



Review Article

Feeding and breeding biology of *Amblypharyngodon mola* – A Review

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Abstract: *Amblypharyngodon mola* is a popular food fish of Indian sub-continent due to its high nutritional value. Earlier many workers have carried out studies on feeding and breeding biology of this fish species but consolidated information on the same is not available. So, a survey of published literatures on the feeding and breeding biology of *A. mola* has been carried out to consolidate the available information. Lacunae of information has been pointed out for further study mainly on age group wise variation in food preference and correlation of breeding periodicity with hydrological parameters and photoperiod.

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Introduction

Amblypharyngodon mola, commonly known as Mola Carplet or Pale Carplet is a popular food fish mainly in Indian sub-continent due to its high nutritional value (Alam et al., 2004; Saha et al., 2009) with high protein, vitamin and mineral content (Zafri and Ahmed, 1981; Mazumder et al., 2008). It is also rich in Fe, Zn and Ca (Roos et al., 2007; Kongsbak et al., 2008). Earlier number of research works has been carried out on its feeding and breeding biology. The main purpose of this review work is to consolidate those scattered information and to highlight the gaps in the knowledge for further research work on this particular fish species.

Amblypharyngodon mola (Cypriniformes: Cyprinidae) is a freshwater fish species (Fig. 1); a natural inhabitant of ponds, canals, beels, slow-moving streams, ditches, baors, reservoirs and inundated fields (Rahman, 1989; Talwar and Jhingran, 1991; Menon, 1999; Saha et al., 2009). The species is distributed in India, Bangladesh, Pakistan

and Myanmar (Talwar and Jhingran, 1991); also has been reported from Afghanistan (Coad, 1981).

Feeding biology

Mookherjee and Basu (1946) have reported *A. mola* as a surface feeder; they have documented unicellular and filamentous algae, protozoans and rotifers as preferred food types for this fish species. Das and Moitra (1963) have reported *A. mola* as herbivorous fish. Piska et al. (1991), Mamun et al. (2004), Gupta and Banerjee (2013b) and Mondal and Kaviraj (2013) have also documented herbivorous feeding habit of this fish species. Piska et al. (1991) also have reported it as a bottom feeder; algae have been documented as the main food for this fish species. Mamun et al. (2004) have reported phytoplankton preference for this fish species; they also have documented Chlorophyceae as the mostly preferred food class for *A. mola*; debris with mud which have been observed in the gut content of the studied specimens by Mamun et al. (2004) have been

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Figure 1. Mola Carplet, *Amblypharyngodon mola*.

considered as the secondary food; while zooplankton and semi-digested food have been considered as incidental food for the fish species. Gupta and Banerjee (2013b) have reported phytoplankton as the basic food and Chlorophyceae as the mostly preferred food class for this fish species. Mondal and Kaviraj (2013) have reported algae as the main food; they have documented high preference for Chlorophyceae followed by Myxophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae for this fish species. Dewan (1973) and Chowdhury (1999) have reported phytoplankton as the most dominant food group for this fish species. Mustafa (1991) has documented blue green algae along with planktonic crustacean and rotifera to form the main food of *A. mola*. Miah and Siddiqui (1992) have reported mola as omnivore with higher feeding preferences for debris and plant foods. Suresh et al. (2007) have reported that *A. mola* feeds predominantly on phytoplankton and Myxophyceae has been reported as the mostly preferred food class for this fish species. Mondol et al. (2013) have reported Chlorophyceae as the mostly preferred food class for *A. mola* followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae in rice field ecosystem of Bangladesh.

Piska et al. (1991) have reported size group wise variance of food preference in *A. mola*; small and medium size group fishes have been reported to prefer algae but in higher size groups algae

consumption has been reported to be less than that of the higher aquatic plants. They have documented low consumption of diatoms in higher size groups. Gupta and Banerjee (2013b) have also studied the size group wise food preference, but have not found any significant change in food preference along different size groups. Mondal and Kaviraj (2013) have reported variation in food preference according to different weight class; lower weight class have been reported to prefer more algae than higher weight class; higher weight class though preferred algae have been reported to consume high amount of other plant materials, debris and mud than the lower weight class.

Mamun et al. (2004) have reported high feeding intensity in *A. mola* but have not correlated it with breeding periodicity. Piska et al. (1991) have reported that feeding intensity is low during the spawning season and high during pre-spawning and post-spawning period of *A. mola*; this observation has later been supported by Suresh et al. (2007), Gupta and Banerjee (2013b) and Mondal and Kaviraj (2013). Piska and Waghray (1986) also have reported high incidence of empty guts coincided with the spawning season of *A. mola*.

Breeding biology

Sexual dimorphism and sex ratio: Except Hoque and Rahman (2008), none have documented any information on the sexual dimorphism of *A. mola*.

Hoque and Rahman (2008) have reported that males and females are different in color; males are comparatively brighter than females. The color of females is light and they are large in size. In case of mature female the abdomen is soft and swollen, pelvic fins are smooth and caudal fin is deeply forked. During the spawning season mature females are with distended abdomen by which they can be easily recognized. Suresh et al. (2007) also have reported the comparative larger size of females than males.

Afroze and Hossain (1983) have reported the average sex-ratio in population of *A. mola* as 1:1.67 for males and females of this fish species. Piska and Waghray (1986) also have observed predominance of females in the population of this fish species. Afroze et al. (1991) have reported significant female dominance over male in *A. mola*. Azadi and Mamun (2004) also have reported the significant dominance of females over males in the population of *A. mola*. They have documented the monthly variation of sex ratio between males and females to be ranged from 1:1.15 to 1:3.64 with an average value of 1:2.078. Suresh et al. (2007) have reported significant variation in sex ratio of *A. mola* in different months from the expected ratio of 1:1 and the ratio of male and female fish have been reported to vary from 1:1 to 1:12. Number of males has been reported to be very low to nil during spawning and post-spawning season; and they have concluded that this may be due to the spawning and post spawning mortality of males. Hoque and Rahman (2008) have also reported the female dominance in population of *A. mola*; they have reported an average ratio of 1:1.71 for males and females of this fish species. Saha et al. (2009) have reported the average sex-ratio in the population of *A. mola* as 1:2.03 for males and females. Gupta and Banerjee (2013a) have reported the average sex ratio of 1:3.04 for males and females of this fish species while Mondal and Kaviraj (2013) have documented the ratio of 1:1.9 for the same.

Length at first maturity: Suresh et al. (2007) have reported the length at first maturity for male and female of *A. mola* as 5.1-5.6 cm and 3.9-4.4 cm,

respectively; early maturation of female than male has been reported by them. On the other hand, Hoque and Rahman (2008) have reported early maturation of male than female; they have documented the length of smallest mature male and female mola as 4.8 cm and 5.5 cm, respectively. Gupta and Banerjee (2013a) later also have supported this view; they have reported 5-5.5 cm and 5.5-6 cm as length at first sexual maturity for male and female fish, respectively.

Fecundity: Mookherjee and Basu (1946) have reported the fecundity of *Amblypharyngodon mola* as 500; same has been documented by Bhuiyan (1964). Dewan and Doha (1979) have reported the fecundity to be ranged from 1,021-13,812. Parveen (1984) has reported the average fecundity of *A. mola* as 3,601. Misra and Jain (1985) have documented the fecundity to be ranged from 1,210-16,072. Afroze and Hossain (1990) have reported the fecundity of *A. mola* to be ranged from 400-8,550. Mustafa (1991) has documented the average fecundity of *A. mola* as 738. Azadi and Mamun (2004) have reported the fecundity to be ranged from 1,280-13,679 with an average of $5,182.67 \pm 3,731.51$. Suresh et al. (2007) have reported the fecundity to be ranged from 21-16,867 while the relative fecundity range has been reported to be 7-2,122. Hoque and Rahman (2008) have reported the lowest and highest mean fecundity of mola as $1,023 \pm 625$ and $6,806 \pm 125$ in size groups ranging from 5.0-5.5 cm and 8.1-8.5 cm respectively in pond and $1,220 \pm 550$ and $6,923 \pm 425$ for the same size groups in beel of Bangladesh. Saha et al. (2009) have reported the fecundity to be ranged from 1,291-12,737 with mean value of $5,751.73 \pm 3,321.73$. Gupta and Banerjee (2013c) have reported the fecundity to be ranged from 1,014-9,690 with an average of 4,592.64. Mondal and Kaviraj (2013) have documented fecundity range of 3,785-12,590 for the fish species.

Maturation and spawning: Azadi and Mamun (2004) have reported three gonadal maturity stages (immature, maturing and ripening) in female *A. mola* while Hoque and Rahman (2008) have documented five maturity stages (immature, maturing, mature,

ripe and spent) for both female and male mola. Gupta and Banerjee (2013a) have documented five maturity stages (immature, maturing, mature, ripe and spent) for female and four maturity stages (immature, mature, ripe and spent) for male mola.

Piska and Waghray (1986) have reported breeding season of *A. mola* in Andhra Pradesh from February to July. In West Bengal, April to October has been documented as the breeding season by Suresh et al. (2007) while Gupta and Banerjee (2013a) have reported April to December as the breeding season with two spawning months in June and November. Mondal and Kaviraj (2013) have documented July as the spawning month for this fish species in West Bengal. Rahman (1989) has reported May to October as the spawning months for this species in Bangladesh. According to Afroze and Hossain (1990), August is the peak breeding season of mola while Parveen (1984) has reported the breeding season of mola from June to October/November in Bangladesh. Kohinoor et al. (2003) have reported May-July and September-October as spawning months for this fish species in Bangladesh. Azadi and Mamun (2004) have reported mola as a multiple spawner and they have documented July, August, October and March as the spawning months in Bangladesh. Hoque and Rahman (2008) have stated April to October as the breeding season in Bangladesh; May and September have been reported as the spawning months by them. Saha et al. (2009) have reported March to August as the breeding season in Bangladesh for this fish species.

Conclusion

From in-depth review of literatures, it is evident that number of works has been carried out on feeding and breeding biology of *Amblypharyngodon mola* mainly in Bangladesh and India but few lacunae are there which must be investigated to benefit fishery of this fish species.

Feeding habit and food preference have been properly documented only for the adult fishes along with size group wise and weight class wise food preference; but no such detail documentation is there

regarding any such significant difference in food preference along with age groups. On the other hand, there is ample information existing on the breeding biology of this fish species; female dominance over male in the population has been reported by all the previous workers and most of them have reported mola as a high fecund fish. Though differences in breeding periodicity and spawning frequency have been observed in the earlier documented information but that too is without any significant study on correlation of breeding periodicity with hydrological parameters and photoperiod. So, there is ample scope for study in this area for more meaningful contribution on feeding and breeding biology of *Amblypharyngodon mola*.

References

- Afroze S., Hossain M.A. (1983). The fecundity and sex ratio of *Amblypharyngodon mola* (Ham.) (Cypriniformes: Cyprinidae). University Journal of Zoology, Rajshahi University, 2: 29-32.
- Afroze S., Hossain M.A. (1990). The reproductive cycle of the fresh water fish *Amblypharyngodon mola* (Ham.). (Cypriniformes: Cyprinidae). University Journal of Zoology, Rajshahi University, 9: 17-21.
- Afroze S., Hossain M.A., Parveen S. (1991). Notes on the size frequency distribution and length-weight relationship of freshwater fish *Amblypharyngodon mola* (Hamilton) (Cypriniformes: Cyprinidae). University Journal of Zoology, Rajshahi University, 10 & 11: 103-104.
- Alam M.J., Dewan S., Rahaman M.R., Kunda M., Khaleque M.A., Kader M.A. (2004). Study on the cultural suitability of *Amblypharyngodon mola* with *Barbodes gonionotus* and *Cyprinus carpio* in a farmer's rice fields. Pakistan Journal of Biological Sciences, 7: 1242-1248.
- Azadi M.A., Mamun A. (2004). Reproductive biology of the cyprinid, *Amblypharyngodon mola* (Hamilton) from the Kaptai Reservoir, Bangladesh. Pakistan Journal of Biological Sciences, 7 (10): 1727-1729.
- Bhuiyan A.L. (1964). Fishes of Dacca. Asiatic Society of Pakistan, Dacca. 39 p.
- Coad B.W. (1981). Fishes of Afghanistan, an annotated check-list. National Museum of Natural Sciences Publications in Zoology, 14:1-26.

- Chowdhury F.A. (1999). Effects of *Hypophthalmichthys molitrix* and *Catla catla* on the growth, survival and yields of *Amblypharyngodon mola* in mixed culture. M.Sc Dissertation. Bangladesh Agricultural University, Mymensingh. 131 p.
- Das S.M., Moitra S.K. (1963). Studies on the food and feeding habits of some freshwater fishes of India. IV. A review on the food and feeding habits, with general conclusions. *Ichthyologica*, 11 (1-2): 107-115.
- Dewan S. (1973). Investigations into the ecology of fishes of Mymensingh Lake. Dissertation. Bangladesh Agricultural University, Mymensingh Bangladesh.
- Dewan S., Doha S. (1979). Spawning and fecundity of certain pond fishes. *Bangladesh Journal of Agriculture*, 4: 1-8.
- Gupta S., Banerjee S. (2013a). Studies on some aspects of reproductive biology of *Amblypharyngodon mola* (Hamilton-Buchanan, 1822). *International Research Journal of Biological Sciences*, 2 (2): 69-77.
- Gupta S., Banerjee S. (2013b). Food and feeding habit of *Amblypharyngodon mola* (Hamilton-Buchanan, 1822) in West Bengal, India. *International Journal of Scientific Research*, 2 (5): 293-297.
- Gupta S., Banerjee S. (2013c). Fecundity study of *Amblypharyngodon mola* (Ham.-Buch., 1822) from an undisturbed wetland of West Bengal. *Fishing Chimes*, 33 (6): 67-69
- Hoque A.S.M., Rahman M.R. (2008). Reproductive Ecology of Mola (*Amblypharyngodon mola*). *Journal of Agriculture and Rural Development*, 6 (1& 2): 165-174.
- Kohinoor A.H.M., Islam M.S., Thilsted S.H., Wahab M.A. (2003). Reproductive biology of three indigenous small fish, mola (*Amblypharyngodon mola*), chela (*Chela cachius*) and punti (*Puntius sophore*). In: M.A. Wahab, S.H. Thilsted, M.E. Hoq (Ed). *Small indigenous species of fish in Bangladesh: Proceedings of BAU-ENRECA/DANIDA workshop on potentials of small indigenous species of fish (SIS) in aquaculture and rice-field stocking of improved food and nutrition security in Bangladesh*. 30-31 October, 2002, Bangladesh Agricultural University, Mymensingh, Bangladesh & ENREC/DANIDA. 3-22 p.
- Kongsbak K., Thilsted S.H., Wahed M.A. (2008). Effect of consumption of the nutrient-dense, freshwater small fish *Amblypharyngodon mola* on biochemical indicators of vitamin A status in Bangladeshi children: a randomised, controlled study of efficacy. *The British Journal of Nutrition*, 99 (3): 581-597.
- Mamun A., Tareq K.M.A., Azadi M.A. (2004). Food and feeding habits of *Amblypharyngodon mola* (Hamilton) from Kaptai reservoir, Bangladesh. *Pakistan Journal of Biological Sciences*, 7 (4): 584-588.
- Mazumder M.S.A., Rahman M.M., Ahmed A.T.A., Begum M., Hossain M.A. (2008). Proximate composition of some Small Indigenous fish Species (SIS) in Bangladesh. *International Journal of Sustainable Crop Production*, 3 (4): 18-23.
- Menon A.G.K. (1999). Checklist - Freshwater fishes of India. *Records of Zoological Survey of India, Occasional Paper*. No: 175: i-xxix, 1-366 p.
- Miah M.J.U., Siddique W.H. (1992). Studies on the food and feeding habits of Mola, *Amblypharyngodon mola*. *Bangladesh Journal of Agricultural Science*, 19 (2): 165-170.
- Misra S.D., Jain K.K. (1985). A study on the fecundity of *Amblypharyngodon mola* (Ham.). *Indian Journal of Zoology*, 13 (1): 1-8.
- Mondal D.K., Kaviraj A. (2013). Feeding and reproductive biology of *Amblypharyngodon mola* (Cypriniformes: Cyprinidae) from two floodplain lakes of India. *International Journal of Aquatic Biology*, 1 (3): 125-131.
- Mondol M.M.R., Nahar D.A., Dewan S., Rahman M.M., Jasmine S., Hossain M.Y. (2013). Food and feeding habits of the mola carplet *Amblypharyngodon mola* (Hamilton, 1822) in rice field ecosystem with consideration of water quality parameters. *Our Nature*, 11 (1): 61-75.
- Mookherjee H.K., Basu S.P. (1946) Life history of *A. mola* (Ham.) a delicate food fish of Bengal. *Science and Culture*, Calcutta, 12: 54-56.
- Mustafa G. (1991). Composite culture and biology of some indigenous fishes of Bangladesh. Ph.D. Dissertation. Faculty of Biological Science, Dhaka University, Dhaka, Bangladesh. 299 p.
- Parveen S. (1984). Studies on the culture methods and some aspects of culture biology of *Amblypharyngodon mola*. M.Sc. Dissertation, Dhaka University, Bangladesh. 137 p.
- Piska R.S., Swamy B.R., Devi P.J. (1991). Food and feeding habits of freshwater cyprinid *Amblypharyngodon mola* (Ham.). *Indian Journal of Fisheries*, 38: 126-128.

- Piska R.S., Waghray S. (1986). Some aspects of reproductive biology of *Amblypharyngodon mola* (Hamilton). *Geobios*, 13 (5): 204-207.
- Rahman A.K.A. (1989). *Freshwater Fishes of Bangladesh*. The Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka, Bangladesh. 364 p.
- Roos N., Wahab M.A., Chamnan C., Thilsted H. (2007). The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *The Journal of Nutrition*, 137 (4): 1106-1109.
- Saha B.K., Islam M.R., Saha A., Hossain M.A. (2009). Reproductive biology of the Mola Carplet *Amblypharyngodon mola* (Hamilton) (Cypriniformes: Cyprinidae) from Netrakona Water. *Bangladesh Journal of Scientific and Industrial Research*, 44 (3): 377-379.
- Suresh V.R., Biswas B.K., Vinci G.K., Mitra K., Mukherjee A. (2007). Biology of *Amblypharyngodon mola* (Hamilton) from a floodplain wetland, West Bengal. *Indian Journal of Fisheries*, 54 (2): 155-161.
- Talwar P.K., Jhingran A.G. (1991). *Inland fishes of India and adjacent countries*. Vol-1 and Vol-2. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Bombay and Calcutta, 1063 p.
- Zafri A., Ahmed K. (1981). Studies on the vitamin A content of fresh water fishes. Content and distribution of vitamin A in mola (*A. mola*) and dhela (*Rohtee cotio*). *Bangladesh Journal of Biological Sciences*, 10: 47-53.