STOCK ASSESSMENT OF SKIPJACK TUNA, *KATSUWONUS PELAMIS* FROM MINICOY, LAKSHADWEEP

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ABSTRACT

Analysis of the past six years data on skipjack tuna fishery by pole and line at Minicoy showed tremendous improvement as from 412.6 t in 2000-01 the catch rose to 1776.9 t in 2002-03. The CPUE was also highest being 370 kg during this year. The size of skipjack ranged from 12 to 74 cm. Bulk of the catch is comprised of the size group 48 to 64 cm. The peak recruitment was found during October and March. The length-weight relationship was $W = 0.00000775 L^{3.2092}$ (L in cm and W in kg). The growth parameters estimated were $L_{oo} = 76.65$ cm and $K = 0.95$ (annual). Accordingly this species is found to reach a size of 47.01, 65.19, 72.22, 74.94, 75.99 and 76.39 cm during first to sixth year respectively. Natural mortality (M) = 1.33, Fishing mortality (F) = 2.39 and total mortality (Z) = 3.72. Thompson and Bell analysis indicates that the present fishing does not exert any significant pressure on the stock. The results of Beverton and Holt yield per recruit analysis also supports this.

Introduction

In Minicoy, Lakshadweep, an aimed fishery for skipjack employing pole and line using live bait has been in vogue since time immemorial. The success or failure of pole and line fishery depends on the abundance/availability of this single resource. Details of pole and line fishery has been given by Jones and Kumaran (1959), Silas and Pillai (1982), Madan Mohan *et al.*(1985), Varghese and Shanmugham (1989), Pillai (1991), James and Pillai (1993), Livingston (1985) and Sivadas (2001). Various aspects of the biology have been given by Appukuttan *et al.* (1977), Madan Mohan and Kunhikoya (1985), Silas *et al.*(1985), James *et al.*(1993), Yohannan *et al.*(1993), Raju (1964), Thomas (1964). As the fishery of skipjack being highly fluctuating and considering the dynamic condition of the resource, it is quite imperative to study the population dynamics to understand the stock. In the present paper the fishery and population dynamics have been studied based on the data collected during the period 1997 to 2003 from Minicoy, Lakshadweep.

Material and methods

The data on catch, effort and length frequency of skipjack collected from pole and line units from Minicoy during 1997-98 to 2002-03 were used to study the various aspects. The length-weight relationship was calculated by least square method. The growth parameter L_{oo} was obtained initially using Powell – Wetherall method as described in Sparre and Venema (1992). 'K' value as well as refinement of L_{oo} was done using the FiSAT module. Total mortality 'Z' was estimated using linearised length converted catch curve. 'M' was obtained by Pauly's empirical formula taking the average temperature as 28°C. 'F' was found out subtracting 'M' from 'Z' . The smallest size was taken as the size at recruitment. Size at first capture was found out using the knife edge selection ogive assuming that the selection is trawl type (Ralston, 1982). Y/R was estimated by the well known method of Beverton and Holt. The VPA and Thomson and Bell analysis were done as per the methods given by Sparre *et al.*(1992).

Results

Status of the fishery

The catch for the six year period was highly fluctuating (Fig.1). From 572t in 1997-98, the catch increased to 956 t in 1998-99. In the subsequent two years, the catch decreased and reached to 413 t in 2000-01. Thereafter the fishery improved and reached an all time high of 1777 t in 2002-03. The CPUE also showed the same pattern of decrease and increase. It had increased to 370 kg in 2002-03 from 133 kg in 2000-01. The effort also increased to 4802 units in 2002-03. Thus the catch showed an increase of 330% over the lowest catch regarded in

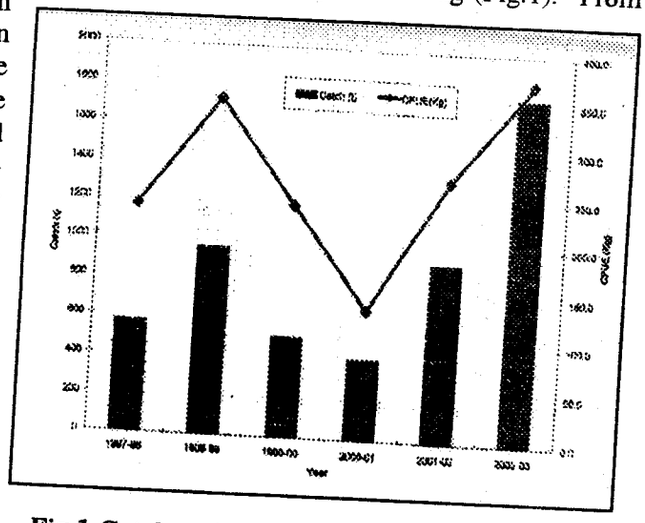

Fig.1 Catch and CPUE of Pole and line fishery for skipjack at Minicoy during 1997-98 to 2002-03

2000-01, the effort increased to 123% and that of CPUE 175%.

The skipjack on an average formed about 90% of the total tuna landed by pole and line. The catch by troll was insignificant.

Size composition

The average percentage frequency of length groups during the period 1997-98 to 2002-03 is given in Fig.2. The fishes ranged in size from 12-74 cm. The individuals of 12 cm size were very rare. The size 46-58 cm mainly supports the fishery.

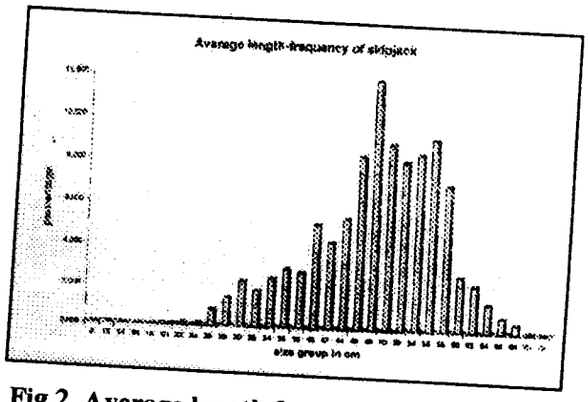

Fig.2 Average length frequency of skipjack landed by pole and line

ength-weight relationship

The relationship was found to be:

$$W = 0.00000775\ L^{3.2092}$$

(n = 383, r = 0.987, L = FL in cm and W = weight in kg)

awning and recruitment

The recruitment pattern given in Fig.3. The uitment was found to be at peak during February – ch with a minor peak in ber.

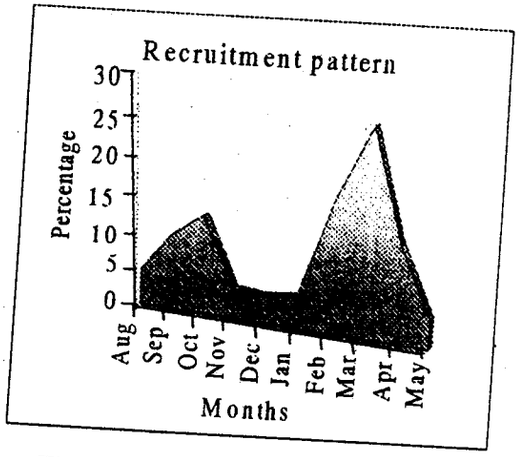

Fig.3 Recruitment pattern of skipjack

Growth

L∞ was estimated as 76.65 cm and K = 0.95 (annual). Accordingly, it was found to reach 47.01, 65.19, 72.22, 74.94 and 75.99 cm respectively from first to fifth year. The growth curve is given in Fig.4.

Class size : 2 Largest class : 73

Parameters :
Asymptotic length (L∞) : 76.65 VBGF Growth constant (K) : 95

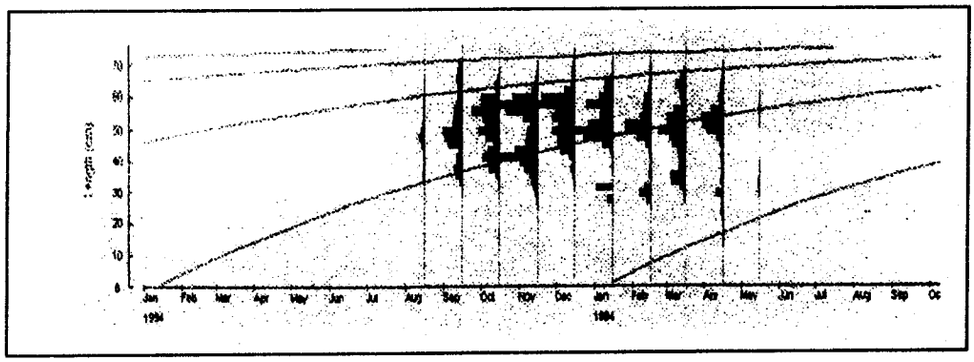

Fig.4 Growth curve of Skipjack from the pole and line fishery

Mortality

Total mortality coefficient (Z) is found to be 3.72, Natural mortality coefficient (M): to be 1.33, Fishing mortality coefficient (F) was 2.39.

L∞: The $L_{c(50)}$ obtained from the pooled data was 50.94 cm and Tc was 1.15 years.

Yield per recruit

Y/R at different values of F was estimated using the following parameters, M, Tc, Tr, W∞, K and t_o.

M = 1.33, T_c = -1.15 years T_r = 0.2 years

W∞ = 8.7 kg, K = 0.95 t_o = 0

The result is given in Fig.5. The maximum yield was obtained at an F-MSY of 4.

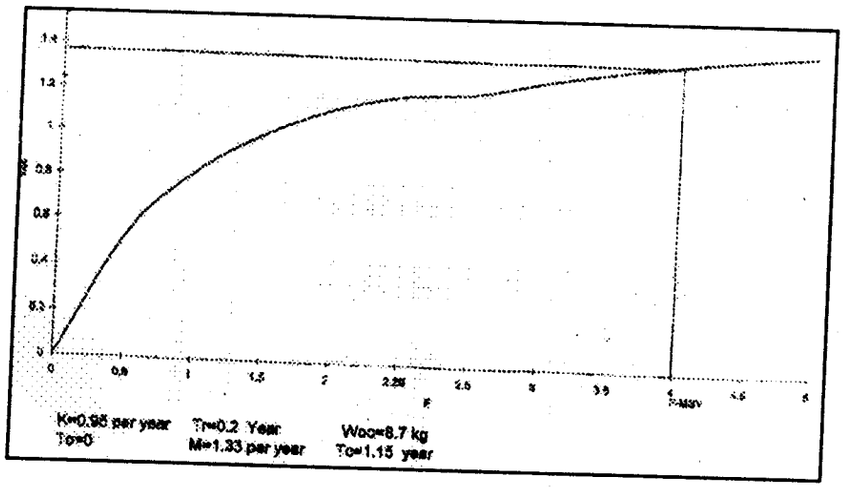

Fig.5 Yield per recruit of F

hompson and Bell analysis

The result is given in Table 1. This indicates that the present fishing fort can be increased 4 times to reach the MSY level.

Table 1: Yield, value of yield and biomass for various F

X-factor	Total yield	Total value	Total biomass
0.0	0.00	0.00	283.60
0.2	27.10	48.80	252.00
0.4	47.70	85.80	226.40
0.6	63.60	114.40	205.50
0.8	76.00	136.80	188.00
1.0	85.70	154.20	173.40
1.2	93.30	167.90	160.90
X-factor	**Total yield**	**Total value**	**Total biomass**
1.4	99.30	178.80	150.20
1.6	104.10	187.50	140.90

1.8	108.00	194.30	116.50
2.0	111.10	200.00	125.70
2.2	113.50	194.80	117.70
2.4	115.50	207.90	113.70
2.6	117.00	210.60	108.70
2.8	118.20	212.80	104.10
3.0	119.20	214.50	100.00
3.2	119.90	215.80	96.20
3.4	120.50	216.90	92.70
3.6	120.90	217.50	89.60
3.8	121.10	218.00	86.70
4.0	121.30	218.30	84.00
4.2	121.30	218.30	81.40
4.4	121.30	218.30	79.10
4.6	121.20	218.30	77.00
4.8	121.10	218.00	74.90
5.0	120.90	217.10	73.00

Discussion

The fact that the Skipjack tuna fishery by pole and line has been in existence since a long time at Minicoy and this species continues to be the dominant one clearly indicating the [illegible] r this resource. This is all the ına over any other species.

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other growth curves had shown that the shape of various growth curves are nearly the same (Fig.6).

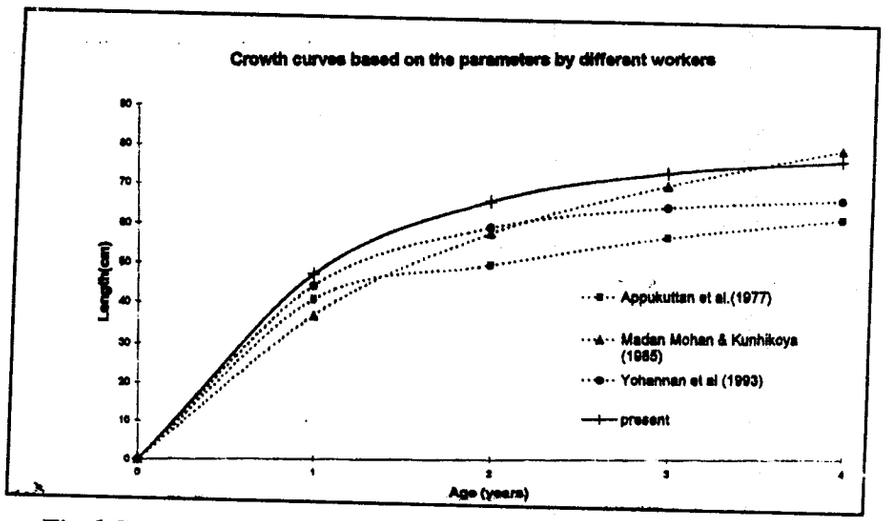

Fig.6 Comparison of growth of skipjack based on the parameters estimated by different workers

According to Madan Mohan and Kunhikoya (1985) skipjack spawns throughout the year. According to James and Pillai (1988) this species spawns during March. In the present study a prolonged spawning season with a peak from November to January and a minor one during July – August was observed.

The Y/R and Thompson and Bell Analysis indicate that the present fishing effort does not adversely affect the stock and there is scope for increasing the effort up to 4 times. The increase of 330% in the catch in 2002-03 over the lowest catch recorded in 2000-01 fortify this. Since the success of pole and line fishing depend on various factors such as the biting response, availability of sufficient quantity of preferred bait, efficiency and expertise of fisherman etc, the catch or CPUE do not often show the true abundance or availability. Not withstanding these, the fishermen seldom show any interest in diversification of the gear as they believe that the pole and line is the most efficient gear and above all least tiresome. Hence the management option should focus on making the pole and line fishing viable besides taking measures to ensure the sustainability. This includes locating the potential fishing grounds, unraveling the mode of movement of skipjack in and around Minicoy, aggregation of tuna to a particular locality through FADs etc. besides constant monitoring. A positive correlation

between the potential fishing zone and occurrence/abundance of skipjack tuna has been found in Minicoy (Pillai *et al.*, 2002). As opined by Pillai (2002) the advisory should reach the end user by the quickest possible means. If effectively carried out, this will help to reduce the cost of operation and help to increase the catch. The FADs would definitely help to increase the production besides reducing the cost of operation. Seasonal movements and variations in abundance of skipjack in Minicoy are not yet fully understood. Skipjack is basically migratory species and the neighboring country Maldives is an important skipjack fishing nation. The tagging studies conducted in Maldives have shown that skipjack released in Maldives are being caught by the neighbouring countries within a short period of time (Yesaki and Waheed, 1992; Anderson *et al.*, 1996). In order to obtain a better understanding of the movement, large scale tagging of tunas is vital as suggested by Silas (1993).

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