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Food and feeding habits of Santer seabream *Cheimerius nufar* (Val.,1830) from the Arabian Sea coast of Oman

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Original Article

Abstract

Food and feeding habits of the Santer Seabream *Cheimerius nufar* were studied from the Arabian Sea coast of Oman for two years during April 2005-March 2007. The stomach contents consisted of substantial quantities of semi-digested matter and identifiable items like sardines, crab, squid, cuttlefish and other crustacean remains indicating the fish is an active carnivore. There was not much variation in the food items encountered during various months. Active, moderate and poor feeding observed at various months, maturity stages and size groups of fish suggested no specific trend in feeding intensity. The information gathered would be useful for trophic modelling of marine fishes of Oman.

Keywords: *Cheimerius nufar, food, feeding intensity, Arabian Sea, Oman.*

Introduction

The distribution and seasonal variation of the food organisms of a fish species might affect the shoaling behavior, migration, growth, and also the fishery (James, 1967). The recent development in modeling of marine ecosystems (Christensen and Pauly, 1993; Walters *et al*., 1997) require information mainly on the diet composition and food consumption rates besides, biomass and mortality estimates of organisms. Hence, the study of stomach contents of fish becomes pertinent to understand the marine food chain and the predator-prey relationship. The santer seabream, *Cheimerius nufar* (Family: Sparidae) is a moderate sized fish and is distributed in the western Indian Ocean including the Red Sea, coasts of Oman, Arabian Gulf, east African coast, Madagascar and the Mascarene Islands (Bauchot and Smith, 1984 ; Smith and Smith, 1986; Randall, 1995; Connell *et al*., 1999). The sparid, *C. nufar* is locally known as 'kofwar' or 'frenka' inhabits inshore waters up to 60-100 m depth and forms an important component of the demersal fishery of Oman. The estimated catches of *C. nufar* from the Arabian Sea coast of Oman for the years 2005-06 and 2006-07 were 2,075 t and 2,018 t respectively (GOSO, 2006). Though, *C. nufar* is a priority species and intensively fished in Oman, no detailed study has been carried out on the seasonal variation of food items and feeding intensity of the species. Thus in the present study an assessment of the general food composition, seasonal variation of food items and feeding intensity of *C. nufar* from the Arabian Sea coast of Oman was made for two years in order to develop database for trophic modelling of Arabian Sea fishes.

Material and methods

A total of 1,325 specimens were collected at random from the fish caught by the artisanal fishing gears such as gillnets,

traps, castnets and beach seines operated in the coastal waters of the Arabian Sea and landed at Lakbi and Salalah landing centers (Fig.1) between April 2005 and March 2007. The fish were brought to the laboratory in ice box for qualitative and quantitative estimation of food. Each fish was measured (± 0.1) to its total length (TL). Then the fish was cut open and the sex and maturity stage of the gonad were determined as I-Immature; II-Maturing 1; III-Maturing 2;IV-Mature; V-Ripe/

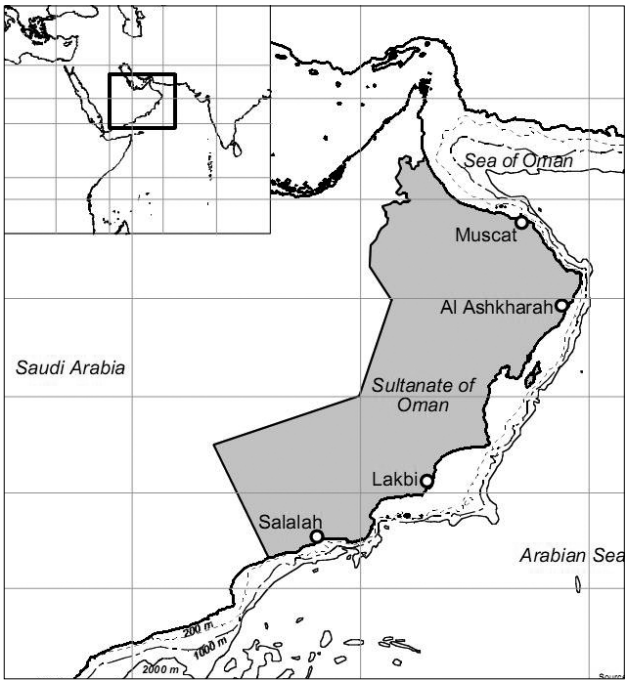

Fig. 1.Map of Oman showing sampling location

Running and VI-Spent based on the macroscopic appearance and microscopic structure of ova in different stages of ovaries and on macroscopic appearance of testes (Al-Marzouqi *et al.*, 2009). The liver was removed and weighed to the nearest 0.001 g using an electronic balance. The stomachs were dissected out and preserved in 5% neutral formalin for subsequent analysis. The size of the fish used for the study ranged from 16 cm to 64 cm.

For the seasonal variation of the quantity of food items, points (volumetric) method (Hynes, 1950) was used. Feeding intensity in *C. nufar* was studied from September 2005 to March 2007. A total of 990 fish were analyzed for the fullness of the stomachs and were grouped into actively fed (full and 3/4 full stomachs), moderately fed (1/2 full stomachs), poorly fed (1/4 full stomachs) and empty. The feeding intensity in relation to months, maturity stages and size of the fish was estimated.

To understand the nutritional state of the fish, the monthly hepato-somatic index (HSI) was calculated following Busacker *et al.*, (1990) .

For the estimation of length-weight relationship in *C. nufar*, a total of 4,132 specimens were measured for their total length to the nearest 1 mm and weighed to the nearest 1 g and the relationship was estimated following Le Cren (1951) .

Analysis of covariance (ANCOVA) (Snedecor and Cochran, 1967) technique was employed to test the significant difference if any, in the relationships between males and females at 5% level.

Results and discussion

General food composition

The common food items found in the gut of *C. nufar* largely belonged to fishes, crustaceans, cephalopods and polychaetes. About 41.21 % of food items were found to be semidigested whereas sardine, crustaceans, cephalopods, polychaetes and other fish represent 37.66 %, 1.88 %, 2.09 %, 1.05 % and 16.11 % of food items respectively (Fig. 2).

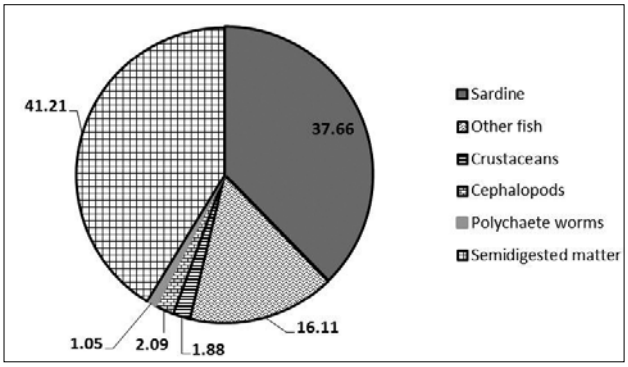

Fig.2. General food composition of *C. nufar* during 2005-07

Monthly variation in the composition of diet

The semidigested matter was the dominant item in the gut of fish during most of the months and the percentage contribution ranged between 89% (January) and 37.8% (December) (Fig. 3). While the contribution of sardine varied from 30% (March) to 89% (December), 'other fish' varied from nil (January) to 36% (December). The other food items such as crustaceans (0% - 11.1%) and cephalopods (0% -14%) occurred for few months. A total of 847 fish with empty stomachs were recorded.

Feeding intensity in relation to months

The empty stomachs were dominant during all the months except in July, August and October (Fig. 4). Active feeding (full and 3/4full stomachs) was found in individuals from 7.8% (February) to 16% (December). Moderate feeding (1/2full

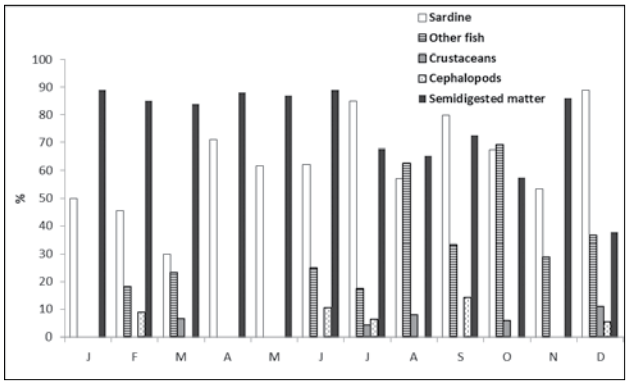

Fig. 3. Monthly percentage composition of food items of *C. nufar* during 2005-07

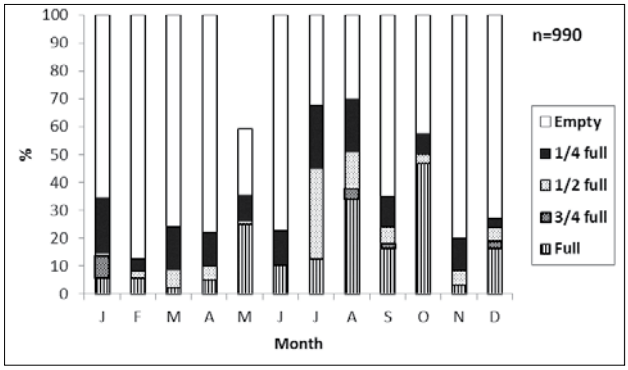

Fig. 4. Feeding intensity as *C. nufar* in relation to months during 2005-2007

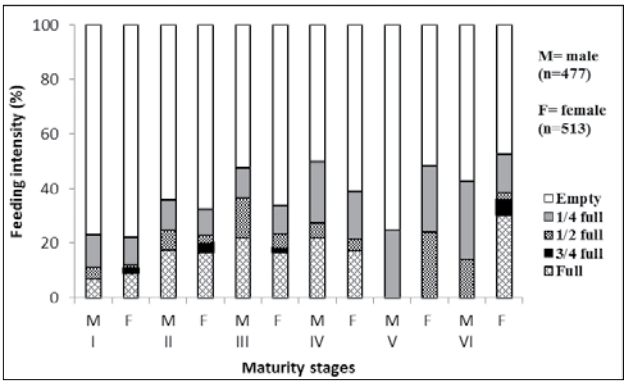

Fig. 5. Feeding intensity in different maturity stages of *C. nufar* during 2005-2007

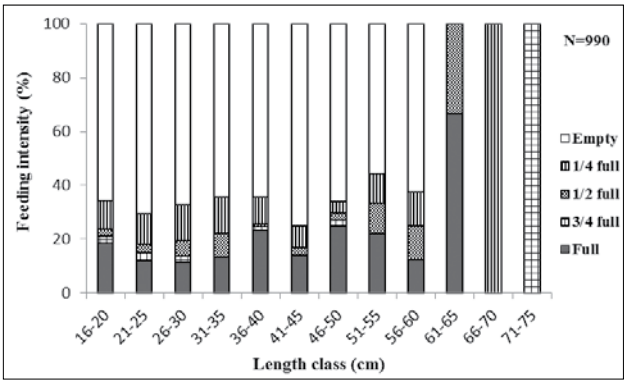

Fig. 6. Feeding intensity in different size groups of *C. nufar* during 2005-2007

stomach) was observed during most of the months and the percentages ranged between 0.9% (January) and 13.2% (August). The highest percentage of poor feeding intensity (1/4full stomach) was recorded during January (19.6%) and August (18.9%) .

Feeding intensity in relation to maturity stages

There was no consistency in the occurrence of active, moderate and poor feeding in various stages of maturity of males and females (Fig. 5). However, empty stomachs were dominant in all the maturity stages that ranged from 50% (stage IV) to 76% (stage I) in males and 47.2% (stage VI) to 77.57% (stage I) in females.

Feeding intensity in relation to size of fish

Feeding intensity in relation to different sizes of *C. nufar* showed inconsistency of feeding among fish (Fig. 6). The percentage of empty stomachs ranged from 55.6% (51-55 mm size group) to 75% (41-45 mm size group). Active feeding was observed in fish of sizes 61-65 mm (66.7%) and 71-75 mm (100%).

Hepato-somatic Index (HSI)

The calculated monthly hepato-somatic indices of female fish registered generally higher values than the males except February and March during 2005-2007 (Fig. 7). The peak value for both males and females were during September, which started declining progressively up to February.

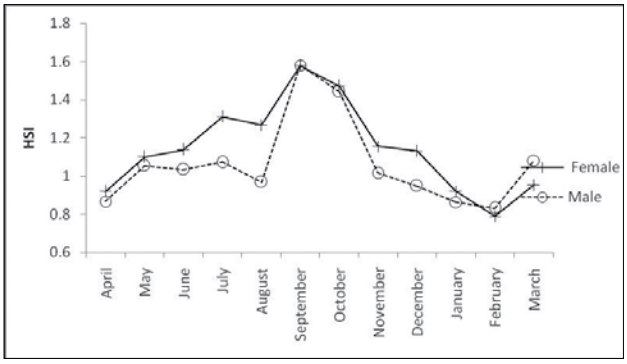

Fig. 7. Monthly hepato-somatic indices in *C. nufar* during 2005-2007

Length-weight relationship

The estimated length-weight relationships of males, females and sexes pooled data of *C. nufar* are shown in Table 1.The ANCOVA test for length-weight relationships of males and females showed that both the slopes and means were not significantly different ($P>0.05$) and hence, the common

equation for the species would fit well. The coefficient of determination (R2) in males, females and sexes pooled were highly correlated.

The food analyses of the gut clearly indicated that the fish was the most preferred food of *C. nufar* followed by cephalopods, crustaceans and polychaete worms. While, the crustaceans were preferred in minor quantities by size groups of 16-30 cm, cephalopods and polychaetes were preferred by small and medium sized fish. Feeding on nektonic and benthic forms by *C. nufar* especially on fish as primary food item and occasional feeding on cephalopods crustaceans and polychaetes has been observed from the Gulf of Aden (Druzhinin, 1975) and South African waters (Smale, 1986).

Occurrence of empty stomachs in several species of fishes from the Arabian Sea is common (Sreenivasan, 1974; Naik *et al.*, 1990; Kalita and Jayabalan, 2000). About 54.9% of *C. nufar* occurred with empty stomachs from South Africa (Coetzee and Baird, 1981). However, in the present study from Oman, the empty stomachs in *C. nufar* accounted for about 67.5% . Though, the spent fish feed actively (Jayabalan and Ramamoorthi, 1985; Jayabalan, 1988) to balance the lost energy during spawning, active, moderate and poor feeding in *C. nufar* occurred in all the maturity stages of males and females indicating inconsistency in feeding intensity. The incidence of empty stomachs in fish may be related to the regurgitation (Job, 1940); high calorific value of the diet consumed (Longhurst, 1957) and faster rate of digestion (Qasim, 1972).

The fish besides storing the energy in the muscle tissue also accumulates in the liver during the periods of high energy intake and the relative size of the liver can be correlated with the nutritional state of the fish and also with the growth rate (Busacker *et al.*, 1990).The declining trend of HSI values from September to February was almost identical to the declining trend of GSI values.

The value of exponent b in length-weight relationship of *C. nufar* from South Africa was found to be 2.7831 (Coetzee and Baird, 1981) which fell within the range generally found for fish (Ricker, 1971). It is interesting to note that while there was significant difference between the slopes of the fork length-weight regressions of males and females in an earlier study from the Arabian Sea off Oman (McIlwain *et al.*, 2006), whereas, in the present study, no such significant difference between the total length-weight relationships could be established.

Table 1. Length - weight relationship of *Cheimerius nufar*

Deviations from regression										
Source	d.f.	ssx	ssy	spxy	Reg. coeff.	S.S.	M.S	F	Prob	
Within										
Males	383	24.84993	212.764	72.22245	2.906345	382	2.860714	0.007489		
Females	492	32.2233	273.1801	93.12948	2.890129	491	4.023914	0.008195		
						873	6.884628	0.007886		
Pooled W	875	57.07322	485.9441	165.3519	2.897189	874	6.888317	0.007881		
Difference between slopes						1	0.003689	0.003689	0.46809	0.494048395
Between B										
W+B	876	57.08046	486.0208	165.3755		875	6.889236			
Between adjusted means						1	0.000919	0.000919	0.116546	0.732893323

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