

SUMMARY

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The targets of fisheries development in India are, to increase fish production to combat against malnutrition, and generating employment potential especially in rural areas. Preliminary works started on the biology of Indian freshwater fishes mainly deals with carps, murrels and catfishes. But no attention has been paid to the study of the biology of freshwater spiny eel, *Mastacembelus pancalus*, a beautiful species among the genus *Mastacembelus*. The smaller size of this species has often been placed into aquaria and kept by hobbyists, while large size fish is used as a food and have high market value when sold alive in the market. Exploitation is reckless. There are signs of dwindling in catches per unit effort. This calls for the application of the rational methods of culturing of the fish. However, the development of a suitable method for culture is inconceivable without a good knowledge of its biology. To keep this view in mind, an attempt was made here to study the different aspects of biology of *M. pancalus*.

The spiny eels are reported from tropical Africa and Asia only. Altogether thirty-three species of freshwater spiny eels are known to us so far, which have been grouped into four genera. The genera *Macrogathus* and *Mastacembelus* belong to sub-family Mastacembelinae. There are eleven species, which have been included under the genus *Macrogathus*, out of which only five species are known to occur in Indian region, which are *M. aral*, *M. caudiocellatus*, *M.zebrinus*, *M. guentheri* and *M.pancalus*. Among them, *M. caudiocellatus* is only known as type specimen due to its smaller in size, the *M.guentheri* is known to occur in marshy canals and rivers of Kerala. *M. zebrinus* is very rare in occurrence, and *M.aral* apparently occurs in lowland habitats and moderate elevation in all the large river system. While *M. pancalus* is the most beautiful and considered to be a good table fish, and particularly popular for those people who relish fish without bones. The demand of the fish always exceeds the supply.

The freshwater spiny eel, *M. pancalus* is restricted to Asia only. It has been reported from India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, Burma, Thailand, Malaysia, and Indonesia. It occurs in a variety of freshwater bodies in the plains as well as in the hills of India. It occurs in rivers, lakes, ponds, estuaries, streams and ditches. It develops a unique niche in the habitat and spends more of its life on the bottom.

The individuals of *M. pancalus* were caught from ponds, canals and rivers of Sant Ravidas Nagar-Bhadohi district for the study of intraspecific diversity. Various morphometric and meristic parameters were applied for the stock separation. In the present study, the population of

M. pancalus was found to contain two stocks which have been denoted here as stock A and stock B. These stocks were sympatric and differed in a number of morphometric and meristic characters. The regression of different body measurements such as standard length (SL), body depth (BD), body width (BWd), caudal fin length (CFL), caudal fin depth (CFD), head length (HL), snout length (SnL), pre-dorsal length (PLD), inter-orbital width (IOW) and orbit diameter (OD) on total length was studied. After plotting the various morphometric measurements against total body length a linear relationship was obtained in each case of the both stocks. Correlation coefficient in all morphometric parameters relationship was significant. Various body proportions are expressed here as percentage of total length. Significant differences in the sets of characters like standard length /total length, head length/total length, snout length/total length, pre-dorsal length /total length, caudal fin length/total length, caudal fin depth/total length, body depth/total length, inter-orbital width/total length and orbit diameter/total length have been found between the individuals of stocks A and B. The equations obtained for length–weight relationships in the fishes of both stocks were also different. Remarkable differences in the growth of weight in relation to length were noticed in both stocks. Stock A, which demonstrated faster growth (weight per unit length (WPUL)=3.22g) occurred with 54.29% frequency, whereas occurrence of stock B (WPUL=1.56g) was at 45.71% frequency. This investigation will be helpful in increasing the production of *M. pancalus* per unit effort in the aquaculture.

Breeding process of *M. pancalus* was investigated. The results were showed that the population of males slightly dominated over females throughout the year except the March and July months. The male: female ratio ranged from 1:0.56-1:2.37, with the average ratio being 1:0.913. Sex ratio varied with size. Gonads were categorized into five phases of maturation with stages I, II, III, IV and V representing immature virgin, maturing virgin and recovering spent, ripe and spent fishes respectively. Seasonal activities of the gonads were clearly demonstrated. The gonadosomatic index was related to the stages of development; it increased with the development of gonad. In both sexes high values of gonadosomatic index was recorded during the period of May through August. Change in the index was more marked in females as compared to males. Spawning in *M. pancalus* commenced in July. Spawning coincides with onset of monsoon. Occurrence of ripe individuals up to late August/early September indicated the extent of the spawning of the fish. The fish spawns only once in a year. Eggs size in this fish shows no fractional spawning in this fish. Fecundity increased with weight and size. Individuals of size range from 7 to 16cm in length produced 315 and 900 eggs respectively. The fecundity 'factor' was 44 eggs cm⁻¹ body length and 35 eggs g⁻¹ of body weight respectively.

The study of organs concerned with feeding and digestion indicated the carnivorous orientation in *M. pancalus*. It is highly predaceous in nature. Well developed dentition, strong built stomach and short intestine are some of the characteristics which were related to the fish's

dietary composition. In place of gill rakers an uneven gill arch or horny notches are present in *M. pancalus*. There was no major shift from a basically carnivorous orientation in the feeding activity of this fish during its various stages of life. The gut contents analysis indicated that aquatic insects (dipterans) and crustaceans were the main food of adult individuals while annelids and crustaceans were taken by young specimens. Digested matter and aquatic vegetation were consumed as incidental food items. Gut length/body length ratio of the fish varied from 1:0.48 to 1:0.66; foraging activity fluctuated with season. Feeding intensity was high in early maturity stages and was relatively reduced in fish with ripe gonads. Adult individuals consumed more food in summer than winter and rainy season. Food intake in young specimens was greater in post monsoon period and autumn, but maximum feeding activity was observed in the month of October. Extremely low feeding was observed in the month of December. In adults, maximum number of empty guts was found during spawning and winter season.

The age of *M. pancalus* was determined by using indirect method such as length-frequency distribution given by Peterson and annual ring checks in opercular bone. Annual rings were found to be absent in below one year old fish. The youngest among the collected individuals of *M. pancalus* was below one year old and the body size was 3cm in length, whereas the oldest among the sampled individuals of this fish was three years old and maximum body length of this group of fish was 165cm and its body weight was 14g. The operculum was found completely opaque

without showing any check formation in forty six fishes. These individuals designated by O⁺, and were 26.29% of the total fish. In order to study the time of the formation of the ring, the outer margin of the skeletal parts (operculum) of fish caught in different months were examined. Growth of the hard parts was found to be proportional to the growth of the fish. A good agreement was found between the estimates of length at age by Petersen method and opercular method. The monthly and per day rates of increment of body length were computed which are 6.25mm/month and 0.21mm/day in the individuals of fish of one or less than one year old. Weight-wise body increments recorded in this group of *M. pancalus* were 0.33g/month and 0.011g/day. Whereas, two years old fish grew 5.5mm/month (0.18mm/day) in length and 0.25g/month (0.008g/day) in weight, while in three years old fish, the length-wise increment growth was 2.75 mm/month (0.09mm/day) 0.20g/ month (0.006g/day) was recorded in weight-wise increment growth.