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Food preference studies of *Plotosus canius* Hamilton and its cultural suitability

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Abstract. The food preference of *P. canius*, carried out from fish samples of Hooghly-Matlah estuary and Chilka lake is described. Qualitative study of the food showed the species to be a predatory carnivore right from its fingerling stage. The study justifies the inclusion of the species in brackishwater aquaculture as a biological control of unwanted crabs.

Keywords. *P. canius*; food preference; cultural stability.

1. Introduction

Plotosus canius Hamilton, the canine catfish-eel from tropical estuarine waters, forms a considerable part of the catfish catch from estuaries and brackishwater lakes of India. Although food habits of a variety of estuarine fish of India, from capture as well as culture waters, have been studied in detail, the information available on food and feeding habit of this species from different areas of the country (Basheeruddin and Nayar 1961; Rajan 1965; Kaliyamurthy and Rao 1972) are scarce. The present paper reports the monthly and locality-wise variations in quantity and quality of food of adults of this species as well as those of the fingerlings, so as to determine its food preference and assess its cultural suitability.

2. Materials and methods

Fish samples were collected from commercial fish catches from two fish assembly centres (Port Canning and Kakdwip) of Hooghly-Matlah estuary and one (Balugaon) of Chilka lake during the period 1974–76. Guts from 458 fish (90–538 mm in length) (176 from Port Canning, 155 from Kakdwip and 127 from Balugaon), were subjected to detailed food preference study. In addition, 22 fingerlings (38–50 mm), collected from seed collection nets operated at Kakdwip, were also examined for their food preference. The formalin preserved specimens, were used for this study. First, the fullness of the stomach was graded into gorged, full, 3/4 full, 1/2 full, 1/4 full, traces and empty following Pillay (1952). The stomach contents were then scrapped into a petridish, thoroughly mixed and a part of it analysed, macroscopically as well as microscopically, to study the different feed items.

Mucous was invariably seen in the guts of *P. canius*. As it is not really a food constituent, a separate percentage was alotted to it which was not considered for alotting percentages to different food constituents.

Point and occurrence methods (Pillay 1952) were followed for stomach content analyses of *P. canius* and the results obtained were converted to volumetric and occurrence percentages respectively. To get a correct picture of food preference by grading and evaluating the gut contents, index of preponderance (I_i) (Natarajan and Jhingran 1961) was constructed for each food item, from volume and occurrence values thus obtained, using the formula

$$I_i = \frac{100 \times V_i O_i}{\sum V_i O_i},$$

where V_i and O_i are the percentages of food item by volume and occurrence respectively. The rectal contents were also examined, both macroscopically and microscopically, to see whether the food encountered was digested or passed out as such.

3. Food preference studies

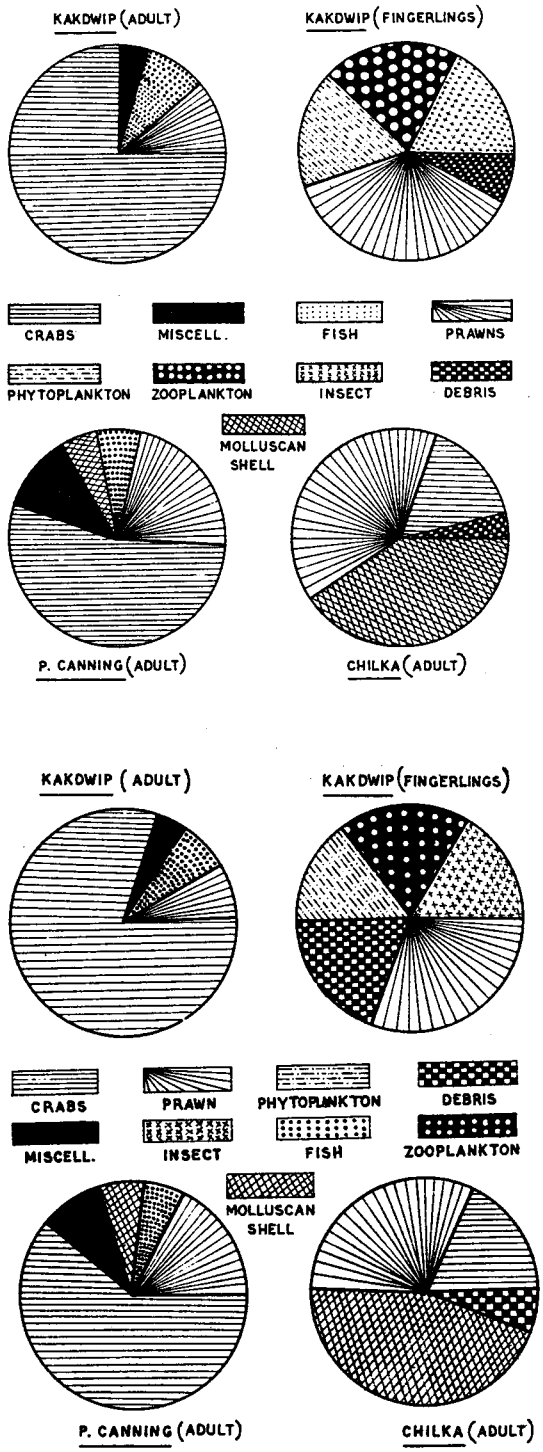
The present study revealed that though there are monthly variations in the quantity of food consumed there was no variation in the quality of food consumed. The variations in the quality of food were determined from samples collected from different centres. The fingerlings showed food items different from those of adults of the same locality.

3.1 *Monthly variations in food intake*

The fullness of stomach of *P. canius*, during different months of the year in samples collected from Port Canning (river Matlah of Hooghly-Matlah estuary) indicated that February to July was the lean period of feeding, with no stomach encountered in gorged or full conditions. The percentages of stomachs in nearly empty condition (empty + traces) ranged between 34·61 and 71·43. Samples during July had the maximum of nearly empty stomachs (71·43) with those during June following (62·5). August to January was the better feeding period. September showed the maximum percentages of stomachs in gorged and full conditions (47·62), followed by August (42·37). The samples collected from Kakdwip and Balugaon also showed a similar pattern of monthly variation with minor variations at some places.

3.2 *Food composition*

Figures 1 and 2 show the average food composition of fish, in terms of occurrence and volume respectively, analysed from different sampling centres. Items contributing less than 5% of the total have been pooled together and depicted as miscellaneous. It is evident that the food of adult *P. canius* mainly consists of crabs, prawns, fish, molluscs and aquatic insects. Plant matter and amphipods (observed in small quantity in samples from Port Canning only) appear to be accidental inclusions, consumed probably due to the bottom-browsing habit of the species. Debris also contributed a part in all cases. The studies also show that crab, fish and molluscs are not preferred at the fingerling stage. The fingerlings appear to subsist on prawns, plankton and insects only.



Figures 1, 2. Food composition of *P. canius* from different sampling centres **1.** Occurrence method **2.** Volumetric method.

Index of preponderance studies indicated that in adults, crabs were the most preferred food item in the Hooghly-Matlah estuary (I_i = 87·3647 and 97·2874), whereas molluscs (I_i = 53·7598) was the dominant item in adult specimens from Chilka lake. In fingerlings, the most preferred food item was prawn (I_i = 50·2519). The group-wise details of different food items, encountered in the stomach of *P. canius*, are as follows:

3.2a *Crabs*: They were the most preferred food item of the species in the adults of the Hooghly-Matlah estuary samples, whereas they ranked third in the adult fish samples from Chilka lake. They accounted for 61·42, 80·63 and 17·55%, by volume, in the food of adults from Port Canning, Kakdwip and Balugaon respectively. The analyses of rectal contents revealed that the soft parts of the animal were completely absorbed in the alimentary tract but parts of the exoskelton were passed out. The species of crabs, commonly observed in the gut contents, were *Scyla serrata*, *Varuna litterata*, *Ocypoda* sp and *Paratelphusa* spp.

3.2b *Prawns*: The fingerlings appeared to consume maximum amount of prawns by volume (30·34%) which, however, received second preference as food in adults from all the three sampling centres, being 17·40, 7·67 and 31·30% in samples from Port Canning, Kakdwip and Balugaon respectively. The rectal content revealed that the prawns are well digested with only the chitinous part passed out. The prawns commonly encountered in the guts were *Acetes indicus*, *Metapenaeus brevicornis* and *Palaemon styliferus*.

3.2c *Fish*: In several samples from Hooghly-Matlah estuary the gut analyses indicated the presence of fish fingerlings to the extent of 5·73 and 7·18% by volume in the average percentages of food analysis in the samples of adults from Port Canning and Kakdwip respectively. However, no fish was encountered in the guts of samples analysed from Chilka lake. But for parts of vertebral column and spines, no other portion of fish was seen in the rectal contents. The fish species encountered were all of weed fish category, such as engraulids (*Thrissocles* sp, *Coilia* sp) and cyprinids (*Barbus* sp).

3.2d *Molluscs*: Molluscan shells were most abundant in the gut content of the adult fish samples analysed from Chilka lake, contributing 45·13% by volume, on an average. They formed much lower percentages in the adults from Port Canning and Kakdwip, being only 6·33 and 0·26% by volume respectively. Whereas the shells encountered in the stomach contents were both with and without animals, the ones in the rectal contents were all without animals only, indicating complete digestion of the animal in the alimentary tract with the broken shells being evacuated in small pieces. The molluscs encountered were *Epitonium* sp, *Capus* sp, *Bursa* sp and *Trochus* sp (all Gastropods), *Geloina bengalensis*, *Crassostrea* sp and *Meretrix* sp (all Lamellidens).

3.2e *Plankton*: Plankton contributed 33·85% by volume in the stomach of fingerlings with the zooplankton showing a slight edge in overall percentage. The phytoplankton commonly found in the stomachs of fingerlings of *P. canius* were Algae (*Protococcus* sp, *Cladophora* sp, *Polysiphonia* sp and *Microcoleus* sp) and Diatoms (*Cyclotella* sp, *Pleurosigma* sp, *Gyrosigma* sp, *Navicula* sp and *Coscinodiscus* sp). The

common zooplankton observed were Copepods (*Acartiella* sp, *Pseudodiaptomus* sp *Diaptomus* sp and *Cyclops* sp) and the cladoceran, *Daphnia* sp.

3.2f *Aquatic insects*: Aquatic insects appeared to be the third preferred food item of the fingerlings, contributing 16·89% by volume. However, in the adult fish collected from Port Canning they were only observed in small quantity (1·69% by volume) (shown under miscellaneous in figures 1 and 2). The rectal contents indicated that only their chitinous shells are evacuated. The insects commonly encountered were *Plea* sp *Anisops* sp, *Cybister* sp and *Anax* sp.

3.2g *Miscellaneous*: Plant roots and leaves (2·45% by volume), amphipod, *Paracalliopa* sp (1·66% by volume) and debris (3·32% by volume) in samples from Port Canning, and molluscs (0·26% by volume) and debris (4·26% by volume) in samples from Kakdwip were also noticed in the guts (shown under miscellaneous in figures). Debris was also present in the guts of adult fish from Chilka lake (4·05% by volume) and fingerlings from Kakdwip (7·15% by volume). These items, however, appear to be accidental inclusions in the diet of *P. canius*.

4. Discussion

The results on monthly variations in food intake in *P. canius* agree with the observation on the species in the Chilka lake by Rajan (1965), who found September as the month of lowest feeding, progressive increase from October to March with lower values from April to June and the peak in July.

P. canius attains maturity in February and breeds during April to August, with maximum breeding in May and June (Sinha 1981). Thus, it appears that the intensity of food intake of the species is inversely related to gonadal maturity and breeding time of the fish. The high intensity of feeding in September now observed is probably due to active feeding following the spawning, as a recuperative instinct. Qayyum and Qasim (1964) and Unnithan (1978) also observed similar correlations between feeding intensity and maturity in other teleosts.

As regards food preferences, Basheeruddin and Nayar (1961) observed juveniles of the species (40–50 mm) subsisting on animal diet (amphipods, isopods, mysids and young prawns) in samples from coastal waters of Madras city. Rajan (1965) observed prawn to be the main diet of the adult of the species in Chilka lake with crabs, molluscs and fish forming the secondary food. Kaliyamurthy and Rao (1972) categorised *P. canius* as benthos feeder with the young ones of the species (33–80 mm) feeding on copepods, diatoms and amphipods, whereas the larger sized ones (above 80–185 mm) fed on prawns, fish polychaetes and hermit crabs. Thus, the present results on the quality of food consumed by *P. canius* indicated it to be a predatory carnivore. The local variations in percentages of food constituents (crabs, prawns, molluscs, fish etc) may be due to variability in the availability of food items in the specific environment. This predatory carnivore habit was present even in the fingerlings of *P. canius*. At this stage, when the fish is not capable of circumvating crabs, molluscs or other fish species, it subsists mainly on smaller prawns and aquatic insects.

5. Remarks on the cultural suitability of the species

In view of these observations, it is felt that *P. canius* is suitable for inclusion, as one of the additional species, in brackishwater fish culture in India for the reasons given below:

(i) None of the species, known to be cultured presently in brackish waters of this country, actively preys upon crabs which are abundantly found in the culture ponds. The most commonly cultured carnivore of brackishwaters of India, *Lates calcarifer*, is reported to be a column feeder, feeding mainly on shrimps, fish, snails and worms (Jhingran 1975; Patnaik and Jena 1976). The other carnivores, cultured in brackishwaters of this country, *viz Elops saurus, Megalops cyprinoides, Polynemus tetradactylus* and *Trachinotus carolinus*, are also not reported to feed upon the adult crabs (Jhingran 1975). Crabs are, in general, unwanted organisms in any culture ponds because of their habit of burrowing and thus, spoiling the pond embankment, as well as harming the young ones of cultured fish with their chelate legs.

P. canius was observed to be actively preying upon the crabs. Its presence in the pond would be of immense use in controlling the crab population. Thus, this species can be used as a biological control for crabs, a method always preferable to other methods, like chemical etc in any aquaculture operation.

(ii) Introduction of any other species of fish for culture, along with *Lates calcarifer*, is difficult in view of its predaceous habit. But *P. canius* can well withstand this hazard because of its strong pectoral and dorsal spines which can protect it from being predated upon. Moreover, *P. canius* being a bottom feeder, would feed in a different niche, on a different food item and would not compete with the column feeding *Lates calcarifer*. It can thus be said that *P. canius* and *L. calcarifer* are compatible species for brackishwater culture ponds.

(iii) The narrow gape of the mouth of *P. canius* prevents it from predating upon fish beyond a certain size. This species can therefore be introduced for culture with other brackishwater fish species, when they have attained a certain size. In such ponds it would utilise the unutilised food resource (crab and molluscs) and act as a 'police fish', besides adding to the total production. This role of this species can be compared to that of *Notopterus chitala* in freshwater aquaculture (Chaudhuri *et al* 1975).

The above points amply prove that *P. canius* can be cultured in brackishwater ponds without competing with other cultured species. Of course, the species cannot be cultured in such brackishwater ponds where prawns are also being cultured. The points amply justify that *P. canius* would be a welcome addition to brackishwater culture. Its culture is worth trying in the field by aquaculturists and might provide a breakthrough in solving one of the important problems of brackishwater fish farming *i.e.* crab control.

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