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NATURAL DIET AND FEEDING HABITS OF THE *SARDINELLA LONGICEPS* VAL. (OIL SARDINE) OF BALOCHISTAN COAST, PAKISTAN

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ABSTRACT

The food and feeding habits of *Sardinella longiceps* Val. (oil sardine), an important food item from coast of Gwadar, Balochistan was investigated for 12 months period . Four hundred and thirty specimens of *S. longiceps Val.* were examined for food and feeding habits, It was caught by gear operating in the sea floor.Fish obtained from the surface gill net showed poor feeding and the food consisted mainly of *Coscinodiscus,* a typical diatom. The fish from bottom gill nets and trawl nets had gorged stomachs and the food item Comprised mainly, either *Pleurosigma* or *Ornithocercus* , typical bottom-dwelling forms. There was variation in feeding in relation to size.

Key- words: *Sardinella longiceps* Val., Food, Feeding habits, Balochistan coast, Marine water fishes.

INTRODUCTION

The oil sardine, *Sardinella longiceps* Val. is a very important pelagic fish. Besides, being a favored nutritionally rich and affordable table fish occurring abundantly almost throughout the year, it also serves as a source for valuable by-products like sardine oil used in several industries and fish-meal for cattle and poultry feed production. Its fishery is Characterized by remarkably wide fluctuations on a seasonal, annual and decadal scale. The successful years of oil sardine fishery bring as much prosperity to the fishing community as its failure a major economic setback.

The biology of Oil sardine grows rapidly during the first few months and matures early Within its life span of about 2 ½ years. The age at first maturity occurs at less than one year, at about 150 mm size. Maturation is controlled by climatic factors like temperature and intensity of rainfall. The oil sardine is a planktivore and diatoms, dinoflagellates and copepods are the favoured food items. The abundance of diatom is said to indicate abundance of oil sardine in coastal waters. The optimum temperature and salinity ranges for distribution and abundance of oil sardine is 27-28°C and 22.8-33.5 ppt, respectively. The food and feeding habits of *Sardinella longiceps Val.*, economically the most valuable clupeiform fish from, had been the subject of study forthe past five decades (Hornell, 1910; Homell and Nayudu, 1924; Devanesan, 1943; Chidarbaram, 1950; Nair, 1953; Nair and Subrahmanyan, 1955; Venkataraman, 1960; Dhulkhed, 1962). Although a general idea of the elements on which the oil sardine subsists is worked out, data published on the food-habits of the different stages in its life-span is scanty and doubtful. Chidambaram (1950) opines that the food of young and adult sardines does not differ much.

Reference that "immature adults and spawners" feed "mostly on phytoplankton"and "very young sardines" feed mainly on copepods has been made by Nair(1953). Similar feeding habits have been reported for others fishes by Abdel Aziz and Gharib (2007), Joadder (2007), Kahilainen (2004), Kumar and Balasubrahmanyan (1989), Nunn *et al*., 2007) (Oronsaye (2005), Shalloof (2009), Stergiou and Karpouzi (2002) and Tsiklirasi (2005).

The aims of this study were to analyze the natural diet and feeding habits of *S.longiceps* Val. inhabiting Gwadar, Balochistan coast.

MATERIALS AND METHODS

Gwadar is situated towards the western end of Pakistan's Makran coast, some 40km east of the border with Iran. Gwadar is a rocky headland connected to the mainland by a Sandspit. The headland stretches east-west for 13km, with a maximum width of 3km. The 430 specimens of *Sardinella longiceps* Val. were obtained from Gwadar coast from January 2009 to December 2009). The fish were transferred to a deep freezer. The preserved specimens were dry before analysis. The standard and total length (in mm) were measured an a measuring board while the weights (in grammas) were determined using a balance. The stomach contents were emptied into a Petri dish and examined under a binocular microscope. The state of fullness of stomach was recorded. The volume of stomach content was determined by the displacement method. In cases where the stomach gorged, the gut content was made up to a known volume (100 ml) and whenever the food was found to be dense, a sub-sample of this was taken and further diluted. An aliquot of 1 ml was taken and spread over a counting chamber. The number method (Hynes,1950)was followed for the estimated of relative items of food was calculated in terms of percentages .

RESULTS AND DISCUSSION

Four hundred and thirty specimens of *Sardinella longiceps* Val. were examined for food and feeding habits. Two hundred and fourteen fishes (49.76 %) had empty stomach (Table1).Analysis of monthly variation in empty stomach (Table 1) showed that the highest occurrence of empty stomachs was in August 2009 (80%),while the lowest was noted in February and May 2009 (25%).variation in empty stomach by size group (Table 2) indicated that the small size group of *Sardinella longiceps* Val. had the least number of empty stomachs (50.84 %).The stomach contents of *S.longiceps* Val. are presented in Table 3 and the summary of the items is illustrated in Fig 1. The fish had fed almost exclusively on a dinoflagellate, *Ornithocercus* . Zooplankters (copepods) were noticed to a negligible extent in the diet almost all around the years. The difference in the gut contents of fish taken from the surface waters and close to the sea floor was evident. In fish from bottom nets the main item of food was *Pleurosigma* or *Ornithocercus*, which are typical bottom dwelling forms.

In the gut of fish from surface gill net on the otherhand, *Coscinodiscus*, a typical diatom of the upper layers of water, formed an important item of food. Thus, it appeared that fish collected from different levels have been feeding on the different species of diatoms or dinoflagellates which were dominant in the respective layers of water. The occurrence of *Pleurosigma* or *Ornithocercus* in the bottom layers may be due to the decrease in the viscosity of surface waters consequent on the increase in temperature and also to the condition of optimum light (Subrahmanyan, 1959; Raymount, 1963). The intensity of grazing as evidenced by the occurrence of single species of phytoplankton in the stomach of oil sardine caught in 10-20 m depth indicates that very rich feeding grounds exist at these depths. The observations also indicate that the oil sardine occasionally resorts to a demersal habitat.

Table 1. Monthly variation in empty stomach of *Sardinella longiceps* Val. from Balochistan coast.

Month (2009)	Number of fish examined	Number with empty stomachs	% Empty stomachs
January	30	10	33.33
February	20	05	25
March	35	20	57.14
April	35	15	43.85
May	20	05	2.5
June	30	20	66.66
July	30	10	33.33
August	50	40	80
September	50	30	60
October	50	20	40
November	30	14	46.66
December	50	25	50
TOTAL	430	214	49.76%

Table 2. Variation in empty stomach by size of *Sardinella longiceps* Val. from Balochistan coast.

Size/Standard length mm	Number of fish examined	Number with empty stomachs	% Empty stomachs
Small-sized fish (155-175)	141	60	42.53
Medium-sized fish (180-200)	171	85	49.7
Large-sized fish (205-220)	118	60	50.84

The other workers,Hornell and Nayudu (1924) stated that the oil sardine "feed upon immense quantities of unicellular plants (Phytoplankton) and animals". John and Menon (1942), Chidambaram (1950) and Nair (1953) observed that diatoms, dinoflagellates and copepods constituted food of oil sardine. It is to be noted here that these workers carried out their investigations at Gwadar. The present study has shown that in the Gwadar waters also the commercial size groups of oil sardine feed entirely on plankton,especially on phytoplankton.

Nair and Subrahmanyan *{op. cit)* have stated that the diatom is the favourite food item of oil sardine at Gwadar. Other important species of diatoms were *Coscinodiscus, Biddulphia* and *Pleurosigma*.Dinoflagellates were also seen.A large numbers on a number of copepods were also observed in the gut inclusion but in lesser numbers.

Table 3. Various food items and displacement volume of stomach of *Sardinella longiceps* Val.

No. of specimen examined	Size range of oil sardine (mm)	Displacement value of stomach (ml) range	Pleuro-sigma	Conscino-duscus	Biddulpnia	Diplonies	Ornitho-cercus	Dinophysis	Copepods
141	155-175	1.1-2.0	38.46	21.79	7.69	12.82	5.12	7.69	6.4
171	180-200	0.8-2.5	36.36	27.2	0.90	3.63	9.09	4.54	18.18
118	205-220	0.4-2.9	24.39	12.19	2.43	7.319	12.19	4.87	36.58

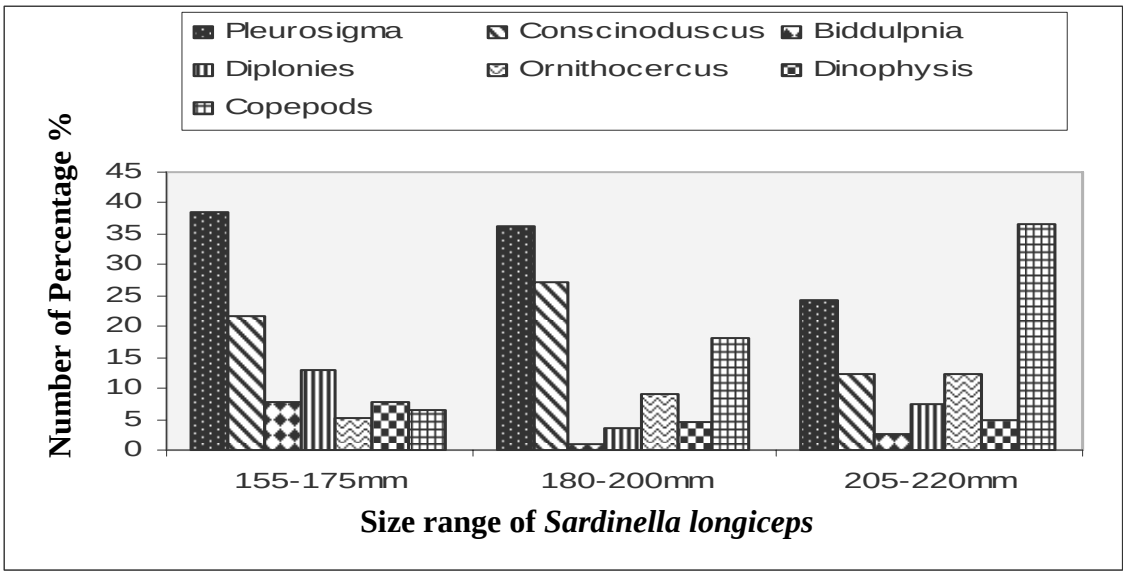

Fig. 1. Stomach contents of *Sardinella longiceps* Val., from Balochistan coast.

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