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Trophic Nature and Feeding Relationships among Al Hammer Marsh Fishes, Southern Iraq

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Abstract

The food habits of eleven sympatric fish species in Al-Hammar marsh were reviewed, data of previous studies on food habit were re-analyzed to calculate the diet overlap among the marsh fishes. Most previous studies were restricted on either one or two species food habit. Although the studies depend on different food analytical methods, similar findings were obtained for major food constituents. Only 11 significant overlap cases out of 55 were obtained. The eleven species were categorized into six groups depending on the priority of food items. The specialization and less diet overlap intensity indicate adequate rich (huge) food resources availability and partitioning among the fish species.

1.Introduction

Iraqi marshes are the largest wetland in the Middle East due to unique environmental, hydrological and meteorological conditions, which support and facilitate the substantial growth of various biotic components , to be one of the rarest and richest bio-tops in the region.

During the 1990's these marshes faced a serious crisis through a planed desiccation led to reduce their original area by 90%, and to the disappearance of this paradise. After 2003 these marshes were uneducated again.

These marshes play an important role as spawning grounds, nurseries and feeding places for fishes, through the availability of food resources, which accelerate the growth of fishes in comparison with other Iraqi water bodies (Mohamed and Ali 1992). The vast areas of marshes; dense macrophytes , played as prefect refuge from predators and wide depression of fishes throughout the marshes to become a major source for livelihood, consequently these marshes could be considered as a natural big multi-species fish pond.

Several taxonomic accounts were published concerning Iraqi fishes e.g., Khalaf (1961), Mahdi (1962) and Al-Daham (1982) including those living in the marshes. Most of fishes existed in the marshes were fresh water with few marine species including anadromous species penetrate to the lower reaches of the southern marshes espically Al-Hammar marsh, (Fig.1) during certain period of the year (Al-Hassan and Naama,1989).

Cyprinidae is the most abundant family and also the most commercial group. Al-Daham (1988) considered few species of this family as the most valuable species and occupy the most important ranks of fish production in the marshes .Thus most of the previous studies were focused on their biology including food habits.

The food habits of cyprinids were studied by several authors e.g., Al-Mukhtar (1982), Barak and Mohamed (1982), Dawood (1986), Hussein and Al-Kanaani (1989, 1991 and 1993) and Al-Daham *et al*. (1992). Few studies were concerned with food habits of other species; e.g., Al-Seyab (1988) on silurid species and Naama (1982) on mugilid species.

Only two studies, Al-Kanaani (1989) and Hussain *et al.,* (1992) were focused on feeding relationships. The former was concerned with diet overlap of common carp,(*Cyprinus carpio)* and other three native species; *Barbus sharpeyi*, *B. luteus* and *B. xanthopterus*. The later was dealt with feeding relationships of eight cyprinids .

The present work is to clarify the food partitioning among (11) fish species occupy Al-Hammar marsh according to their food analysis reported by studies mentioned above.

Fig. (1) Map showing Iraqi Southern Marshes

3.Analytical methods

Only food components constitute >10% were used in similarity analysis of food habit between each two species using the following equation of Schooner (1970):

$$\alpha = 1- 0.5 \sum | pi-pj |$$

α : similarity level,

pi & pj: percent of food item for species (i) and species j.

According to Zaret and Rand (1971) overlap ≥ 60% was considered as significant diet overlap.

4.Results

Food habit:

Table (1) presents the food items constituting >10% of the total food components. Point's method by Hynes (1950) and relative importance index by George and Hadley (1979) were the main food analysis methods used in studies listed in Table (1). Food items percentage for each species are plotted in Figure (2). With the exception of *B. luteus* and *B. xanthopterus*, the investigated species were mainly fed on tow and/or three food items.

Table 1.
Data used in analysis of feeding relationships of Al Hammer marsh fishes.

Species	Food items								Method	Reference
	P	A	D	C	I	M	F	Z		
B. luteus		21.3	11.5		14.3	15.5			Points	Al-Mukhtar, 1982
=	63.2	12.5							Points	Barak & Mohamed, 1982
=	17.3	15.8		15.4	14.9	19.6			IRI	Al-Kanaani, 1989
=	21.9	19.5		13.5	13.1	14.2			Points	Al-Redaini, 1989
=		45.2		12.1					Points	Hussain *et al.*, 1992
B. sharpeyi	46.2	48.4							IRI	Al-Kanaani, 1989
=	44.3	47.4							Points	Al-Redaini, 1989
=		58.8	11.5						Points	Hussain *et al.*, 1992
C. carpio			11.9	22.4		25.8			Points	Dawood, 1986
=				31.2	11.6	30.8			IRI	Al-Kanaani, 1989
=				17.9	13.8	19.2		15.4	Points	Al-Redaini, 1989
=				34.4		36.5			Points	Hussain *et al.*, 1992
A. vorax					13.4		58.1		Points	Al-Mukhtar, 1982
=				49.1		14.0	25.0		IRI	Hussein & Al-Kanaani, 1989, 1991
=				31.4	20.7		21.3	14.6	Points	Al-Redaini, 1989
=				45.3			31.5		Points	Hussain *et al.*, 1992
B. xanthopterus				26.9	13.1	38.6			IRI	Al-Kanaani, 1989
=			23.4		20.1	14.1			Points	Hussain *et al.*, 1992
S. triostegus				20.2			73.7		IRI	Al-Seyab, 1988
B. grypus		29.0	39.0	17.0					Points	Hussain *et al.*, 1992
B. scheich			18.1	59.8					Points	Hussain *et al.*, 1992
B. sub-quicnciatus		47.2	28.9						Points	Hussain *et al.*, 1992
L. subviridis	65.0	10.0							Points	Namaa, 1982
L. abu	13.8	15.8	18.0						Points	Namaa, 1982

P: Plant, A: Algae, D: Detritus, C: Crustacea, I: Insects, M: Molluscs, F: Fishes, Z: Zooplankton ,IRI: Index of relative importance.

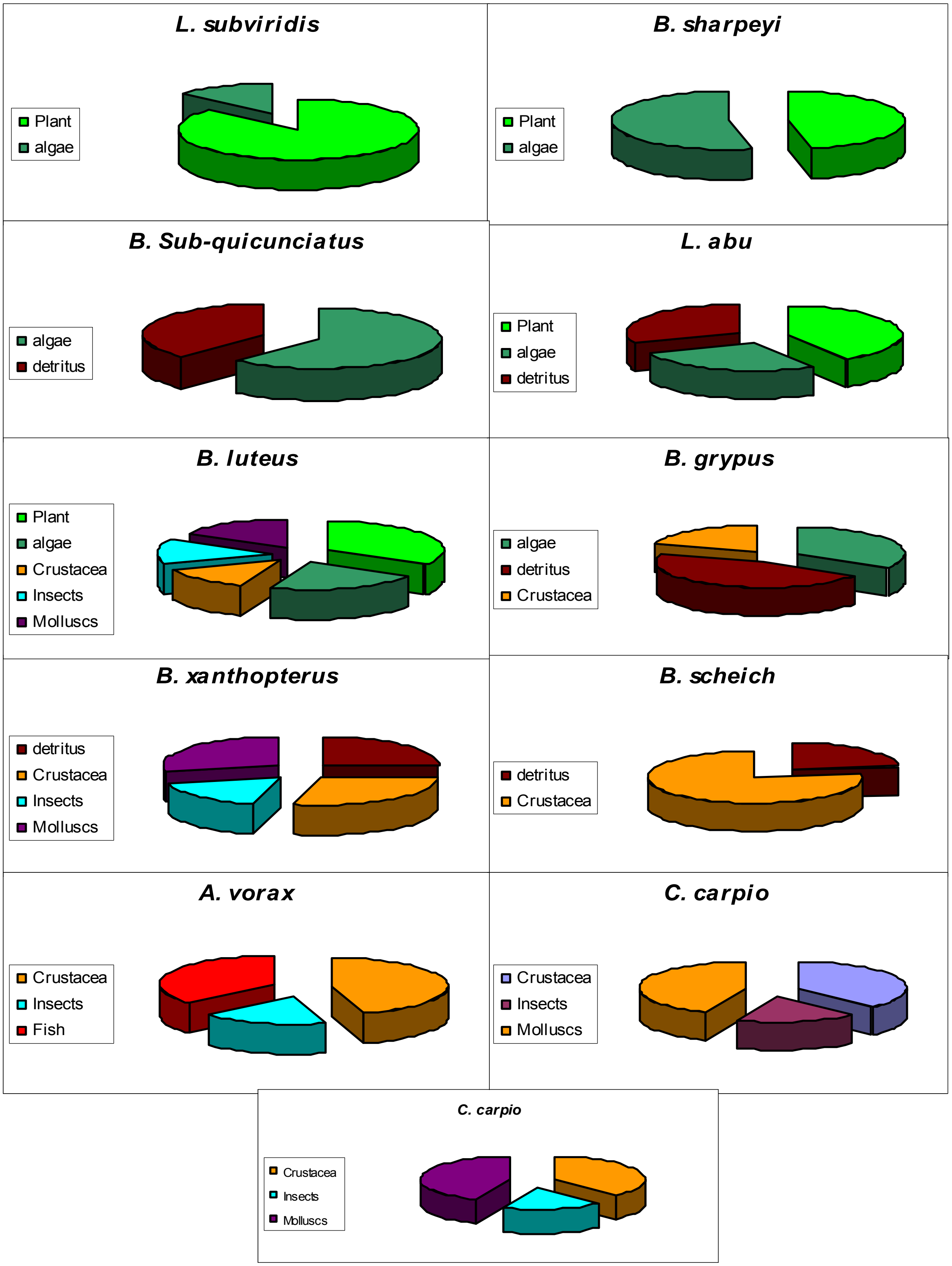

Fig. (2) Food items constitute >10% of food of Al Hammer marsh fishes

Due to negligible difference among studies dealing with the same species, the average percentage of each food item was calculated and listed in (Table 2). Generally, three feeding patterns could be apparently distinced. The first was herbivorous group including species depend mainly on aquatic plants and algae, represented by three species; *B. sharpeyi*, *L. subviridis, L. abu.* The second was omnivorous group represented by *B. Subquicunciatus, B. grypus,* and *B. luteus.* The third was carnivorous group including five species; *B. Scheich, B. xanthopterus, C. carpio, A. vorax* and *S. triostegus*, which depend on animal origin food components.Subgroup could be separated represent the pscivorous species like *S.triostegus and A. vorax .*

Table (2):
Grouping of Al Hammer marsh fishes based on food habit.

	Species	Food Items %						
		Plant	**Algae**	**Detritus**	**Crustacea**	**Insects**	**Molluscs**	**Fishes**
Herbivorus	*B. sharpeyi*	45.2	51.5					
	L. subviridis	65.2	10.0					
	L. abu	23.8	15.8	18.0				
Omnivorus	*B. sub-quicunciatus*		47.2	28.9				
	B. grypus		29.0	39.0	17.0			
	B. luteus	34.1	21.8		13.6	14.1	16.4	
Carnivorus	*B. scheich*			18.1	59.8			
	B. xanthopterus			23.4	26.9	16.6	26.3	
	C. carpio				26.4	12.7	30.5	
	A. vorax				41.9	16.0		34.1
	S. triostegus				20.2			73.7

Feeding relationships:

The similarity values between each couple of species were displayed in Table (3). Only (11) cases of significant diet overlap were noticed out of (55) cases. Similarity values were plotted as a dendrogram (Fig. 3). Six

Table (3):
Similarity matrix of diet overlap among Al Hammer marsh based , on Schooner's equation

	B. luteus	*B. sharpeyi*	*C. carpio*	*A. vorax*	*B. xanthopterus*	*B. grypus*	*B. subquicnciatus*	*B. scheich*	*S. triostegus*	*L. subviridis*	*L. abu*
B. luteus		○	○	○	○	○	○	○	○	○	●
B. sharpeyi	58		○	○	○	○	●	○	○	●	●
C. carpio	52	0		○	●	○	○	○	○	○	○
A. vorax	31	0	53		○	○	○	○	●	○	○
B. xanthopterus	47	0	84	50		○	○	●	○	○	○
B. grypus	46	38	40	29	51		●	○	○	○	●
B.subquicnciatus	39	61	0	0	47	77		○	○	○	●
B. scheich	24	0	53	57	60	54	41		○	○	○
S. triostegus	16	0	58	61	27	28	0	34		○	○
L. subviridis	56	69	0	0	0	30	35	0	0		●
L. abu	60	63	0	0	43	64	67	50	0	68	

● Significant overlap
○ Non-significant overlap

clusters could be categorized based on (60%) similarity level. The first includes *L. abu, B. sharpeyi* and *L. subviridis* their diet mainly of aquatic plants and algae. The second group include omnivorous species; *B. luteus* depends on wide spectrum food items. The third group includes *B. grypus* and *B. subquantalus*, which fed mainly on algae and detritus. The fourth group contains crustacean feeder, *B. scheich.* The fifth group includes *C. carpio* and *B. xanthopterus* mainly preyed on molluscs and crustacean. Finally, the sixth group was represented by *A. vorax* and *S. triostegues,* preyed on fish and crustacean.

5-Discussion:

The previous reviewed articles coincided with the major food items of the eleven fish species even different methods of food analysis were used. the trophic pyramid existed among the marsh fishes was normal since natural constituents were existed , *B. sharpeyi* at the base of the trophic pyramid, representing the most herbivorous habit (plant origin items comprised 80%) and *S. triostegus* at the apex of the table representing the piscivority habit (fish comprised 73%). Between these two species wide and diverse food spectrum components were existed.

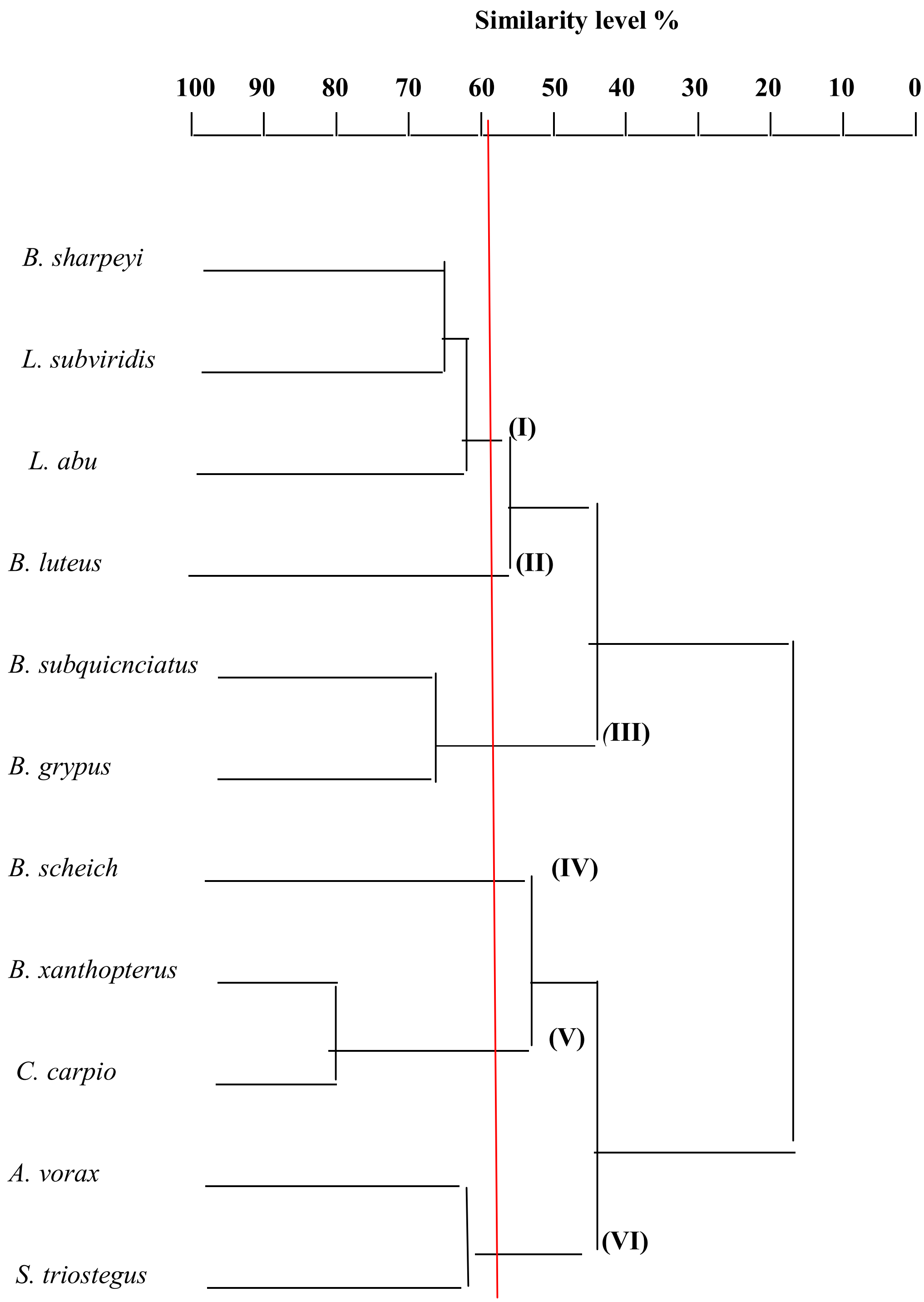

Fig. (3)- Dendrogram of diet overlaps among Iraqi marsh fishes

Although some species exhibited high similarity level as between *C. carpio* and *B.* xanthopterus there was a difference in their preferable food item. The priority for molluscs characterized the food habit of *C. carpio* and detritus for *B. xanthopterus*.

The highest diet overlap were between *B. xanthopterus* and *C. carpio* (84%) and between *B. grypus* and *B. Subquicnciatus* (77%). Even for these two cases the availability of food resources offset the competition, which seems to be as theoretical case more than a real one.

The food partitioning among the (11) species was represented by the six groups, which may decrease any significant diet overlap between each couple of species .

The specialization and low diet overlap level reflect the wide range of diversity and the richness of trophic pyramid in marshes that provide a good advantage for prey-selection. The local information on fish abundance in Iraqi marshes during 1980's indicated that *B. sharpeyi, C. carpio, L. abu, B. lutues, S. triostegus* and *L. subviridis* were the most abundant species.

The less abundant species may be highly sensitive for environmental changes occurred in marshes in late eighties due to the increasing of salinity up to (2-8 ‰)as stated by Abed (1989) however , in late 1970's in particular, this parameter was about (0.4 ‰) as reported by Al-Saadi *et al.* (1981).Therefore, the decreas in abundance of those species may be related to such environmental changes and not due to any feeding ecological factor.

Further comprehensive studies concerning food and feeding studies should be conducted to evaluate to which extent the marshes restore its biological importance as fish feeding ground after reflooding. Moreover, food partitioning and diet overlap among different species might be considered particularly in case of introduced species(alien species) as that of *C. carpio* in 1950's and the recent one of *Carassius carassius* and *C. auratus* to clarify their competitor impact.

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