Short Communication

Morphometric relationship and fishery of Indian Ocean lobsterette, *Nephropsis stewarti* Wood-Mason 1873 along the southwest coast of India

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Abstract

The Indian Ocean lobsterette, *Nephropsis stewarti,* is landed at Mangalore Fisheries Harbour by deep-sea trawlers operating at 250-500 m depth off North Kerala and South Karnataka from the year 2000 onwards. During 2000-2006, the average annual landing of the species was estimated at 23.3 t with the highest landing in 2001 (51 t) and the lowest in 2005 (9 t). Studies on length-frequency and morphometric characteristics of the lobster were carried out during 2005-2006. Fishery was constituted by the length range 58-158 mm. Females < 80 mm (total length) were found to be immature. Highest percentage (33%) of immature females was found during November, 2006. The total length-body weight relationships derived for males and females were $W = 0.01737\ L^{2.942954}$ and $W = 0.01873\ L^{2.89537}$ respectively. The carapace length-body weight relationships were $W = 0.66626 CL^{3.09198}$ for males and $W = 0.62579\ CL^{2.89828}$ for females. Significant differences between slopes and elevations of carapace length-body weight and carapace length-total length relationships were found between sexes. Males were found to be heavier than females of similar size.

The Indian Ocean lobsterette, *Nephropsis stewarti* is reported to have wide distribution in the Indo-West Pacific from Eastern Africa to Japan, the Philippines, Indonesia and Northwestern Australia from 170 to 1,060 m depth (Chan, 1998). Even though sporadic landings of these lobsters were reported from elsewhere (Kizhakudan and Thirumilu, 2006), regular landing of the species supporting a fishery was not described from any part of the world. The landing of the species was observed in Mangalore from the year 2000 and since then it is recorded regularly during November-February at Mangalore Fisheries Harbour. The meat of this lobster is a delicacy and demands good price in export market.

Study of biometric relationships is of vital importance in fishery biology investigations and stock assessment. In management perspective, this relationship is used for fixing minimum legal size in many developed countries (Thomas, 1973). For size measurements of shrimps and lobsters, either total length or carapace length or both (Dall *et al.*, 1990) are used. For comparison of data from different sources, the relationship existing between total length and carapace length is a handy tool. Since the lobster is an export oriented perishable commodity, in many instances the fishermen do not spare their catch for collecting length and weight measurements because the time delay may deteriorate the quality and acceptability of the lobsters. Hence it is necessary to derive inter-dimensional relationship so that if one dimension is known, the other dimensions can be calculated. As the processing plants usually export lobster tails of nephropid and scyllarid lobsters by removing carapace, a considerable number of carapace was available for morphometric study. Taking into account the practical implications, a study was conducted on the morphometric relationship of *Nephropsis stewarti*. In the present study, relationships between (1) total-length and body weight, (2) carapace- length and body-weight and (3) carapace-length and total-length of *N. stewarti* are presented.

Berry (1969) was the first to describe the morphomertic relationships in a nephropid lobster, *Metanephrops andamanicus* from the African coast. Ivanov and Krylov (1980) studied on the morphometric relationship of six deep-sea lobsters of the Indian Ocean.

Materials and methods

During 2000-2006, data on catch were collected on an average of 8 days (2 days/week) in a month from the commercial trawl catches at Mangalore Fisheries Harbour. Samples of *N. stewarti* collected during January 2005-December 2006 were washed thoroughly in seawater and excess water from the body was removed using a blotting paper. A total of 182 males and 189 females were used for the study. The total length and carapace length ($\pm$ 0.1 cm) and total weight ($\pm$ 0.01 g) were recorded for males and females separately. The total length was measured from tip of posterior margin of the orbit to the tip of the telson, to the nearest millimeter, keeping the abdomen fully stretched. Carapace length was measured with Vernier calipers from orbital notch to the hind edge of the carapace along the mid dorsal line (Farmer, 1975).

The linear equation ($\log W = \log a + b \log L$) was fitted for males and females separately with log transformed data. Regression analysis was performed to determine the constants 'a' and 'b' and relationship between length and weight. The correlation coefficient (r) was determined to know the strength and pattern of relationship between the two variables (Ivanov and Krylov, 1980). Analysis of covariance (Snedecor and Cochran, 1967) was performed to test the significant difference in the relationship between the sexes at 1% level.

Results

Fishery and size distribution: The landing of *N. stewarti* at Mangalore Fisheries Harbour started in 2000. During 2000-2006, the annual average landing was estimated as 23 t. The species is mainly landed by deep-sea trawlers (overall length 15 to 16 m), fitted with 122 hp engines and operated at 250-500m depth off North Kerala and South Karnataka. Major landing occurred during November-February. The highest annual landing was observed in 2001 (51 t) but it declined in later years recording the lowest of 9 t in 2005 (Fig. 1). The length-range of the lobster was 58-158 mm (total length). The total length of males ranged from 67 to 113 mm (carapace length: 19 to 31 mm) and that of females from 58 to 158 mm (CL: 17 to 54 mm). The individual weight of males ranged from 3.5 g to 21 g and females from 3.8 g to 54
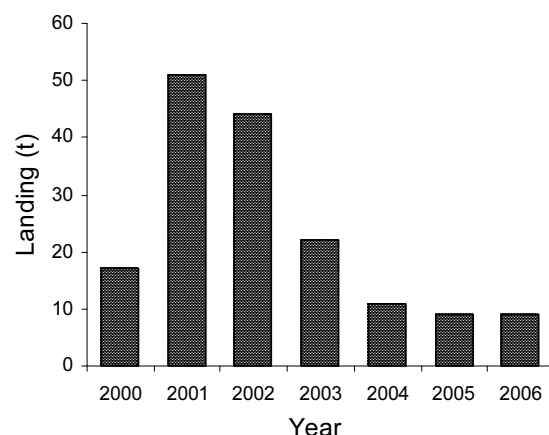

Fig. 1. Annual landing of *Nephropsis stewarti* at Mangalore Fisheries Harbour

g. The modal length of males and females were 110 and 115 mm respectively (Fig. 2). It was found that 89% (in numbers) of the catch was males in the length range of 80-105 mm.

Maturity: Since the landing was restricted to 3 to 4 months a year, annual reproductive cycle could not be traced. However, berried females were found in the fishery throughout the period of collection.
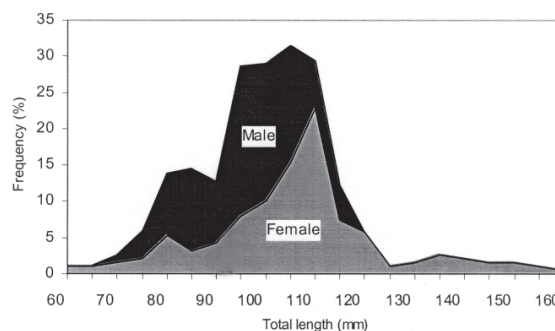

Fig. 2. Length distribution of *Nephropsis stewarti* landed at Mangalore Fisheries Harbour

Study on the maturity stages conducted during 2005-2006 revealed that all the females (in 102-150 mm total length) in January 2005 and 2006 were ovigerous. In February, the percentage of berried females was reduced to 30% (2005) and 58% (2006). Females smaller than 80 mm (TL) were immature and their percentage was found maximum (33%) in November, 2006.

Total length-total weight relationship: The slope and elevation of regression lines between male and female derived through analysis of covariance did not indicate significant variation in slope (F = 0.35, *df*: 1 and 370) whereas in the case of elevation it showed significant difference (F =10.30, *df*: 1 and 370; *P*< 0.01).

The total length-weight relationship for males (n = 182) and females (n = 189) in exponential form is as follows:

Males   : $W = 0.01737L^{2.94295}$ (r = 0.986)

Females : $W = 0.01873\ L^{2.89537}$ (r = 0.977)

where *W* is the total weight (g) and *L* is the total length (cm).

The total length-body weight relationship for pooled data of sexes is as follows:

$$W = 0.01981L^{2.87732}$$

Carapace length-total weight relationship: The data on the carapace length and total weight of the lobsters were also subjected to linear relationship. The regression equations between male and female were tested for equality through analysis of covariance which indicated that there is a significant variation in slope (F = 6.8, *df*: 1 and 370 *P*< 0.01) and elevation (F = 479, *df*: 1 and 370 *P*< 0.01).

The carapace length-weight relationships for males and females are as follows:

Males : $W = 0.66626CL^{3.09198}$ (r = 0. 986)

Females: $W = 0.62579\ CL^{2.89828}$ (r = 0. 975)

Total length-carapace length relationship: The slope and elevation of regression lines between male and female derived through analysis of covariance indicated significant variation in slope

and elevation necessitating separate relationship for males and females.

The equation for total length-carapace length relationship for males and females are as follows:

Males   : $TL = 0.1300 + 0.2625CL$ (r = 0.980)

              $CL = -0.3005 + 3.7343TL$

Females : $TL = 0.4681 + 0.2928\ CL$ (r = 0.995)

              $CL = -1.3872 + 3.3657\ TL.$

Discussion

Landing of *N. stewarti* at Mangalore since 2000 was the result of introduction of deep-sea trawlers at Mangalore Fisheries Harbour. The catch was high in the initial stages of the fishery, which decreased as the exploitation continued. It is also possible that the trawlers would have shifted to new fishing grounds. Further studies are required before coming to any conclusion regarding the status of stock of this species.

In the present study, significant variation between slopes and elevations of carapace length-body weight and carapace length-total length relationships is found between sexes. Similar observation was reported in the case of *Metanephrops andamanicus* from the Western Indian Ocean (Ivanov and Krylov, 1980). Higher 'b' values for males in both total length-body weight and carapace length-body weight relationships in *N. stewarti* show that males are heavier than the females of the same length. Ivanov and Krylov (1980) found similar relationships in the lobsters, *Palinurus delagoae*, *Puerulus angulatus*, *Linuparus somniosus*, *Thenus orientalis*, *Ibacus novemdentatus* and *Metanephrops andamanicus.* Biometric relationship derived from these types of studies can be used for conversion of one parameter to another. Information on these relationships are helpful for management of lobster fishery for fixing minimum legal size as employed in the case of *Homarus americanus* (Thomas, 1973; Kelly, 1987) along the coast of Maine.

Acknowledgements

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