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Diel diet and feeding behavior of scaldfish (*Arnoglossus laterna* Walbaum, 1972) in the Bay of Mersin

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The diel diet composition and feeding behavior of Arnoglossus laterna *WALBAUM, 1792 collected from Tirtar in the Bay of Mersin have been studied and found that they are diurnal and continuous feeders. Crustaceans formed the main prey, followed by teleostean fishes, polychaetes, nematods and mollusks.*

INTRODUCTION

Remarkably, few investigations are present on the food items and the diurnal feeding behavior of the scaldfish (*Arnoglossus laterna* WALBAUM, 1792). Hence, special attention was given to these topics in the Northern Cilician Basin (Fig. 1).

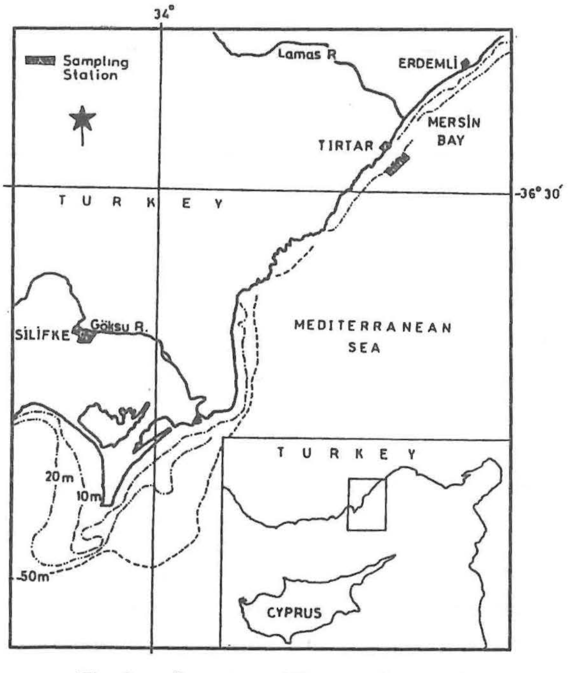

Fig. 1. Location of the sampling station

Few studies concerning different aspects of scaldfish biology were carried out. For example DANIEL (1983) studied the reproductive biology of the flatfishes, including *A. laterna*, *A. thori* and *A. imperialis*. MENGI (1971) compared morphometry of *A. laterna* and *A. macrostoma* to separate identical forms along the Turkish coasts and found that there are two populations of *A. laterna* inhabiting the Sea of Marmara and the middle Aegean Sea. AVSAR *et al.* (1988) studied the morphometric separation of scaldfish stocks in the Gulf of Mersin, and demonstrated that there are three different stocks of *A. laterna* in the Mersin Bay. Among them, the stock of Tirtar formed the main group, while the other two stocks showed much heterogeneity. DE GROOT (1971) studied the interrelationship between the morphology of the alimentary track, the type of food, the feeding behavior and especially diurnal nourishment in flatfishes. He identified scaldfish obtained from North Sea mostly as crustacean feeders and reported that scaldfish predate also on small fish. Similary GIBSON and EZZI (1980) studied the biology of the scaldfish from the west coast of Scotland. They stated that this carnivorous species predates also on small bottom invertebrates; mainly Decapoda, Mysidacea and Polychaeta.

Scaldfish commonly inhabits sandy and muddy bottoms at depths between 10 and 200 m (NIELSEN, 1973) and spawns between March and November in the Mediterranean (TORTONESE, 1975). According to DANIEL (1975; 1983), eight species of the genus *Arnoglossus* are common in the Mediterranean Sea. During quantitative fishing carried out by the IMS-METU (Institute of Marine Sciences of the Middle East Technical University) between 1980-1984 mostly *A. laterna* was caught in the Mersin Bay. This fish grows to a maximum of 19 cm (FISHER, 1973) in the Mediterranean water system. BINGEL (1987) found that the hypothetical maximum length of scaldfish is (L_{∞}) = 15 cm in the study region (Fig. 1). However, it is generally caught at the lengths of 6 to 10 cm. Scaldfish currently has no economic importance in the Gulf of Mersin, where it formed from 3% to 7% of the main catch between 1980-1984. It can be depicted that the scaldfish in the Gulf of Mersin will have considerable economic importance in the future for commercial fishery (BINGEL, 1981).

MATERIAL AND METHODS

The material of this study was collected from Tirtar region in the Northern Cilician Basin (Turkish coast) during a 24h survey on August 8-9, 1985 by a trawler equipped with bottom net. The cod-end mesh size of the net was 28 mm in stretched form. Samples were taken at every one hour over a 24h period starting at $12^{\underline{08}}$ and ending at $11^{\underline{22}}$ the next day. During this period only two samples (the hauls of $24^{\underline{00}}$ and $02^{\underline{00}}$) couldn't be performed. Sampling site was under influence of Lamas Stream and was about 60 m deep (Fig. 1).

Fish hauled on board was washed out by sea water from the mud and other organic and inorganic particles and sorted into species. The total of scaldfish material of each haul was immediately transferred into separate plastic jars of 5 liters and preserved in 10% neutralized formalin as recommended by DE GROOT, 1971 and RICHARD *et al.*, 1980. The supplementary pieces of information (haul number, depth and time etc.) were recorded.

In order to preclude any bias, all samples were treated as soon as possible in the laboratory. The total of 296 specimens were analyzed. Total length was measured in centimetric scale by lying the fish on the blind side and measured to the nearest lower cm groups. Sex and maturity in larger individuals were macroscopically performed as indicated by HOLDEN and RAITT (1974), whereas those of the smaller specimens microscopically, since their gonads were newly ripening.

Small fishes were regarded as immatures. The length of immature males and females was generally between 6 and 7 cm and rarely reached a minimum of 5 cm and a maximum of 8 cm. Based on the ideas of JONES and GEEN (1977) and GAULD (1979) the length interval was divided into three major categories including immature (5-7 cm), maturing (8 cm) and mature (>= 9 cm) individuals respectively. All analysis were performed by using the totals of each length and sex groups, and their size distribution was given in Table 1.

Table 1. Sample size distribution in the length and sex groups which are classified according to the state of maturation

Length Group		Sample Size (n)		
		Male	Female	Total
Immature	(5-7 cm)	49	52	101
Maturing	(8 cm)	36	44	80
Mature	(>= 9 cm)	46	69	115
Total		131	165	296

Additionally, the stomachs which were found empty, were recorded. Furthermore to obtain a smoother data base, each of these categories was grouped into eight equal time periods as given in Table 2.

Each fish was mopped on paper towels and was weighed on an electronic balance, which was sensitive to 0.01 gr. Stomachs of the preserved fishes were taken after slitting the gut cavity from anterior side of anus to posterior side of pelvic fin. The wet weight of full sto-

Table 2. Sample frequency, number of fish caught for each tow and periodical groups of data set

Hours	Sampling time	Sampled fish in number	Grouped day hours and name	
01^{00}	01^{01} - 01^{16}	5		
02^{00}	-	-		
03^{00}	03^{02} - 03^{17}	11	03^{00} - 04^{00}	(Period between midnight & dawn)
04^{00}	04^{00} - 04^{15}	12		
05^{00}	04^{58} - 05^{13}	15		
06^{00}	06^{10} - 06^{35}	9	05^{00} - 07^{00}	(Dawn)
07^{00}	07^{18} - 07^{38}	4		
08^{00}	08^{01} - 08^{16}	7		
09^{00}	09^{05} - 09^{20}	11	08^{00} - 10^{00}	(Midmorning)
10^{00}	10^{00} - 10^{20}	13		
11^{00}	11^{07} - 11^{22}	10		
12^{00}	12^{08} - 12^{30}	17	11^{00} - 13^{00}	(Noon)
13^{00}	13^{12} - 13^{22}	19		
14^{00}	14^{03} - 14^{23}	23		
15^{00}	15^{05} - 15^{25}	8	14^{00} - 16^{00}	(Midafternoon)
16^{00}	16^{01} - 16^{21}	16		
17^{00}	16^{58} - 17^{18}	16		
18^{00}	18^{03} - 18^{23}	8	17^{00} - 19^{00}	(Dusk)
19^{00}	18^{58} - 19^{18}	26		
20^{00}	20^{08} - 20^{28}	16		
21^{00}	21^{08} - 21^{23}	20	20^{00} - 22^{00}	(Period between dusk & midnight)
22^{00}	22^{05} - 22^{20}	14		
23^{00}	23^{02} - 23^{17}	16		
24^{00}	-	-	23^{00} - 01^{00}	(Midnight)

machs was determined after damp dry on bibulous paper. Later, stomach contents were emptied into a petri dish. Then wet weights of emptied stomachs were determined similary. Large prey items were sorted by macroscopic examination whereas those of the small and partly digested specimens were identified and counted using binocular-dissecting microscope. Both large prey items and small dietary constituents were routinely identified to the lowest taxon as far as possible (Table 3).

Index of Nutrition (I.N.%) and Coefficient of Vacancy (C.V.%) were used for the assessment of feeding intensity and feeding time respectively (FOCARDI *et al.*, 1980):

$$\text{Index of Nutrition (I.N.\%)} = 100 * \frac{\Sigma sw}{\Sigma bw}$$

Where:

Σsw: Total weight of stomach contents

Σbw: Total weight of fishes examined

Table 3. Food item frequency distribution and sample size based on the numerical occurrence in the grouped day hours (1: Noon, 2: Midafternoon, 3: Dusk, 4: $20^{\underline{00}}$ - $22^{\underline{00}}$, 5: Midnight, 6: $03^{\underline{00}}$ - $04^{\underline{00}}$, 7: Dawn and 8: Midmorning)

	Grouped day hours							
Diet list	1	2	3	4	5	6	7	8
CRUSTACEA								
Decapoda	28	15	24	9	3	-	4	15
(Reptantia)	(10)	(6)	(11)	(6)	(3)	-	(3)	(8)
(Natantia)	(18)	(9)	(13)	(3)	-	-	(1)	(7)
Amphipoda	50	63	30	10	1	1	6	21
Mysidacea	1	-	-	-	-	-	-	5
Euphasiacea	6	2	-	-	-	-	-	2
Copepoda	2	-	-	-	-	-	-	-
POLYCHAETA	3	6	2	4	-	-	-	-
NEMATODA	1	1	1	-	-	-	-	2
MOLLUSKS								
Gastropoda								
Murex turunculus	-	-	2	-	-	-	-	-
Bivalvia	-	-	-	-	-	-	1	-
FISH								
Gobius sp.	-	1	-	-	-	-	1	-
Trigla sp.	-	-	-	-	-	1	-	-
Apogon nigripinnis	-	1	-	-	-	-	-	-
Blennius ocellaris	-	9	-	-	-	-	-	-
Unidentified fish	1	3	1	1	-	-	2	-
UNIDENTIFIED ITEM	3	19	7	3	1	-	-	1
TOTAL PREY	95	120	67	27	5	2	14	46

$$\text{Coefficient of Vacancy (C.V.\%)} = 100 * \frac{\Sigma es}{\Sigma s}$$

Where:

Σes: Total number of empty stomachs

Σs: Total number of stomachs including empty ones

The main food items were calculated using the dominance method. Using this method, the number of fishes which contain the target prey categories was expressed as the percentage of total number of fish (HYSLOP, 1980):

$$\text{Dominance (D\%)} = 100 * \frac{s_i}{\Sigma s}$$

Where:

s_i: The number of stomachs which contain ith prey category

Σs: Total number of stomachs including empty ones

The frequency of occurrence was used for an estimation of proportion of the scaldfish that feeds on a particular food item (HOLDEN and RAITT, 1974; WINDELL and BOWEN, 1978):

$$\text{Frequency of Occurrence (F.O.\%)} = 100 * \frac{f_i}{\Sigma f}$$

Where:

f_i: Frequency of ith prey category

Σf: Total frequency of all prey categories

The numerical occurrence was performed for the estimation of the relative abundance of a particular food item in the diet (HOLDEN and RAITT, 1974):

$$\text{Numerical Occurrence (N.O.\%)} = 100 * \frac{n_i}{\Sigma n}$$

Where:

n_i: The number of ith prey category

Σn: Total number of all prey categories

For an estimation of similarity among eight periodical day hours in sexes and length groups, the similarity coefficient of SANDERS was tested. It was calculated summing the smaller percentage of those food item present in both meals.

RESULTS AND DISCUSSION

Feeding intensity of sexes

The intensive feeding of males started at dawn and reached its maximum value at midmorning, continued more or less during midday and midafternoon. Afterward, the food intake was decreased through dusk and reduced abruptly to a minimum at 20^{00} - 22^{00} (Figs. 2a and 2c). Then it is increased slightly relative to that minimum towards midnight till 03^{00} - 04^{00} (Figs. 2a and 2c). The feeding intensity at night was much smaller than that at day time.

Females stopped feeding at 03^{00} - 04^{00} and started again at dawn (Figs. 2a and 2c). Later, the feeding intensity of females increased with time till noon, reaching a maximum value between noon and midafternoon. After midday (noon and midafternoon), the feeding intensity of females showed a decreasing trend till 03^{00} - 04^{00}.

The time periods of intensive feeding was midmorning for males and midafternoon for females. The minimum feeding takes place within the time periods of 17^{00} - 19^{00} to 05^{00} - 07^{00} for both sexes, which shows the time gap for minimum nutrition of both sexes is approximately 11h (Figs 2a and 2c). The maximum feeding of the females continued more or less 6h from midmorning to midafternoon, while it was continued for 2h for males from midmorning to midafternoon. On the other hand, the feeding in males and females occurred during day time, started by dawn, showed increasing trend till around noon and decreased abruptly till dusk and continued for male till 20^{00} - 22^{00} and for female till 03^{00} - 04^{00} (Figs. 2a and 2c). These feeding characteristics indicate that feeding intensity is positively influenced by illumination. The intensive feeding of males began after 03^{00} - 04^{00}, while that of females took place

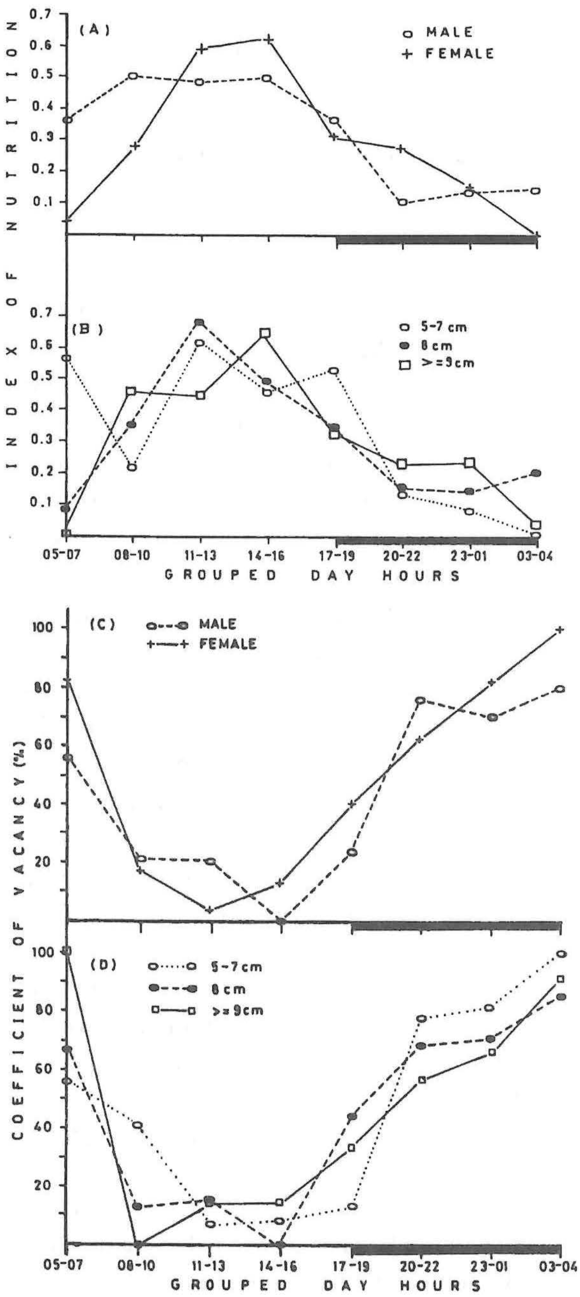

Fig. 2. Variations in the index of nutrition and Coefficient of Vacancy with Sex (A and C) and in different length groups (B and D) of *A. laterna* in the grouped day hours respectively

almost 2h later than that of males (Figs. 2a and 2c). This may be an indication that feeding intensity seems to be reduced by night. However, the appearance of a weak feeding at night period indicates that they have some characteristics of non-visual night feeding (DE GROOT, 1971).

Feeding intensity of length groups

Feeding activity of immature specimens stopped at 03^{00} - 04^{00} (Fig. 2b) which is evident by the empty stomachs (Fig. 2d). Then, the feeding started before dawn and after approximately 2.5h, reached nearly maximum value at dawn and decreased to the minimum value of the day period and midmorning. They started feeding again from midmorning to noon when the maximum feeding was reached throughout 24h. Food intake decreased again from noon to midafternoon and started increasing again in midafternoon till dusk, then decreased continuously towards 03^{00} - 04^{00} o'clock.

Maturing individuals started feeding after dawn and continued in midmorning till noon (Fig. 2b). The maximum feeding activity was observed at noon also for immatures (Figs. 2b and 2d). After noon, the feeding was continuously decreased from midafternoon to 20^{00} - 22^{00}, but remained stable from 20^{00} - 22^{00} to midnight. They showed a small feeding activity from midnight to 03^{00} - 04^{00} o'clock and decreased again till dawn. Then, it can be said that, a little feeding was performed by maturing individuals during the night period.

The feeding activity stopped by matures at dawn and followed by an intensive feeding after dawn to midmorning (Figs. 2b and 2d). They showed more or less stable feeding till noon and reached to their maximum value at midafternoon, and started to decrease continuously till 20^{00} - 22^{00}. Stable feeding was observed during the time period of 20^{00} - 22^{00} and midnight, then decreased again from midnight to 03^{00} - 04^{00}.

Scaldfishes showed characteristically continuous feeding for approximately 15h during the day time (Figs. 2a, 2b, 2c and 2d). However, there were some fluctuations in the feeding intensity throughout this feeding period. This may be related to the variations of the prey availability in the feeding ground and variations of the proportion of each length group in the population at each particular sampling period. The fluctuations showed by immatures can be caused by the fact that they can consume smaller preys, because their mouth gap is smaller (CAILLIET, 1977), and these small preys, e.g. copepods, amphipods, mysids, are probably digested much more rapidly than the larger ones. Maturing fishes showed a feeding activity at $03^{\underline{00}}$ - $04^{\underline{00}}$ o'clock, but its magnitude was much smaller than that of noon. Mature fishes showed much stable feeding activity in comparison with the other groups, and, as maturings, they have two distinct feeding periods. One of them was from midmorning to noon, the other (which had a smaller magnitude than that of day) was at night between the time intervals of $20^{\underline{00}}$ - $22^{\underline{00}}$ and midnight.

Briefly, it can be said that there is a parallelism between the feeding behavior of the different sexes and the different length groups of (immature, maturing and mature) scaldfishes during the 24h day period (Figs. 2a, 2b, 2c and 2d).

Main food item in sexes

Main prey of the males were crustaceans from midmorning to midnight (Figs. 3a, 4a and 5a) and made more than 50% of the diet in terms of the number of prey eaten during the day and reached 100% at midnight (Fig. 4a). There was no male feeding on fish at midmorning and midnight while, more or less, half of

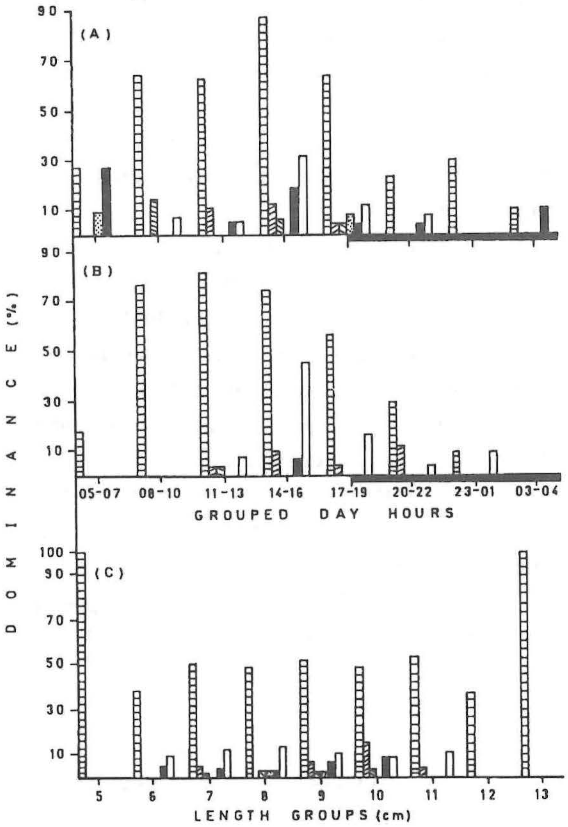

Fig. 3. Periodical variations in the food items of different sexes (A: MALE - B: FEMALE) and variations in the length groups of the food items in the stomach contents of *A. laterna* based on (%) Dominance (C).

: Crustacea, : Polychaeta, : Nematoda, : Mollusks, : Fish, and : Unidentified sp.

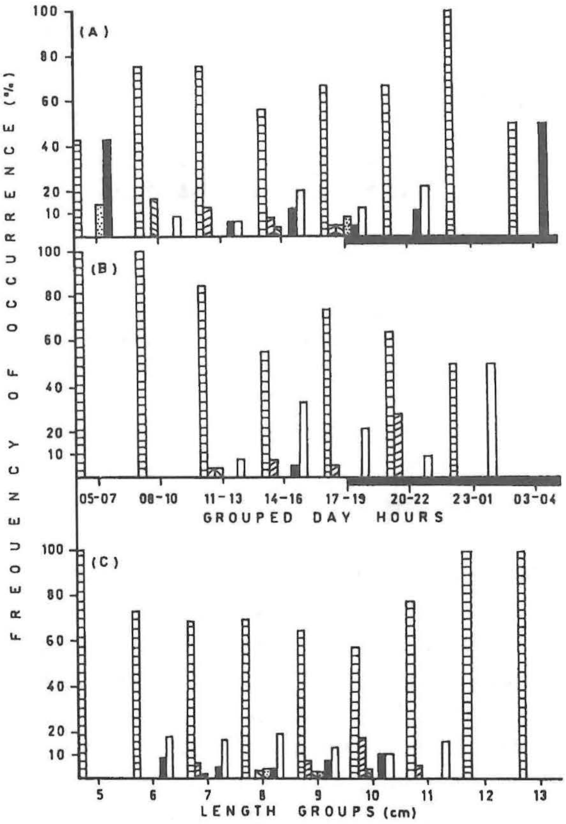

Fig. 4. Periodical variations in the food items of different sexes (A: MALE - B: FEMALE) and variations in the length groups of the food items in the stomach contents of *A. laterna* based on (%) Frequency of Occurrence (C).

: Crustacea, : Polychaeta, : Nematoda, : Mollusks, : Fish, and : Unidentified sp.

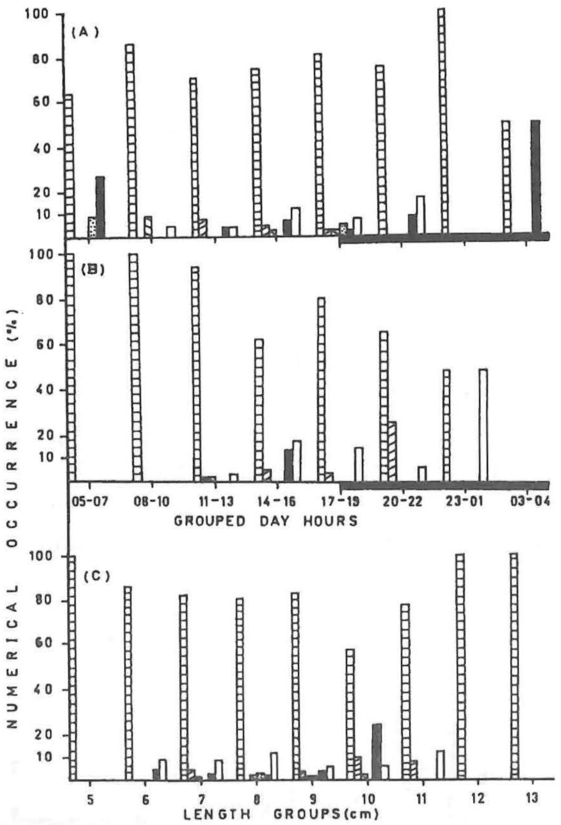

Fig. 5. Periodical variations in the food items of different sexes (A: MALE - B: FEMALE) and variations in the length groups of the food items in the stomach contents of *A. laterna* based on (%) Numerical Occurrence (C).

: Crustacea, : Polychaeta,
: Nematoda, : Mollusks,
: Fish, and : Unidentified sp.

them feeds mainly on both crustaceans and fishes at the time intervals between 03^{00} - 04^{00} and dawn respectively (Fig. 4a). The proportion of males that feed on crustaceans showed some fluctuations by increasing from dawn to midmorning and reaching a relative stability at noon, decreasing from noon to midafternoon and increasing again at dusk and later was stable at the time of 20^{00} - 22^{00}. The secondary important preys were nematods in midmorning, polychaetes at noon and fishes in midafternoon. At dawn and dusk, mollusks were the main food item followed by crustaceans (Figs. 3a and 4a) and polychaetes at noon. The proportion of males consuming nematods decreased from midmorning (15%) to dusk (4%). Unidentified prey of males were observed frequently during the day and the variety of food items was poor at night. It may be depicted that the males derive their food from the five following groups of prey (given in descending order of importance): crustaceans, fishes, polychaetes, nematods and mollusks.

In females, crustaceans were the main prey during the 24h feeding period (Fig. 3b) except the time between 03^{00} - 04^{00} o'clock when all stomachs of females were empty (Figs. 2c, 3b and 4b). The feeding of females at dawn and midmorning was based on crustaceans only. The variety of their prey increased between noon and midnight (Fig. 4b). In midafternoon and dusk, the polychaetes form the secondary important food item of females and together with nematods at noon. Fishes were observed in females' stomach contents only in midafternoon (Fig. 4b). Therefore, the main food constituents of females may be given in descending order of importance: crustaceans, polychaetes, nematods and fishes.

It was observed that both the variety and the number of prey eaten by males reach their maximum at midafternoon and dusk (Figs. 3a and 5a), whereas the same maximum for females was reached at noon and midafternoon (Figs. 3b and 5b). These results seem to confirm those found by DE GROOT (1971) and GIBSON and EZZI (1980) for scaldfishes from the North Sea and west coast of Scotland respectively. They identified this species as a visual day-feeder (DE GROOT, 1971) and a day active predator (GIBSON and EZZI, 1980).

Main food item in length groups

Again crustaceans were expectantly the main prey for all length groups (Figs. 3c, 4c and 5c). In fact, it is clearly shown that 100% of smallest (5 cm) and longest fishes (>= 12 cm), fed on crustaceans (Figs. 3c, 4c and 5c). The variety of prey increased with increasing length up to 9 cm, and inverse relation was observed for the longer length groups. Polychaetes were the another prey group for mature (>= 9 cm) and immature (5-7 cm) individuals, while the rest (nematods, molllusks and fishes) were preffered usually by maturing fishes (= 8 cm). Fishes were found to be a secondary food category in small length groups of immature individuals (5-7 cm) and polychaetes were replaced with fishes with increasing length of immatures. Polychaetes, together with fishes, were the secondary food in smaller mature fishes. Individuals feeding on fish, polychaeta, nematoda and mollusks were concentrated at a moderate length group of 6 to 10 cm (Figs. 3c, 4c and 5c).

Finally, as shown in Figs. 2a, 2b, 2c and 2d, scaldfishes are diurnal feeders and their main prey are crustaceans (Figs. 3a, 3b and 3c, table 3). The walking forms of crustaceans (*Reptantia*, *Amphipoda*, harpacticoid copepods and mysids) show a slow horizontal movement, while diurnal vertical migratory movements are conducted by swimming ones (*Natantia*, *Euphausiacea*) (Barnes, 1968). A few hours before sunset the swimming forms begin to move upward from the bottom to the surface and around midnight they descend to the bottom (Barnes, 1968). In the present study, the swimming forms consisting 19% of the identified crustaceans in number (Table 3), may have no effect on diurnal feeding of scaldfishes. Therefore, crustaceans, especially the walking forms, could be the main prey of *Arnoglossus laterna* (Figs. 3a, 3b and 3c). The variety of food items in all length groups and both sexes of scaldfishes was higher and fed more during the day period as compared to night period. This supports that they feed on their prey by detecting visually as depicted earlier by de Groot (1971) and Gibson and Ezzi (1980).

Relative abundance of prey in sexes

Crustaceans were the most abundant prey in the diet of males in all the time periods, except 03^{00} - 04^{00} (Fig. 5a). The dominance of crustaceans was over 60% in Numerical Occurrence (N.O.%) and showed a smooth distribution during the day-night periods as a favorite food of males. The abundance of the teleostean fishes found together with crustaceans in the stomach contents of males was maximum at 03^{00} - 04^{00} while they decreased abruptly by sunrise and constituted the second fraction of the diet in terms of N.O.% at dawn (Fig. 5a). In midmorning and midnight, there were no fish while they represented the 3rd group and rose to the second group in terms of abundance at noon and midafternoon, respectively. While in dusk, fishes were the 3rd group althogether with polychaetes and nematods, increased again to the second order at 20^{00} - 22^{00} (Fig. 5a). Nematods and polychaetes were the next abundant food items after crustaceans in midmorning and at noon. Mollusks represented the second and the 3rd group in the diet and were observed in stomach contents only at dusk and dawn when they are easily detected visually due to their largeness.

Crustaceans were the most abundant prey in the stomach contents of females and their abundance decreased slightly from dawn-midmorning to midnight, but showed a fluctuation in midafternoon which may be related with the relatively higher values of N.O.% at the previous period in comparison with males (i.e. they are much more satisfied) (Figs. 5a and 5b). Only crustaceans were observed in the stomachs of females at dawn and midmorning. The increasing variety of prey began at noon. Polychaetes and nematods formed the second abundant food groups. Fishes and polychaetes were the next prey in the stomach content of females during midafternoon, dusk and at 20^{00} - 22^{00} (Fig. 5b). However, the relative abundance of combined items (polychaetes, nematods and fishes) was two times smaller than that of crustaceans.

Relative abundance of prey in length groups

The abundance of crustaceans was high in the diet of all length groups and they were observed as an unique prey in stomachs of 5 cm and 12-13 cm length groups (Fig. 5c). The abundance of crustaceans decreased slightly with length increasing from 5 to 7 cm (immatures) and then to 8 cm (maturing). Later, it showed a decreasing trend in smaller length groups of mature fish (>= 9 cm) and continued increasing in fishes larger than 10 cm.

In immatures, there was no 2nd abundant prey in 5 cm length group while the fishes and polychaetes were the next in 6 and 7 cm, respectively (Fig. 5c). Mollusks constituted the second rank after crustaceans and were more abundant in the diet of maturing (8 cm) individuals than fishes and nematods. In small length group of matures (9 cm), both teleostean fishes and polychaetes had a secondary importance. Fishes were more abundant than polychaetes in 10 cm length group while there was no fish in the diet of larger individuals and polychaetes formed the second item in the diet of 11 cm length group.

Crustaceans were the most abundant prey in the diet of scaldfishes and formed a considerable portion of main catch in the region (BINGEL, 1987). Small teleostean fishes made the second abundant prey in the diet due to their slow motion capacity and visibility, which characteristics attract scaldfishes. These were also invoked by HOLMES (quoted in GIBSON and EZZI, 1980).

Meal similarity in sexes

Highest similarity was observed (0.83) between the food contents taken at dusk and noon of males (Table 4a). The similarities between the meals at the grouped day hours increased generally from noon to dusk and decreased from dusk to midnight, and also it increased again from midnight to midmorning. Low similarities obtained between the meals of midnight, $03^{\underline{00}}$ - $04^{\underline{00}}$ and the other grouped day hours are obviously related to the lower variety of prey of males which is caused by the decreased feeding intensity in the first two periods (Fig. 3a and Table 4a).

Similar fluctuations were observed in females but the magnitude of similarities were generally smaller than those of males (Table 4a), indicating that males usually feed on relatively uniform prey types.

Maximum similarities obtained between the day meals of both sexes showed that variety and the number of prey are more or less the same in the day period. The similarities between the meals of night and day periods were obtained at a moderate level except that of $03^{\underline{00}}$ - $04^{\underline{00}}$ (Table 4a). The food intake of males and females was decreased during the night and fully stopped by females between $03^{\underline{00}}$ - $04^{\underline{00}}$ (Fig. 2a) resulting a zero (0) similarity value. Both males and females fed on different prey at midnight, e.g. decapods and amphipods respectively, so that their midnight meals were totally dissimilar.

Meal similarity in length groups

All the meals of immatures were similar at the level of 0.50 - 0.75 during the 24h feeding period except $03^{\underline{00}}$ - $04^{\underline{00}}$ at which the stomachs were empty (Table 4b and Fig. 2d). The similarities between the meals from dawn to dusk and from $20^{\underline{00}}$ - $22^{\underline{00}}$ to dawn were found at the level of 0.50 to 0.75 and 0.00 to 0.50 respectively. The low similarities obtained among the meals of dark period should be due to the fluctuations in feeding of maturing scaldfishes (Fig. 2b) and may depend on the availability, the size, shape (NIKOLSKII, 1969) and visibility (DE GROOT, 1971) of their prey such as mollusks and fishes (Fig. 3c). The similarities within the meals of matures during the dark period were observed at the range of 0.05 to 0.12 or zero (0) (Table 4c). This may possibly rise from the fact that either the midnight meal consists of less specimens or feeding is stopped at $03^{\underline{00}}$ - $04^{\underline{00}}$ and dawn (Fig. 2b). The similarities among the meals of matures during the day period (from midmorning to dusk), showed similar characteristics to that of maturings, where the variety and number of prey were similar at the value of 0.50 - 0.75 (Table 4d). These high similarities within the meals of maturing and mature fishes during the day may also be related to the coincidence of maturing and mature individuals during the reproduction period (NIKÒLSKII, 1963). Zero similarity values obtained in Tables 4b, 4c and 4d demonstrate that no food is being eaten in related time periods (Fig. 2d). Comparison of the paired length groups (5-7 cm - 8 cm, 5-7 cm - 9 cm and 8 cm - 9 cm) reveal that much of the similarity was observed among the food items taken during the day period (>0.50) rather than the night period (<0.50).

(A)		MALE								FEMALE							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	1	100															
	2	72	100														
	3	83	71	100													
	4	60	61	68	100												
	5	11	5	17	33	100											
	6	48	50	45	33	0	100										
	7	60	53	65	68	18	36	100									
MALE	8	69	59	74	64	18	41	64	100								
FEMALE	1	87	72	80	55	10	50	56	71	100							
	2	73	76	69	64	5	47	52	61	67	100						
	3	81	71	89	74	16	44	61	71	78	77	100					
	4	76	63	76	62	13	40	59	67	68	65	77	100				
	5	52	62	52	50	0	50	36	45	53	65	60	47	100			
	6	0	0	0	0	0	0	0	0	0	0	0	0	0	100		
	7	59	67	62	67	33	50	55	59	65	52	60	53	50	0	100	
	8	82	62	81	58	17	50	62	79	85	62	80	67	50	0	67	100

(B)		MALE 5-7 cm								FEMALE 8 cm							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	1	100															
	2	72	100														
	3	67	69	100													
	4	60	65	50	100												
	5	55	55	50	72	100											
	6	0	0	0	0	0	100										
	7	55	57	60	60	60	0	100									
5-7 cm	8	64	72	56	68	63	0	59	100								
8 cm	1	73	70	75	65	65	0	70	69	100							
	2	70	89	79	66	60	0	64	72	76	100						
	3	65	72	64	64	64	0	69	75	74	78	100					
	4	68	70	88	43	43	0	50	49	68	74	57	100				
	5	5	5	13	22	50	0	20	13	20	10	14	0	100			
	6	52	61	38	56	50	0	40	63	45	55	50	43	0	100		
	7	55	55	50	72	75	0	60	63	65	60	64	43	25	50	100	
	8	80	69	72	64	59	0	59	76	69	74	73	70	9	55	59	100

Table 4. Similarity coefficients of SANDERS among 8 periodical day hours in sexes (A) and in length groups (B, C and D). Periodical day hour numbers are shown at the margins of the half matrix as: 1 = noon, 2 = midafternoon, 3 = dusk, 4 = 20^{00} - 22^{00}, 5 = midnight, 6 = 03^{00} - 04^{00}, 7 = dawn and 8 = midmorning

CONCLUSIONS

It was observed that the feeding of both sexes and all length groups occurred during the day time, and hence it can be clearly said that the scaldfishes are continuous diurnal feeders.

Their diet consists of the crustaceans (Decapoda, Amphipoda, Mysidacea, Euphausiacea and Copepoda), small demersal teleostean fishes, polychaetes, nematods and rarely mollusks.

The crustaceans can be defined as the primary foods, while the small demersal teleostean fishes and polychaetes are the secondary food. The mollusks and nematods can be considered relatively unimportant prey groups, but this classification can be changed, except the position of the crustaceans, by the seasonal variations in the distribution of the preys. Since the present study is based on a single sampling, further generalization cannot be done.

The results obtained from the similarity analysis of diet showed that as a general tendency there is no difference between the sexes and the length groups during day time, whereas the composition of night and day time viewed an obvious dissimilarity. This supports the previous conclusion that states that scaldfishes are diurnal feeders. Besides these, it should be indicated that the similarity values between the sexes and length groups are slightly different in the order of magnitude which can be explained by the size differences of scaldfish in length groups and both sexes as well.

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Dnevni režim prehrane i ishrana (*Arnoglossus laterna* Walbaum, 1972) iz zaljeva Mersin

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KRATKI SADRŽAJ

Izučavani su sastav hrane i ishrana vrste *Arnoglossus laterna* WALBAUM, 1972 iz predjela Tirtar u zaljevu Mersin.

Ustanovljeno je da se oba spola ove vrste hrane tijekom dana te se stoga može tvrditi da spadaju među ribu koja se hrani neprekidno.

Hrana koju ova riba uzima sastoji se od rakova (Decapoda, Amphipoda, Mysidacea, Euphausiacea i Copepoda), malih demersalnih koštunjavih riba, poliheta, nematoda i rjeđe školjkaša. Rakovi su ujedno i hrana koju ova vrsta preferira.