

DIET OVERLAP AND FOOD COMPETITION AMONG THREE PREDATOR FISH SPECIES IN GAMBHIR RIVER

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Abstract: The potential of competition for food among fish species has been the subject of much speculation. Here, we evaluate the dietary overlap among three fish species - *Mystus seenghala*, *Channa punctatus* and *Heteropneustes fossilis*. Fishes were collected between January - December 2009 from three different study sites of the Gambhir River. In this study dietary overlap (Langton's scale) was found higher between *M. seenghala* and *C. punctatus*, whereas between *M. seenghala* & *H. fossilis* medium dietary overlap occurred. *H. fossilis* and *C. punctatus* also show medium dietary overlap. We conclude that the diets of fish species overlap substantially, and that the species co-occur spatially and temporally. Therefore, the potential for competition for prey exists in study sites.

Keywords: Competition, Dietary overlap, Prey, Predator.

Introduction: The study of food and feeding of fishes is very important in aquatic biology as it relates to various activities of the fish and even the entire fisheries industry. So in this study I investigated the food sources availabilities and preference for *Mystus seenghala*, *Channa punctatus* and *Heteropneustes fossilis* in Gambhir River.

Study Area: Fish samples were collected from three different localities of Gambhir River (Dam site, Kantharkhedhi and Ambodia). River Gambhir is tributary of Kshipra River. The dam was constructed on River (in year 1991) near village "Ambodia" located 19 Kms. away from Ujjain, Madhya Pradesh. It has total catchment area of about 1152 sq. Kms. (fig.-1)

Methods and Materials: Three permanent localities were used for sampling fishes for a period of one year

(January - December, 2009). Fishes were sampled in all seasons using gill nets at each of the localities (i.e. Dam site, Kantharkhedhi & Ambodia)

The gut contents of the fish sampled for each locality was combined with the various months within each season.

The oesophagus and foregut (anterior third of intestine) of all the three fishes were preserved in 5% Formaldehyde. The stomach content of each fish was filtered through a 100 micrometer mesh plankton net and was identified to genus level using the keys provided by Admondson (1959), Needham and Needham (1974) followed by calculation of percentage contribution of each food group.



Fig1: Satellite image of Gambhir River and Dam



Comparison of dietary overlap between groups was determined using the simplified Morisita index(C_H)

$$(Kreb, 1989) C_H = \frac{2 \sum_i^n P_{ij} P_{ik}}{\sum_i^n P_{ij}^2 + \sum_j^n P_{ij}^2}$$

Where P_{ij} = proportion of prey type i in the the diet of species j .

P_{ik} = Proportion of prey type i in the diet of species k .

The degree of overlap was based on Langton's (1982) scale; Small overlap $C_H = 0 - 0.29$; Medium overlap $0.30 - 0.59$; and Higher overlap >0.60 .

Result: Wide variety of prey was identified from the stomach contents of *M. seenghala*, *C. punctatus* & *H. fossilis*. Different prey organisms for all the predator

fishes were categorized into 7 major groups - Algae, Zooplankton, Insecta, Mollusca, Teleosts, Decapoda & miscellaneous group. Average percentage contribution of different prey groups in the gut of all the fishes are illustrated in table - 1, fig 2.

Result shows that *Mystus seenghala* feeds upon Insecta (28.98%), Teleosts (18.26%), Miscellaneous (35.78%) and Decapada (16.97%), whereas different prey groups for *Channa punctatus* were Insecta (43.18%), Mollusca (0.17%), Teleosts (27.35%), Miscellaneous (22.74%) and Decapoda (6.84%). Predator fish *Heteropneustes fossilis* feeds upon Insecta (41.79%), Mollusca (22.96%) Teleosts (2.05%), Algae (6.20%), Zooplankton (4.61%), Miscellaneous (13.02%) and Decapoda (6.66%).

Table - 1 Average % contribution of different prey groups in the three predator fishes (1=*M. seenghala*, 2=*C. punctatus* & 3=*H. fossilis*).

Prey groups	1	2	3
Algae	-	-	6.20+
Zooplankton	-	-	4.61+
Insecta	28.98+	43.18+	41.79+
Mollusca	-	17+	22.96+
Teleosts	18.26+	27.25+	2.05+
Decapada	16.97+	6.84+	6.66+
Miscellaneous	35.78+	22.74+	13.02+

Diet Overlap: It was found that the most common food groups between *M. seenghala* & *C. punctatus* were Teleosts & Insecta and the degree of dietary overlap(C_H) between these two predator fishes was found high ($W= 0.80$, $S=0.72$, $R=0.70$) in all the three seasons, where as dietary overlap (C_H) between *C. punctatus* and *H. fossilis* was medium ($W=0.58$,

$S=0.56$, $R=0.45$) throughout the study period as preferred food groups for *H. fossilis* were Insecta and Mollusca and preferred food groups for *C. punctatus* were Insecta and Teleosts. *M. seenghala* & *H. fossilis* shows medium dietary overlap (Table 2, fig 3) in all seasons ($W=0.60$, $S=0.61$, $R=0.61$).

Table - 2 Dietary overlap index (C_H) among *Mystus seenghala*, *Channa punctatus* and *Heteropneutes fossilis* in different seasons. (W = Winter, S= Summer, R = Rainy).

Species	Season	<i>C. punctatus</i>			<i>M. seenghala</i>		
		W	S	R	W	S	R
<i>H. fossilis</i>	W	.58	-	-	.60	-	-
	S	-	.56	-	-	.61	-
	R	-	-	.45	-	-	.61
<i>M. seenghala</i>	W	.80	-	-			
	S	-	.72	-			
	R	-	-	.70			

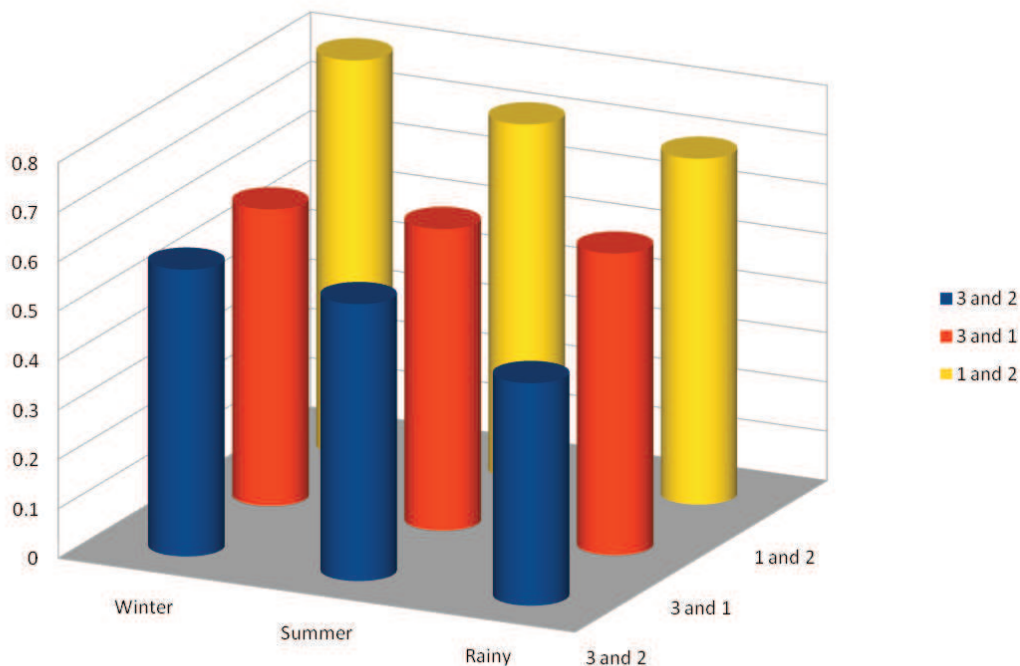


Fig 3: Dietary overlap between *Mystus seenghala* (1), *Channa punctatus* (2) and *Heteropneustes fossilis* (3).

Mystus seenghala feeds on fish as reported by earlier workers (Alikunni & Rao, 1948, Vinci, 1986) Fernando & Idrasen (1969) have categorized *C. punctatus* as carnivorous. Johal & Tondon (1981) documented *H. fossilis* as bottom feeder who feeds on Mollusca & Zooplankton.

Discussion: All the three fishes were found to consume a diverse range of prey including Insecta, Mollusca, Teleosts, Algae, Zooplankton, Decapoda. This diverse diet is consistent with previous reports of all the three fish's diet. The results indicate that *M. seenghala* & *C. punctatus* is important predator of Insecta and Teleosts in the present study. Whereas *H. fossilis* is dominant predator of Insecta and Mollusca group. According to Bennett (1997 a,b) if the aquatic macro invertebrate community in the reservoir or river where unable to support the food demand of fishes, dietary overlap becomes more critical. The closer the different species rely upon the same food source, increase in competition or dietary overlap will result. Werner, (1984), Weatherley (1963) describe the role of an animal in its ecosystem by referring to its "niche". If two species are found to show the same niche, or even have an overlap, the weaker will certainly languish.

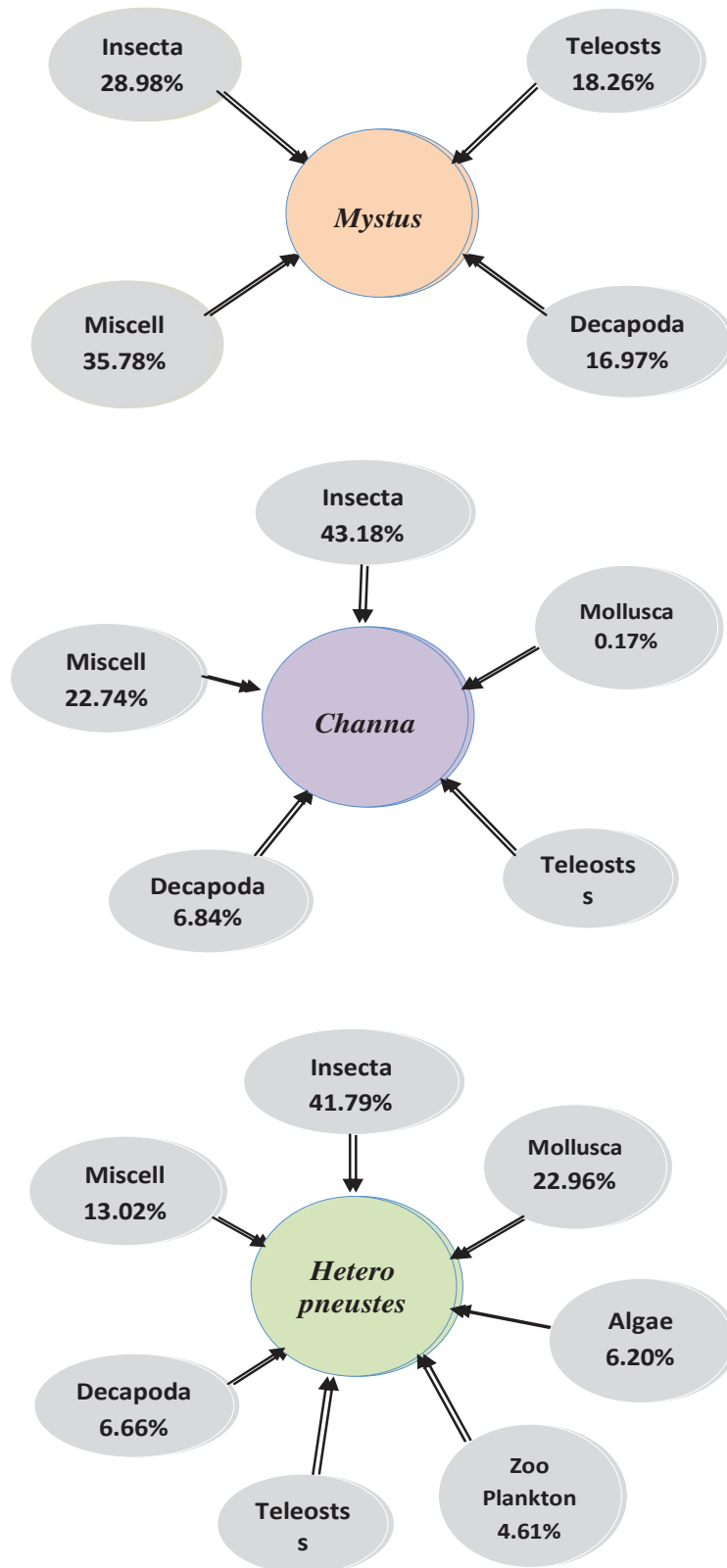
However, in the present study based on the unlimited food sources in the Gambhir River, the biological significance of this dietary overlap for forage fishes is likely not contributing to mortality in fishes.

In the study diets of all the three fish species indicates a response of food competition or dietary overlap. Dietary overlap or inter specific food competition may however is less than that shown by analysis of stomach content, if direct competition (i.e. competition in which there is a direct contact between individuals) is reduced by differences in the feeding behavior. In this study all the 3 fishes stretch up the entire water column from bottom to surface. So the observed dietary overlap may be due to changed feeding condition or food availability of observed fishes. Differences in diet or prey preferences may be due to some factors like the ability to catch and consume prey, availability of prey, density of prey and prey profitability. Further research is needed to better understand the factors that influence the diet of the fishes, but studies from throughout its range have provided a good base from which to build.

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Fig. 2: Average % Contribution of different prey groups in *M. seenghala*, *C. punctatus* & *H. fossilis*



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