Indian J. Fish., 60(1) : 37-40, 2013

Index of relative importance of diet components in *Mastacembelus armatus* (Lacepède, 1800) from Karapuzha Reservoir, Wayanad, Kerala, India

PREETHA PANIKKAR, M. FEROZ KHAN, A. P. SHARMA*, B. C. JHA*, AND M. E. VIJAYKUMAR

Regional Centre of Central Inland Fisheries Research Institute, Hessarghata Lake Post, Bangalore- 560 089, Karnataka, India
**Central Inland Fisheries Research Institute, Barrackpore, Kolkata- 700 120, West Bengal, India*
e-mail: preetha23@gmail.com

ABSTRACT

The dietary analysis of the spiny eel, *Mastacembelus armatus* showed that the fish subsisted mainly on small forage fishes. The gut contents were analysed using the frequency of occurrence, numerical counts and gravimetric methods. In addition to fishes, the gut content comprised prawns, insects, aquatic plants and digested matter. The index of relative importance (IRI) values indicated that fishes and prawns were the major diet components. Feeding intensity was high in the early maturity stages and was relatively lower in fishes with ripe gonads. The highest feeding intensity was observed during summer months and the lowest coincided with the monsoon months.

Keywords: Gut contents, Index of relative importance, Karapuzha Reservoir, *Mastacembelus armatus*

Introduction

The spiny eel *Mastacembelus armatus* is an economically important freshwater food fish native of India, Pakistan, Sri Lanka, Sumatra, Thailand, Vietnam, Indonesia and other parts of South-east Asia.

Study of diet composition and dietary habits based on gut content analysis, is widely used in food-web ecology of fishes as an important means of investigating trophic relationship in the aquatic communities (Arendt *et al*., 2001) and in the creation of trophic models as a tool to understanding complex ecosystems (Ergene and Kuru, 1998; Lopez-Peralta and Arcila, 2002; Ikpi and Okey, 2010). Various investigations have been conducted on the food and feeding habits of fish with the aim of determining their dietary requirements. Though there are information on the biology of *Mastacembelus* spp. (Pazira *et al*., 2005; Eroðlu and Þen, 2007; Oymak *et al.,* 2009) but very limited information available on the feeding biology of these fishes. The digestive system/gut content of *Mastacembelus mastacembelus* has been reported by Pala *et al*. (2010). Only a few reports are there on the feeding biology of the spiny eel, *M. armatus* (Serajuddin and Mustafa, 1994; Serajuddin *et al.,* 1998).

The evaluation of stomach contents of fish using measurements of frequency of occurrence, numbers and weight may not depict the exact relative value. Frequency of occurrence tabulations tends to cause sampling error. Few large organisms may be camouflaged by the presence of numerous small organisms. The volumetric measurements may get distorted by differential digestive rates. An ideal representative value would probably be the one, which integrates each of the above. An index of relative importance (IRI) assists in evaluating the relationship of the various food items encountered in stomachs, knowing that it may fall short of some theoretical ideal (George *et al*., 2009). The present study on the feeding habits of *M. armatus* was undertaken by analysing gut contents.

Materials and methods

The samples for the study were collected from Karapuzha Reservoir (Fig. 1) in Wayanad District of Kerala which has a water spread area of 855 ha at FRL. The stomach content of a total of 103 specimens of *M. armatus* of sizes ranging from 300 to 470 mm was examined. The fishes were caught by mono-filament gillnets as a part of

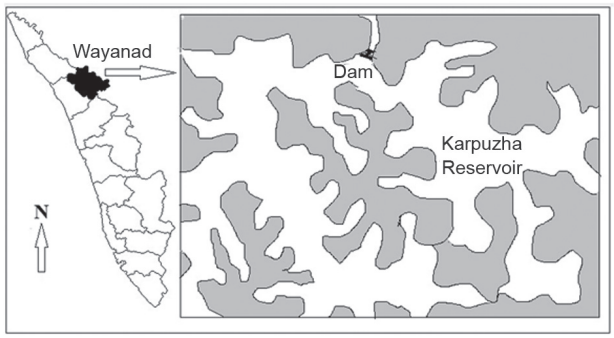

Fig. 1. Map of Karapuzha Reservoir in Wayanad

experimental fishing conducted in the reservoir during April 2009 to March 2011. Length, weight and sex of the fishes were recorded. The feeding intensity was measured by recording the condition of the gut. The stomachs were categorised as full, ¾ full, ½ full, ¼ full and empty as described by Pillay (1952). The digestive system of the fish was removed from the body cavity and kept in labelled jars filled with 5% formalin. Prior to examination, samples were removed from formalin and kept in flowing water for 24 h to get rid of toughness caused by the formalin treatment. The organisms in the gut content, identified under a binocular microscope, were grouped and counted. Macroorganisms were separated from the gut content and the rest of the content was diluted with water. The counting was done in 1 cm^3 diluted stomach content liquid. For the analysis of gut contents, methods like the frequency of occurrence, numerical counts and gravimetric method were applied as summarised by Hyslop (1980). For qualitative analysis, the prey items were identified and categorised according to their systematic status. To reduce bias, dietary importance of food items was determined using the index of relative importance (IRI) (George and Hadley 1979; Hyslop 1980). This IRI is a modified version of the index where the original term of volume % was replaced by the weight % (Alonso *et al.,* 2000) and this index was used to describe predator diets in the present investigation. In order to improve interpretation of the IRI, this index was expressed on percent basis (%IRI) (Cortés, 1997).

Sex ratio of the fish was studied using Chi-square test (χ^2), following the equation of Fisher (1970), assuming that the ratio of male to female in the population to be 1: 1.

Results and discussion

The feeding intensity of *M. armatus* was fairly low with about 58.50% of the fish having nearly empty stomachs. Many workers reported large number of empty guts in carnivorous fishes. This observation was similar to those recorded by Serajuddin and Ali (2005) and Ayotunde *et al*. (2007); who recorded 40 - 65%, and Suresh *et al.* (2006) reported 81.8% of empty guts in samples of *Macrognathus puncalus* (striped spiny eel) in their study. A higher percentage of empty stomachs may reflect short period of feeding followed by period of rapid digestion (Ikpi and Okey, 2010). According to Ekpo (1993), the relatively higher incidence (> 50%) of stomachs with various food items is indicative of abundance of food supply in the habitat. The fishes were found to feed voraciously during the summer months (March-May) (Fig. 2). However, they consumed a lesser amount of food during monsoon (July- September) and winter (November- January). Maximum feeding intensity was observed in maturing and mature fishes (stage II and III). The intensity of feeding declined in ripe and gravid fishes which are ready to spawn.

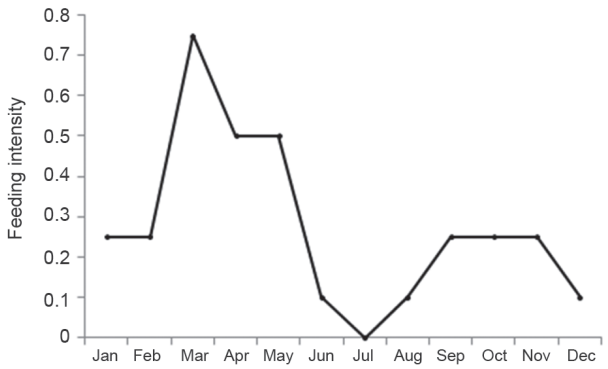

Fig. 2. Average monthly variation in the feeding intensity of *M. armatus* in Karapuzha Reservoir

Poor feeding coinciding with peak breeding in other freshwater fishes has been reported by Jhingran (1961), Bhatnagar and Karamchandani (1970), Desai (1970), Khan *et al*. (1988), Piska *et al*., (1991) and Serajuddin and Ali (2005). Low feeding intensity in other months may be attributed to the non-availability of live food organisms as reported by Serajuddin and Ali (2005). The overall sex ratio of the pooled observations varied significantly from the expected ratio ($p < 0.01$) with 2.33 females for every male. There was no significant difference in the prey preference among the sexes.

The frequency of occurrence method (Table 1) showed that fish parts accounted for 43% of the stomach contents. Fishes and fish parts followed by prawns had the highest percent frequencies of occurrence. Insect parts was found to be 6% and plant matter constituted less than 2% in the gut content. The absence of gill rakers rule out the importance of plant matter in the spiny eel's diet as reported by Serajuddin and Mustafa (1994). Table 1 also shows the results of the index of relative importance (IRI) in the gut of *M. armatus* based on the three analytical methods employed. Food items with >5% of IRI were considered as major food items. The IRI was highest for fish parts (53.52%) followed by small forage fishes (35.85%) and prawns (8.52%) suggesting that *M. armatus* in Karapuzha Reservoir in Wayanad, primarily feed on these three prey groups.

M. armatus in this reservoir was found to be euryphagous in dietary habit, consuming mainly small forage fishes and shrimps (Table 1). The gut content was devoid of sand and mud, though the fish spend considerable time in the bottom which is in concurrence with the report of Serajuddin and Mustafa (1998). A distinct preference of live feed over dead organisms was observed. The ingested organisms are generally swallowed whole, particularly when the size is large, with no mastication as reported by Serajuddin and Mustafa (1994) as the fish lacks structural support to consume food items which require oral

Table1. Diet composition and index of relative importance (IRI) of major food items in the stomach of *M. armatus* from Karapuzha Reservoir, Wayanad

Food items	Occurrence		Gravimetric		Numerical		IRI%
	No.	%	Weight	%	No.	%	
Fish	223.00	30.4	213.3	34.36	223.00	31.85	35.85
Prawns	94.00	12.8	152.7	24.60	94.00	12.75	8.52
Fish parts	315.00	43.0	178.3	28.73	315.00	41.14	53.52
Fish eggs	32.00	4.4	18.2	2.93	36.00	4.90	0.61
Insect parts	45.00	6.1	36.6	5.88	45.00	6.10	1.30
Plant matter	13.00	1.8	12.2	2.0	13.00	1.76	0.12
Digested matter	11.00	1.5	9.4	1.5	11.00	1.50	0.08

grinding. The well developed and thick stomach, short intestine and dominance of prey of animal origin and their body parts in the gut content of *M. armatus* indicate the carnivorous and predatory habits as reported by Serajuddin and Ali (2005) in the striped spiny eel, *Macrognathus puncalus.* The fishes seemed to feed on prey of considerable size range from minute insect larvae to fully formed shrimps and small fishes. The presence of wide variety of organisms in the stomach contents reveals effective probing of the environment for the prey. This foraging habit of the spiny eel makes it adaptable to an ecosystem characterised by fluctuations in its food chain components.

References

Alonso, K. M., Crespo, E. A., Pedraza, S. N., García, N. A. and Coscarella, M. 2000. Food habits of the South American sea lion (*Otaria flavescens*) of Patagonia, Argentina. *Fish. Bull.,* 98: 250-263.

Arendt, M. D., Olney, J. E. and Lucy, J. A. 2001. Stomach content analysis of cobia, *Rachycentron canadum,* from lower Chesapeake Bay. *Fish. Bull.,* 99: 665–670.

Ayotunde, E. O., Ochang, S. N. and Okey, I. B. 2007. Parasitological examinations and food composition in the gut of feral African carp, *Labeo coubie* in the Cross River, South-eastern, Nigeria. *Afr. J. Biotechnol.,* 6 (5): 625-630.

Bhatnagar, G. K. and Karamchandani S. J. 1970. Food and feeding habits of *Labeo fimbriatus* (Bloch) in river Narbada near Hosangabad (M.P.). *J. Inland Fish. Soc. India*, 2: 30-50.

Cortés, E. 1997. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. *Can. J. Fish. Aquat. Sci.,* 5: 726 -738.

Desai, V. R. 1970. Studies on the fishery and biology of *Tor tor* (Ham.) from river Narbada. *J. Inland Fish. Soc. India*, 2: 101-112.

Ekpo, A. O. 1993. *Growth, feeding and reproductive biology of Hydrocynus forskalii, Alestes macrolepidotus and Channa obscura in Asejire Reservoir, Nigeria*. Ph. D. Thesis, University of Ibadan, Ibadan. 209 pp.

Ergene, S. and Kuru, M. 1998. Feeding characteristics of *Dicentrarchus labrax* living in Akgol-Paradeniz lagoon located in Göksu Delta. In: Celikkale, M. S., Duzgunes, E., Okumus, I. and Mutlu, C. (Eds.), *Proceeding of the First International Symposium on Fisheries and Ecology,* 2nd -4th September. 1998, Trabzon, Turkey. p. 76-83.

Eroðlu, M. and Þen, D. 2007. Reproduction biology of *Mastacembelus simack* (Walbaum, 1792) inhabiting Karakaya Dam Lake (Malatya, Turkey). *Int.. J. Nat. Eng. Sci.,* 1*:* 69-73.

Fisher, R. A. 1970. *Statistical methods for research workers*. 14th edn., Oliver and Boyd, Edinburgh, 362 pp.

George, E. L. and Hadley, W. F. 1979. Food and habitat partitioning between rock bass *(Ambloplites rupestris)* and smallmouth bass *(Micropterus dolomieui)* young of the year. *Trans. Am. Fish. Soc.,* 108: 253-261.

George, A. D. I., Abowei J. F. N. and Inko-Tariah, 1. M. B. 2009. The composition in different size groups and Index of relative importance (IRI) of *Callinectes amnicola* (De Rochebrune, 1883) food from Okpoka Creek, Niger Delta, Nigeria. *Int. J. Anim. Vet. Adv.,* 1(2): 83-91.

Hyslop, E. J. 1980. Stomach contents analysis-a review of methods and their application. *J. Fish Biol.,* 17: 411-429.

Ikpi, G. and Okey, U. I. B. 2010. Estimation of dietary composition and fecundity of African carp, *Labeo coubie*, Cross River, Nigeria. *J. Appl. Sci. Environ. Manage.,* 4: 19 – 24.

Jhingran, A. G. 1961. Studies on the maturity and fecundity of the Gangetic anchovy, *Setipinna phasa* (Ham.). *Indian J. Fish*., 8: 291-311.

Khan, M. S., Ambak, M. A. and Mohsin, A. K. M. 1988. Food and feeding biology of a tropical catfish, *Mystus nemurus* with reference to its functional morphology. *Indian J. Fish.,* 35: 78-84.

Lopez-Peralta, R. H. and Arcila, C. A. T. 2002. Diet composition of fish species from sourthern continental shelf of Colombia. *Naga World Fish Cent. Quart.,* 25: 23-29

Oymak, S. A., Kýrankaya, Þ. G. and Doðan, N. 2009. Growth and reproduction of Mesopotamian spiny eel

(*Mastacembelus mastacembelus* Banks & Solander, 1794) in Ataturk Dam Lake (Þanlýurfa), *Turk.. J. Appl. Ichthyol.,* 25: 488-490.

Pala, G., Tellioðlu, A. and Eroðlu, M. 2010. The digestive system content of *Mastacembelus mastacembelus* (Banks & Solander, 1794) inhabiting in Karakaya Dam Lake (Malatya-Turkey), Dursun ªen. *Turk. J. Fish. Aquat. Sci.,* 10: 229-233.

Pazira, A., Abdoli, A., Kouhgardi, E. and Yousefifard, P. 2005. Age structure and growth of the Mesopotamian spiny eel, *Mastacembelus mastacembelus* (Banks & Solander in Russell, 1974) (Mastacembelidae), in southern Iran. *Zool. Middle East,* 35: 49–60.

Pillay, T. V. R. 1952. A critique of methods of study of food fishes. *J. Zool. Soc. India*, 42(2): 185-200.

Piska, R. S., Ramaswamy, B. and Devi, I. P. 1991. Food and feeding habits of freshwater cyprinid, *Amblypharyngodon mola* (Ham.). *Indian J. Fish*., 38: 126-128.

Serajuddin, M. and Mustafa, S. 1994. Feeding specialisations in adult spiny eel *Mastacembelus armatus. Asian Fish. Sci.,* 7: 63-65.

Serajuddin, M., Khan, A. A. and Mustafa, S. 1998. Food and feeding habits of the Spiny eel *Mastacembelus armatus. Asian Fish. Sci.,* 11: 271-278.

Serajuddin, M. and Ali, R. 2005 Food and feeding habits of striped spiny eel, *Macrognathus pancalus* (Hamilton). *Indian J. Fish.,* p. 52(1): 81-86

Suresh, V. R., Biswas, B. K.,. Vinci, G. K., Mitra, K. and Mukherjee, A. 2006. Biology and fishery of barred spiny eel, *Macrognathus pancalus* Hamilton. *Acta ichthyol. Pisc.,* 36(1): 31–37.

Date of Receipt : 15.03.2012
Date of Acceptance : 09.10.2012