SOME BIOLOGICAL ASPECTS OF (SCOLOPSIS GHANAM (FORSKAL) PERCIFORMES: SCOLOPSIDAE) IN ZANZIBAR CHANNEL

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Fishes of the family *Scolopsidae* are found in the tropical Indo-Pacific region. Three species of the genus *Scolopsis*, *S. bimaculatus*, *S. ghanam* and *S. vosmeri* are present in the whole East African coast and as far as the Red Sea. In East Africa, there is a subsistence fishery for *S. bimaculatus* and *S. ghanam* in the coastal lagoons. However, except for comprehensive studies on the biology and fishery of *S. bimaculatus* (Nzioka, 1981), there is little known on the biology of *S. ghanam*.

Fishing in this area is faced with two distinct sets of conditions which are brought about by the changing winds from south-east to north-east resulting in changes in the productivity of the water which is usually linked to changes in fish availability and breeding activity. The present paper is a preliminary account of the biology of *Scolopsis ghanam* (Forsk.) Perciformes: Scolopsidae) in Zanzibar Channel (Fig. 1), based on data collected from 1974 to 1977. The Zanzibar Channel is part of the East Continental shelf with a depth of less than 80 meters. Near Zanzibar island the channel is dotted with small islands, surrounded by coral reefs which are rich in fish fauna.

MATERIALS AND METHODS

The specimen were caught on the reef in traps made of bamboo splinters with mesh size 18.0 cm. The traps were baited with sardines of 4.3 cm and a one way mouth opening of or crabs which were tied in a fine mosquito net so as to make them inaccessible to the trapped fish.

Several traps were joined in series with a distance of 10 metres between them and then left over night, and hauled the following day. Sampling was carried out at the bottom at depths ranging from 15 meters and 45 meters where most of the local fishermen set their traps. The individuals of *S. ghanam* occurred with other species and after initial sorting of the catch in the laboratory the individuals were then weighed, total length measured, sexed and gutted. Gonads were weighed and then preserved in 5 percent formal saline for further

analysis. Guts were also preserved in 5 percent formal saline. To estimate relative fecundity, a piece was cut from each ovary and weighed on analytical balance. The oocytes were then separated from the follicular membrane with the aid of dissecting needles and counted under a low power binocular microscope. The number of yolked oocytes per unit weight in the subsample was then multiplied by the total ovary weight to obtain an estimate of fecundity. Total number of eggs were counted from 60 fish. Six gonad stages were adopted (Nzioka, 1979) based on morphological observations, these being immature (I), maturing or recovering (II), active (III), ripe (IV), running ripe (V) and spent (VI). Food analysis was based on the method of Hynes (1950). Each stomach was classified as full, $\frac{3}{4}$ full, $\frac{1}{2}$ full, $\frac{1}{4}$ full or empty and food items in the stomach were listed and points were distributed among them according to relative abundance taking into account the size of organisms as well as the relative abundance. Length-weight relationship and relative condition factor were calculated by the method of Le Cren (1951).

$$\text{Log}_{10}W = \text{Log}_{10}a + n \text{Log}_{10}L$$

the expected weight of the fish obtained from the length weight relationship formula. Since in some years data was small and available for only a few months it was decided to group the data in seasons irrespective of the year.

Food and feeding habits

A total of 295 stomachs were examined; of these 49.9 percent were empty. No attempt was made to carry out a detailed analysis of the stomach contents. The results of the visual analysis of the stomach contents indicated crustaceans as a dominant constituent of the diet (29.6 percent), followed by molluscs, 11.2 percent), echinoderms (9.5 percent), fish (4.5 percent) and coral fragments (0.9 percent). Unidentified decomposed matter formed 31.7 percent. Sand appeared in appreciable quantities (12.6 percent) and was probably ingested with other food organisms; however, its importance in the stomachs needs further investigation.

Fig. 1: Map of Zanzibar Island showing the sampling area

Scolopsis ghanam

Length-weight relation and relative condition factor

A sample of 261 *S. ghanam* was used to determine the length-weight relationship for the fish population that entered the trap fishery. The derived parabolic equation was

$$\text{Log}_{10}W = -1.6570 + 2.8571 \text{Log}_{10}L$$

(Fig. 2a) which was close to the cubic law of isometric growth. The logarithmic relationship was linear (Fig. 2b) with a correction coefficient $r = 0.96$. The relative condition factor was calculated for each season and a seasonal fluctuation was observed. In the S.E. monsoon the mean relative condition factor was 1.13, in the intermonsoon (September—November) 1.02, in the N.E. monsoon 1.00 and in the intermonsoon (March—May) 0.96.

Spawning season and relative fecundity

Seasonal variations in the proportion of gonad maturity stages are given in Table I and since sampling was not conducted on a regular basis, the sample taken during the entire period have been combined on a seasonal basis.

The observations made on the gonad development indicate that most breeding takes place from the intermonsoon period (September—November), through the N.E. monsoon to the next intermonsoon (March—May). There may be some breeding in the S.E. monsoon since gonads showed a considerable degree of development to stage III and IV (Table I). The value of relative condition factor begins to fall in September—November (1.02) which is an indication of loss of gonad products, reaching the minimum value in March—May (0.96). March—May (intermonsoon) is the time when

most of the fish are recovering (Stage 11, 61.1 percent) with quick development in S.E. monsoon (Stage IV, 12.5 percent). The fecundity of 60 ripe females was estimated from fish in stage IV of gonad maturity. Their size ranged from 17.2 to 18.1 cm total length and 73.6 to 82.9 g respectively. The number of eggs was found to range from 12790 to 22810 with a mean fecundity of 16550 eggs.

Sex ratio and size at first maturity

The overall sex ratio of the Zanzibar population of *S. ghanam* was found to be 1: 1.98 females to males. There was a predominance of males in the intermonsoon period (September—November) 1: 1.92 female to males and 1: 0.41 females to males and in the N.E. monsoon 1: 0.39 females to males. But in the intermonsoon (March—May) the sex ratio was 1:1. A possible explanation to the deviation from 1:1 sex ratio would be behavioral differences since spawning has been observed from intermonsoon (September—November) when sex ratio is 1:1.92 females to males; it would appear that males aggregate earlier than the females during spawning and disperse immediately after shedding their sperms leaving the females behind. Another possibility of the deviation from 1:1 ratio would be sex reversal but no work was carried out determine hermaphroditism.

The size at which *S. ghanam* attain sexual maturity was determined by plotting percentage of mature fish (stage III and above) against total length (Fig. 3). The length at which 50 percent of the fish were mature was taken as size at first maturity, and was found to be 15.0 cm total length.

TABLE I—SEASONAL VARIATIONS IN THE PROPORTIONS OF GONAD MATURITY STAGES DURING THE REPRODUCTIVE CYCLE OF *S. Ghanam* (%)

Season	No.	I	II	III	IV	V	VI
S.E. Monsoon	34	4.2	66.6	16.7	12.5	—	—
(June—August)		(1)	(16)	(4)	(3)		
Intermonsoon:	192	20.3	31.8	30.7	15.6	1.6	—
(September—November)		(39)	(61)	(59)	(30)	(3)	—
N.E. Monsoon:	81	12.4	54.3	8.6	21.0	3.7	—
(December—February)		(10)	(44)	(7)	(17)	(3)	
Intermonsoon:	36	8.3	61.1	16.7	2.8	2.8	8.3
(March—May)		(3)	(22)	(6)	(1)	(1)	(3)

Number in parentheses = number of fish.

Fig. 2: (a) Length-weight relationship of *S. ghanam*
(b) data for (a) converted to logarithm

DISCUSSION

The composition of the food of *S. ghanam* and the apparent dominance of crustaceans found in the stomach of fish is a reflection of the abundance of this group in the benthos as well as of selective feeding. In a multi-species stock, Darracott (1977) found that the fish feed on other fishers or crustaceans the latter being pronounced during the spawning migration of crabs in August–September (Heath, 1973). The occurrence of sand in all the guts examined indicates that the fish actively predate on bottom dwelling organisms. The value $n=2.85$ in the length-weight equation for *S. ghanam* is in close agreement with the cubic law of isometric growth for an ideal fish maintaining constant shape. This is not far from the value of 3 reported elsewhere (Allen, 1938). Following gonad development, it is observed that *S. ghanam* starts to spawn from September and continues to January with the recovery period from March to May.

Okeru (1974) reported spawning activity in *Sardinella albella* and *S. gibbosa* started from September and continued until March with peak in September/October. In contrast the peak for *S. ghanam* was found to be December–January which is in the N.E. monsoon. However, similar spawning activity in the N.E. monsoon period has been reported in reef fishes (Nzioka, 1979) and other related studies (Wheeler and Ommanney, 1953; Talbot, 1960, and Morgan, 1962, 1964).

Breeding activity is usually linked with temperature and productivity of the water, it has been reported (Krey and Babenard, 1976) that November to April, during the N.E. monsoon is the time of increased phytoplankton production. For the whole population the sex ratio was close to 1:1, but at the beginning of the spawning season males became more predominant. During the peak of spawning, in December–January females were predominant

SUMMARY

The biology of *Scolopsis ghanam* (Forsk.) (Periformes: Scolopsidae) in the coastal waters of East Africa was studied in Zanzibar Channel from 1974 to 1977. The diet consisted of crustaceans (29.6 percent), molluscs (11.2 percent) echinoderms (9.5 percent) and fishes (4.5 percent). Sand (12.6 percent) and coral fragments (0.9 percent) in the digestive tract indicate that

this species also predate on bottom dwelling organisms. The length-weight relationship was found to be close to the cubic law of isometric growth. The spawning period of the species was found to be from September to January during the intermonsoon period and N.E. monsoon, and the relative fecundity ranged between 12790 and 22810 with a mean of 16550. Sex ratio was 1:1 with slight variation during the spawning period when females were dominant.

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