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ON THE FOOD AND FEEDING HABITS OF EIGHT  
SPECIES OF *LEIOGNATHUS* FOUND IN MANILA  
BAY AND SAN MIGUEL BAY

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ABSTRACT

This paper describes and tabulates the food organisms and notes specific feeding habits of *Leiognathus splendens*, *L. bindus*, *L. insidiator*, *L. ruconius*, *L. blochii*, *L. daura*, *L. equulus* and *L. leuciscus*, noting particularly the differences between the consumption of plankton and benthos by the several species.

INTRODUCTION

This study was carried out as part of a research programme on marine fishery resources conducted while the senior author was a FAO Fishery Biologist in the Philippines in 1956-1958 (Tiews, 1959). Manacop (1955) notes that the different species of *Leiognathus* comprise a great bulk of the commercial trawl catches in Manila Bay and in other fishing areas of the Philippines. In fact, they are the most abundant group of demersal marketable fishes. A previous report by Tiews and Caces-Borja (1965) listed 17 species of the family Leiognathidae that were found to form part of the commercial catches of otter trawls in Manila Bay, Luzon, namely: *Leiognathus ruconius*, *L. insidiator*, *L. elongatus*, *L. fasciatus*, *L. smithursti*, *L. leuciscus*, *L. equulus*, *L. blochii*, *L. brevirostris*, *L. dussumieri*, *L. splendens*, *L. bindus*, *L. daura*, *L. lineolatus*, *L. brevis*, *Gazza minuta* and *Gazza acblamys*.

Presented at the 13th Session of the Indo-Pacific Fisheries Council, Bombay, India, Feb. 13-April 30, 1959.

The investigation on the food and feeding habits of different species of *Leiognathus* found in Manila Bay and San Miguel Bay (Pacific side of Luzon) was carried out to determine the important animal and plant components in their diets. This research was part of the biological programme initiated on this family of fish. The main research was conducted on fish collected in Manila Bay. It was extended also to fish of San Miguel Bay for control reasons only.

MATERIALS AND METHODS

Only the eight most important species of *Leiognathus* were studied, which are *Leiognathus splendens*, *L. bindus*, *L. insidiator*, *L. ruconius*, *L. blochii*, *L. daura*, *L. equulus* and *L. leuciscus*.

The total of 656 fishes used in this study from Manila Bay were taken from the commercial catches of otter trawlers. They were collected from March to November 1957 from different localities of Manila Bay. From San Miguel Bay, a total of 196 fish were examined. They were taken from July to October 1957 also from the commercial catches of otter trawlers. Fishes of different size groups, sexes and sexual maturity stages were utilized.

In examining the gut contents, the whole gut was dissected along its length. All of the contents were carefully removed and separated as far as possible into taxonomic groups. The contents were spread over a glass slide and identified under the microscope.

The percentage of dominance of each food item was evaluated by dividing the number of times an individual food item occurred in the stomach by the total of all the food items and multiplied by 100. The percentage of dominance for animal and plant components were computed separately (Table I and IV). Also the average number of food items eaten has been compiled for Manila Bay (Table III).

The percentage of occurrence was computed by dividing the number of the stomachs containing a particular food item by the total number of stomachs examined, disregarding the amount, and multiplied by 100 (Tables II and V).

The detailed tabulation of the different components of the dinoflagellates and diatoms was diligently done by Miss P. Divino. Volumetric measurement was not employed because the general size and number of the food organisms were small.



## SUMMARY OF RESULTS

All species of *Leiognathus* feed on a great variety of zooplankton and phytoplankton species. There is little variation between the stomach contents of the same species caught in one area. It may be concluded that the several slipmouth species have certain specific feeding habits, as marked differences of stomach contents between species indicate. *Leiognathus splendens* and *L. daura* had eaten much more foraminiferans than the other species and that was true for both research areas. On the other hand in *L. insidiator* and *L. ruconius* benthic animals were either absent as in Manila Bay or nearly absent as in San Miguel Bay, and instead purely pelagic organisms were consumed. This marked difference of the food and feeding habits of the different species can be partly attributed to the differences in mandibular structures. The last two species have the mouths opening upwards, while the others either open horizontally or are protracted downwards.

Although benthic animals contributed, at least in some species, substantially in the diets of those species whose mouths open downwards or horizontally when protracted, pelagic copepods still predominate in the food composition.

An attempt was made to differentiate the food and feeding habits between the male and female fish. It was observed that no distinct difference existed between the food of the two sexes.

The total number of the zooplankton as food items present in the diet of the *Leiognathus* species except of *L. equulus* exceeds the total number of the phytoplankton (Table III). Among the phytoplankton, diatoms occurred in all of the stomachs. *Coscinodiscus* and *Gyrosigma* were the most abundant diatoms present. All the species consumed a considerable amount of fish eggs.

As shown on the tables on frequency of occurrence, *L. splendens*, *L. daura* and *L. equulus* consumed a greater variety of food organisms than the other species. It can be noted that there are food items that appeared in the diet of the slipmouths from San Miguel Bay but were absent in the diet of the slipmouths from Manila Bay. Examples of these are the foraminiferans like *Bulivinita*, *Cymbyloporetta*, *Discorbis*, *Globorotalis*, *Haverina*, *Loxostonum*, *Nonsniella*, *Peneroplis*, *Pseudoglandularia*, *Pygro*, *Robulus*, *Sorites*, *Spirol* (Mil.) and *Uvigerina*.

On the other hand, there were a few food items which appeared in the diet of the Manila Bay specimens but were absent from the diet of the fish from San Miguel Bay.

The phytoplankton diet of the San Miguel Bay slipmouths corresponded closely with that from Manila Bay.

There is a greater variety of food available to the slipmouths in San Miguel Bay than in Manila Bay.

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Table I Dominance of the Different Food Organisms (in percent) in Eight Species of *Leiognathus* from Manila Bay (See text)

	<i>L. splendens</i>	<i>L. bindus</i>	<i>L. insidiator</i>	<i>L. ruconius</i>	<i>L. bloehii</i>	<i>L. daura</i>	<i>L. equulus</i>	<i>L. leuciscus</i>
No. of fishes researched	124	106	84	89	76	8	57	112
SIZE range (mm)	49 - 144	54 - 147	56 - 95	54 - 77	65 - 124	68 - 82	65 - 164	53 - 108
Ave. total length (mm)	85.7	77.9	69.4	61.4	90.6	74.7	102.3	84.5
Time of collection	Mar.-Sept.	Apr.-Sept.	May-Sept.	Apr.-Sept.	June-Nov.	Oct.	Apr.-Sept.	Apr.-Oct. 1967
Food ORGANISMS								
Animal components = 100%								
Protozoan								
Dinoflagellates	4.0	4.6	0.8	5.7	1.1	1.3	3.4	7.2
Foraminiferans	29.4	2.7	0	0	0.6	43.5	9.3	1.0
Crustaceans, Copepods	46.2	40.1	71.6	56.5	55.0	16.2	13.8	45.3
Others	2.6	2.8	2.2	11.6	4.8	1.8	2.9	3.5
Mollusk larvae	0.8	-	-	-	0.2	4.1	0.1	0.1
Annelid larvae and adults	0.7	-	0.3	0.2	0.1	-	5.2	0.2
Echinoderm larvae	1.0	-	-	0.2	-	-	-	-
Unidentified inver.larvae	0.1	-	0.2	2.7	-	-	0.1	0.4
Fish and fish larvae	0.1	-	0.4	-	-	-	-	1.5
Fish eggs	6.7	13.0	16.3	8.8	5.0	2.8	18.8	14.9
Unidentified animals and miscellaneous items	8.4	36.8	8.2	14.3	33.2	30.3	46.4	25.9
Plant components = 100%								
Diatoms								
Coscinodiscus	63.5	42.5	61.2	16.9	33.1	58.2	39.5	72.6
Nitzschia	1.0	3.5	-	0.4	0.9	13.0	-	0.8
Solenicola setigera	-	-	-	-	15.4	-	-	-
Gyrosigma	18.5	8.1	0.9	4.4	8.3	2.1	42.2	20.9
Others	11.0	7.3	6.7	1.3	15.4	14.6	7.4	5.7
Filamentous algae	4.9	20.2	1.0	76.7	10.4	-	5.0	-
Miscellaneous items	0.4	-	-	-	-	-	-	-
Thalassiothrix	0.7	18.4	30.2	0.3	16.5	12.1	5.9	-

Table II Occurrence of the different food organisms in per cent in eight species of *Leiognathus* from Manila Bay. (See text)

	<i>L. splendens</i>	<i>L. bindus</i>	<i>L. insidiator</i>	<i>L. ruconius</i>	<i>L. bloehii</i>	<i>L. daura</i>	<i>L. equulus</i>	<i>L. leuciscus</i>
No. of fishes researched	124	106	84	89	76	8	57	112
SIZE range (mm)	49-144	54-147	56-95	54-77	65-124	68-82	65-164	53-108
Average total length (mm)	85.7	77.9	69.4	61.4	90.6	74.7	102.3	84.5
Time of collection	Mar.-Sept.	Apr.-Sept.	May-Sept.	Apr.-Sept.	June-Nov.	Oct.	Apr.-Sept.	Apr.-Oct. 1967
Food ORGANISMS								
Dinoflagellates								
Ceratium	2.4	1.9	3.6	5.6	6.4	-	5.8	8.9
Noctiluca	25.7	11.8	9.5	2.3	10.4	43.3	11.6	20.5
Foraminiferans								
Bullina	2.4	-	-	-	1.4	-	8.8	-
Calcarina	6.4	-	-	-	-	-	8.7	-
Cibicides	11.0	1.0	-	-	-	-	-	0.9
Cornuspira	9.7	-	-	-	-	26.7	1.5	3.5
Ephidium	-	-	-	-	-	16.7	2.9	-
Gyrodina	5.7	-	-	-	-	30.0	-	-
Globigerina	2.4	-	-	-	-	-	-	-
Marginfera	0.8	-	-	-	-	-	-	-
Nodosaria	0.8	-	-	-	-	-	-	-
Nonion	12.1	-	-	-	-	-	-	-
Operculina	36.2	1.9	-	-	1.3	73.3	0.6	3.4
Pleurotomella	4.8	-	-	-	-	-	5.9	-
Quinqueloculina	10.4	-	-	-	-	-	0.6	-
Reseuella	2.4	-	-	-	-	73.3	-	-
Rotalis	-	-	-	-	-	16.7	-	-
Spiroloculina	-	-	-	-	-	16.7	-	-
Textularia	33.5	-	-	-	2.6	16.7	1.5	3.6

Table II Occurrence of the different food organisms in per cent in eight species of Leiognathus from Manila Bay. (Continuation)

	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	
Trilaculina																						
Unidentified Foraminiferans	25.0		1.2	3.4			1.3															1.9
Amphipods	0.8		73.6	67.5			75.0															75.0
Copepods	98.4						1.3															1.9
Decapods																						2.6
Ostracods	18.6		1.2																			
Schizopods																						
Lucifer			1.2				19.9															9.8
Nysis	1.6		13.4	25.8																		
Nauplius				1.1																		
Echinoderm larvae	1.6																					
Folycnetae																						
Adult larvae	4.9		4.8				1.4															3.6
Pelocypod																						
Veliger larvae	9.7		2.4				7.5															1.8
Fish larvae																						2.7
Unidentified fish larvae	2.4																					
Fish eggs	28.2		42.6	20.0			43.3															20.8
Pteropod shells																						
Unidentified larvae	1.6		6.0	2.3																		3.5
Unidentified items and Miscellaneous items	27.4		34.7	17.5			57.4															24.6
Diatoms																						
Biddulphia	2.4																					1.9
Chaetoceres	0.8																					
Coccolodiscus	81.3		47.5	2.3			56.9															63.4
Ditylum	0.8																					
Gyrodinium	69.1		4.7	6.4			10.8															26.9
Nauicula	7.3						2.6															17.2
Mitochondria	2.8						2.6															3.2
Rhizocolenia																						
Solenicola estigera	1.6		6.0				3.9															5.4
Sarrirella			2.4				9.0															1.9
Smedra																						
Thalassiosira	0.8																					
Thalassiothrix	8.9						2.2															1.9
Unidentified diatoms	4.8		14.3	1.1			14.4															
Miscellaneous items	14.9																					
Filamentous algae	7.3																					
Cocillatoria	9.6						82.0															
			1.2																			

Table III Average number of different food organisms taken in by eight species of Leiognathus from Manila Bay (calculated on the basis of all stomachs investigated).

	<i>L. splendens</i>	<i>L. bindus</i>	<i>L. insidiator</i>	<i>L. ruconius</i>	<i>L. blochii</i>	<i>L. daura</i>	<i>L. equulus</i>	<i>L. leuciscus</i>
Total No. of Specimens researched	124	106	84	89	76	8	57	112
Ave. Total length in cm.	85.7	77.9	69.4	61.4	90.7	74.7	102.2	84.5
FOOD ORGANISMS	Mar.-Sept.	Apr.-Sept.	Apr.-Sept.	June-Nov	Oct.	Apr.-Sept.	Apr.-Sept.	Oct. 1957
<u>Animal components</u>								
Dinoflagellates	1.4	0.5	0.2	0.4	0.2	0.7	0.4	1.2
Foraminiferans	10.5	0.3			0.1	24.6	1.3	0.2
Crustaceans	17.3	4.6	21.0	5.0	14.0	9.9	2.6	8.3
Echinoderm larvae								
Mollusk larvae	0.3					2.3		
Annelid larvae	0.3		0.2				0.7	
Fish and Fish larvae			0.7					0.3
Fish eggs	2.3	1.4	4.6	0.6	1.2	1.6	2.7	2.5
Pteropod shells							0.1	
Unidentified larvae			0.1	0.2				
Unidentified items			0.1					
Miscellaneous items	3.1	4.0	2.3	1.0	7.9	17.5	6.5	3.4
<u>Plant components</u>								
Diatoms (Identified)	20.6	4.4	2.0	0.8	6.0	17.2	13.3	4.9
Unidentified diatoms	0.4				0.6	0.3	4.7	
Miscellaneous items	0.3							
Filamentous algae	0.9	1.1		2.6	0.8		4.5	
Oscillatoria		0.1						



Table IV Dominance of the different food organisms (in per cent) in seven species of *Leiognathus* from San Miguel Bay (see text)

	<i>L. splendens</i>	<i>L. insidiator</i>	<i>L. ruconius</i>	<i>L. blochii</i>	<i>L. daure</i>	<i>L. equulus</i>	<i>L. blindus</i>
No. of fishes researched	31	20	30	50	10	20	35
Ave. total length in mm	180.4	97.6	58.2	93.2	82.3	120.7	83.8
Time of collection	July, Sept Oct	July, Sept.	Sept., Oct.	Oct.	Sept.	July, Sept. Oct.	July, Oct. 1957
<b>Food Organisms</b>							
Animal components = 100 %							
Dinoflagellates	0.3	0.4	0.1	6.5	0.1	0.1	1.8
Foraminiferans	24.4	0.1	0.1	2.5	27.6	11.0	0.3
Crustaceans	16.2	20.7	71.9	52.3	20.2	2.1	83.5
Gastropods: Veliger larvae	1.6	-	-	-	-	0.1	-
Pelecypods: Veliger larvae	3.8	-	0.1	-	0.2	1.2	-
Fish larvae	-	-	-	-	-	-	-
Fish eggs	22.5	5.8	12.5	4.5	23.5	42.3	7.1
Polychaetes (adults + larvae)	0.6	-	0.5	5.4	1.0	1.1	0.4
Pteropod shell	2.0	-	-	-	-	0.2	-
Unidentified items and	0.2	1.0	0.3	-	0.6	0.9	0.1
Miscellaneous items	28.4	72.0	14.5	28.4	26.8	41.1	6.8
Plant components = 100 %							
Diatoms (identified)	76.7	80.2	40.0	95.6	64.7	69.8	78.2
Unidentified diatoms	2.6	18.2	0.3	-	0.3	5.6	-
Filamentous algae	-	-	59.5	4.4	-	-	21.8
Ocellularia	-	-	-	-	-	1.3	-
Miscellaneous items and	-	-	-	-	-	-	-
Unidentified items	20.7	1.6	0.2	-	35.0	23.3	-

Table V Occurrence of the different food organisms (in per cent) in seven species of *Leiognathus* from San Miguel Bay (see text).

No. of fishes researched	<i>L. splendens</i>		<i>L. insidiator</i>		<i>L. ruconius</i>		<i>L. blochii</i>		<i>L. daure</i>		<i>L. equulus</i>		<i>L. blindus</i>	
	July-Sept. Oct.	July-Sept.	20	30	50	10	20	35 <th>50</th> <th>82.3</th> <th>120.7</th> <th>83.8</th> <th>Sept. July-Sept.</th> <th>July-Sept.</th>	50	82.3	120.7	83.8	Sept. July-Sept.	July-Sept.
Size range (mm)														
Ave. total length (mm)	108.4	97.6	58.2	93.2	82.3	120.7	83.8							
<b>Food Organisms</b>														
Dinoflagellata	14.3	6.7	2.0	70.0	10.0	8.9	15.0							
Noctiluca	37.2	-	-	-	10.0	23.5	9.1							
Foraminiferans	-	-	-	-	-	-	-							
Bullina	8.5	-	-	-	45.0	5.8	5.8							
Bullivinita	5.8	-	-	-	15.0	11.0	17.3							
Calcarina	41.9	-	-	-	40.0	11.5	5.8							
Cibicides	50.0	-	-	-	-	-	-							
Cornuspira	2.8	-	-	-	-	-	-							
Gymnoloporetta	3.9	-	-	-	-	-	-							
Discorbis	7.7	-	-	-	-	-	-							
Elphidium	50.0	-	-	-	-	-	-							
Globigerina	23.7	-	-	-	-	-	-							
Globorotalia	75.0	-	-	-	-	-	-							
Gyroldina	18.2	-	-	-	-	-	-							
Haverina	44.1	-	-	-	-	-	-							
Lagena	7.7	-	-	-	-	-	-							
Loxostomum	5.7	-	-	-	-	-	-							
Medusaria	60.7	-	-	-	10.0	6.3	34.1							
Monon	2.8	-	-	-	-	-	-							
Mononella	54.5	-	-	-	-	-	-							
Operculina	14.3	-	-	-	-	-	-							
Peneroplis	3.9	-	-	-	-	-	-							
Pleurotomella	2.8	-	-	-	-	-	-							
Pseudolamularia	7.7	-	-	-	-	-	-							
Pygro	63.9	6.7	2.0	10.0	50.0	40.9	16.8							
Quinqueloculina	31.4	-	-	-	5.0	3.1	9.4							
Reseneella	17.7	-	-	-	-	-	-							
Robulus	22.0	-	-	-	-	-	-							
Rotella	22.5	-	-	-	10.0	14.2	5.0							
Soritis	-	-	-	-	-	-	-							

Table V Occurrence of the different food organisms (in per cent) in seven species of Leiognathus from San Miguel Bay (See text).  
(Continuation)

Spiroloculina	39.1	-	2.0	-	35.0	23.5	-
Spirol (Mil)	26.3	-	-	-	65.0	36.7	-
Textularia	65.9	-	-	-	30.0	2.6	-
Triloculina	13.3	-	-	-	-	-	-
Triglerina	11.5	-	-	-	-	-	-
Crustaceans	25.9	3.6	2.0	-	10.0	33.6	90.0
Amphipods	75.0	90.5	90.0	10.0	65.0	57.1	-
Copepods	-	-	-	-	-	8.4	-
Decapods	-	-	-	-	-	-	-
Megalopa	-	-	-	-	-	-	-
Schizopods	-	-	-	-	-	-	-
Lucifer	2.8	3.6	4.0	30.0	10.0	3.1	10.0
Mysis	10.5	10.7	4.0	40.0	-	-	15.0
Nauplius	10.5	3.1	4.0	-	20.0	46.1	-
Ostracods	-	3.6	2.0	-	-	-	-
Zoea	-	-	-	-	-	-	-
Gastropods	61.1	-	-	-	-	5.3	-
Velliger larvae	-	-	-	-	-	-	-
Polyceyods	52.4	-	2.0	-	30.0	32.4	-
Velliger larvae	-	-	-	-	-	2.6	-
Fish larvae	53.9	-	8.0	20.0	25.0	86.3	10.0
Polychaeta	38.0	3.1	-	-	-	6.3	-
Pteropod shell	3.9	-	-	-	-	-	-
Larvae of Holothuridae	51.3	44.7	8.0	-	25.0	25.7	5.0
Unidentified larvae	2.8	6.7	2.0	-	30.9	33.0	32.5
Unidentified Itanus	45.2	37.0	17.0	55.0	95.0	83.7	40.0
Unidentified Itanus	66.7	59.8	22.0	20.0	-	-	-
Eggs of Fish	-	-	-	-	-	-	-
Diatomeles	-	-	-	-	50.0	2.6	-
Acnathes	7.7	17.0	-	-	-	-	-
Biddulphia	2.8	3.1	-	-	-	3.1	20.0
Chaetocera	72.2	33.5	30.0	100.0	90.0	72.2	30.0
Coscinodiscus	-	-	-	-	-	5.3	-
Ditylum	-	-	8.0	30.0	20.0	62.8	35.0
Gyrosigma	59.0	20.1	-	-	-	2.6	-
Melanosira	-	-	6.0	-	15.0	40.8	-
Navicula	65.6	-	2.0	-	-	5.8	-
Nitzschia	15.0	9.8	-	-	5.0	2.6	-
Rhizocolandia	-	-	-	-	5.0	2.6	-
Thalassiosira	7.7	-	-	-	-	-	-
Thalassiothrix	17.1	1.0	14.0	-	-	-	-
Unidentified diatoms	16.2	16.5	2.0	-	5.0	21.5	-
Unidentified filamentous algae and Oscillatoria	-	-	52.0	100.0	-	-	90.0
Unidentified filamentous algae and Oscillatoria	48.6	3.1	-	-	25.0	25.7	-