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Short Communication

Population dynamics of red-toothed triggerfish *Odonus niger* (Ruppell, 1836) along southwest coast of India

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Abstract

The red toothed trigger fish *Odonus niger* (Ruppell, 1836) contributed up to 96.5% to the total catch of the exploratory trawler operating in the Wadge bank. The catch rate was 2.26 t hr^{-1}. Its distribution was recorded up to 130 m depth between 7° N and 10° N Lat., 75° E and 77° E Long. Length (mm) - weight (g) relationship of this species was estimated as $W = 0.0002\ L^{2.5218}$. The von Bertalanffy equation was derived as $L_t = 33\ (1\text{-}e^{-0.78\ (t\ +\ 0.214)})$. The natural mortality (M), fishing mortality (F) and total mortality (Z) were estimated as 1.48, 1.32 and 2.80, respectively. The exploitation ratio (E) was 0.47. The mean length at first capture (Lc) was estimated as 16.4 cm. Recruitment of this species was observed during February - April, and the peak was in March. Virtual Population Analysis showed that the mortality was more in the size group of 23 cm.

Keywords: *Odonus niger*, population dynamics, length-weight relationship, southwest coast

Introduction

The fishermen of southwest coast of India especially those from Colachal, Vizhinjam and Trivandrum are familiar with dense school of *Odonus* spp. that appear periodically in surface waters, close to the coast. As a consequence of intense exploitation of economically important fishes, the population of non-conventional fishes has increased and replaced the conventionally exploited fishes from their order of abundance along the Indian coasts (Ramachandran *et al.,* 2004). There are not many biological studies on such non-conventional fishes. The red-toothed trigger fish *Odonus niger* (Ruppell, 1836) is one of the commercially non-conventional fishes available along the southwest coast of India. Often it is obtained as bycatch in good quantities, but discarded at sea because of low market value. Its occurrence was reported several times from southwest coast, Wadge Bank and Gulf of Mannar (Sivaprakasam, 1986; Joseph *et al.,* 1987; Sulochanan and John 1988; Kunjipalu, 1994, 1996). Except studies on length-weight relationship (Satish Sahayak, 2005; Vaitheeswaran and Venkataramani, 2008), there is no information on distribution and population dynamics of *O. niger* from Indian waters. We made an attempt to find out distribution and estimate asymptotic length (L_∞), growth coefficient (K), natural mortality (M), fishing mortality (F), total mortality (Z), exploitation ratio (E) and recruitment pattern (L_c/L_∞; where L_c is length at first capture) and M/K and length-weight relationship of *O. niger* from southwest coast of India.

Material and Methods

Samples of *Odonus niger* (Family: Balistidae) were collected from bottom trawl (head rope length: 46.5 m, cod end mesh size: 30 mm) catches of *Matsya Varshini* (overall length: 36.5 m; gross tonnage: 268.8 t) of Fishery Survey of India from 30 - 200 m depth in the area between Lat.7° N and 10° N, Long.75° E and 77° E (southwest coast of India) during January 2003 – April 2004. The total length (range: 80-315 mm) of 503 specimens was measured to the nearest 1 mm and weighed to 0.5 g accuracy using electronic balance (Essae – DIGI

DS – 450 ss). The von Bertalanffy growth parameters, namely, L_∞ and K were estimated by length frequency (in discrete series) analysis using computer program ELEFAN I as suggested by Pauly and David (1981) and Saeger and Gayanilo (1986).

The natural mortality (M) was estimated using the empirical relationship derived by Pauly (1980) as follows:

$$\text{Log}_{10} M = -0.0066-0.279 \text{ Log}_{10} L_\infty+0.6543 \text{ Log}_{10} K+ 0.4634 \text{ Log}_{10} T$$

where, L is expressed in cm and T (29°C) is the mean annual environmental temperature. The t_0 was estimated following the empirical formula derived by Pauly (1979) as given below:

$$\text{Log}_{10} (-t_0) = -0.3922-0.2752 \log_{10} L_\infty -1.038 \log_{10} K.$$

The total mortality (Z) was estimated by the length –converted catch curve method (Pauly, 1983). Fishing mortality (F) was estimated by subtracting M from Z and exploitation rate (E) from E = F/Z (Gulland, 1971). Relative yield-per-recruit (Y/R) was obtained from the estimated growth parameter and probability of capture by length (Pauly and Soriano, 1986). All other calculations were made using ELEFAN program developed by ICLARM. Length-weight relationship was estimated by least square method using the formula of $W = aL^b$. The relative condition factor (Kn) was calculated by following the equation Kn = W/w, (where W= estimated weight and w = calculated weight (Le Cren, 1951).

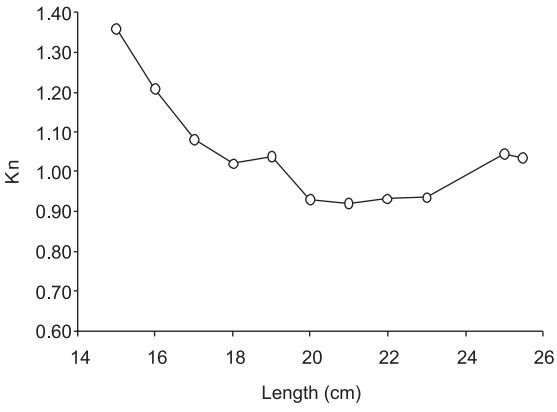

Fig. 1. Relative condition factor (Kn) in respect to different length groups

Results and Discussion

Length-weight relationship: The total length in the samples ranged between 80 and 315 mm and the body weight between 14 and 389 g. However, there was only one fish above 270 mm recorded. The length-weight relationship of *O. niger* was $W = 0.0002 L^{2.5218}$. *O. niger* increased in weight by a power of cube and less than cube of length. Randall *et al.* (1990) studied the length-weight relationship of *O. niger* in Pacific Ocean and reported the slope value of 3.0. Satish Sahayak (2005) reported b value of 2.08 from Gulf of Mannar, whereas Vaitheeswaran and Venkataramani (2008) reported b = 2.1-2.2. The differences in slope value may be due to difference in the growth between localities. Fig. 1 indicates the variations in the mean values of Kn with respect to different length groups. The smaller size groups have higher Kn value compared to larger size groups indicating well being of smaller fish. Kn would also reflect maturation and spawning of the fish (Nair *et al*., 1983).

Growth parameters: Fig. 2 shows the restructured length distribution for the computed growth curve. The von Bertalanffy growth equation for *O. niger* was estimated as $L_t = 33 (1-e^{-0.78 (t + 0.214)})$ (L_∞ = 33.0 cm and K = 0.78 year^{-1}). However, the maximum length of this species has been reported as 50 cm (Smith and Heemstra, 1986). The present species is relatively moderate in growth (K= 0.78). According to Sparre and Venema (1993) fishes with moderate K are characteristic with moderate natural mortality, and it is related to age and size of the fish. The M value is 1.48, and the M/K ratio of *O. niger*

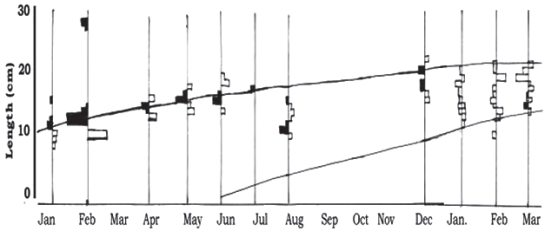

Fig. 2. Growth parameters of *Odonus niger* during January 2003 - March 2004 estimated by ELEFAN (L_∞ = 33 cm and K = 0.78 year^{-1})

is 1.89. The M/K ratio is found to be in close proximity limit among the closely related species (Beverton and Holt, 1959). The M/K ratio in fishes generally falls within the range of 1.5 – 2.5.

The total mortality (Z) and fishing mortality (F) were 2.80 and 1.32, respectively. Fig. 3 represents the catch curve constructed for estimation of Z. The darkened quadrilateral represents the points used for estimating Z through least square. The open circles represent points either not fully recruited or nearing L_∞ and hence not considered for calculation. Good fit to the descending right hand limits of the catch curve was considered.

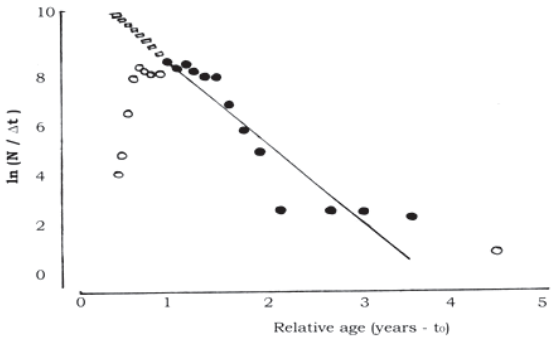

Fig. 3. Length - converted catch curve of *Odonus niger*

Exploitation ratio (E) was estimated as 0.47. As the E is < 0.5, it appears that the stock of *O. niger* along southwest coast is not under much fishing pressure. According to Gulland (1971), if the E is >0.5, the stock may be considered as overfished. The results of Virtual Population Analysis showed that F increases to a maximum at 23 cm (Fig. 4).

Recruitment pattern: The peak of normal distribution was inferred by NORMSEP program for determining the recruitment. This species was recruited to the fishery during February - April, and the peak was in March.

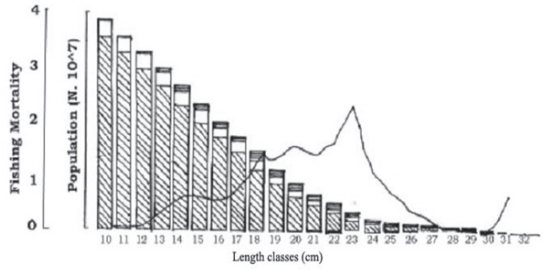

Fig. 4. Virtual Population Analysis (the line indicates fishing mortality)

Yield per recruit and biomass per recruit: The estimated length at first capture (L_C) was 16.41 cm. The relative yield per recruit and biomass per recruit were determined as a function of Lc/ L_∞ and M/K ratio, which are 0.48 and 1.89 respectively. The plot of yield per recruit (Y/R) against E is shown in Fig. 5. The maximum Y/R was at E = 0.76. The present E (0.47) has not exceeded the optimum exploitation rate (E_{msy} = 0.55, which maintain the 50% of the stock biomass). The optimum yield per recruit is 3.7 g. It is suggested that for attaining the maximum yield the fishing pressure could be increased by 39% from the present level.

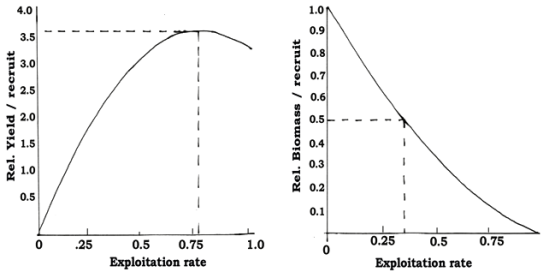

Fig. 5. Relative yield-per-recruit and biomass-per-recruit of *Odonus niger* (Lc / L_∞ = 0.48 M/K = 1.89)

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References

Beverton, R. J. H. and S. J. Holt. 1959. A review of the spans and mortality rates of fish in nature and their relation to growth and other physiological characteristics. *In*: G. E. W. Wolsteholme and M. O. Connor (Eds.) *The Life Span of Animals*. CIBA Foundation colloquia on ageing, London, Churchill, 5**:** 142 - 180.

Gulland, J. A. 1971. *The Fish Resources of Ocean*. West By fleet, Survey, Fishing News (Book) Ltd. FAO, 255 pp.

Joseph, K. M., P. Sulochanan, M. E. John, V. S. Somavanshi, K. N. V. Nair and Antony Joseph. 1987. Demersal fishery resource of Wadge bank. *Bull. Fish. Surv. India,* 12: 1 – 52.

Kunjipalu, K. K. 1994. Occurrence of trigger fishes in Wadge Bank trawl catches. *Fish. Technol.,* 31(2): 179 - 180.

Kunjipalu, K. K. 1996. On the geographical distribution of some marine fish along the Indian coast. *Indian J. Fish.,* 43(1): 79 - 86.

Le Cren, E. D. 1951. The length weight relationship and seasonal cycle in gonad weight and condition in perch (*Perca fluviatilia*). *J. Anim. Ecol*., 20: 210 - 210.

Nair, R. J., N. B. Nair and N. K. Balasubramanian. 1983. Condition and relative condition cycles in the tropical glassy perchlet *Chanda* (= *Ambassis*) *commersonii* (Cuv. and Val.) (Pisces: Centropomidae). *Proc. Indian Acad. Sci. (Anim. Sci.),* 92(6): 415 - 422.

Pauly, D. 1979. *Theory and Management of Tropical Multispecies Stocks: A Review, with Emphasis on the Southeast Asian Demersal Fisheries*. ICLARM Studies and Reviews, 1: 35 pp.

Pauly, D. 1980. On the interrelationships between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. *J. Cons. Int. Explor. Mer.*, 39(3): 175 - 192.

Pauly, D. 1983. Some simple methods for the assessment of tropical fish stock. *FAO Fish. Tech. Pap*., 234: 52 pp.

Pauly, D. and N. David. 1981. Elefan I, A basic program for the objective extraction of growth parameters from length – frequency data. *Meeresforsch.,* 28(4): 205 - 211.

Pauly, D. and M. L. Soriano. 1986. Some practical extensions to Beverton and Holt's relative yield-per-recruit model. *In*: J. L. Maclean, L. B. Dizon and L. V. Hosillos (Eds.) *The First Asian Fisheries Forum. Asian Fisheries Society*, *Manila, Philippines,* p. 491 - 495.

Ramachandran, S., K. P. Philip, M. Narayanan and Y. Tharumar. 2004. Distribution and some biological aspects of grub fish *Parapercis alboguttata* (Gunther) in southwest coast of India. *Indian J. Fish*., 49(2): 205 - 207.

Randall, J.E. G.R. Allen and R.C. Steene. 1990. *Fishes of the Great Barrier Reef and Coral Sea*. University of Hawaii Press, Honolulu, Hawaii. 506 pp.

Saeger, J. and F. J. Gayanilo. 1986. A revised and graphics oriented version of ELEFAN I and II badic programs for use on HP/86/87 micro computers. *Tech. Res. Dept. Marine Fish,* 8: p.1 - 233.

Satish Sahayak. 2005. Length-weight relationship of *Suflamen fraenatus* (Latreille, 1804) and *Zenodon niger* (Ruppell, 1835). *Indian J. Fish.,* 52(3): 357 - 360.

Smith, M. M. and P. C. Heemstra. 1986. Balistidae. *In*: M. M. Smith and P. C. Heemstra (Eds.) *Smiths' Sea Fishes*. Springer-Verlag, Berlin, p. 876 - 882.

Sparre, P. and S. C. Venema. 1993. Introduction to tropical fish stock assessments Part I - Manual. F.A.O**.** *Fish. Tech. Pap.,* 306: 376 pp**.**

Sivaprakasam, T. E. 1986. A study of the demersal resources of the Wadge Bank and the Gulf Mannar. *Bull. Fish. Surv. India*, 15: 1 - 37.

Sulochanan, P. and M. E. John. 1988. Off shore, deep sea and oceanic fishery resources off Kerala coast. *Bull. Fish. Surv. India,* 16: 27 - 46.

Vaitheeswaran, I. T. and V. K. Venkataramani. 2008. Length-Weight relationship of *Odonus niger* (Ruppell, 1836). *Tamilnadu J. Veterinary & Animal Sciences,* 4(2): 48 - 51.

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