Foods and feeding of the rabbit fish *Siganus rivulatus* (Forsk.) in the Southeastern Mediterranean

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This paper deals with the quantitative and qualitative aspects of the feeding habits of both adolescent (< 20 cm TL) and adult stages of *S. rivulatus* in the SE Mediterranean waters off the Egyptian coast. Guts of 673 male and female specimens, ranging from 10 to 25 cm total length (TL), were analyzed. Monthly samples were obtained from the commercial fish catch landed at Alexandria fish market throughout a complete year. Fishes were measured, sexed and the stomach contents of each weighed. The food organisms in the examined stomachs were identified to the lowest possible taxon. Variations of the diet with size, sex and seasons were analyzed using the frequency of occurrence (WALKER, 1978) and percentage composition by point method (THOMPSON, 1959) together with the preponderance index (PI) (NATRAJAN & JHINGRAN, 1961). Monthly and seasonal variations in fullness coefficient (FC) and filling index (FI) were analyzed.

The present study showed that *S. rivulatus* feed on a wide variety of both plant and animal food. The plant food (green, brown, and red algae, and diatoms) was dominant and formed 70% of the stomach contents by composition and 92% by occurrence. While the total animal food (Bryozoa, Crustacea, Polychaeta, Mollusca) was less, forming 28% by composition and 42% by occurrence; Green algae, mainly *Ulva* spp. represents the preferable food item taken by the fish, PI, 57%, brown algae *Cystoseira* spp. ranked second, PI, 16% while red algae (*Corallina* spp.), Bryozoa and Amphipoda came third in order of importance, annelids, molluscs and sand appeared to be inadvertently consumed. It is worth to note that *Ulva* is the most abundant genus of the green algae in Alexandria region, followed by genus *Corallina* of the red algae (KHALIL *et al.*, 1988).

No significant differences were found between the diet of males and females. In both sexes, plant foods were dominant, (PI, 83% in females and 87.7% in males), and composed 68% and 72% of the diet and occurred in 89% and 96% of the stomachs of females and males, respectively. The food items of animal origin were less important (PI 16 in females and 11 in males). It constituted 30% and 25% and occurred in 45% and 39% of the analyzed females and males stomachs, respectively.

Food composition changes with fish growth, total plant food decreased with increase in size of the fish, while the amount of animal food increased. In juvenile fish (<15 cm TL) plant foods formed 81% of the diet and occurred in 100% of the fish examined *Ulva* was the major food item (65% by composition) followed by *Corallina* and diatoms. Brown algae were almost completely absent. Animal foods were less common and formed 18.5% by composition and 23% byoccurrence. Bryozoa, amphipods and annelids were the major animal foods ingested (Figure 1). There food items (particularly *Ulva* and diatoms) are generally more common in the coastal waters where juvenile stages usually abound. These results corroborate with those reported by LA LAMI (1971). In adult fish (>25 cm TL) both plant and animal foods were quite important, they constituted 54% and 40% of the diet and occurred in 86% and 66% of the examined fish, respectively. Brown algae were the dominant items forming 32% by composition and 82% by occurrence with *Cystoseira*, *Sargassum*, and *Colpomenia* the most important. Red algae formed 14% by composition and 41% by occurrence. Green algae, and seaweed (*Posidonia oceanica*) constituted 6% by composition and 46% by occurrence. Of the animal food, Bryozoa and Amphipoda occurred in 41% and 36% and constituted 10% and 8% of the ingested food, respectively. Mollusca, Annelida, together with barnacle shells were of secondary importance. Such a change in the feeding habits is probably correlated with the behavior of the adult fish which, contrary to juvenile stages, move into deeper waters where there food items are more abundant (KHALIL *et al.*, loc. cit.).

The present results clarify that the fish exhibits substantial seosonal variation in feeding intensity ; these variations are probably related to both the behavior of the fish as well as the relative abundance of suitable food. In all seasons, plant food exceeded that of animal origin.

Juvenile fish feed more intensively (maximum FC and FI) during spring and summer, while feeding intensity was minimum in winter.

These results seem to appertain with the relative abundance of preferable food items in the coastal waters in both spring and summer seasons (KHALIL *et al.*, 1988). On the other hand, adult fish feed heavily during autumn following the spawning season in summer (May-August). In summer and winter the feeding intensity was low.

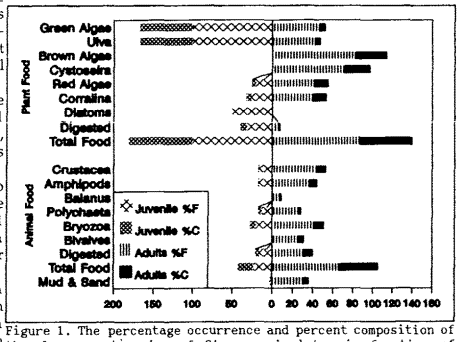

Figure 1. The percentage occurrence and percent composition of the forage categories of Siganus rivulatus in function of size.

The decrease in feeding intensity during summer is presumably because of the large space occupied by the developed gonads, while the low winter temperature and diminished stock of suitable food may be the cause of the low feeding activity in winter. The present results clearly demonstrates that *S. rivulatus* is a herbivorous-omnivorous fish with greater preference to macrophytes. GOLANI & BARANES (1990) reported that the Mediterranean population of the two rabbit fishes *S. rivulatus* and *S. luridus* show higher trophic selectivity than the source populations in the Red Sea probably indicating their adjustment to the new environment.

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Application des modèles globaux sur l'exploitation du Pageot commun du Golfe de Gabès

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Introduction et Méthode d'Etude.

La pêche au chalut dans le Golfe de Gabès a connu ces dernières années plusieurs irrégularités, l'effort de pêche a considérablement augmenté bien que la production ait diminué pour la plupart des espèces de la zone et surtout le pageot commun *Pagellus erythrinus* (espèce principalement par ce type de pêche).

Dans ce travail, nous essayons d'analyser l'état d'exploitation de cette espèce par les modèles globaux de SCHAEFER et de FOX.

Ces deux mèthodes ont été appliquées sur les captures du pageot par les chalutiers du port de Sfax (principal port de la zone) et sur 14 ans (1977-1990).

Nous avons considéré la capture du pageot par jours de mer des chalutiers de la catégorie de puissance comprise entre 200 et 300 cv comme prise par unité d'effort standard.

L'effort de pêche standard se déduit alors en divisant la production totale du pageot des les différents chalutiers par la prise par unité d'effort standard.

Résultats et Discussion.

Les résultats obtenus par application des deux méthodes sont consignés dans le tableau 1; les courbes correspondantes sont représentées sur la figure 1.

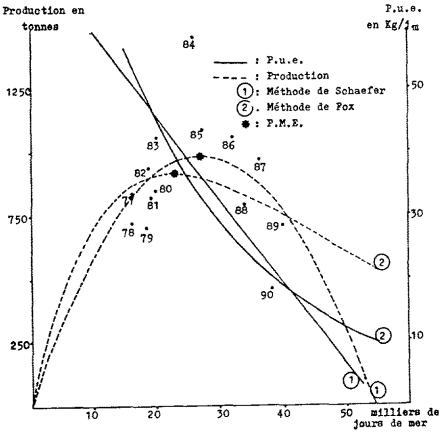
Nous remarquons que les efforts de pêche déployés depuis 1986 et 1984 dépassent l'optimum obtenu respectivement par la 1ère et la 2ème méthode; cette augmentation n'a pas entrainé une élévation de la production mais au contraire celle-ci a regressé d'une façon remarquable. Ceci laisse penser que le stock du pageot dans le Golfe de Gabès est entré dans une phase de surexploitation; nous signalions par ailleurs qu'il faudrait prendre cette évaluation avec prudence car les chalutiers du Golfe de Gabès entrent clandestinement dans les zones littorales réservées légalement aux petits métiers. Il serait intéressant alors de réduire l'effort de pêche: une telle mesure a été souvent proposée pour la préservation d'autres espèces tels que les rougets (GHARBI, 1985).

L'analyse de l'évolution de la taille moyenne du pageot débarqué par les chalutiers du port de Sfax a montré que des mesures de préservation prises en 1981-1982 et 1984 ont eu un effet favorable sur la régénération du stock (GHORBEL et BOUAIN, 1990) mais depuis 1986, ces mesures deviennent insuffisantes devant l'augmentation considérable de l'effort de pêche et le chalutage anarchique pour la capture des espèces nobles telles que la crevette et les céphalopodes (BRADAI *et col.*, 1991).

Tableau 1: Résultats obtenus par application des modèles globaux de SCHAEFER (1) et de FOX (2). (J.m. = Jours de mer)

	(1) Pue = Ad + B	(2) Log Pue = B + Af ou Pue = Uoo e^{-bf}
A	-1.325 10^{-3}	-4.404 10^{-5}
B	+72.170	+4.695
R	-0.846	-0.845
foot	27238 j.m.	22806 j.m.
P.M.E.	982.893 kg.	914.162 kg.

Figure 1: Modèles globaux appliqués aux captures du pageot dans le Golfe de Gabès. P.U.E.: Prise par unité d'effort; P.M.E.: Productions maximales équilibrées.



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