

Some Biological Aspects of the Filefish *Stephanolepis diaspros* (Family: Monacanthidae) from the Gulf of Suez, Egypt.

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Abstract: The reproductive characteristics and stomach contents of the filefish *Stephanolepis diaspros* in the Gulf of Suez were investigated through samples collected from 2004 to 2007. The overall sex ratio of males to females was estimated as 1.00: 0.18, where females are represented in small sizes (8.0- 16.0 cm) while males largely outnumber females up to the length interval 16.0- 26.0 cm. The monthly average values of gonad weight percentages and monthly different maturity stages showed that the species spawns during summer season with intensive spawning in May. The length at first sexual maturity was estimated at 9.5 cm for males and 8.5 cm for females. The diet of file fish consisted of a wide variety of items, dominated by Crustaceans and mollusks. Algae, Echinoderms and fish remains were also demonstrated in the stomachs of the file fish. Sponges, Hydra sp., foraminifera and Pryozoa were also preyed by the file fish. The maximum feeding intensity was attained in spring season, while the minimum feeding intensity was observed during summer (June and September).

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Introduction

Representatives of the family Monacanthidae (file fishes) are widely distributed in shelf waters of the tropical and subtropical, Indian and Pacific oceans (Assadi, and Deghani, 1997). Recently, they are important component of fisheries in many countries (Nakazono and Kawase, 1993; Mancera-Rodriguez and Castro-Hernández, 2004). In the Gulf of Suez, *Stephanolepis diaspros* is the most abundant monacanthid. Currently, it has a relatively high occurrence in the landings of, the trawl and purse seine fisheries, and a significant percentage of the benthic-demersal species in the small scale fishery. File fishes were discarded species till the 1990s (El-Ganainy, *et al*, 2005), but it became an important commercial species in the middle of 1990s, and currently showed overfishing symptoms (El-Ganainy and Sabrah, 2008).

Biological information on the file fish *S. diaspros* is scarce, although there are some limited studies on the reproductive biology, behavior and stomach analysis of relative monacanthid species (Ishida and Tanaka, 1983; Barlow, 1987; Peristiwady and Geistdoerfer, 1991; Nakazono and Kawase, 1993; Kawase and Nakazono, 1996; Mancera-Rodrigues, 2000; Kawase, 2003).

The objective of this study is to investigate the reproductive characters and stomach contents of the filefish *Stephanolepis diaspros* in the Gulf of Suez.

Material and Methods

Samples of the filefishes *Stephanolepis diaspros* were collected from the commercial trawl catches landed at Attaqa fishing harbor during the period from November 2004 till March 2007. Total length in cm, total weight in gm, sex, stage of maturity and degree of fullness of the stomachs for each sampled specimen were recorded. Sex and maturity stages were determined macroscopically and weight of the gonads (GW) was recorded to the nearest 0.01 g. Stages of maturity were classified as follows: I, immature; II, developing; III, mature; IV, ripe; V, running; and VI, spent.

The sex ratio of the sampled population was analyzed monthly and according to the size intervals. The spawning season, condition and development of the gonads were determined following the monthly changes of the gonadosomatic index (GSI), calculated as follows (Anderson and Gutreuter, 1983);

$$\text{GSI} = 100 \text{ GW/TW}$$

Where GW is the gonad weight and TW is the total fish weight.

Size at maturity was determined as the length at which 50% of individuals were in maturity stage III and above.

Stomach contents were analysed microscopically and identified to the lowest possible taxonomic level, depending on the type and digestion level of each prey item. For each identified taxa, the percentage of occurrence (%O) and percentage composition %C (Mohan and Sankaran, 1988), were calculated. The degree of stomach fullness was

estimated by an arbitrary 0-4 point scale as follows: 4 for full, 3 for 3/4 full, 2 for 1/2 full, 1 for traces of food and 0 for empty stomachs. The fullness index was calculated as the number of empty stomachs divided by the total number of stomachs multiplied by 100. Stomach contents were sorted into groups and analyzed for relative frequency (Hureau 1969).

Results

Sex ratio

The overall sex ratio of males to females was 1.00: 0.18 and the proportion of females was significantly much lower than males (χ^2 35.1; $P < 0.001$). The highest percentage of females was recorded in May (Fig 1). The variation in both the number and percentage of males and females in different length groups (Fig 2) show that males reach larger sizes. Females are represented in small sizes (8.0- 16.0 cm) while males largely outnumber females up to the length interval 16.0- 26.0 cm.

Spawning season

The material used for this study covered ten months, (from September until June), as there was no available data during the closed season (summer). Analysis of the monthly variation in the GSI (Fig. 3) and different maturity stages (Figs 4 & 5) for males and females *S. diaspros* showed that the average values of gonad weight percentages increase substantially from March until June, High values were recorded also during September. The maximum values were recorded in May; this indicates that *S. diaspros* spawns during summer, with an intensive spawning in May. Males and Females in full ripe and running stages were found during May, June and September (Figs 4 & 5).

Size at first maturity

Analysis of the percentage of mature and immature fish in each length class (Figs 6) showed that size at which 50% of fishes get mature is 9.5 cm for males and 8.5 cm for females. These results indicate that all individuals get mature at the end of the first year of life.

Stomach analysis

A total of 288 stomachs were examined, the sampled fish ranged in length from 7.0 cm. to 26.1 cm. with an average of 14.59 ± 3.61 cm. From the total number of the examined specimens, 123 individuals had empty stomachs and 165 were with full stomachs.

Table (1) Percentage composition (% C) and percentage of frequency of occurrence (% O) of the different food items found in the stomachs of the file fish *S. diaspros* from the Gulf of Suez.

Food items	%C	%O
Crustacea	25.72	45.91
Crabs	15.62	25.51
Copepods	4.6	8.16
Isopods	3.68	7.14
Squilla sp.	1.83	5.1
Mollusca	15.63	31.63
Bivalves	13.79	26.53
Gastropods	1.84	5.1
Algae	15.8	25.51
Green algae		
Echinoderms	20.22	23.47
Sea Urchin		
Fish remains	8.46	21.45
Scales and eggs		
Porifera	6.44	8.16
Sponges		
Coelenterates	1.65	2.04
Hydra sp.		
Protozoa	4.23	5.88
Foraminifera		
Bryozoa	1.84	5.1
Bugula sp.		

Diet composition

The diet of file fish consisted of a wide variety of items, dominated by Crustaceans and mollusks Table (1). Crustaceans were clearly the most consumed item scoring the highest values of %O (45.91) and %C (25.72). Mollusks were second, being mostly composed by shells of bivalves and gastropods. Algae especially the green algae were the third most important prey group. Echinoderms were frequently consumed (22.20%) and were the fourth most important prey group, particularly sea urchin. Fish remains, mainly scales and eggs, were also important in the diet of the file fish. Sponges, Hydra sp., foraminifera and Pryozoa (*Bugula sp*) were also preyed by the file fish but at lower levels.

Food in relation to length

In order to determine the effect of size on food habits of the file fish *S. diaspros* the fishes from which stomachs have been examined, were grouped into 6 length groups (3 cm intervals). The abundance of food items in each length group showed that crustaceans and mollusks are the major food items recorded in all length groups Table (2). Fish remains, foraminifers and Bryozoans were recorded in small lengths ≤ 17.0 cm only.

Food item	Length intervals					
	8.0-10.9	11.0-13.9	14.0-16.9	17.0-19.9	20.0-22.9	23.0-25.9
Crustacea	26.45	28.85	28.04	29.73	42.31	35.71
Mollusca	13.23	10.95	21.5	6.76	1.28	22.32
Algae	22.22	18.41	2.8	12.16	7.69	
Echinoderms		9.95	23.36	17.57	23.08	26.97
Fish remains	16.93	12.93		8.14	7.78	
Porifera	18	4.98	1.87			
Coelenterates		9.95	19.63	25.64	17.86	
Protozoa		3.98	2.8			15
Bryozoa	3.17					

Seasonal variation in the feeding intensity

For the determination of the feeding intensity, all the examined individuals were classified whether their stomachs were empty or not (Fig 7). Out of 288 fish were examined, 165 (57.29%) had full stomachs, while 123 fish (42.71%) had empty stomachs. The maximum feeding intensity was attained in spring where most of the examined fishes (91.5%) were found to be feeding. The minimum feeding intensity was observed during summer (June and September), where most of the examined stomachs (71.9 %) were found empty.

Seasonal variations in food composition

Seasonal variations in feeding habits were observed in terms of the percentage composition (Fig 8). Crustaceans, mollusks and echinoderms were represented all over the year. The highest percentage of algae was recorded in summer, while the highest percentage of echinoderms was observed in winter. Fish remains were recorded by small percentage during spring only.

Discussion

The increasing economical importance of file fish's fishery in recent years in the Gulf of Suez makes it desirable to have information on the different aspects of its natural history, in order to successfully manage this fishery.

Publications on the biology of the file fishes Monacanthidae are mostly limited, this may be due to it was a by-catch and discarded species in many fisheries (Mancera-Rodriguez, and Castro-Hernández, 2004; El-Ganainy, *et al*, 2005; El-Ganainy and Sabrah, 2008).

The monthly sex ratio of *S. diaspros* showed a predominance of males over females nearly during all the fishing season, and in sizes larger than 16 cm. The variability of sex composition in fishes may

caused by selective natural and fishing mortalities between the sexes; or by the segregation of the sexes through various periods of the year including segregation resulting from sex difference in age and size at maturity (Smith, 1956). For the file fish, the very high percentage of males can be attributed to the disappearance of females after spawning (Nakazono and Kawase, 1993), and to the selective fishing mortality. Mancera-Rodriguez (2000) attributed the larger growth rate in males of *S. hispidus* relative to females, to the length at maturity of females being smaller than that of males. So, the decrease in percentage of females *S. diaspros* with the increase in length can be regarded to the difference in longevity and growth rate between the two sexes.

The variations in maturity stages and gonadosomatic index were used for discrimination between the different conditions of the gonads in the different periods, in order to identify the spawning season. The study indicated that *S. diaspros* spawns during summer, with an intensive spawning in May. Ishida and Tanaka (1983) reported that the spawning season of the file fish *Rudarius ercodes* extends from May to September in Japan. The estimated size at which 50% of fishes get mature was 9.5 cm for males and 8.5 cm for females, these values is smaller than those (13.9 and 14.9 cm respectively) recorded by Mancera-Rodriguez (2000) for *S. hispidus* in Canary Islands. The estimated length at first maturity in this study is close to the length at first capture ($L_c=8.5$ cm) estimated by El-Ganainy and Sabrah (2008). This implies that the fishery is depending on small individuals, and the stock dynamics of this species would be seriously affected. The high vulnerability of juvenile fish to capture by trawling would result in the reduction of the future yield of this species. Thus, the protection of juveniles is probably the key factor for the sustainability of the resource; through periodic spatial closure of the spawning and nursery areas.

This may be achieved through the establishment of certain reserves in the Gulf of Suez to protect the spawning stock biomass, and then monitoring their effects as a management strategy (El-Ganainy and Sabrah, 2008).

The analysis of diet composition showed that the species is mainly omnivores, feeds on a wide variety of items, dominated by Crustaceans, mollusks, echinoderms and algae. Peristiwady and Geistdoerfer (1991) stated that the food of *Monacanthus tomentosus* in Indonesia consisted principally of gastropods, seagrasses, sponges, algae, amphipods and sedentary polychaetes. He also reported that Pelecypods, opisthobranchs, isopods, copepods, ostracods, foraminiferans, bryozoans, ascidians, nematodes, mollusk eggs and fish eggs were found only in small percentages.

The minimum feeding intensity was observed during summer (June and September), which is coincide with the spawning period, i.e. the feeding activity of the file fish is affected by the reproductive cycle.

Seasonal changes in the diet of *S. diaspros* reflect changes in the availability of food items; this was confirmed by the presence of high percentage of green algae in the stomachs of *S. diaspros* during spring, which is the blooming season for most of the green algae in the Gulf of Suez.

For the proper management of file fishes in the Gulf of Suez, further multispecies studies based on stomach contents analysis should be conducted to investigate the interaction between species, also a map for the spawning and nursery grounds of the filefishes in the Gulf of Suez should be prepared on the basis of sound biological research.

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