FIELD STUDIES ON THE EFFECT OF THE FISHES *OREOCHROMIS NILOTICUS* AND *HAPLOCHROMIS DESFONTAINESI* ON VECTOR SNAILS IN EARTHEN FISH PONDS AND NATURAL HABITAT IN EGYPT

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ABSTRACT

Field studies were conducted at 7 earthen fish ponds (fish hatchery at Al-Abbassa, Sharkia Governorate) used for breeding the fish *Oreochromis niloticus* to survey both vector and non vector snails in fish ponds and to determine the efficiency of fish against snail vectors. The results indicated that snails belonged to eight species, in descending order: *Bellamya unicolor* (51.3%) > *Physa acuta* (25.3%)> *Gabbialla senaariesis* (10.3%)> *Cleopatra bulimoides* (4.9%)> *Bulinus truncatus* (3.3%)> *Lansists carinatus* (1.9%)> *Melanoides tuberculate* (1.9%)> *Lymnaea cailliaudi* (1.1%). Ponds which contained young fish accommodated higher snails diversity than those contained parent fish. Also, stomachs of specimens of *O. niloticus* collected from fish ponds were examined for the purpose of studying their food with emphasis given to vector snails. Results of the index of relative importance (I.R.I.) emphasized the importance of artificial fish food as a major food resource (8090.3) followed by snails (3880) and then insects (382.3). Seasonal variation in the composition of the diet showed that snail shell parts were the major food category in the diet during summer (43%), and reached the lowest level during winter (2%). In contrast, the artificial fish food was recorded as the highest proportion in the diet during winter (58%) decreased remarkably during spring (33%) and summer (35%) but increased again in autumn (56%). In addition, stomachs of the fish specimens of *Haplochromis desfontainesi* and *O. niloticus* collected from Ismailia irrigation canal were examined to investigate the nature of the diet with emphasis given to vector snails. Results of the I.R.I. indicated that snails were the second important food items in the diet of both species. Snails were present in the diet of *H. desfontainesi* in all seasons; however, they exhibited marked seasonal variation in abundance with maximum level during spring. They reached the highest level in the diet of *O. niloticus* also during spring decreased during summer and remained at the same level during autumn until disappeared in winter.

INTRODUCTION

Several fish species are malacophagous, but rigorous observations on their efficiency in field situations are still lacking. Further studies should be encouraged as fish ponds often provide suitable habitats for snail hosts, and they may also act as potential transmission sites in which molluscicides can not be applied because of their toxicity to both snails and fish. Thus biological control is needed to control snail hosts. Some fishes may be of value in the control of snails in fish ponds (McCullough, 1981; Brown and Devries, 1985; MeKaye *et al.*, 1986; Slootweg *et al.*, 1993; Slootweg *et al.,* 1994; Kat and Kibberenge, 1990). Slootweg *et al.* (1994) reviewed the field experiments which were performed in the South of Cameroon, in Kenya and the North of Cameroon. Wild caught *Astatoreochromis alluaudi* fish which have been used in pond trials in the South of Cameroon, showed that snails were effectively controlled, and that *A. alluaudi* could be successfully cultured together with *Oreochromis niloticus*. In a field analysis of food selectivity by carp in Skadar Kake, Yugoslavia, Stein *et al*. (1975) found that carp preferred molluscs that were thin shelled and possessed some appropriate size and shape. According to Brown and Devries (1985) fish predators could act dramatically by altering the population dynamics of a single snail species, although in their search, predation pressure never reach levels where snails were completely eradicated from their environment. On the other hand, before a proper evaluation may be made of the possible efficiency of the control which fish may exert on natural populations of snails quantitative field studies on the food chains of predacious fish must be available. It is also of importance to determine if fish are selective in their choice of molluscan food, or if the availability of a particular species of snail is the determining factor (Slootweg *et al*., 1994).

The present study was designed to survey both vector and non vector snails in fish ponds containing the cichlid fish *Oreochromis niloticus* at Al-Abbassa fish hatchery to evaluate the effect of this fish on the distribution and abundance of snails .Also, study the food composition by examining the stomach contents of this fish inhabiting the earthen fish ponds as well as fishes of *O. niloticus* and *Haplochromis desfontainesi* collected from Ismailia irrigation canal to determine their food and feeding habits with emphasis given to vector snails.

MATERIALS AND METHODS

1. Fish Hatchery at Al-Abbassa

A monthly visit was paid to the fish hatchery at Al- Abbassa, Sharkia governorate between May 1992 and October 1993 to survey possible vector and non vector snails in fish ponds used for nursing and keeping parent fishes and to study the food and feeding habits of *O. niloticus* .

A total of 7 earthen ponds (30 m long x 20 m wide, and a maximum depth of 2.0 m) were surveyed monthly, with an aluminium handle (150 cm long).

Snails were collected from the four edges around each pond. Snails collected from each pond were kept in separate plastic bags and then labeled. At the laboratory, snails were identified to species level (Danish Bilharziasis Laboratory, 1983). Living specimens were kept separately from the dead ones. Monthly variations in number of snails/m^2 from fish ponds were calculated for each specimen collected, the size (width and height) was measured in mm.

Monthly samples of O. *niloticus* inhabiting the earthen ponds of the fish hatchery were collected by gill nets. All captured fish were presented immediately in 10% formalin solution and kept in laboratory for later examination. Fish total length and weight were measured for each individual fish. Then entire digestive tract was removed and preserved in 10% formalin solution until food analysis was performed. Stomachs were cut open and their contents were then transferred into a small divided Petri-dish and diluted by water. Food items were sorted out under binocular microscope (manufactured by Wild, model M3) and identified to the nearest taxonomic group. Food analysis was carried out using the numerical, points of assessment and frequency of occurrence. The number of different identified items were counted and expressed as a percentage of total, representing the numerical method. The fullness of stomach swelling, for each fish, was recorded. The proportion of stomach swelling volume occupied by bolus was estimated and given a number of points out of 30. The points were then divided amongst the different food categories according to their relative bulk, representing the points assessment method. Method of frequency of occurrence was also applied, where the percentage of fishes in which a given prey item was frequent from the total fish examined was calculated (Hyslop, 1980; Windell and Bowen, 1978). Data of the three methods of analyses (N%, P%, and F %) were combined together (to reduce the bias inherent in each method) into the index of relative importance (I.R.I) as follows:

I.R.I = (N%+P %) x F%, (Windell, 1971).

Water temperature, pH, salinity and dissolved oxygen were measured directly by portable pH meter (Model HI 8424, Hana instruments), Salinometer (Model Aqua Lytic) and Dissolved oxygen meter (Model HI 8543, Hana Instruments).

2. Natural Habitat

The objective of this study was to examine the different types of food of the Nile fishes in their natural habitat in order to know to what extent fishes can act as biological control of snail vectors of schistosomiasis.

Ismailia irrigation canal was chosen in the present study as a natural habitat, this is a main canal which received water from the Nile, extending from Cairo to Ismailia. The width of canal is 47 m and the depth is ranged from 2,5-3 m.

Monthly samples of the two cichlid fish species *O. niloticus* and *Haplochromis desfontainesi* were collected by hook lime and Gill nets from Ismailia irrigation canal. Fishes were immediately preserved in 10% formalin solution for examination in the laboratory. Each fish was wet weighed in gm and its total length was determined in cm. Methods of examining food types and feeding habits followed the same procedure described before for fishes collected from Al-Abbassa fish hatchery.

RESULTS AND DISCUSSION

1- Results:

Abundance of snails in fish ponds:

Results indicated that snails collected monthly from earthen fish ponds (seven ponds) containing young and parent fish, *O. niloticus* belonged to eight species (Fig. 1). The abundance of species in descending order was as follows: *Bellamya unicolor* (51.3%) > *Physa acuta* (25.3%)> *Gabbialla senaariesis* (10.3%)> *Cleopatra bulimoides* (4.9%)> *Bulinus truncatus* (3.3%)> *Lansists carinatus* (1.9%)> *Melanoides tuberculate* (1.9%)> *Lymnaea cailliaudi* (1.1%). Ponds which contained young fish accommodated higher snail diversity than those ponds accommodating parent fish. This was also evident in the results of ponds which contained no fish. They accommodated higher number of snails and species than those which contained parent fish. Results in Table (1) showed that in pond 1 which contained only young fish (3-7 cm, total length), the total number of snails during May and June were relatively large being respectively 76.75 and 141.25 snails/meter². When fish were removed from this pond, the total amount of snails had increased. In the months (July- February), the fish pond was stocked with fish, resulted in dramatic decrease in total number of snails ranged from 0.75 in October to 36.25 in August snail/m². The fish pond 2 which contained parent fish during May was snail free. When it was stocked with young fish in June, number of snails was 24.25 snail/ m², such number has increased to double amount from July (50.25 snail/m²) till September (49.75 snail/m²). Fish pond 3 was free from fish in May, during this month; number of snails was remarkably high, with an average of 117.5 snail/m². Once the pond was stocked with large fish in June, number of snails had fallen sharply and remained as such till the end of the survey. In pond (4), snails were remarkably very low in number or completely absent at most months, during which parent fish were stocked in the pond (Table 1). In contrast, pond 5, which contained fry and young fish for most of the year, exhibited different patterns regarding snail diversity, corresponding with fish size. During May, June and July, when fish pond was stocked with young fish, number of snails was 51.0, 24.0 and 55.5 snail/m² respectively. As the fish began to grow, number of snails decreased remarkably, varying from 0.0 to 15.25 snail/m² and when fish removed from the pond the number of snails had increased to 24 snail/m². The amount of snails in pond 6, which contained parent fish was quite small or empty of snails at most months. When the pond emptied of fish in February and October 1993, the number of snails increased, being 35 and 39.5 snail/m² respectively. In pond 7, number of snails was relatively high. In May, June and July 1992, the number of snails varied from 0.0 to 12 snail/m^2, however, when fishes were taken from the pond, number of snails has increased to 23 and 53.0 snail/ m^2 in November and December 1992, (Table 1). When the pond was stocked with fish fry and young fish, their number were 43.25 and 62.5 snails m$^{2\ during}$ May and June 1993. As the fish began to grow in size, number of snails had fallen and reached only 1.5 and 1.75 snail/ m$^{2\ during}$ September and October.

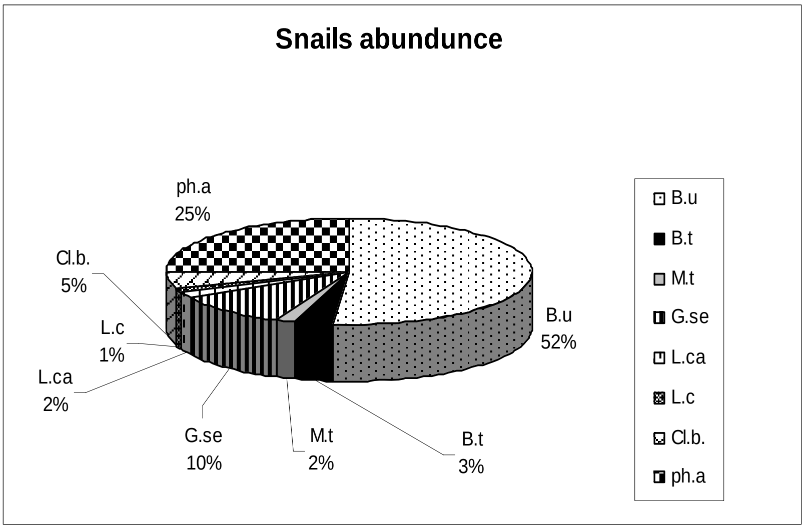


Fig.(1): Percentage of snails collected from fish ponds at Al-Abbassa Fish Hatchery.

B.u. =*Bellamya unicolor* , B.t. = *Bulinus truncatus* , M.t.= *Melanoides tuberculata,* G.se.= *Gabbiella sensariensis,* L.ca.= *Lanistes carinatus,* L.c.= *Lymnea cailliaudi*, Cl.b.= *Cleopatra bulimoids* , Ph.a.= *Physa acuta.*

Table (1): Monthly variation in number of snails/ m^2 from 7 fish ponds at AL-Abbassa fish hatchery.

Months \ Ponds	1	2	3	4	5	6	7
May	76.75	-	117.50	-	51.0	17.5	-
June	141.25	24.25	24.0	-	24.0	3.75	11.5
July	22.0	50.25	20.75	2.75	55.5	02.0	12.0
August	36.25	18.25	0.50	-	-	-	23.50
September	14.00	49.75	01.50	-	15.25	-	-
October	05.75	20.75	0.50	-	1.75	-	12.50
November	14.0	02.25	0.50	5.75	-	-	23.0
December	10.50	26.75	10.25	-	1.25	00.50	53.0
January	10.75	01.25	01.00	-	00.50	02.75	03.0
February	09.0	01.50	09.50	-	-	35.0	0.75
March	48.25	20.0	24.50	3.0	05.0	-	-
April	10.25	07.25	0.25	5.75	0.75	0.50	-
May	45.0	13.75	-	25.75	24.0	-	43.25
June	62.75	04.50	-	05.75	16.50	01.25	62.50
July	29.0	01.50	01.75	8.25	10.50	15.75	03.0
August	11.25	0.25	08.0	-	20.50	03.0	09.0
September	02.0	-	06.25	-	45.0	39.50	01.50
October	00.75	01.25	06.50	-	20.0		1.75

Food and feeding habits of the fish *O. niloticus* inhabiting the fish ponds:

Stomachs of 289 specimens of *O. niloticus* collected from fish ponds at Al-Abbassa Fish Hatchery were examined for the purpose of studying their food and feeding habits with emphasis given to vector snails.

Annual composition of the diet:

A complete list of food items in the stomachs of *O. niloticus* was given in Table (2). Food items included snail shells, artificial fish food, snail soft bodies, insect parts, insect larvae, fish scales, worms, eggs, Cyclops, daphnia, fish, algae and sand particles. Table (2) showed that by the method of point assessment (P%), the dominant food items were the artificial fish food (47.4%), followed by snail shells (25.8%), then insect parts (5.9%), snail soft bodies (4.5%) and then worms (4.1%).

Table (2): Analysis of the diet composition of *Oreochromis niloticus* collected from Al-Abbassa Fish Hatchery by abundance (N %), point assessment (P %) and frequency of occurrence (F %) methods.

Methods / Food items	N%	P%	F%
Snail shells	31.10	25.81	68.18
Artificial fish food	50.70	47.40	82.47
Snail soft body	3.30	4.50	35.71
Insect parts	3.80	5.93	39.29
Insect larvae	0.52	2.51	9.42
Fish scale	0.24	1.86	17.21
Worms	1.70	4.16	11.69
Eggs	0.03	0.05	1.30
Cyclops	2.80	1.82	5.19
Daphnia	1.30	0.82	5.84
Fish	0.01	0.15	0.32
Algae	2.10	2.43	5.19
Sand particles	2.30	2.15	14.61
Unknown	0.10	0.40	3.25

Data expressed as average percentage.

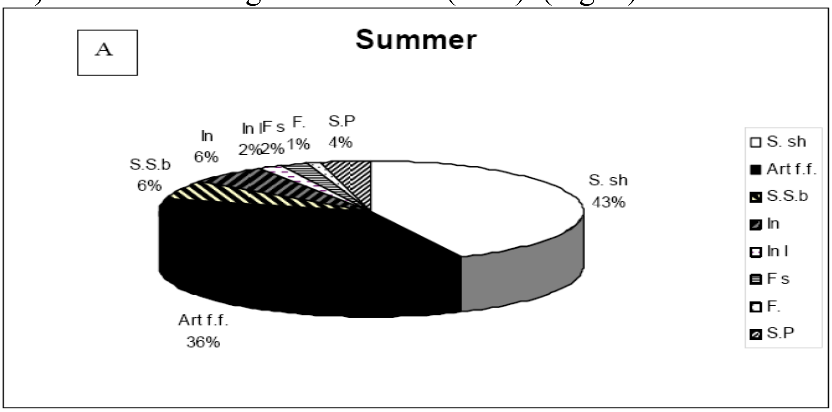
Similarly, numerical method (N %) indicated that the artificial fish food was the main food item (50.7%), followed by snail shells (31.1%) and insect parts (3.8%). The method of frequency of occurrence (F %), however, exhibited another pattern where different food items were present in different frequencies. The major food item in descending orders were the artificial fish food (82.5%)> snail shells (68.2%) > insect parts (39.3%) > snail soft bodies (35.7%). Results of the index of relative importance (Table 3) indicated that the artificial fish food was the major food category (8090.3) followed by snail shell parts as a second food item (3880.1). Insects (382.2) were the 3rd food followed by snail soft bodies (255.1).

Table (3): Index of relative importance (I.R.I.) of different food items of *Oreochromis niloticus from* Al-Abbassa Fish Hatchery.

Food items	Index of relative importance (I.R.I.)
Artificial fish food	8090.31
Snail shells	3880.12
Insects	382.29
Soft bodies of snails	255.14
Worms (polychaeta)	68.50
Sand particles	65.01
Fish scale	36.14
Insect larvae	28.64
Cyclops	23.98
Filamentous algae	23.51
Daphnia	12.38
Unknown	1.63
Eggs	0.10
Fish remains	0.05

Seasonal variation in the diet composition:

The artificial fish food and snail shell parts were the main food items in the diet of the fish *O. niloticus*, however they exhibited marked seasonal variation in abundance. Differences were statistically highly significant. Snail shell parts were the major food category during summer (43%), after which they decreased remarkably during autumn and reached the lowest level during winter (2%). This proportion increased again in spring (18%). In contrast, the artificial fish food was recorded as the highest proportion in the diet during winter (58%) decreased remarkably during spring (33%) and summer (35%) but increased again in autumn (56%). (Fig. 2).



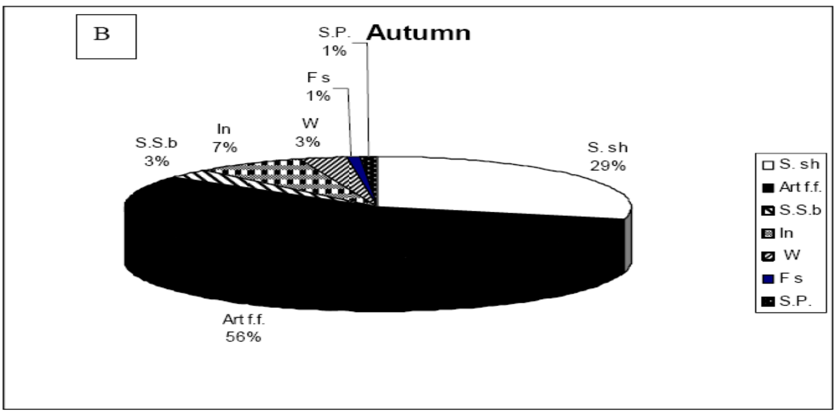
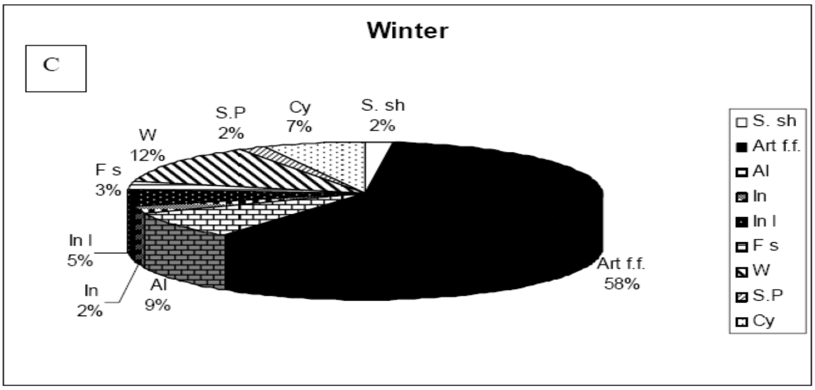


Fig. (2): Variation in the diet composition of *Oreochromis niloticus* from Al-Abbassa Fish Hatchery during Summer (A), Autumn (B), Winter (C) and Spring (D).

(S.sh. :Snail shells, Art. f.f.: Artificial fish food, S.S.b.: snail soft body, In.: Insect, In.l. : Insect larvae, F.S.: Fish scale, F.: Fish, S.P.: sand particals,).



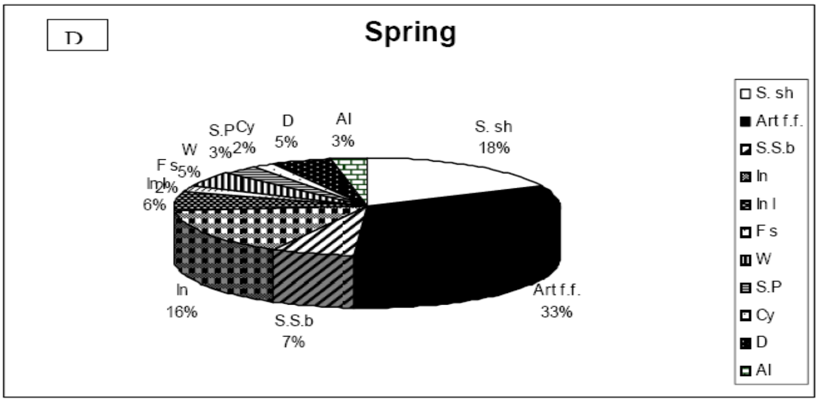


Fig . (2): Continuo.

Water analysis:

Results of the monthly analysis of water from the fish ponds are presented in Table (4).

Natural Habitat:

Annual composition of the diet:

A summary of the food items in the stomachs of *O. niloticus* and *Haplochromis desfontainesi* with a comparison of the different methods of analyses (N%, P%, F %) is presented in Table (5). It is clear that both species consumed a wide range of food items. These included snail shell parts, insect parts, insect larvae, snail soft parts, worms, Cyclops, daphnia, fish scales, eggs, filamentous algae, seeds and sand particles.

Results of the index of relative importance (I.R.I) in Table (6) indicated that the principle food items in *O. niloticus* were: filamentous algae, followed by snail shells and then insects, whereas in *H. desfontainesi* they were insects, shells and worms. Thus, snails are considered the second important fod item in the diet of *O. niloticus* both species from natural habitat.

Table (4): Monthly variation in water quality at Al-Abbassa Fish Hatchery, Sharkia governorate.

Months	Temperature ˚C	pH	Dissolved Oxygen ppm	Salinity ppm
May	29	8.24	6.6	0.35
June	28.8	8.16	9.6	0.30
July	31.2	10.1	9.3	0.30
August	31.5	7	9.5	0.36
September	29.7	6.66	9.3	0.44
October	26.0	6.94	7.2	0.50
November	19.0	7.68	6.6	0.50
December	13.3	7.2	7.6	0.52
January	15.0	6.86	7.4	0.36
February	16.6	6.22	6.6	0.43
March	25.0	6.56	6.5	0.51
April	24.4	6.93	6.3	0.40
May	28.5	7.2	6.6	0.46
June	29.5	7.5	9.3	0.40
July	30.4	8.7	9.3	0.25
August	31.0	6.58	9.6	0.28
September	25.9	8.14	9.3	0.27
October	26.5	6.1	9.3	0.58

Table (5): Analysis of the diet composition of *Haplochromis desfontainesi* and *Oreochromis niloticus* collected from Ismailia Irrigation Canal by abundance (N %), point assessment (P %) and frequency of occurrence (F %) methods.

Fishes	*Haplochromis desfontainesi*			*Oreochromis niloticus*		
Methods / Food items	N%	P%	F%	N%	P%	F%
Snail shells	13.08	10.96	35.97	10.31	11.92	40.48
Insect parts	14.33	17.31	35.97	1.85	6.57	30.95
Insect larvae	14.04	16.41	31.65	17.9	18.17	19.05
Snail soft body	4.3	4.9	10.79	0.04	0.29	4.76
Worms	5.62	25.93	23.74	0.93	5.9	16.67
Cyclops	13.01	7.31	16.55	0.43	1.23	9.52
Daphnia	16.79	5.66	17.27	0.5	0.92	14.29
Fish Scale	1.42	3.50	20.14	0.1	1.53	19.05
Eggs	1.85	1.22	7.19	0.02	0.17	4.76
Algae	11.14	3.24	14.39	66.61	51.28	73.81
Seeds	0.02	0.1	1.44	0.40	1.01	2.38
Sand particles	2.83	2.62	5.76	0.11	0.29	4.76
Unknown	1.57	0.84	3.60	0.8	0.72	7.14

Data expressed as an average percentage.

Table (6): Index of relative importance (I.R.I.) of different food items of *Haplochromis desfontainesi* and *Oreochromis niloticus* collected from Ismailia Irrigation Canal.

Food items	*Haplochromis desfontainesi*	*Oreochromis niloticus*
Insect parts	1138.09	260.60
Insect larvae	9963.74	687.13
Snail shells	864.72	899.87
Worms	748.10	113.86
Daphnia	387.71	20.29
Cyclops	336.30	15.80
Algae	206.93	8701.46
Snail soft body	99.27	1.57
Fish Scale	99.09	31.05
Sand particles	31.39	1.90
Eggs	22.07	0.90
Unknown	8.68	10.85
Seeds	0.17	3.36

Seasonal variation in the diet composition:

Results in Fig. (3) and (4) showed that during winter, filmentous algae were the main food category by point assessment in the diet of *O. niloticus* (44.05%). In contrast it represented in the diet of *H. desfontainesi* by only 0.87%. Snail shell parts and snail soft bodies contributed in the diet of *H. desfontainesi* by 12.6% and 3.5% respectively, however they were not present in the diet of *O. niloticus* in winter. During spring, snail shell parts represented by 30.18% and 12.42% in the diet of and *H. desfontainesi* respectively. Filamentous algae and insect larvae contributed in the diet of *O. niloticus* by 25.38% and 31.71% , respectively.

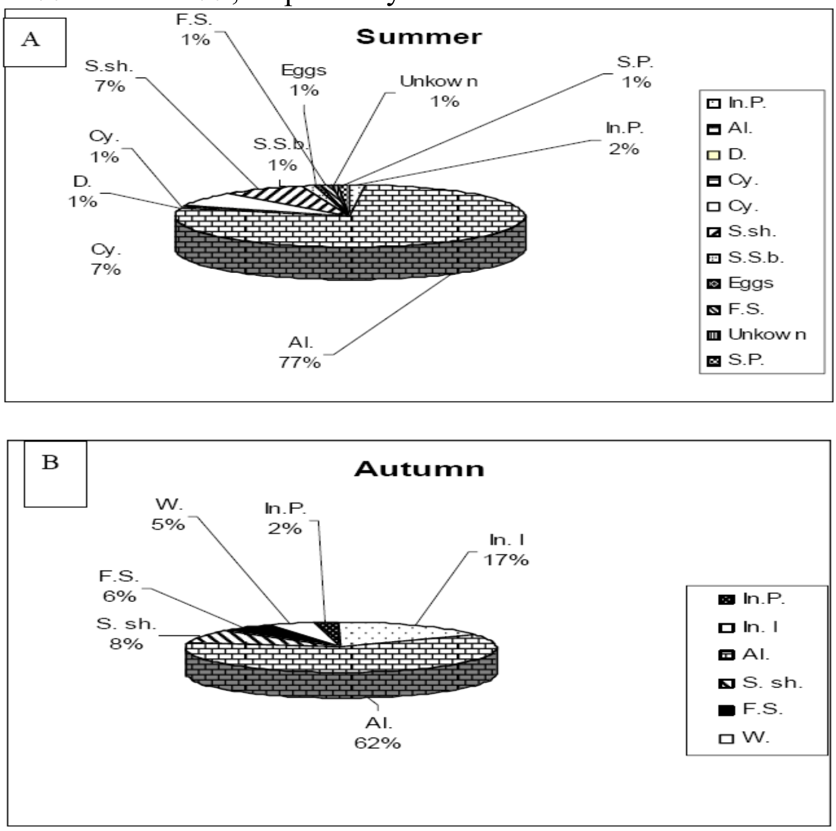
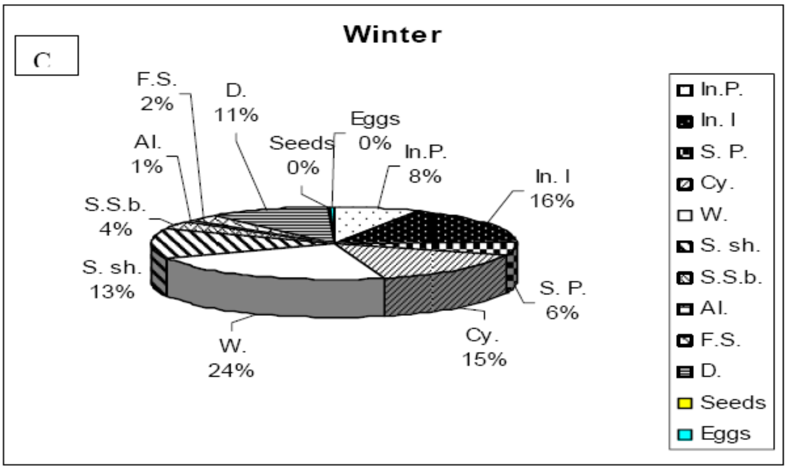


Fig . (3): Variation in the diet composition of *Oreochromis niloticus* from Ismailia irrigation canal during Summer (A), Autumn (B), Winter (C) and Spring (D).

(S.sh. :Snail shells, Art. f.f.: Artificial fish food, S.S.b.: snail soft body, In.: Insect, In.l. : Insect larvae, F.S.: Fish scale, W.: Worms, Cy.: Cycolops, D. Daphnia, F.: Fish, S.P.: sand particals, Al. : Algae.



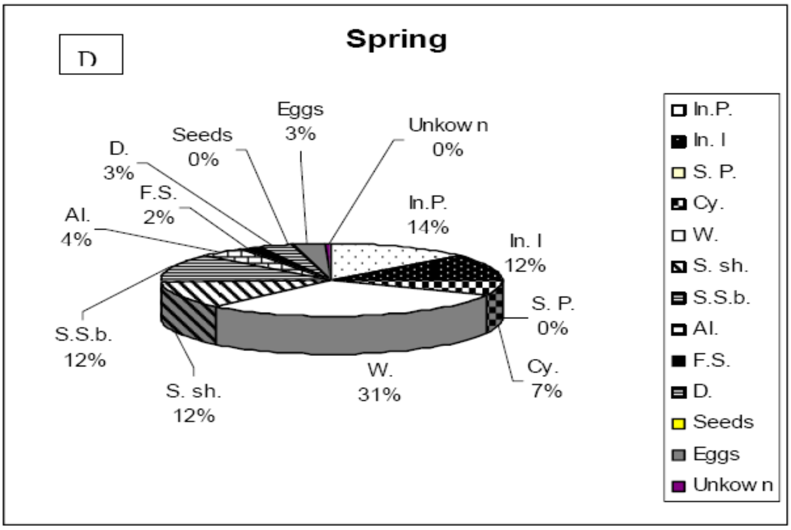
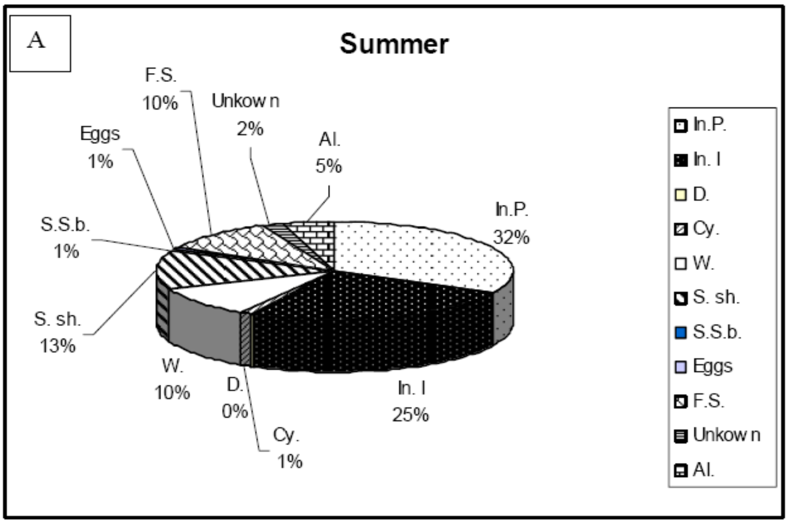


Fig. (3): Continuo.

Through summer months, filmentous algae and snail shell parts presented by 77.5% and 7.98% respectively in the diet of *O. niloticus*. Whereas, snail shell parts and snail soft bodies in the diet of *H. desfontainesi* decreased to 8.62% and 046% respectively. The diet of both species showed some variation during autumn. Snail shell parts contributed by the smallest proportion (4.35%) in the diet of *H. desfontainesi* but remained at the same level (8.33%) in *O. niloticus* and filamentous algae slightly decreased in this season to 61.65%.



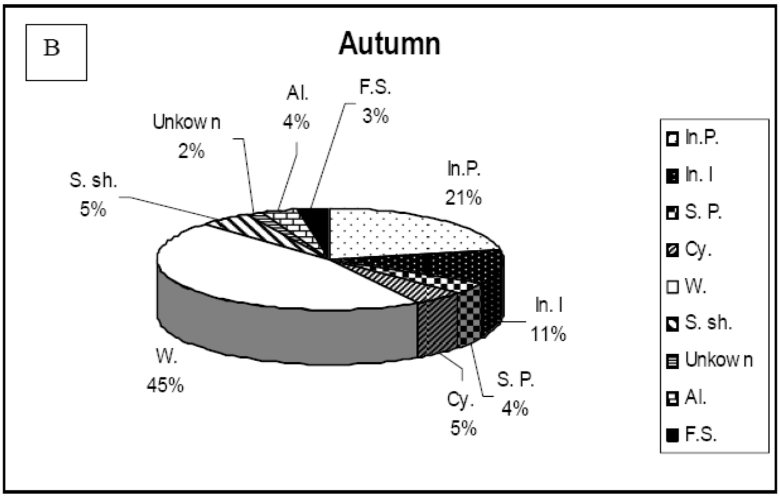
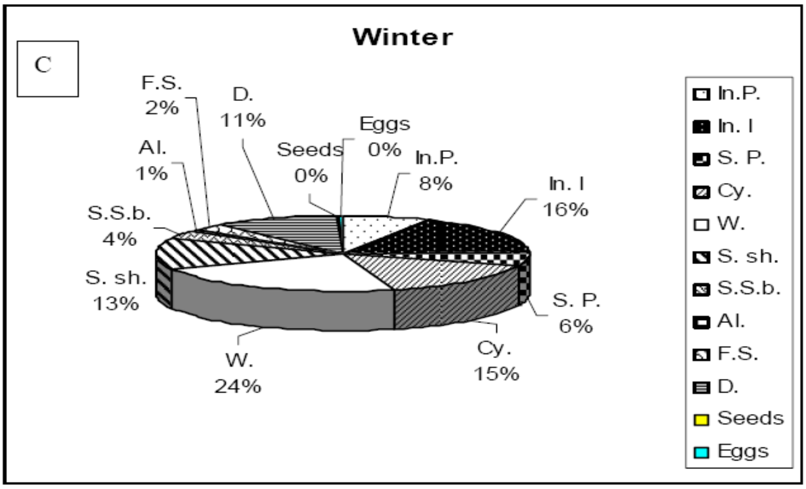


Fig. (4): Variation in the diet composition of *Haplochromis desfontainesi* from Ismailia irrigation canal during Summer (A), Autumn (B), Winter (C) and Spring (D).

(S.sh. :Snail shells, Art. f.f.: Artificial fish food, S.S.b.: snail soft body, In.: Insect, In.l. : Insect larvae, F.S.: Fish scale, W.: Worms, Cy.: Cycolops, D. Daphnia, F.: Fish, S.P.: sand particals, Al. : Algae.



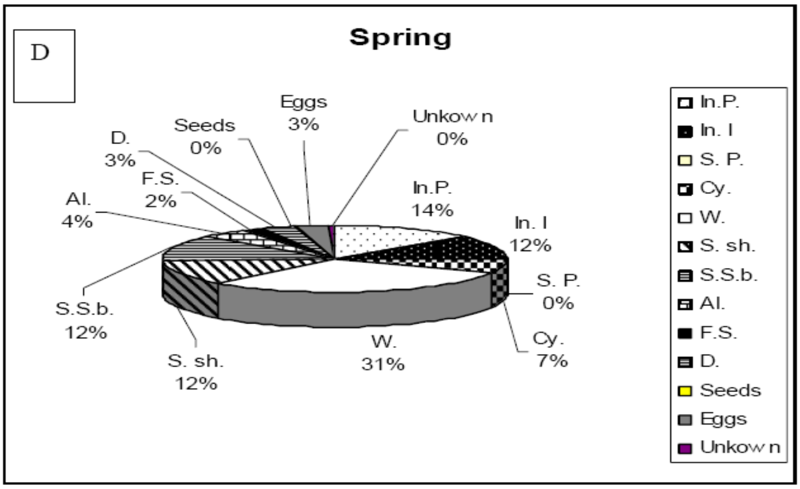


Fig . (4): Continuo.

2- Discussion:

In the present study, *Bulinus truncatus* was the only intermediate host snails for schistosomiasis in Abbassa fish ponds together with other snail species. Eight snail species were collected monthly from earthen fish ponds. The most dominant species in descending orders were *Bellamya unicolor* > *Physa acuta* > *Gabbialla senaariesis* > *Cleopatra bulimoides* > *Bulinus truncatus* . In fish ponds which contained young fish, the number of snails and diversity were much higher than those ponds which accommodated parent fish and ponds contained no fish. *B. unicolor* snails were present in fish ponds all over the year and they varied considerably from one month to another. The abundance of *B. truncatus* was high during spring and early summer and decreased during autumn and winter. *P. acuta* showed monthly variation in abundance, they abundant in May and June, common in July. *Lymnaea cailliaudi* reached the highest level during February; their number fluctuated remarkably from one month to another. Similarly, the other snail species exhibited seasonal fluctuation in abundance, reflecting the time of recruitment of young snails to the adult parent generation. Similar results were obtained by Yousif *et al*., (1993 a,b) on snail populations in irrigation canals in Egypt where *Bimphalaria alexandrina* and *B. truncatus* snails showed two peaks in population density during spring and late autumn-early winter. It was found that the increase of water temperature in summer harmed snail populations leading to significant decrease in densities. As in many other studies, it was difficult to find parameters that might explain the distribution and abundance of snails at Abbassa ponds. Only water temperature correlated significantly with snail densities. The relation between water temperature and snail populations is complex, and factors indirectly kinked with temperature, such as oxygen saturation and primary production will also influence snail densities, reflected in snail populations lagging one or two months behind the temperature minimum (Slootweg *et al*., 1994). Other studies carried out by El-Emam & Roushdy (1981) who attributed the decrease in snail populations in summer in irrigation canals to relative increase of water temperature (32-33 ºC). Thus, the present data indicated that snails have a definite annual cycle in age composition and reproductively which was correlated with environmental conditions, mainly temperature. This cycle, although somewhat different in various canals, seems to have a generalized pattern. However, the role of fish either in natural habitats (e,g. irrigation canals) or in fish ponds can not be ignored, or at least they act a limiting factor in reducing snail population but not eliminating them. Fish size is also an important factor. Furthermore, in the present study, when stomachs of the fish (*O. niloticus*) inhabiting Al-Abbassa fish ponds were examined, it was found that snails came second in relative abundance after artificial food. However, this does not mean that fish are specialized on snails. The reason why fish prefer to feed first on artificial fish food can be explained according to optimal foraging behaviour theory (Werner, 1974; Stephens &Krebs, 1986) where a fish will optimize its foraging to be able to maximize its food intake. Fish will accept first the type of prey with highest profitability {energetic yield (E) per unit of handling time (Ht)}. Artificial fish food have higher E/Ht ratio than snails and hence fish ate it first, then they switched to eating snails when artificial fish food was probably less abundant. The present results go well with other observations by Brown & De Vries (1985) who made a study on two populations of *Lymnaea elodes,* one in a temporal and the other in permanent pond. They surveyed both ponds to detect any difference in snails abundances. Results showed that snail densities were roughly much greater in temporary than in the permanent pond. The most obvious difference between the two ponds involved the fish *Umbra limi*, absent from the temporary pond, but present at a fairly high density in the permanent pond. Similarly, Louda *et al.* (1985) ; McKaye *et al.* (1986) and Slootweg *et al.* (1994) have shown that predation by molluscivorous cichlids was a significant factor in the distribution of Lake Malawi gastropods. Brown & De Vries (1985) stated that fish predator could dramatically alter the population dynamics of a single snail species. Also, present study confirms the investigations of El-Safi *et al.* (1985) who gave a study on the food of *O. niloticus* in Gezira irrigation canals, and the stomach contents of the fish were analysed by the point method. They found that gastropods contributed, 1.9% (for fish size group 30-60 mm), 3.64% (for size 60-90 mm), 2.78% (for 90- 120 mm), 4.24% (for 120-150mm), 4.53% (for size 150- 180 mm). Also, Davis (1985) found that molluscs contributed by 2.8% by frequency of occurrence and by 1.1% by numerical method of analysis. Similarly, the point method was used to analyze the stomach contents of the fish *Lates niloticus* by Huges (1986) who found that gastropods was represented by 3% in the diet of the fish. Present results indicated that artificial fish food and snails exhibited marked seasonal variation in stomachs of fish. Differences were statistically significant. The lowest proportion of snails was recorded in winter (2%) and the highest in spring and summer but less abundant in autumn. In contrast, the highest proportion of artificial fish food was recorded in winter and decreased remarkably during spring and summer. These could be explained according to the foraging theory in combination with other environmental parameters particularly water temperature.

During winter, the lowest amount of food intake by fish was recorded, reflecting the low availability of natural food. The water temperature was also low, resulted less activity of fish which they selected the most profitable food (i.e. artificial fish food), hence snails would be the least to be eaten either because of their less profitability and more handling time by fish or because of their lower densities in winter. As water temperature raised in spring and reached its maximum level during summer, more natural food would be available, fish became more active, hence they would search for food and switched to other food available, including snails.

In the present study at Ismailia canal, the food items exhibited marked seasonal variation in relative abundance, reflecting the availability of the natural food. In *O. niloticus,* the highest proportion of filamentous algae was recorded in summer whereas snails were abundant in spring, decreased in summer and became rare in autumn and absent in winter. Similarly, snails were present in the diet of *Haplochromis desfontainesi* all year round; however, they exhibited marked seasonal variation in relative abundance. The present data agree with Getachew (1987) who studied the natural food of O. *niloticus* from two Ethiopian Rift valley lakes from the stomach contents. He stated that identification of the snails and algae in the stomach of *O. niloticus* revealed that essentially the same groups were represented with minor variation in both lakes.

Also, present results confirm the other investigations by Shehata (1982) who found that molluscs came third (19%) in the relative importance of the animal food in the diet of the cichlid fish *Hemichromis bimaculatus* in Egyptian Lake Manzalah. *Melania tuberculata* and *Pirenella conica* were the main important food items; whereas *Cleopatra bulimoids, Limnea spp*. and *Bulinus truncatus* were present in the diet in very small amounts.

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دراسات حقلية على تأثير اسماك اوريوكروماس نيلوتكس (البلطى النيلى) و هبلوكروماس ديسفونتانيسى على القواقع الناقلة فى الاحواض السمكية والبيئة الطبيعية فى مصر

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تم عمل دراسة حقلية فى 7 احواض أرضية بالمفرخ السمكى بالعباسة ، محافظة الشرقية لعمل مسح شامل للقواقع فى الاحواض السمكية وذلك لتحديد مدى فاعلية تغذى أسماك البلطى على قواقع العائل الوسيط.

تنتمى القواقع الى 8 أنواع مختلفة رتبت ترتيبا تنازليا حسب أعدادها كلاتى: بيلاميا يونيكلر (51,3%)، فيسا أكيوتا (25,3%)، جابيلا سينارنيسس (10,3%)، كليوباترا بليمويدز (4,9%)، بولينس ترنكاتس (3,3%)، لانستس كاريناتس (1,9%)، ميلانيويدز تيوبوركلات (1,9%) و اخيرا ليمنيا كايودى (1,1%).

وجد ان الاحواض التى تحتوى على أسماك صغيرة تحتوى على أعداد كبيرة من القواقع (ذات الانواع المختلفة) أكثر من الاحواض التى تحتوى على أمهات الاسماك.

تم ايضا دراسة الطبيعة الغذائية لاسماك البلطى النيلى المجمعة من الاحواض السمكية وقد اظهرت النتائج ان غذاء السمك المصنع يأتى فى المركز الاول من حيث الاهمية (8090,3) فى غذاء هذا السمك يليه القواقع (3880) ثم الحشرات (382,3). أثبتت النتائج ايضا ان هناك تغيرات موسمية فى مدى توافر مكونات الغذاء حيث وجد ان أجزاء القواقع كانت أهم أصناف الغذاء الرئيسية خلال الصيف (43%) بينما سجلت أقل نسبة لها فى فصل الشتاء (2%) وعلى العكس من ذلك فقد سجل غذاء السمك المصنع أعلى نسبة له خلال فصل الشتاء (58%) ، انخفضت هذه النسبة تدريجيا لتصل الى 33%، 35% فى فصلى الربيع و الصيف على التوالى ولكنها ازدادت مرة أخرى لتصل الى 56% خلال فصل الخريف.

بالايضافة الى هذا فقد تم تجميع عينات من أسماك البلطى النيلى و هبلوكروماس ديسفونتانيسى شهريا وعلى مدار 12 شهرا من قناة رى الاسماعلية وذلك لفحصها لمعرفة الطبيعة الغذائية لهذه الاسماك بغرض ملاحظة وجود القواقع النافلة للمرض فى غذائها . أظهرت النتائج ان القواقع أتت فى المرتبة الثانية فى غذاء كل من النوعيين من الاسماك .

تواجدت القواقع فى غذاء أسماك هبلوكروماس ديسفونتانيسى فى كل المواسم وكانت اعلى نسبة لها خلال فصل الربيع. وقد سجلت القواقع أيضا أعلى نسبة لها فى غذاء اسماك البلطى النيلى خلال فصل الربيع ، انخفضت بعد ذلك تدريجيا خلال فصل الصيف وظلت فى نفس المستوى خلال فصل الخريف الى أن اختفت تماما من الغذاء خلال فصل الشتاء.