecundity to be ranged from 3,891-1,68,358 with an average of 32,909.49.

Breeding periodicity: Pantulu (1961) has reported July as the spawning month for *M. gulio* in Hooghly estuary; though spawning of some fishes again in December has been reported by him. Pandian (1966) has stated commencement of gonadal activity in January and spawning in late September and early October for *M. gulio* in Cooum backwaters of Madras (currently Chennai); spawning of few fishes again in January has also been documented by him. In both these cases, spawning activity has been reported to be correlated with commencement of monsoon season. Jhingran and Natarajan (1969) have reported June to November as breeding season for this fish species. Kaliyamurthy (1981) has reported August-October as the breeding season with September-October as spawning months for *M. gulio* in lake Pulicat, India. Sarker et al. (2002) have reported March-November as breeding season with July as the spawning month in Bangladesh; and later Islam et al. (2008) have reported the same duration (March to November) of breeding season with the same spawning month (July) in Bangladesh.

Single spawning nature of *M. gulio* has been earlier reported by Pantulu (1961) and later has been supported by David (1963), Pandian (1966) and Kaliyamurthy (1981).

Conclusion

From the early literatures available on food and

feeding habit of *M. gulis*, it is quite clear that maximum of the workers have concluded this fish as a carnivorous species; though omnivorous feeding habit has been reported by Begum et al. (2008a). Analysis of the mucosal surface of the alimentary canal is an effective tool to determine the feeding habit of a fish; Yusuf and Majumdar (1993) have studied the same in *M. gulis* and have reported its omnivorous feeding habit with tendency towards carnivore character. Therefore, more detail study is needed in this aspect to firmly conclude something about its feeding habit. Enzymatic analysis of the alimentary tract can also be a good technique to ascertain regarding its feeding habit. Age wise and size wise variation in food preference which is unavailable for many of the *Mystus* sp.; but the same has been documented in details for this fish species which is quite satisfactory.

Most of the workers have documented female dominance over male in this fish population along with high fecund nature of *M. gulis* females. There lies major lacking of information regarding length at first maturity (length at which 50% of the fish population is in mature condition) for this fish species as all the previous workers have documented minimum size at maturity (minimum length at which mature specimen has been observed); so detail work is needed in this aspect. All the previous workers have reported *M. gulis* as a single spawner; variation in spawning month and breeding periodicity has been reported earlier. Some of the workers have correlated onset of monsoon season with spawning activity for this fish species and thus have concluded variation in breeding periodicity with change in time of monsoonal onset in different regions. But still detail work is needed to conclude firmly on this type of variation along with existing relationship of breeding periodicity and spawning with other hydrological and meteorological parameters if any for this fish species.

There exists contradiction regarding growth pattern of *M. gulis*; Kaliyamurthy (1981) and Dasgupta (1997) have reported positive allometric growth while Pantulu (1961) and Begum et al. (2008b) have

reported isometric growth pattern. This difference may be due variation in feeding, reproductive activities, habitat, season, health, environmental condition, sampling procedure etc.

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