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RESEARCH ARTICLE

POPULATION CHARACTERISTICS OF *ATROPUS ATROPOS* [BLOCH AND SCHNEIDER, 1801] FROM MANGALORE COAST, INDIA

***Rajesh, D.P., Anjanayappa, H. N., Ganesh Prasad, L. and Benakappa, S.**

Karnataka Veterinary, Animal and Fisheries Sciences University, College of Fisheries, Mangalore 575002, India

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Corresponding author:* **Rajesh, D.P.

ABSTRACT

The fishes of the family Carangidae, *(Atropus atropos)* commonly called as "Cleftbelly trevally" are distributed in the tropical and sub-tropical waters of the Indo-West Pacific region. The population parameters *viz*., growth, mortality, exploitation ratio and length at first capture were investigated to derive requisite information for their effective management. The von Bertalanffy growth equations were derived as Lt =26.25 [1-e –0.69 $^{(t+0.2425)}$]. The annual total instantaneous mortality (Z), natural mortality (M) and fishing mortality (F) were assessed as 2.94, 2.34 and 0.6 respectively. The estimated exploitation ratio (E) and exploitation rate (U) were 0.20 and 0.193 respectively. The estimated probability of Length at capture (Lc) of fish, the length at which 25 percent of fish (L_{25}) vulnerable for capture by the gear was 11.23 cm; length at which 50 percent of fish (L_{50}) vulnerable for capture by the gear was 12.44 cm. Similarly for L_{75} was at 13.66 cm.

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INTRODUCTION

The fishes of the family Carangidae are one of the important resources from Indian waters as they constituted nearly 13.22% of the annual marine fish landings of 3.73 million tonnes during the year 2016-17 (Anon, 2017). From the studies conducted on the fishery and biology of various carangids from the Mangalore area, it was observed that *Atropus atropos* which is locally known as "kurchi" (Mangalore) occurred in small quantities in the commercial catches throughout the year. Carangids are pelagic fishes widely distributed in the Indo-Pacific region. About 32 genera and 140 species of carangids have been reported world over (Smith-Vaniz *et al*., 1999; Smith-Vaniz, 2003).

MATERIALS AND METHODS

The present study is based on the observation of a total of 1601specimens, in the size range from 100 to 260 mm (TL), consisting of 704 males and 897 females. Fortnightly random samples were collected from the Mangalore main fish landing center (Bunder jetty) and fish market from August, 2015 to May, 2017.

Age and growth: A sound knowledge of the age and growth of fish species contributing to the fishery is essential for understanding, among others, the longevity of exploited stocks, the age composition of the catch, the age at sexual maturity, the suitability of different environments for growth, the population dynamics and the possible identification of stocks on the basis of differences in growth rates.

Elefan: The length data of *A. atropos* were utilized for estimating the growth parameters. The lengths were classified in to one cm size groups for estimating von Bertalanffy growth parameters, smoothened length frequency data were used as input data for analysis using the computer software FiSAT [FAO - ICLARM Stock Assessment Tool ver. 1.2.2, Gayanilio *et al.,* 1988)]. Pauly and David (1981) developed computer software: Electronic Length Frequency Analysis called ELEFAN.

Von - Bertalanffy plot : von - Bertalanffy (1957) estimated K and to from age/length data using the equation. - Ln (l - L_t/L_∞) = - K t_0 + K_t with the age "t" as the independent variable (X) and - L_n (l – L_t/L_∞) as the dependent variable (Y), the equation defines a linear regression, where the slope b = k and the intercept a = - K t_o.

Estimation of Total mortality rate (Z): The annual instantaneous total mortality (Z) was estimated by length converted catch curve of Pauly (1980) using the total annual length frequency distribution of catch. $\mathbf{L_n\ (N/\Delta t) = a + bt}$. Where, N = Number of fish in the length class **Δt** = Time required for the fish to grow from a lower to higher class interval t = age at a given length b = coefficient of total mortality (Z).

Natural mortality rate (M): The annual instantaneous natural mortality rate (M) was estimated using the equation of Pauly (1980). For this purpose the temperature value in the fishing grounds was taken as 26^0 C (Anon, 2017 b).

$$L_n (M) = - 0.0152 - 0.279 L_n (L_\infty) + 0.6543 L_n (K) + 0.463 L_n (T)$$

Where, L_∞ = is the asymptotic length (cm), K = is the growth coefficient, T = is the mean sea temperature (^{0}C).

Fishing mortality rate (F): The value of fishing mortality (F) was derived from Z and M.

F = Z – M

Exploitation ratio (E) and Exploitation rate (U): The value of E was derived by using the following formula.

$E = F/Z$ & $U = F/Z (1-e^{-z})$

Estimation of biomass per recruit: Relative biomass – per – recruit (B'/R) was estimated from the relationship B'/R = (Y'/R)/F Emax, E 0.1 and E 0.5 were estimated by using the first derivative of this fuction.

RESULTS AND DISCUSSION

Growth equation: From the biological point of view to understand any fish population it is necessary to fit the growth equation with respect to length or weight. These may form the basis for calculations leading to knowledge on the growth, mortality, recruitment and other fundamental parameters of a population. These parameters are further used for evolving effective management strategies for the development and judicious exploitation of the fisheries resources. The length at age data obtained by Electronic Length Frequency Analysis (ELEFAN) and Pauly's method were used to estimate the parameters of von-Bertalanffy growth equation. Table 1 provides the growth parameters obtained for both the sexes of *A. atropos*. The peak growth curve and the maximum Rn value estimated for both sexes. The fitted growth equation may be expressed as $Lt = 26.25 [1-e^{-0.69 (t+0.2425)}]$. The growth parameters obtained from different methods are presented Table 1. L_∞ and K values obtained from Ford – Walford plot were 26.25 cm and 0.69 for both the sexes respectively. In the light of the available information, the growth parameters L_∞, K and to obtained in the present study, are in close agreement with the earlier workers (Sreenivasan, 1982; Mansor, 1987; Widodo, 1988; Jaiswar *et al.*. 2001 and Manoj Kumar, 2007). Murthy (1991) studied some aspects of biology and population dynamics of *D. russelli* at Kakinada. von – Bertalanffy growth parameters were estimated as L_∞ =23.23cm, K=1.08 per year and t_0 = -0.08 year.

Mortality rates: It is seen from the slope of the descending line of the Length-converted catch curve (Fig.1) that the total mortality coefficient (Z) for *A. atropos* was 2.94. The natural mortality coefficient (M) for *A. atropos* was found to be 2.34. By subtracting the natural mortality coefficient from the total mortality coefficient the fishing mortality coefficient (F) for *A. atropos* was found to be 0.6. The average exploitation ratio (E) and exploitation rate (U) for *A. atropos* was 0.20 and 0.193.

Probability of capture (Lc): The estimated probability of Length at capture (Lc) is shown in the Fig. 2. The data were corrected for selection using selection parameters. Length at which 25 percent of fish will be vulnerable to the gear was 11.23 cm, length at which 50 percent of fish will be vulnerable to the gear was 12.44 cm and L 75 was at 13.66 cm.

Table. 1. The growth parameters of *A. atropos* during the period August, 2015 – May, 2017

Method	L_∞	K	t_o
ELEFAN	26.25	1.40	-

Table 2. The exploitation ratio (E), Yield per recruit and Biomass per recruit for *A. atropos*

Exploitation ratio (E)	Yield per recruit (Y/R)	Biomass per recruit (B/R)
0.01	0.011	0.832
0.20	0.021	0.677
0.30	0.029	0.535
0.40	0.034	0.408
0.50	0.037	0.297
0.60	0.038	0.203
0.70	0.037	0.127
0.80	0.034	0.068
0.90	0.030	0.026
0.99	0.025	0.002

Relative yield per recruit and biomass per recruit: The relative yield per recruit and biomass per recruit are represented in Table 2 and Fig. 3. From the relative yield per recruit diagram, it is seen that the maximum yield could be obtained when the exploitation ratio is 0.594, while the relative biomass will be reduced to 52% of the exploited phase.

Recruitment pattern: The recruitment pattern demonstrated that *A. atropos* was recruited in the fishery continuously throughout the year with two peaks from September to November and March to May, (Fig. 4). In general, short lived fish species reach their asymptotic lengths in the first few years of life and are characterized by a high value of K (the growth coefficient). In the present study asymptotic length (L_∞) of *A. atropos* was similar to the range provided by (Reuben *et al.*, 1992), but smaller than that noted by (Jaiswar *et al.*, 1994; Kasim, 1996) but higher than observed by (Zafar *et al.*, 2000; Panda *et al.*, 2012; Jadhav and Mohite, 2014). This difference may be due to the ecological characteristics such as habitat, fish adaptive life pattern and location that directly affect the growth rate. Moreover, sampling methods and population size also influence the growth parameters (Adam, 1980). The total, fishing and natural mortality estimates were greater than previously found (Jaiswar *et al.*, 2001; Panda *et al.*, 2012). Fishing mortality rate of 0.71 and 1.30 in both species was substantially greater than the targets/biological reference points Fopt, and Flimit and optimum level (Gulland, 1971). Management action should aim to reduce catch and effort to achieve sustainability, which could be achieved through a revision of mesh size regulations and a substantial reduction in fishing effort and undersize catching should be discouraged (Panhwar and Liu, 2013). The estimates of exploitation ratio (E) revealed that *D. russelli* (0.61) stock was facing more fishing pressure than *M. cordyla* (0.40) in Mumbai waters. Jaiswar *et al.* (2001) estimated the exploitation ratio for *D. russelli* from Mumbai waters as 0.66, indicating overexploitation, which corroborates the present finding. Similar observation was made by Murty (1991) for *D. russelli* from Kakinada waters. Reuben *et al.* (1992) observed that *D. russelli* and *M. cordyla* were underexploited in north-west coast of India. Manojkumar (2007) reported that *D. russelli* resource was underexploited in Malabar coast.

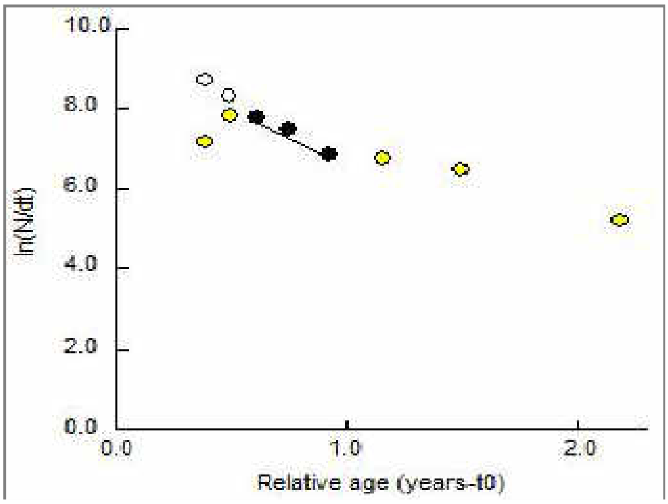

Fig. 1. Length – Converted Catch Curve of *A. atropos* for estimated value of Z.

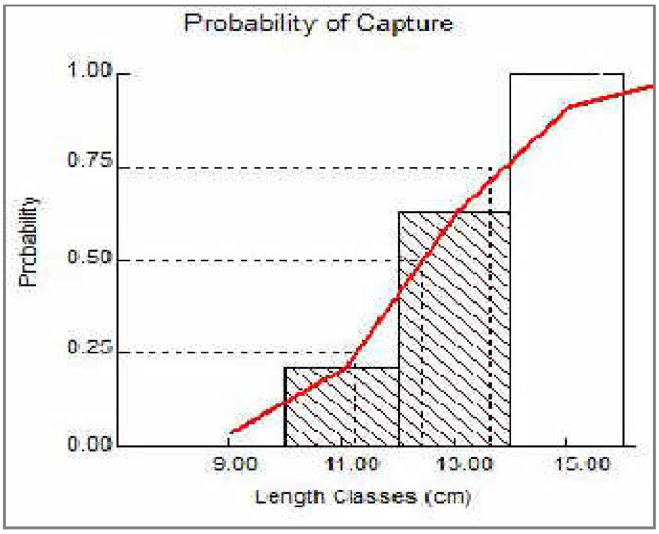

Fig. 2 : Probability of Capture curve (Lc) of *Atropus atropos*

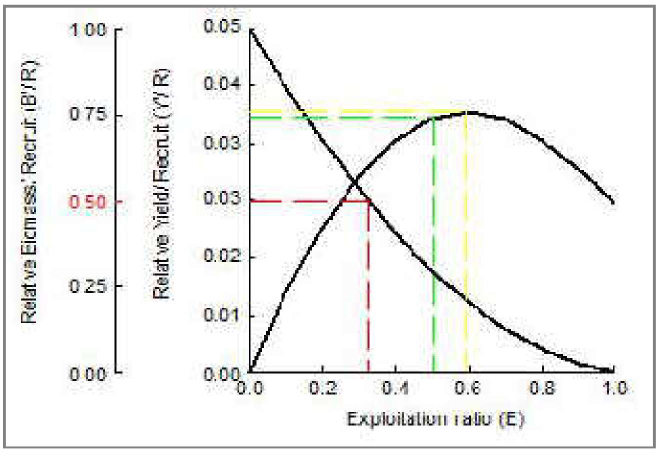

Fig. 3. Relative yield per recruit and biomass per recruit as function of exploitation in *Atropus atropos*

Similar observation was also made by Zafar *et al.* (2000) for *M. cordyla* from Bangladesh waters. The recruitment was continuous and throughout the year for both the species. Two distinct peaks were observed during September to November and March to May for *A. atropos*. Similar observations were also made by Ingles and Pauly (1984) in Philippines waters, Balasubramanian and Natarajan (2000) along Vizhinjam coast and Manojkumar (2007) along Malabar coast.

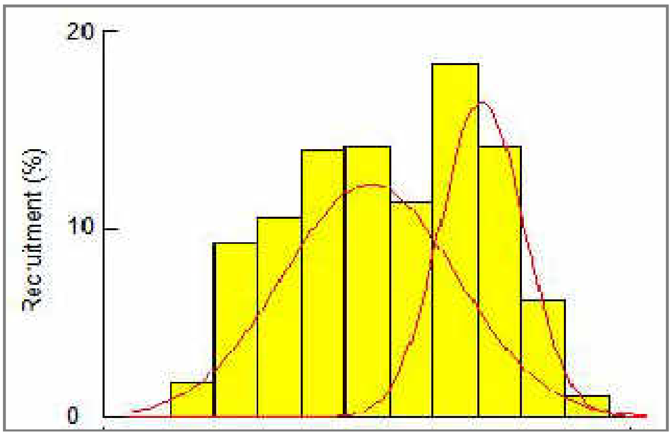

Fig. 4. Recruitment curve of *A. atropos* during August, 2015 to May, 2017

The length at recruitment (Lr) was found to be 12 cm for *Atropus atropos* in the present study, while the same was reported to be 5.5 cm by Manojkumar (2007) from Malabar waters. Zafar *et al.* (2000) reported continuous recruitment with two peaks for *M. cordyla* from Bangladesh waters' in conformity to the present study wherein two distinct recruitment pulses were observed during September to November and March to May.

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REFERENCES

Adam, P. 1980. Life history pattern in marine fishes and their consequences for fisheries management. *Fish. Bull.,* 78 : 1 - 12.

Anonymous, 2017 a. Annual Report 2016-17, Central Marine Fisheries Research Institute, Cochin. 1 - 345.

Balasubramanian, N. K. and Natarajan, P. 2000. Studies on the biology of scads, *Decapterus russelli* and *Decapterus macrosoma* at Vizhinjam, south-west coast of India. *Indian J. Fish.,* 47 (4) : 291 - 300.

Gayanilo, F. C., Soriano, M. Jr. and Pauly, D., 1988. Draft guide to the Compleat elefan Iclarm Software project 2 : 64 - 65.

Gulland, J. A., 1971. The fish resource of the ocean. FAO, *Fisheries Technical paper* England : Fishing News (Books) Ltd. 97 : 424- 425.

Ingles, J. and Pauly, D., 1984. An atlas of the growth, mortality and recruitment of Philippines fishes. *ICLARM Tech. Rep*., 13 : 126 - 127.

Jadhav, T. D. and Mohite, S. A., 2014. Reproductive biology of Horse mackerel *Megalaspis cordyla* (Linnaeus, 1758) along Ratnagiri coast of Maharashtra, India. *J. Mar. Bio. Ass. India,* 55 (2) : 35 - 40.

Jaiswar, A. K., Biradar, R. S. and Gulati, D. K., 1994. Stock dynamics of horse mackerel, *Megalaspis cordyla* (Linnaeus) along north-west coast of India. *J. Indian Fish. Assoc .,* 24 : 115 - 119.

Jaiswar, A. K., Chakraborty, S. K. and SWAMY, R. P., 2001. Studies on the age, growth and mortality rates of Indian scad, *Decapterus russelli* (Ruppell) from Mumbai waters. *Fish. Res.*, 53 : 303 - 308.

Kasim, H., 1996. Carangid Fishery of Veraval Coast with Notes on the Biology and Population Dynamics of *Megalaspis cordyla* (Linnaeus). *The Fourth Indian Fisheries Forum Proceedings* 24-28, November, 1996. : 377 - 380.

Manojkumar, P. P., 2007 b. Stock assessment of Indian scad, *Decapterus russelli* (Ruppell, 1830) off Malabar Coast. *J. Mar. Biol. Ass. India,* 49 (1) : 76 - 80.

Mansor, M. I., 1987. On the status of *Rastrelliger* and *Decapterus russelli* fisheries of the west coast of peninsular Malaysia in 1984- 1985. *BOBP Report*, 39 : 81 - 100.

Murty, V. S., 1991. Observations on some aspects of biology and population dynamics of the scad, *Decapterus russelli* (Ruppell) (Carangidae) in the trawling grounds off Kakinada. *J. Mar. Biol. Ass. India,* 33 (1&2) : 396 - 408.

Panda, D., S. K. Chakraborty, A. K. Jaiswar, A. P. Sharma, B. C. Jha, B. T. Sawant, S. K. Bhagbati. and T. KUMAR, 2012. Fishery and population dynamics of two species of carangids, *Decapterus russelli* (Ruppell, 1830) and *Megalaspis cordyla* (Linnaeus, 1758) from Mumbai waters. *Indian J. Fish.* 59 (4) : 53 - 60.

Panhwar, S.K, and Liu Qun., 2013. Population statistics of the migratory hilsa shad *Tenualosa ilisha* in Pakistan, *J. of Applied Ichthyology*, 29 : 1091 - 1096.

Pauly, D. and David, N., 1981. Elefan 1, a basic programme for the objective extraction of growth parameters from length – frequencies data. Meereforsch, 28 (4): 205 – 211.

Pauly, D., 1980. A selection of simple methods for the assessment of tropical fish stocks. *FAO Fish. Circ*., 729 : 53 - 54.

Reuben, S., Kasi, H. M., Sivakami, S., Radhakrishnan, P. N., Kurup, M. Sivadas, K. N., Noble, A., Nair, K. V. S. and RAJE, S. G., 1992. Fishery, biology and stock assessment of carangid resources from the Indian seas. *Indian J. Fish*., 39 : 195 - 234.

Smith-Veniz, W.F., 2003. Carangidae. In Carpenter K.E. (ed.) The living marine resources of the western central Atlantic. FAO species identification guide for fishery purposes, *Rome: FAO*, 3 (2): 1426–1468.

Smith-Vaniz W.F., Collette, B.B. and Luckhurst, B.E., 1999. Fishes of Bermuda: History, zoogeography, annotated checklist and identification keys. Lawrence, KS: *American Society of Ichthyologists and Herpetologists Publ.* 4: 424 .

Sreenivasan, P. V., 1982. Age and growth of *Decapterus dayi* Wakiya from Vizhinjam coast. *Indian J. Fish.*, 29 (1&2) : 144 – 150.

Von – Bertalanffy., 1957. Quantitative laws in metabolism and growth. *Quart. Rev. Biol.* 32 : 217-231.

Widodo, J., 1988. Population biology of Russell's scad (*Decapterus russelli*) in the Java Sea, Indonesia. In: Venema, S. C., Christensen, J. M. and Pauly, D. (Eds.), Contributions to tropical fisheries biology. FAO/DANIDA follow-up training course on fish stock assessment in the tropics, Denmark, 1986 and Philippines, 1987. *FAO Fish. Rep*. 389 : 308 - 323.

Zafar, M., Mustafa, M. G., and Haque, M. A., 2000. Population dynamics of *Megalaspis cordyla* (Linneaus, 1758) from northeastern part of the Bay of Bengal, Bangladesh. *Indian J. Fish.,* 47 (3) : 163 - 168.

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