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Age and growth of *Decapterus russelli* and *D. macrosoma* along Karnataka coast, India

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Abstract

Decapterus spp. popularly known as scads form an important component of the pelagic fishery resource along Karnataka coast. Their contribution to the total fish catch increased from 2% during 80's to 5% in 90's. The resource formed 21% of the total carangid landings of the state. The study provides information on the age and growth of *D.russelli* and *D.marososma* and is based on samples collected from five major landing centres. The von Bertalanffy's growth equation for *D.russelli* is $L_{(t)} = 231.87\ [1\text{-}e^{-0.7(t\text{-}0.1628)}]$ and that for *D.macrosoma* $L_{(t)} = 238\ [1\text{-}e^{-0.75(t\ -0.0777)}]$. The growth curve of *Decapterus* spp. was found to be similar to that of other small tropical pelagic fishes of the Indian coast. The growth rate in both the above species was rapid during the first year indicating a total length of 140 mm and 150 mm respectively. The commercial fishery here is supported by 1 + yr class.

Keywords: Age and growth of scads - *Decapterus russelli* and *D. macrosoma*

Introduction

Decapterus spp. generally known as scads comprise a very important component of the family Carangidae. Of late, the catch of scads has recorded a steady increase and in India it formed nearly 7% of the total pelagic group and 26% of the carangid landing during 1999. Of the several species reported from the Indian waters, *Decapterus russelli* and *D.macrosoma* are of commercial importance. In Karnataka, scads form a fishery for nearly ten months in a year contributing to 3% of the total pelagic and 21% of the total Carangid landings of the state. They are landed by the trawls and the purseseine here and their fishery have gained importance in the recent past. The annual average landings showed an increase from 1,900t to 17,650 t in the 90's (1990-1999).

The fishery of scads has gained a lot of importance all over the world especially in the Asia-Pacific region. Age and growth studies on scads include those by Ingles and Pauly, 1984: Suzuki, 1971; Corpuz *et al.*, 1985; Mansor, 1987; Jabat and Dalzell, 1988; Widodo, 1988; Gonzales, 1991; Chee, 1997; Calvelo, 1997; and Chullasoran, 1997. In India, the resource has gained importance only since the 90s and studies on some aspects of scads have been reported by Sreenivasn, 1982; Yohannan and Balasubramanian, 1987; Murty, 1991; Reuben *et al.*, 1992; Balasubramanian, 1997 and Bhargava *et al.*, 1998. However, in Karnataka though scads form a fishery of importance, not much information is available on the age and growth of the component species. Present investigation, therefore, has been taken up to study the age and growth of *D.russelli* and *D.macrosoma* of Karnataka waters along the southwest coast of India.

Materials and methods

The samples for the study were collected at fortnightly intervals during 1998 from the trawl and purseseiene landings at Mangalore, Malpe, Bhatkal, Tadri and Karwar, the major fishing harbours in Karnataka. The species were then measured in millimeter (mm) for their total length (from tip of snout to the longest caudal ray) and wet weight to the nearest gram (g). The length measurements were then grouped into 5 mm class intervals. The data were then raised to get the days catch and subsequently to the fortnight's catch. The catch estimated for the two fortnights were then pooled to get the monthly estimated numbers in each class. The exercise was carried out separately for each landing centre. The data on species composition as well as the fishery of the scads collected from the different landing centres were pooled to get month wise estimates for the entire Karnataka coast. These monthly average of estimated numbers obtained during the two fishing seasons (1998 and 1999) formed the database for further analysis.

FiSAT (FAO-ICLARM Stock Assessment Tools), package developed by the FAO and ICLARM (1990) for

length based fish stock assessment was used for the analysis of length frequency data. The package is structured around an integration of routines incorporated in LFSA and COMPLEAT ELEFAN package. Files were created separately for the monthly length frequency data estimated for the observation centres. These files were merged, pooled and then the average calculated to get one file consisting of average monthly estimated length frequency data. The figures estimated were then merged and classified into 10 mm class intervals using the routine available in FiSAT. This file was used for the estimation of growth parameters using different methods provided in FiSAT.

Results

D.russellli

Powell-Wetherall plot was carried out. The points used above 180 mm (L') were selected for the regression analysis against $\overline{L}$L' at 11.176 mm which gave values of 'a', 'b' and 'r' as 48.97, -0.211 and 0.974 respectively. Substituting the values to the equation L_α = -a/b (-48.97/ -0.211) we get a value of 232.4 mm (Fig.1). The automatic search routine in the ELEFAN-1 programme gave the highest Rn value of 0.155 for L_α = 231.8 mm and K = 0.7. The maximum length observed in the fishery was 223 mm.

The monthly means obtained by the Bhattacharya were used for the Gulland and Holt Plot. The regression analysis of the mean length ($\overline{L}$)and the growth rate (L/ t) gave an estimate of L_α= 236.06 and K = 0.79.

The regression of age in years 't' against [-ln(1-$L_{(t)}$/ L_α)] gave an 'a' value of 20.99 and b = 128.91. From this t_o was calculated as

$$-a/b = -20.99/128.91 = -0.16$$

The von Bertalanffy growth equation for *D.russelli* as estimated by different methods was comparable and the best fit as obtained by ELEFAN can be expressed as:

$$L_{(t)} = 231.87\ [1\text{-}e^{-0.7(t-(-0.1628))}]$$

D.macrosoma

The L_α value obtained by the Powell and Wetherall Plot was 236.91 mm (Fig.2). The points used above 210 mm (L') were selected for regression analysis against $\overline{L}$L' at 13.62 mm which gave values for 'a', 'b' and 'r' as 117.47, -0.496 and 0.977 respectively. Substituting the values to the equation, L_α = -a/b = -117.47/-0.496=236.83 was obtained. The automatic search routine in the ELEFAN-I programme gave the highest R_n value of 0.242 for L_α= 238 mm and K= 0.75. The maximum length observed in the fishery was 232 mm. The monthly mean length of the cohorts constituting the fishery as identified by Bhattacharya method and followed by the Gulland and Holt plot gave L_α and K estimates as 236.68 mm and 0.8.

The regression of age in years't' against [-ln (1-L_t/ L_α)] gave an 'a' value of 0.075 and b = 0.96. From this t_o was calculated as,

$$-a/b = -0.075/0.968 = 0.077$$

The von Bertalanffy growth equation for *D. macrosoma* as estimated by ELEFAN gave the best fit and can be expressed as: $L_{(t)} = 238\ [1\text{-}e^{-0.75(t-(-0.0777))}]$

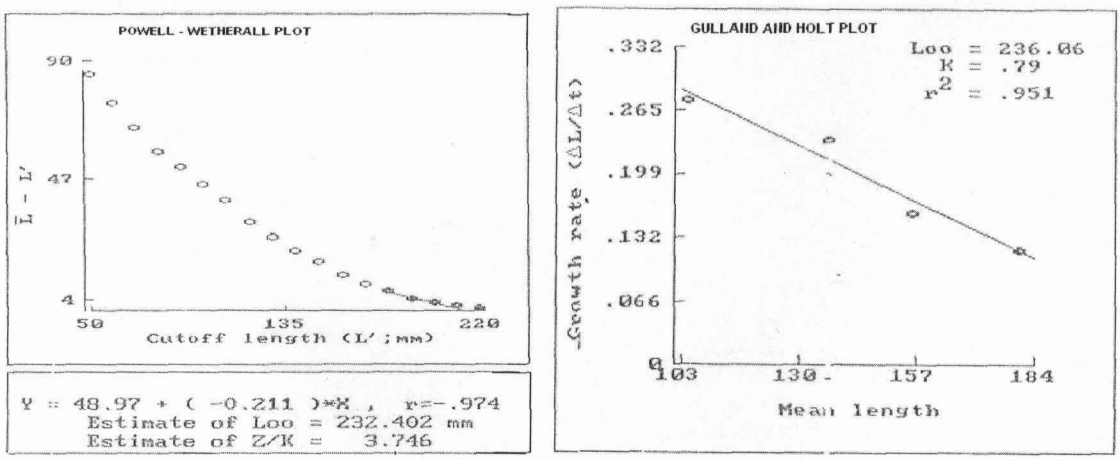

Fig. 1. Powell-Wetherall Plot and Gulland-Holt Plot for *Decapterus russelli* caught along Karnataka coast

Discussion

The growth parameters estimated for *D.russelli* using Powell-Wetherall, ELEFAN and Bhattacharya analysis followed by Gulland and Holt plot were comparable. The values estimated for this species from other regions also have been compiled (Table 1). The L_α values of *D.russelli* in the Philippine waters ranged from 260 to 330 mm (Ingles and Pauly, 1984) and 337 mm (Jabat and Dalzell, 1988). From the Indian waters, Sreenivasan (1982) obtained a L_α value of 260 mm (FL) for *D.dayi* and Murty (1991) obtained an estimate of 232 mm for *D.russelli*. Reuben *et al.* (1992) estimated the L_α for *D.russelli* as 221 mm from the east coast, 299 mm from the northwest coast, 248 mm from southwest coast and an overall L_α estimate of 232 mm for the Indian coast. Balasubramanian (1997) got an estimate of 290 mm for *D.russelli* collected from Vizhinjam area. The estimates of L_α obtained in the present study are very close to that obtained by Reuben *et al.* (1992) for studies carried out in the Indian waters. The difference in the L_α values for the species from different regions may be due to difference in size structure at different localities caused by differences in the environmental parameters, the type of fishing gears used and methodology adopted for the study of growth parameters.

The ELEFAN as well as Beverton and Holt method gave an optimum K value of 0.7/yr and 0.79/yr for *D.russelli* and *D.marosoma* in the present study. As observed in the case of L_α value, the K value too ranged from 0.27 (Tang *et al.*, 1997) to 1.31 (Atmadja, 1988). The K value estimated in the present study is within the range of values observed in Philippines (Ingles and Pauly, 1984) and Java Sea (Widodo, 1988) and close to the estimates made by Reuben *et al*; 1992 (Table 1).

The L_α obtained by different methods for *D.macrosoma* were comparable and the estimate of 238 mm is within the range obtained by Ingles and Pauly (1984), Anon (1985) and Atmadja (1988) from Philippine, Taiwan and Indonesian waters respectively (Table 1). The only earlier work on *D.macrosoma* from Indian waters (Vizhinjam) by Balasubramanian, 1997 gave a higher L_α estimate of 257 mm. The difference in the values may be due the difference in type of fishing gears (sample mainly landed by gillnets at Vizhinjam) as well as discontinuous availability of samples throughout the year.

The K value of 0.75 for *D.macrosoma* obtained in the present study is also comparable to the values obtained for the species in Philippines (Ingles and Pauly, 1984) and Java Sea (Widodo, 1988 and Atmadja, 1988). A slightly higher K value of 0.9 obtained by Balasubramanian (1997) for the species may be due to the reasons mentioned above.

The growth curve of *Decapterus* spp. was similar to those observed for other small tropical pelagic fishes of India. The growth rate for both *D.russelli* and *D.macrsoma* was rapid during the first year reaching a total length of 140 mm and 150 mm respectively. However, the estimates of L_α and K obtained by ELEFAN was found to be the most suited for the growth pattern observed in *Decapterus* spp. along Karnataka coast. The maximum length of *D.russelli* observed in the fishery was 222 mm and that of *D.macrosoma* was 232 mm. The L_α estimate of 231.87 mm for *D.russelli* and 238 mm for *D.macrosoma* and a respective lifespan of 4.3 years and

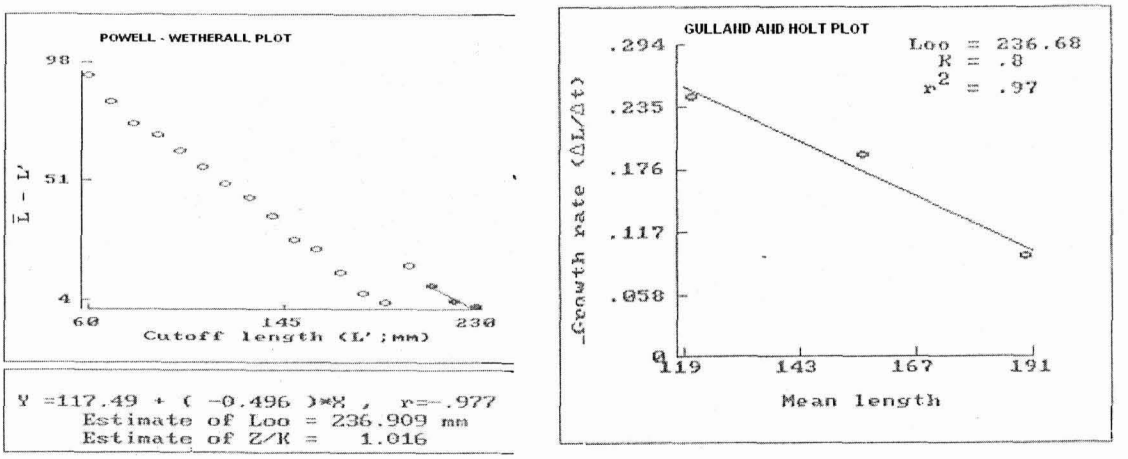

Fig. 2. Powell-Wetherall Plot and Gulland-Holt Plot for *Decapterus macrosoma* along Karnataka coast

Table 1. Estimated growth parameters (L_∞ and K) of *Decapterus* spp. in Karnataka waters and those available in the literature

Species	L_∞ (T.L. in mm)	K/yr	Region	Reference
D.russelli	244-248	0.43-0.62	Mozambique	Gjøsaeter and Sousa, 1983
D.russelli	330	0.8	Philippines	Ingles and Pauly, 1984
D.russelli	247-283	0.39-0.50	Indonesia	Dwiponggo *et al.*, 1986
D.russelli	240-270	0.81-1.01	Malaysia	Mansor, 1987
D.russelli	245-283	0.4-1.2	Java Sea, Indonesia	Widodo, 1988
D.russelli	337	0.36	Camotes Sea	Jabat and Dalzell, 1988
D.russelli	232.3	1.08	Kakinada	Murty, 1991
D.russelli	221	0.71	East coast of India	Reuben *et al.*, 1992
D.russelli	299	0.45	Northwest coast, India	Reuben *et al.*, 1992
D.russelli	248	0.78	Southwest coast, India	Reuben *et al.*, 1992
D.russelli	230	0.86	Northwest coast, India	Bhargava *et al.*, 1988
D.russelli	290	0.81	Vizhinjam coast, India	Balasubramanian, 1997
D.russelli	231.87	0.7	Karnataka coast	Present study
D.dayi	260 (F.L.)	0.19	Vizhinjam coast, India	Sreenivasan, 1982
D. maruadsi	269-330	0.4-0.8	Manila Bay	Corpuz *et al.*, 1985
D. maruadsi	361	0.27	East China Sea	Tang *et al.*, 1997
D.macarellus	412	0.8	Sri Lanka	Dayaratne 1997.
D.macrosoma	230-330	0.50-1.26	Philippines	Ingles and Pauly, 1984
D.macrosoma	269-330	0.45-0.80	Manila Bay	Corpuz *et al.*, 1985
D.macrosoma	232-275	0.9-1.2	Thailand	Anon, 1985
D.macrosoma	256	1.05	Indonesia	Sadhotomo and Atmadja, 1985
D.macrosoma	231-256	0.7-1.1	Java Sea Indonesia	Widodo, 1988
D.macrosoma	224-265	0.86-1.31	Java Sea, Indonesia	Atmadja, 1988
D.macrosoma	257	0.9	Vizhinjam coast, India	Balasubramanian, 1997
D.macrosoma	249	0.77	Philippines	Aripin and Showers, 2000
D.macrosoma	238	0.75	Karnataka coast, India	Present study.

4.0 years in the present study is reasonable. Furthermore, the similar phi prime value of 2.4 obtained for both the species during the present study establishes the reliability of the estimates of the growth parameters.

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