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Age and growth, mortality and stock assessment of *Euthynnus affinis* (Cantor) from Maharashtra waters

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ABSTRACT

Kawakawa, *Euthynnus affinis* contributed on an average 1,563 t to the annual fish landings during 1996-2000 in Maharashtra. The drift net is the major gear, which exploits tuna resource. The species form about 87 % of the tuna landings by drift net at Sassoon dock (Mumbai). The other species were *Thunnus tonggol, Auxis thazard and A. rochei*, which together constituted about 13.0 % of the drift gill net catch. The size range of E. *affinis* in the drift net was from 26 to 73 cm. The growth parameters estimated are L ∝= 81.7 cm and K = 0.79 (annual). The total mortality coefficient (Z) varied between 2.04 and 2.88 during 1996-2000 with an average of 2.24 during the last 3 years with exploitation ratio (F/Z) of 0.6. The natural mortality coefficient (M) has been estimated as 0.928. The biomass is 1,344 t off Maharashtra, while the present average yield is 1,722 t. The maximum sustainable yield (MSY) has been estimated as 1,725t for Maharashtra indicating that the present exploitation is close to MSY.

Introduction

Kawakawa, *Euthynnus affinis* is an important coastal species among tunas, which constitute a fishery on both the coasts of India. It contributes about 58% of the tuna landings in India (Pillai and Pillai, 2000). Limited work has been done on the resource characteristics particularly on the population characteristics of the species, except Silas *et al.* (1986), James *et al.* (1993) and Pillai *et al.* (2002). Though it forms an important component of drift net fishery in Maharashtra, no work has been done on its growth, mortality and stock assessment from this area. An attempt has been made to estimate the different population parameters based on the data collected during 1996-2000.

Material and methods

The basic data on the catch and effort together with data on the length frequency were collected from Sassoon dock based on drift gillnet landings, while the Maharashtra landings were obtained from the Fishery Resource Assessment Division of the Institute. Fork length measurements were grouped into 2cm group interval and the number of fish in each size group was estimated. The present account deals with the data collected during 1996-2000. Growth parameters L∝ and K were estimated using ELEFAN I programme (Gyanilo *et al.*, 1988). Estimates of the fishing mortality and stock assessment estimation were made

employing FISAT programme (Gyanilo *et al*., 1996).

Results and discussion

Fishery

Tunas contributed about 1,248 t (1996) to 3,654 t (1999) during the last decade with an average catch of 2,400 t. The catch of *Euthynnus affinis* ranged from 1000 t (1998) to 2,212 t (2000) with an average catch of 1,563 t (Fig.1). It constituted 7% of the tuna landings by drift gillnets at Sassoon dock. The other tuna resources are *Thunnus tonggol*, *Auxis thazard and A. rochei* , which together constituted about 13.0 % of the drift gill net catch.

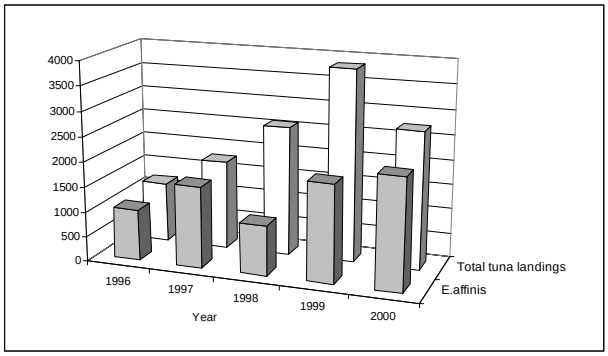


Fig.1 Total tuna landings in Maharashtra.

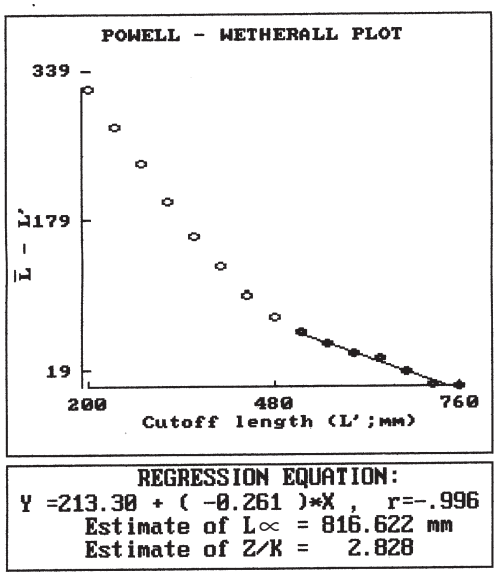


Fig.2 Powel Wetherall plot, *E. affinis* (Maharashtra).

Age and growth

The size range of *E. affinis* in the drift gillnet fishery recorded was 26 to 73 cm. A preliminary estimate of asymptotic length (L∝) was obtained by Powell and Wetherall method (1986), which gave the following parameters:

L∝ = 81.7 cm and Z/K =2.8 with r^2 = 0.996. (Fig. 2)

The month-wise data on size distribution of *E. affinis* collected during 1999-2000 was utilized for the estimation of growth parameters through ELEFAN I programme. A preliminary estimate of K was obtained with an input of L∝ of 81.7 cm, which gave the value of K as 0.79. It also gave estimation of Ø (growth performance index) for the species as 5.72 (Fig.3).

The ELEFAN I programme exercise produced the following growth parameters:

L∝ = 81.7 cm K = 0.79 (annual) with Rn = 0.262.

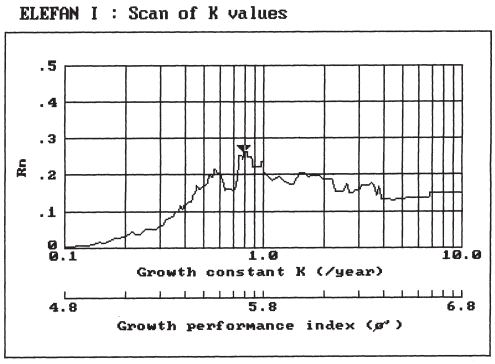
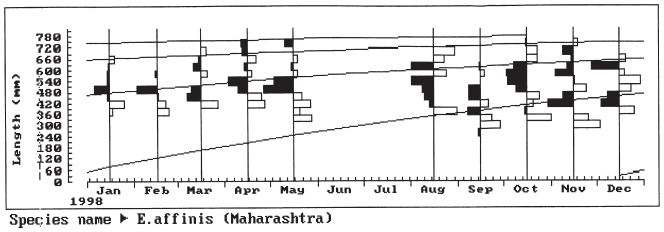


Fig.3 Scan of 'K' values, *E. affinis* (Maharashtra).



Species name ▸ E.affinis (Maharashtra)

Loo ▸ 817.00
K ▸ 0.790
C ▸ 0.000
WP ▸ 0.000
SS ▸ 1
SL ▸ 480.00
Rn ▸ 0.262

Fig.4 Estimation of growth parameter through ELEFAN I programme of *E. affinis*.

The species appears to grow at faster rate and attains a size of 44.6, 64.9 and 77.4 cm at the end of first, second and third year respectively. (Fig. 4.)

The natural mortality coefficient (M) was estimated by Pauly's equation (Pauly, 1980) with input $L\infty$ = 81.7 cm, K = 0.79 and mean annual temperature 28.2 ^{o}C The M arrived by the equation is 1.16. However, being pelagic species the same is multiplied with 0.8 as suggested by Pauly (1984). Thus the M estimated was 0.928.

Total mortality coefficient (Z) was estimated by the catch curve method for the period 1996-2000. Z varied between 2.04 (1996) to 2.88 (1998). The average Z during the last three years was 2.24 (Fig. 5.). The exploitation rate (F/Z) estimated was 0.6.

The fishing mortality estimated by length structured virtual population analysis (VPA) based on the data for the period 1998-2000 with the input of terminal F=2.0. The average F > 43 cm is 1.806. The average yield was about 1,722 t during 1998-2000, while the biomass is 1,374 t from off Maharashtra.

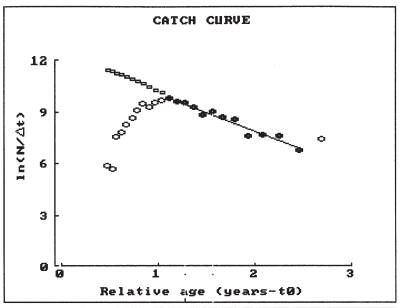
Length-weight relationship

Length-weight relationship was estimated from 150 specimens ranging from 35-70 cm, weighing 0.95 to 5.5 kg. The relationship arrived at was Log W = -1.432128 L 2.786. The study indicates that the length-weight relationship follows cube law closely (Fig. 6).

Thompson and Bell studies indicate the present level of fishing is close to the maximum sustainable yield of 1,725t (Fig.7) and there is a very limited scope of increasing the catch by enhancing the effort.

Tunas are known to form a fishery along the northwest coast of India during post monsoon period. There is no target fishery but it constitutes about 20-30 % of the fish landings in the multimeshed gillnet (90-120 mm). *E. affinis* formed the main species landed at all the centers. Two peak spawning seasons are reported i.e. October-November and April-May. The size at first maturity has been estimated to be at 44 cm (Muthiah, 1986).

There appears no agreement



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Growth Parameters
Loo : 81.70 cm K : 0.79
C : 0.00 WP : 0.00

cutoff length (L') = 47.000
mean length (from L') = 56.289

Z from catch curve = 2.24
Z entered = 2.24
natural mortality
(M, for T= 28.2°C) = 1.16
M value used = 0.93
fishing mortality (F=Z-M)
(Z & M as entered) = 1.31
exploit. rate (E=F/Z) = 0.59

Species name :
▸ E.affinis
Other file identifiers:
▸ Mumbai

Range of length observations :
▸ 25 - 73 cm
Class size :
▸ 2 cm

Fig.5 Total Mortality estimates by catch curve method during 1996-2000 of *E. affinis*.

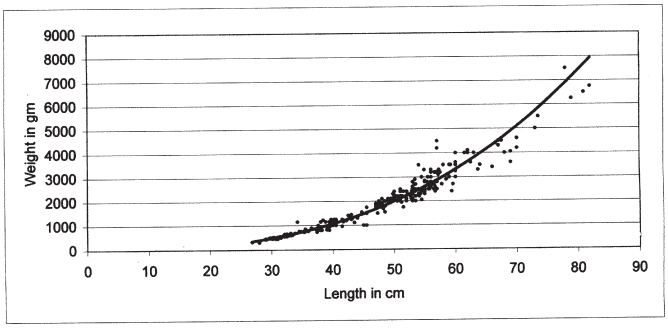

Fig.6 Length-weight relationship of *E. affinis*

between different workers on the growth rate. It varied between 0.36 (Silas *et al.*, 1986) and 2.23 (Supongpan and Saikliang, 1987). However, recent work on growth rate of this species from Philippines indicated a faster growth rate than observed by the most of the workers (Yesaki, 1994). Keeping in view of the above, the present estimates of K 0.79 and L∝ 81.7 cm appears to be reasonable estimate. *E. affinis* also grows at a faster rate and attains the first year growth of 44.6 cm, which is close to minimum size of maturity as reported by Muthiah (1986).

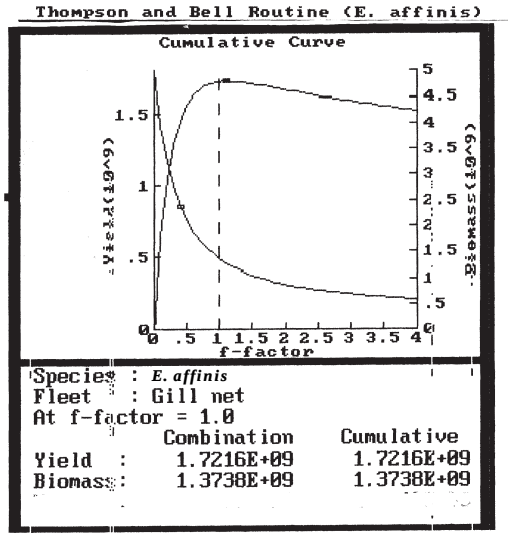

Fig.7 Thompson and Bell analysis of *E. affinis*

Both natural mortality and total mortality is dependent upon the input of K and hence cannot be compared with those of earlier works. However, the earlier works indicate the resource being optimally exploited along the coasts of India (James *et al.*, 1993). The resource appears to be optimally exploited from Maharashtra coast also.

Acknowledgements

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