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The diet of *Horabagrus brachysoma* (Gunther), an endangered bagrid catfish from Lake Vembanad (South India)

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A stomach content analysis of *Horabagrus brachysoma* from Lake Vembanad, South India, showed that this species was omnivorous and euryphagous, with few qualititative differences in the diet among size classes. Feeding rates changed over the course of a year in response to environmental change associated with the monsoon.

Key words: aquaculture; feeding behaviour; monsoon; reproduction; yellow catfish.

The yellow or Gunther's catfish *Horabagrus brachysoma* (Gunther), known locally as '*manjakoori*' is one of the most important bagrid catfishes in the inland waters of Kerala state in South India (unpubl. data). This catfish is in high demand in the region owing to its popularity as a food resource and value as an ornamental fish. Overexploitation, habitat alteration, pollution and related anthropogenic pressures on their natural habitats, however, have considerably reduced populations of this species by 60–70% during the last few years (Zoo Outreach Organisation, unpubl.data). The distribution of *H. brachysoma* is currently restricted to type localities in a few river systems in the states of Kerala and Karnataka and also Lake Vembanad in Kerala where it has been listed as 'endangered' (Zoo Outreach Organisation, unpubl. data). Because stocks are declining in the wild, the prospects for culturing *H. brachysoma* especially in small-scale rural farming systems along the banks of Lake Vembanad have been considered (unpubl. data). The success of efforts to cultivate this species, however, will depend on information about the food and feeding habits, nutritional requirements and trophic ecology of this species. The absence of any published data on the diet of this endangered catfish in the wild prompted the present investigation.

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The study was conducted in Lake Vembanad in Kerala, (9°28′ to 10°10′ N; 76°13′ to 76°31′ E), the southernmost state of India. The lake covers an area of 21 500 ha and a total of 150 species of fishes have been reported from the region (Kurup & Samuel, 1985). Because of the 'endangered' status of *H. brachysoma*, fish collection was restricted to specimens caught by local fishermen and available at landing centres and markets located along the banks of the lake. Samples for the present study were collected from June 2003 to May 2004. Fish were collected live. Samples were preserved in ice and transported to the laboratory where they were sorted, the total length (L_T) measured to the nearest 0·1 mm, with individuals grouped into three size groups: <100, 100–200 and >200 mm.

The fish were dissected and the stomach of each weighed to the nearest 1 g. Those stomachs containing whole-prey items were immediately opened and the prey identified, measured and the individual masses of each recorded. The weighed stomachs were preserved in 10% formalin until a more detailed study was carried out; gut contents were examined under a stereomicroscope (×10) and all the food items identified. Subsequently, food items in the stomach were counted, weighed and measured. The percentage volume of major gut items was estimated by using the points method of Pillay (1952), whereby the contents of each stomach sample were taken as unity and the items expressed as percentage volume by visual inspection. The percentage occurrence of food items was analysed by the method of Hynes (1950). To estimate the dominant food items, results of the percentage occurrence and points method were combined to yield the index of preponderance (I) proposed by Natrajan & Jhingran (1962): $I = V_1 O_1 \ (\Sigma V_1 O_1)^{-1}$, where V_1 and O_1 are the volume and percentage occurrence of a particular food item, respectively. I gave the relative abundance of food items (mean %) in the stomachs of *H. brachysoma*. Feeding intensity (F_I) was then calculated from: $F_I = 100 N_F N_T^{-1}$, where N_F is the number of specimens with full stomachs and N_T is the total number of specimens examined.

In addition, the maturity of specimens was determined following Hickling & Rutenberg (1936). This method was also used to correlate the feeding intensity of *H. brachysoma* to its reproductive cycle.

A total of 180 specimens between 65 and 286 mm L_T were analysed. In majority of the cases, the gut contents could not be identified to species due to partial digestion. Crustaceans were the most important prey items in all L_T groups (Table I). Although there was little difference in the diet composition among L_T groups, some variations in the proportion of different food items during different stages of growth were observed. It was also evident that feeding specificity underwent moderate ontogenetic changes. The largely crustacean component of the diet of fingerlings (<100 mm) was reduced with increasing size. Likewise, the abundance of secondary food items underwent minor changes with ontogeny. The presence of detritus and molluscan remains in the gut also indicated a possible benthic feeding activity of *H. brachysoma*. In addition, fish scales constituted a major food item in all three size groups. Scale eating has been found to be common among other species of catfishes (Khan *et al.*, 1988). Adult *H. brachysoma* consumed a broad variety of food items including the bones of amphibia (frogs) and terrestrial insects. Mud and sand particles were encountered sporadically in the gut contents. A euryphagous feeding habit

TABLE I. Percentage volume (V_1), occurrence (O_1) and index of preponderance (I) of food items in the gut contents of *Horabagrus brachysoma* belonging to three total length (L_T) classes

Food Item	V_1	O_1	I
<100 mm L_T			
Plant matter	11·43	4·35	1·45
Crustaceans	38·06	57·13	76·22
Detritus	5·00	12·50	1·88
Fish larvae	9·14	23·68	6·27
Fish scales	12·07	7·29	2·55
Semi-digested organic matter	13·34	26·94	10·40
Unidentified	10·96	4·12	1·30
100–200 mm L_T			
Plant matter	10·10	6·38	22·70
Crustaceans	27·35	39·12	37·42
Insects	11·67	14·03	5·72
Detritus	8·12	17·13	4·86
Fish larvae	18·13	26·81	17·0
Fish scales	6·82	10·12	2·41
Semi-digested organic matter	11·69	18·19	7·43
Molluscs	2·00	8·47	0·59
Unidentified	4·12	12·33	1·77
>200 mm L_T			
Plant matter	10·36	4·11	2·13
Crustaceans	18·39	36·33	33·5
Insects	7·30	4·17	1·52
Detritus	16·19	12·69	10·3
Fish larvae	10·93	48·12	26·4
Fish scales	16·11	18·36	14·82
Semi-digested organic matter	11·49	13·45	7·75
Molluscs	1·28	2·14	0·13
Amphibian (frog) bones	1·01	0·76	0·03
Unidentified	7·00	9·81	3·44

has previously been recorded in several species of catfishes (David, 1963; Khan *et al.*, 1988; Olojo *et al.*, 2003). In general, the diet preferences of *H. brachysoma* from Lake Vembanad were similar to those of bagrid catfishes (Idodo-Umeh, 2002).

The high incidence of crustaceans and fishes in the stomach contents of *H. brachysoma* may be related to the differential digestion of specific food particles. Crustaceans and fish remains, particularly scales and otoliths resist digestion and tend to be overrepresented in gut content analyses. Crustaceans with chitinous exoskeletons are reported to be identifiable in fish guts over a longer period compared to many other food items (Wootton, 1990). The abundance of crustaceans and fish parts in the guts of *H. brachysoma* in the present study may be a reflection of variations in digestion rates.

The feeding pattern of adult *H. brachysoma* varied with season (Fig. 1) and stage of sexual maturity (Table II). The feeding intensity of a fish is related

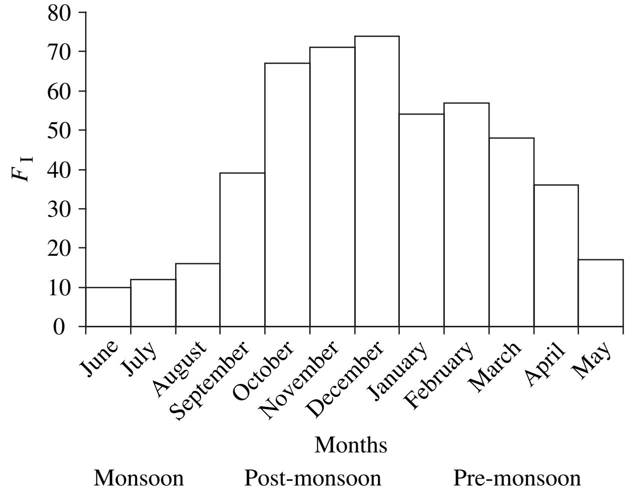

FIG. 1. Monthly variation in feeding intensity of *Horabagrus brachysoma* from Lake Vembanad based on proportion of individuals with full stomachs.

to its stage of maturity, reproductive state and the availability of food items in its environment (Ricker, 1956). An increase in feeding activity was noted in *H. brachysoma* from September to December (post-monsoon) with a reduced rate from May to July (monsoon), which coincides with the spawning season of this species in Lake Vembanad (unpubl. data). The low rate of feeding of *H. brachysoma*, however, was not only associated with the spawning season but probably due also to the major ecological changes in the lake brought about by the south-west monsoon, including abrupt fluctuations in temperature and salinity and the resultant decrease in the abundance of zooplanktons, benthos and other food resources.

TABLE II. Proportion (%) of stomachs of *Horabagrus brachysoma* either empty, partially full or full in relation to stage of sexual maturity

		Stomach fullness		
Maturity*	*N*	Empty	Partial	Full
Male				
1	16	31·3	43·7	25·0
2	18	16·6	55·5	27·9
3	12	28·3	43·3	28·4
4 and 5	32	28·7	55·0	16·3
Female				
1	18	33·4	50·0	16·6
2	24	12·5	37·5	50·0
3	17	41·2	29·4	29·4
4 and 5	26	42·4	15·0	7·6

*After Hickling & Rutenberg (1936).

The major hydrological changes in Lake Vembanad associated with the monsoon are known to bring about drastic changes to the biota of the lake ecosystem. In a study of the food and feeding habits of *Labeo dussumieri* (Valenciennes) in the River Pampa, which flows into Lake Vembanad, Kurup (1993) reported that the ecological changes brought about by the monsoon floods resulted in obliteration of feeding grounds, which in turn affected the feeding rates of fishes. The present results showed that maximum feeding intensity and stomach fullness were during the post-monsoon months of September to December, followed by the pre-monsoon months of February to April. The low feeding intensity during the monsoon (May to July) may be attributed to a decrease in food availability. The peak occurrence of crustaceans, which were a major food item of *H. brachysoma* in this region, has been shown to be during the post-monsoon months of September to December (Mohammed & Rao, 1971). Likewise, the maximum and minimum populations of benthic organisms in Lake Vembanad occurred during the pre-monsoon and monsoon seasons, respectively (Menon *et al.*, 2000); suggesting that prey selection by *H. brachysoma* is a function of prey availability and may not reflect prey preference.

The results of the present study suggest that *H. brachysoma* is unspecialized in its feeding habits. Except from some minor disparity among different size groups, *H. brachysoma* appears capable of widening the spectrum of food items in its diet in response to food availability. A relatively unspecialized and flexible feeding habit may be an optimal strategy for habitats where food sources are subject to seasonal fluctuations (Welcomme, 1979), as in the case of Lake Vembanad.

The ability of *H. brachysoma* to feed at different trophic levels, its rapid growth rate (Sreeraj, 2005) and increasing consumer demand makes this species a potential candidate for small-scale rural aquaculture in the region (unpubl. data). Studies on rearing this catfish in controlled conditions and quantifying their nutrient requirements at different life stages, however, will need to be undertaken before adopting this species for commercial-scale aquaculture operations.

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