Studies on the Prevailing Parasitic Disease Problems in Some Cultured Fishes in Relation to Marine Environment

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Abstract

The present study was aimed to investigate the disease problems in some marine fishes were represented as *Dicentrarchus labrax, D punctatus* and *Argyrosomus regius* and collected from the fish farms of western region of Port Said. The parasites encountered were carefully removed, isolated and identified. The present study investigated the occurrence of Ergasilus sp. in *Dicentrachus labrax,* Lernanthropus sp. in *D punctatus* and *Argyrosomus regius* The Ergasilus species parasitized (20%) of *D labrax,* Lernanthrropus, Parachamallanus, Rhabdochona parasitized (80%) of *D punctatus* and *Anisakis simplex* parasitized (4.9%) of *A regius*. The total prevalence was (6.7%).The main sites of parasitic infestation were the gill filaments, gut and ovaries. Besides, both phyto and zoo planktons in water ponds were analyzed and estimated. The relation between such plankton and fish parasites was discussed.

Introduction

In respect to the crazy elevation of the world population, the animal sources of protein become not enough for this elevation, so other sources of protein are demanded. Of which fish protein has been efficiently increasing the animal protein resources in the world, due to modern techniques of fish culture. Moreover, it is characterized by high nutritive value, cheaper, palatable and easily digested. Fish exhibit a time honored place in the nutritional, economical, therapeutical history science it gives high calorific value and fat, also various proteins and fat-soluble vitamins ***(Hepher et al, 1971).***

Fishes are generally rich in unsaturated fatty acids which preferred by some diseased people especially with heart and circulatory disorders ***(Hisk, 1987)***. Marine fishes are preferable than freshwater fishes as the former are rich in trace elements as phosphorous and iodine, which are essential for cell metabolism. Generally marine fish act as either final or intermediate host for parasites which may cause injuries and even death to these fishes. Parasitic infestations represent the majority of the known infectious diseases affecting fish ***(Eissa, 2002)***

Parasites are one of the pathogenic organisms causing mortality of fish in ponds. Others, however, don't actually kill fish, unless the parasites occure in very large numbers, but the growth rate and market value of the fish may be reduced ***(Hepher and Pruginin, 1981).*** Fish diseases are considered as great problems either in cultured or wiled fishes that may be the main cause of low body weight gain, high mortality, immarketability and some of these diseases may have a zoonotic importance ***(Eissa and Hala, 1993 and Eissa, 2002).***

The present study intended to investigate the prevailing parasitic diseases infecting some cultured marine fishes (*Dicentrarchus labrax, D punctatus* and *Argyrosomus regius)* in relation to water quality.

Materials and Methods

Fishes:

The examined fishes were collected seasonally during the period from December 2011 to November 2012 from the fish market of the fish farms located in northern Lake Manzala at the western region of Port Said. A total of 177 marine fish species belonging to *Dicentrarchus labrax* (106), *D punctatus* (10) and *Argyrosomus regius* (61) were collected. Fish samples were transported to laboratory for examination. The body weights were ranged as 350-1500, 6.9-32.3 and 200-400g respectively.

Water sampling:

At the collection of the water samples, the bottles rinsed with surface water and then the water were collected from different regions by public boat from the aquatic environment of the water ponds.

Plankton collection:

The concentrated phytoplankton samples by sedimentation technique were measured after siphonation and subsample of one ml each was transferred into counting cell for counting the phytoplankton cells or coenobium or filaments per liter. The zooplankton collection involves primarily the filtration of water by net, 10 liters of seawater were collected by bottles with known capacity of water. Samples were filtered using zooplankton net. The net washed with tap water and kept in bottles with adding formalin for preservation.

Parasitological examination:

The external and internal parasites of freshly dead fishes were isolated, stained and identified according to the methods described by ***Lucky (1977).***

Results

Parasitological examination

1. Parasitic crustaceans

The identification of crustaceans was based on the morphological and parasitological characters.

a. ***Ergasilus*** sp. was isolated from gills of *D. labrax*. The body length of mature females may range from 0.5 to 1.6 mm. they have white to yellowish coloration and appear nodule-like egg sacs on the attacked gills. They have single median eyespot toward the anterior end. Also, terminal powerful curved claws. There were four pairs of segmented swimming legs (Photo,1A,B).

b. ***Lernanthropus*** **sp.** It was isolated from the gills of *D. punctatus.* The male body is slender in shape. The terminal segment of second maxilla is provided with 2 rows of blunt teeth and spines on the inner margins. The caudal rami are short. The female is cylindrical in shape. The head separated by a constriction from the rest of the body. The first thoracic leg is biramous, the exopod of the first segment bear blunt distal spines, while the endopod bear an elongated distal spine. The egg strings are elongated and uniseriate (Photo 2&3).

c. **Parasitic nematodes**

Anisakis simplex*:* It was isolated from the ovary of *A. regius*. It is worm-like coiled in shape there are dorsal and ventral longitudinal nerve cords. *Anisakis* possess three protruding lips around its mouth opening. This lips are poorly developed in juvenile stage, but contain inner labial papillae, Male possess simple spicules (Photo 4).

Paracamalanus sp. It is isolated from the posterior part of pharynx of *D. punctatus* It. is medium sized larviparous worm. with a buccal capsule, funnel shaped and yellow colored. The anterior part is armed with a large scelerotized trident. The male is smaller with curved posterior end. The posterior end is provided with transverse cuticular striations. There are a small caudal alae and papillae. Spicules are unequal and dissimilar (Photo5).

Rhabdochona sp. It was isolated from the intestine of *A. regius*. and is characterized by a prostom with 8 anterior teeth, the presence of basal prostomal teeth, bifurcated deirids, arrangement of genital papillae, non-filamented eggs,. Two lateral denticular outgrowths in female and numerous fine spines in male. (Photo 6).

Severity of infection

In relation to type of fish

As shown in the figure (1) the most infected fish was *D. punctatus* while D.labrax and *A. regius* was lower than infected fishes.

The percentage of infection showed the maximum value (80%) in autumn when the temperature was 17°C. On the other hand, during the two extreme seasons with the highest temperature (summer, 25.5°C) and the lowest temperature (winter, 15.5°C), the percentages of infections were lower (4.9 and 20%, respectively), while no infection appeared in the spring.

Plankton as bioindicator for water quality

Zooplankton

During this study, the recorded zooplankton were belonged to five groups namely; Copepoda, Cladocera, Rotifera, tintinnids and nematodes, in addition to larvae (nauplius and polychaete) and eggs. The annual abundance of all groups was 3060 individuals /L. Of all recorded zooplankton, copepods and nauplius larvae were the most important groups with almost close contribution. They contributed 44.11% (1350 individuals/L) and 41.17 % (1260 individuals /L), respectively by number of the total zooplankton crop (Fig 5)

Regarding seasonal variation of all zooplankton density, it was found that there were nearly two similar pronounced peaks in spring and summer with values of 960 and 920 individuals/L, respectively (Fig.5). Zooplankton crop decreased during autumn (760 individuals/L) then reached to the lowest value in winter (420 individuals/L).

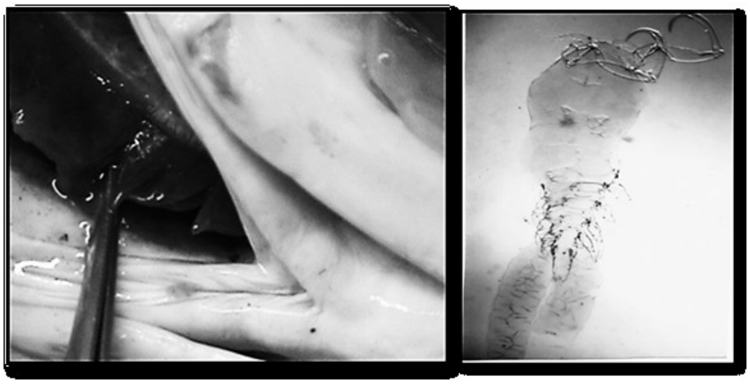
Seasonal distribution of each zooplankton group revealed that the only two groups, Copepoda and nauplius larva occurred throughout all seasons. On the other hand, Rotifera, polychaete larvae and eggs were found collectively in winter and spring, in addition to summer for Rotifera and autumn for polychaete larvae. Tintinnids and nematodes presented in spring and autumn, while Cladocera existed only in spring.

It is obvious that the abundance of Copepoda decreased gradually after peak duration, during summer and autumn. Also, Nauplius larvae showed gradual increase before peak duration, during winter and spring. Otherwise, the standing crop of all remaining groups during each season did not exceed 5% of the total seasonal standing group except for Rotifera in summer (70 individual/L, 7.6%) and tintinnids in autumn (80 individual/L, 10.5%). With respect to seasonal diversification, spring looked the most diversified season since all groups were represented, while summer was the less diversified season Figure(7).

Phytoplankton

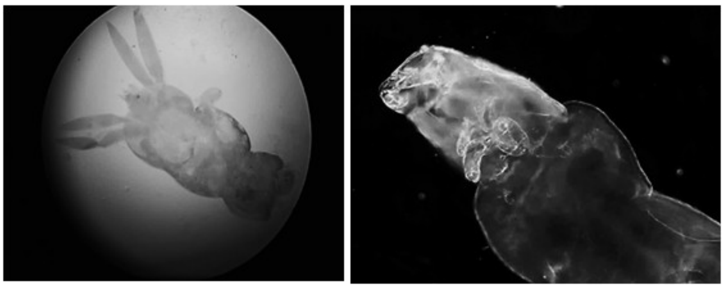
In the present study, the recorded phytoplankton species belong to six groups, namely; Bacillariophyta, Chlorophyta, Cyanobacteria, Dinoflagellata, Euglenophyta and Ochrophyceae. The annual average of the total phytoplankton standing crop was 2010× 10^3/L. Seasonal values of the total phytoplankton standing crop observed that the study area was productive all year round. Seasonal phytoplankton abundance showed the presence of bimodal peaks with the pronounced one in summer (4717× 10^3/L) representing about 58.7% of the total annual phytoplankton density, and the lesser one in winter (2046× 10^3/L, 25.4%). Spring and autumn attained the low values of phytoplankton density with the lowest value of 390 × 10^3/L in autumn constituting about 4.9% of the total density.

Of the all recorded phytoplankton groups, Bacillariophyta constituted the main bulk (5717× 10^3/L) of the phytoplankton population in the study area (Fig. 9). It formed more than 67% of the community with a maximum seasonal value of 4430 × 10^3/L in summer, followed by 1150 × 10^3/L in winter and a minimum value of 20 × 10^3/L in autumn. Cyanobacteria and Chlorophyta occupied the second and third orders after Bacillariophyta, in terms of the magnitude of cell count, with relatively close values (1337 and 913 × 10^3/L, respectively). Seasonally, Cyanobacteria peaked in winter and summer with approximately similar values (506 and 500 × 10^3/L, respectively), while Chlorophyta peaked in spring (339 × 10^3/L). Ochrophyta and dinoflagellata were represented by low cell numbers (83 and 15.3 × 10^3/L, respectively) compared to other groups.



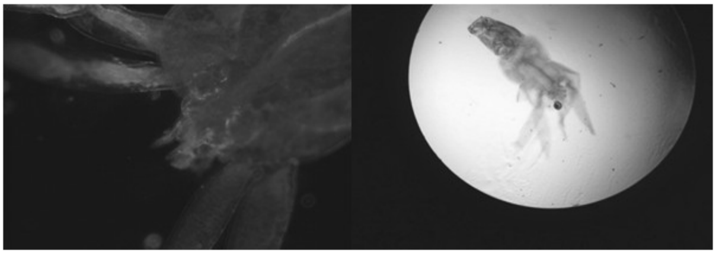
A B

Photo (1): *Ergasilus sp. (A) infected gills of D labrax, and (B) whole mount of parasite*



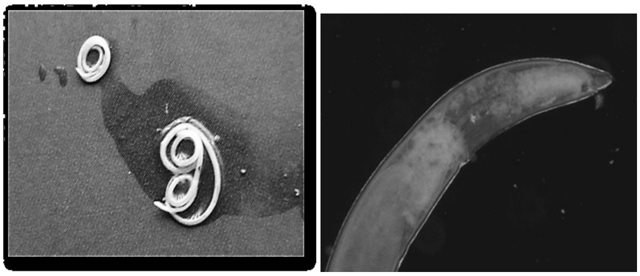
A B

Photo (2): Lernanthropus sp. (A) whole body, and (B) anterior part



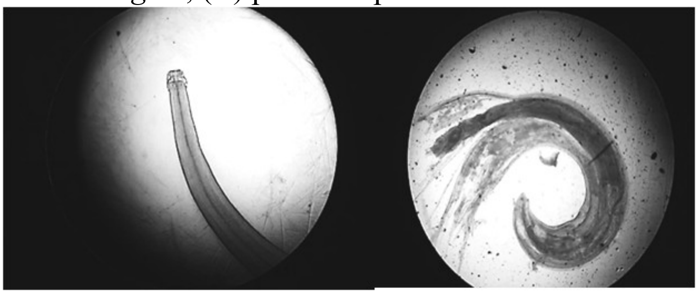
A B

Photo (3): Lernanthropus sp. (A) posterior part and (B) lateral view



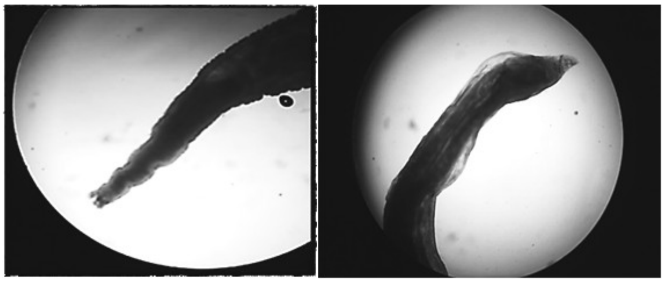
A B

Photo (4): (A) Whole body of *Anisakis simplex* isolated from the ovary of *A. reguis*, (B) posterior part of the worm



A B

Photo (5): *Paracamalanus* sp. (A) anterior part, and (B) posterior end of the parasite



A B

Photo (6): Rhabdochona sp. (A) anterior part, and (B) posterior part of the parasite

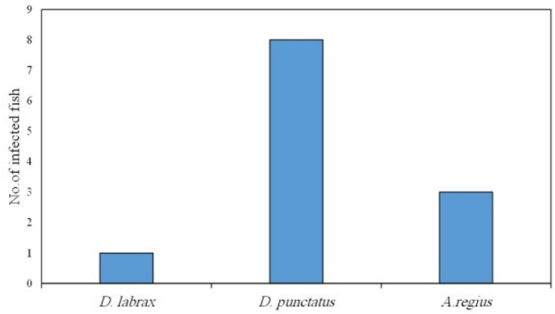


Figure (1): No. of infected fishes in each different examined fish species

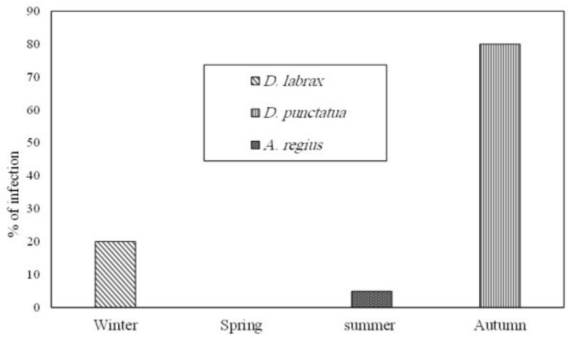
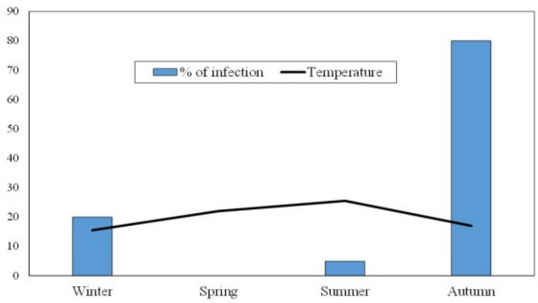


Figure (2): % of infection in different seasons



Figure(3): The percentage of infection and temperature in different seasons

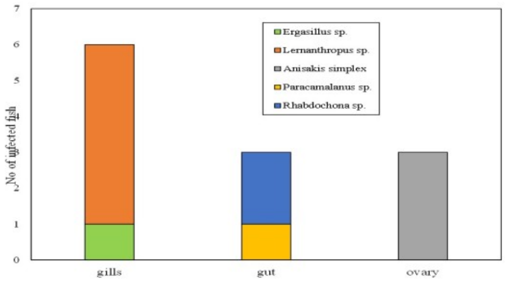


Figure (4): The prevalence of parasites among fish tissues and organs

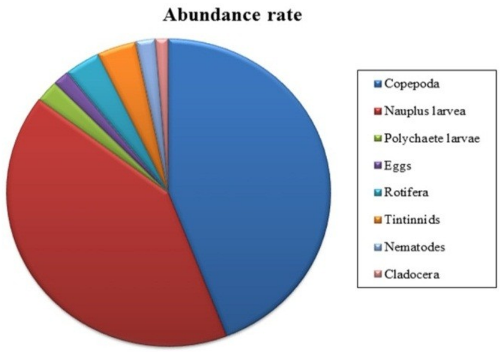


Figure (5): Annual abundance of zooplankton groups in studied area

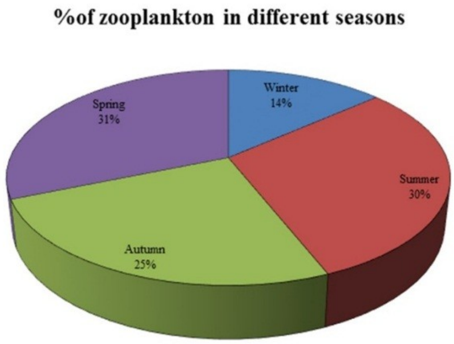


Figure (6): Percentage of all recorded zooplankton in different seasons

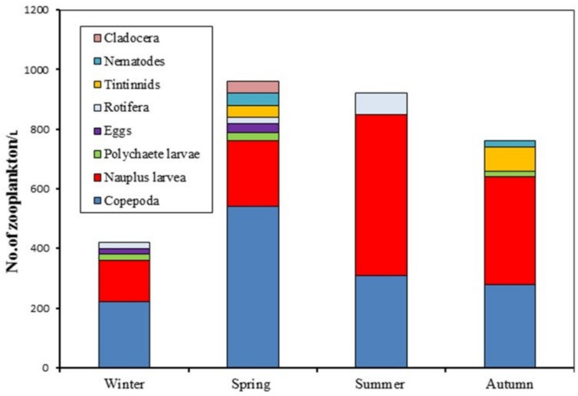


Figure (7): Seasonal distribution of zooplankton crop for each group during the study period

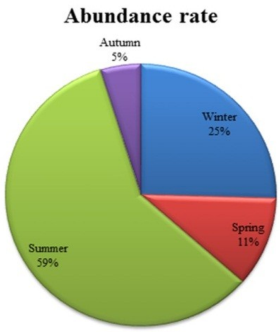


Figure (8): The abundance rate of phytoplankton during study period

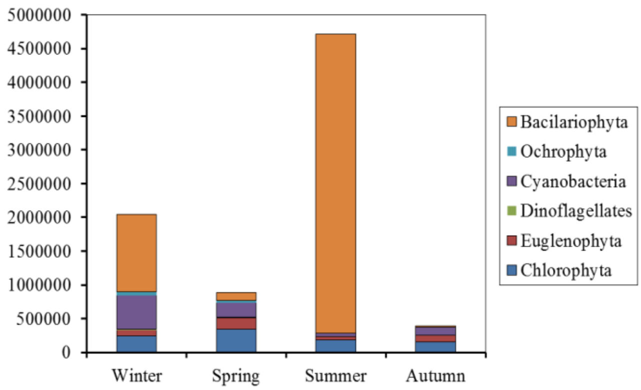


Figure (9): Density of phytoplankton groups in different seasons during study period

Discussion

Any slight structural damage of gills can render a fish very vulnerable to osmoregulatory dysfunction as well as respiratory difficulties, as fish gills are responsible for regulating the exchange of salt and water and play a major role in excretion of nitrogenous waste products ***(Mahy Ghobashy, 2000).*** These results may be attributed to the low respired oxygen of destructed gill epithelium which caused by feeding activity, attachment, fixation and locomotion of crustaceans causing massive destruction of respiratory epithelial cells ***(Eissa, 2002).*** Emaciation recorded in *D. labrax* may be due to crustacean infestation which reduce fish appetite and became off food. This findings agreed with results obtained by ***Luque (2001) and Nagasawa (2004).***

Regarding the nematode infestation, *Paracamallanus* infestation rate was 16.6% from the total infested fish. This result disagree with ***Abd el-Aal (1996).*** The variation in localities, type of breeding systems, age, feeding programs and water quality may clarify the variation of infestation rates.

Regarding the seasonal prevalence of infestation, the peak was obtained in the autumn. This finding in consistence with ***Maather Mohamed (2007)*** and disagree with ***Doaa Faisal (2008)*** who found that the highest infestation was recorded in spring and the lowest was in the winter season. This difference may be due to the geographical distribution of host and parasites.

The main clinical signs of heavily infested fishes with *Anisakis* were emaciation pale color on the external body surface, but with no pathogenic clinical signs as the nature of all nematodes in affected fish ***(Schaperclaus, 1992).*** The prevalence of *Anisakis* reached 25 % and the highest rate was in the summer. These results disagree with ***Eissa et al (2010)*** **w**ho said that *Anisakis* was highest in the autumn (10%) and 0% in winter and summer. This may be attributed to the change in locality and examined fish species.

In this study *Ergasilus sp.* lead to gill damage resulted in loss of gill surface area for respiration and led to suffocation, particularly at high water temperature these results agree with ***Grabda (1961)***. The prevalence of *Ergasilus sp.* reached 8.3 % these results disagree with ***Mostafa et al (1991)*** who reported that the incidence of parasitic gill infestation in cichlid fish from different extensive fish farms at El-Raswa and Lake Manzala was 71% this difference may be due to the change in the fish type.

The prevalence of *Lernanthropus* sp. is 41% , these results disagree with ***(Kabata, 2003)*** who reported that *Lernanthropus kroyeri* has been frequently observed in sea bass culture from many localities along the coast of Europe, from the

Adriatic Sea to the Southern North Sea. And also disagree with ***Dezfuli et al (2003) and Toksen (2007)*** they reported that Prevalence and mean intensity of 35 to 100% and 10.8 to 50.3% were recorded for *Lernanthropus kroyeri* from cultured *D. labrax* in the Mediterranean and Aegean Sea, respectively. This difference may be due to the change in locality.

The prevalence of *Rhabdochona* sp. is16.6% these results disagree with ***M. Saraiva*** *and* ***Moravec (1998),*** they mentioned that a total of 25 *Anguilla anguilla* examined, 5 (20 %) proved to be infected with *Rhabdochona anguillae*. this difference may be due to the change in the fish type and geographical changes

Zooplankton are good indicators of particular environmental conditions and their change as revealed by many studies. Zooplankton has been used as indicator of water quality for a long time. Some species flourish in highly eutrophic waters while others are very sensitive to organic or chemical wastes ***(El-Enany, 2009).*** Water samples in the present study showed that rotifers constituted the main food of animal origin for the Cichlid species ***(Hegab, 2010).*** Rotifers, especially *Brachionus*, constitute an important link in the food chains of inland waters. They are considered preferred food for many fish larvae ***(Guerguess, 1993).***

Eutrophication can be defined as nutrient and organic matter enrichment or both that results in high biological productivity or decrease in volume within an ecosystem ***(Likens and Bormann, 1972).*** In this study the total abundance of rotifers was 3.5% and these result disagree with ***Abdel Mola et al (2012)*** who recorded that Rotifera constituted the main dominant group in the lake contributing about 80.04 % of the total zooplankton population. Copepods abundance in these study displayed 44.11% and this also disagree with ***Abdel Mola and et al (2012)*** who recorded that the abundance of copepods was17.29 %, and nearly agree with them in Cladocera abundance (1%) and the study abundance is (1.3%).

The present study revealed that the density of zooplankton increased in the summer and decreased in winter. These result agree with ***Sarma et al (2011)*** who said that in general the density of zooplankton was higher during summer months (April to July) than during winter.

Nematoda, and fish eggs were more abundant due to the flourishing of the nauplius larvae and this result agree with ***Abd El-.Mageed (2007).*** In this study, the most dominant class in Lake Manzala was Bacillariophyta (71%) and the second and third abundance were cyanobacteria and chlorophyta (11%). These results disagree with ***Abd El-Karim (2008).*** who said that the more dominant phytoplanktons was chlorophyta, cyanoprokaryotes and diatoms. This difference could be attributed to different study locality and water pond temperature and pH. cyanoprokaryotes and chlorophytes were subdominant. These results agree with ***Maclaren Engineers (1981) and Khalil (1990).***

Chlorophyta in this study was dominant in spring and winter after that. And these results disagree with ***El-Sherif and Gharib (2001)*** who reported that chlorophytes dominated through autumn. The higher the total standing crop and the number of individuals of the dominant species, the higher the trophic status phytoplankton ***(Round, 1981and Reynolds, 1984).***

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