



# Biological aspects of the Sack fish, *Neopinnula orientalis* from southeastern Arabian Sea

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Short Communication

## Abstract

Biological aspects of *Neopinnula orientalis* is reported based on samples collected from the by-catch landed by deep-sea trawlers at Cochin Fisheries Harbor. The estimated length at first maturity ( $L_m$ ) of females was 195 mm and males 192 mm. Diet study indicated strongly carnivorous feeding habit dominated by fishes (55%), cephalopods (27%) and crustaceans (18%) occurring in deeper waters. Absolute fecundity ranged from 12,149 to 1,54,556 with relative fecundity 737 eggs/g body weight and indicated a multiple spawning habit.

**Keywords:** *Neopinnula orientalis*, diet, reproduction, life history

## Introduction

Fishes of the family Gempylidae (Snake mackerels) usually inhabit deep waters at depth ranges from 200 to 500 m and *Neopinnula orientalis* (Gilchrist and Von Bonde, 1924) is commonly observed in the deep sea trawl by-catch along the

Indian coast. The Snake mackerel fishery landed at Tuticorin has been reported by Balasubramanian and Abdussamad (2007). Reports from exploratory surveys (Sivakami, 1990; Khan *et al.*, 1996; Jayaprakash *et al.*, 2006; Venu and Kurup 2006; Karuppasamy *et al.*, 2008 and Sreedhar *et al.*, 2013) indicate its occurrence along the Indian coast. Results of the exploratory surveys in the Arabian Sea indicate that the species is abundant in 7°-12° N latitudes with catch rates varying from 6-11 kg/h (Venu and Kurup, 2006) to 67 kg/h (Mathew *et al.*, 1993). Although, initially not considered as a table fish, demand for snake mackerels have since grown in the domestic market (Abdussamad *et al.*, 2011) making it a potential target for fishing as exploitation of deep-sea resources develop in India. Hence baseline data on the fishery aspects and life history traits of the species need to be documented.

## Material and methods

Samples were collected from the trawl by-catch at Cochin Fisheries Harbor during the period of 2009-2010. From monthly samples, 1,309 specimens were individually analysed for length frequency distribution and their biology recorded. Stomachs were visually categorized based on the fullness of the gut and classified into active (1/ 2 to full) and poor feeding (1/4 to traces) condition. Empty stomachs were

recorded separately. Occurrence method (Hynes, 1950) was used to determine preferred prey items using stomachs which contained food (n= 473). Macroscopic assessment of gonads for different stages of maturity stage, using egg size, gonado somatic index and gonad appearance was made. Fishes with stage V and VI gonads, classified as ripe (n=26, total length 215-265mm) were used for estimation of fecundity by gravimetric method. Length at first maturity ( $L_m$ ) was estimated using logistic curve method (King, 1996) with fish of size range 135-280 mm (n=275). Length-weight relationship was determined as:  $W = a L^b$  where,  $W$  = weight of fish (g) and  $L$  = length of fish (mm).

## Results and discussion

### Length frequency

The size distribution of males ranged from 140 to 220 mm and females from 130 to 280 mm. Females of comparatively larger size range than that of males were available in the by-catch. Females dominated among the fishes having size > 220 mm (Fig.1). Length weight relationship showed allometric growth with no significant differences among the sexes. The pooled length weight relation  $W = a L^b$  was determined as:  $W = 0.000001 L^{3.230}$  ( $r^2 = 0.7736$ )

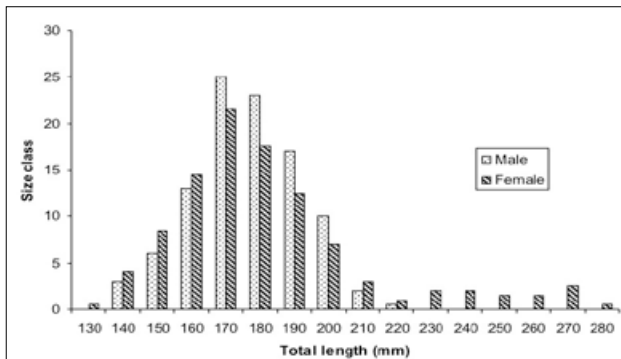


Fig. 1. Size distribution of males and females of *Neoepinnula orientalis*

### Diet studies

Fishes (55%) constituted the major food component followed by cephalopods (27%) and crustaceans (18%). Fishes were abundant in August to November, cephalopods during December, January and March and crustaceans in May (Fig. 2). *N. orientalis* is strongly carnivorous with squids, fishes, octopuses, shrimps, ribbonfish and myctophid as common food items (Fig. 3). Off Tuticorin coast, a diet dominated by myctophids and mesopelagic fishes was reported by Abdussamad *et al.* (2011), while Karuppasamy *et al.* (2008) reported myctophids and shrimps as dominant. However, in the present study the oceanic squid *Sthenoteuthis oualaniensis* (36%) and ribbon fishes 25(%) formed the single largest diet components which could be due to the increased availability

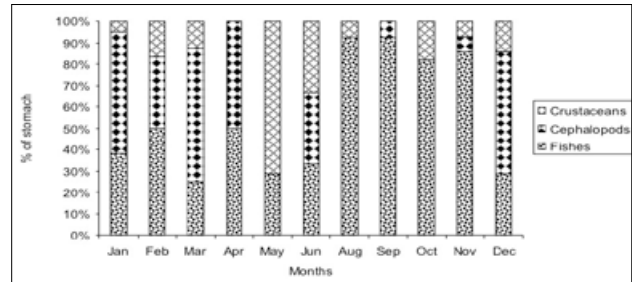


Fig. 2. Percentage composition of different groups in the stomach content of *N. orientalis*

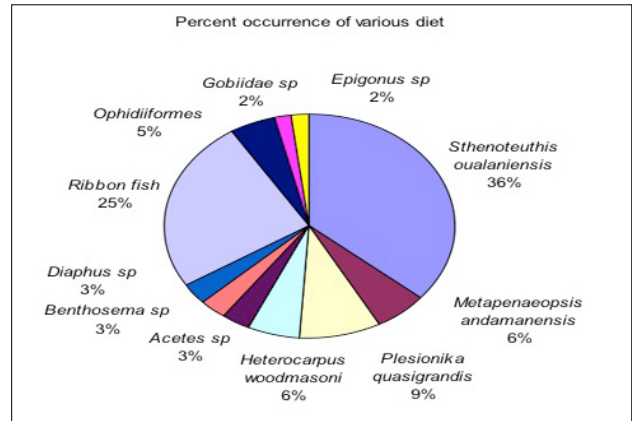


Fig. 3. Percentage occurrence of various diet component in *N. orientalis*

of these resources in the Arabian Sea (FAO, 2011) as compared to Gulf of Mannar ecosystem in the Bay of Bengal. The study thus indicates that the species has a broad diet width and accepts fishes, shrimps and molluscs as food, when available which becomes a favorable factor while scoring the general resilience capacity of the species.

### Reproductive biology

Length at first maturity ( $L_m$ ) was estimated as 192 mm in males and 195 mm in females (Fig. 4) which is slightly higher than the size of 180 mm (sexes pooled) estimated in the Gulf of Mannar ecosystem.

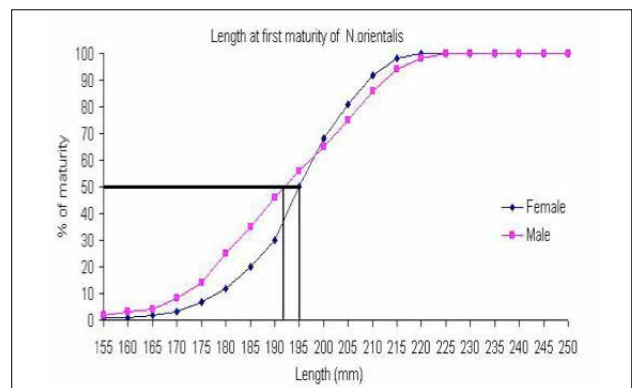


Fig. 4. Length at first maturity of *N. orientalis*

Gonadosomatic index indicated stage I and stage II are with immature ova; stage III, IV, and V are mature stage; VI ripe and stage VII spent. High gonadosomatic indices were recorded for both male and female in ripe mature stages with females having higher GSI than males. GSI of females nearly doubled when they passed from maturing to ripe stage, but the increase in GSI was comparatively lower in males (Fig. 5).

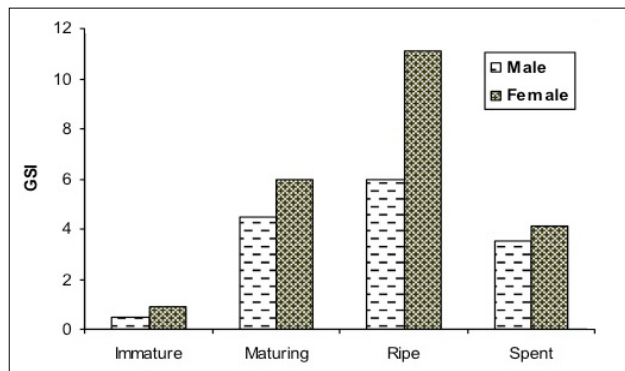


Fig. 5. GSI during various maturity stages of *N.orientalis*

Macroscopically ripe ovaries were whitish in colour and maximum spawning activity as observed from occurrence of ripe gonads was during November to December (Fig. 6). Immature fishes dominated in May. Abdussamad *et al.* (2011) reported that mature fishes occur in the Gulf of Mannar during December to March which is similar to the observation in the present study.

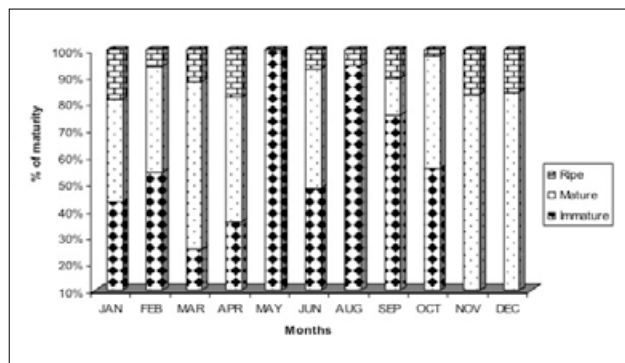


Fig. 6. Maturity stages recorded in *N.orientalis* during different months

Table 1. Gonad stages in female *N.orientalis*

Gonad condition	Stage	Ova diameter range	Ova diameter mode	Ovary condition	GSI
Immature	I	0.03-0.09 mm	0.07 mm	Ovary very small, colorless, eggs not visible to naked eye.	0.5- 0.9
Immature	II	0.05-0.2 mm	0.1 mm	Translucent, ovary pinkish red in colour.	
Developing	III	0.05-0.4 mm	0.2 mm	Ovary whitish in colour with blood capillaries, eggs visible as whitish granules.	4.5- 6
Early mature	IV	0.2-0.6 mm	0.4 mm	Opaque white ovaries with prominent blood vessels. Eggs visible with naked eyes.	
Mature	V	0.3-0.7 mm	0.6 mm	Opaque white ovaries filling body cavity.	6- 11.08
Ripe	VI	0.1-0.8 mm	0.7 mm	Opaque white ovaries with prominent round eggs.	
Spent	VII	0.4-0.8 mm	0.7 mm	Dull whitish flabby ovaries with a few opaque eggs.	3.5- 4.1

Absolute fecundity of ripe female fishes ranged from 12,149 to 1,54,556 eggs. The relative fecundity (fecundity/g body weight) was between 501 to 972 with a mean value of 737 eggs. Abdussamad *et al.* (2011) had estimated a relative fecundity of 794 eggs in the Gulf of Mannar. Fecundity of snake mackerel, a deep sea species is thus comparable to species with high fecundity and rapid population turnover rates like mackerel found in the pelagic realm. Relation between body length, gonad weight and body weight to fecundity indicated that total length had strongest relation to fecundity ( $r^2=0.8$ ) (Fig.7) compared to gonad weight ( $r^2 = 0.2$ ) and body weight ( $r^2 = 0.15$ ). Regulating the size of fish

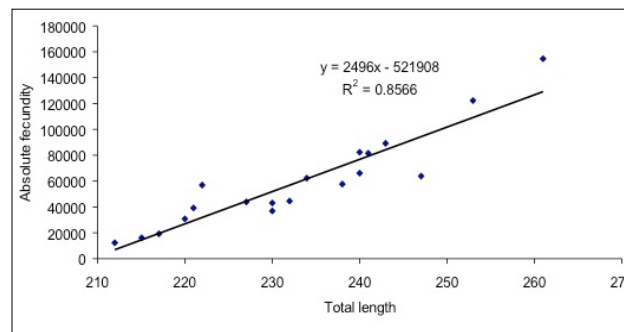


Fig. 7. Relationship between total length and absolute fecundity of *N.orientalis*

caught will therefore be an important fisheries management tool for this species if fisheries targeting the deeper water resources develop in the future.

Egg size of 0.4 mm was observed in the first stage of maturity and 0.7 mm in fully ripe stages (Table. 1). Histological examination of ripe ovaries revealed presence of three batches of oocytes (Fig. 8 and 9) that contained immature oocytes (< 0.3 mm), mature oocytes (0.3 mm-0.7 mm), and ripe oocytes (> 0.7 mm) which indicated that the fish is a multiple spawner.

High relative fecundity and multiple spawning nature indicate potential for high population turnover rates. Catch

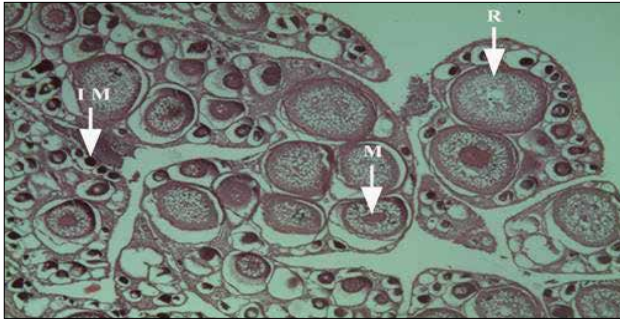


Fig. 8. Histological section of ripe gonad of *N.orientalis*: IM -Immature eggs, M- Mature eggs, R-Ripe eggs ( H&E, x 40)

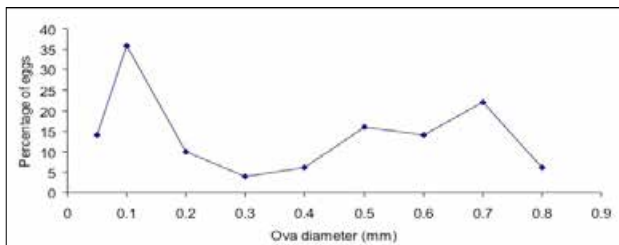


Fig. 9. Ova-diameter of ripe gonad in *N. orientalis*

rates in exploratory surveys and by-catch estimates also indicate its relatively high abundance in Indian seas. The results of the study suggest that this species is one of the potential fishery resources that can be exploited from beyond 200 m depth zone.

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