

## POPULATION DYNAMICS OF *TERAPON JARBUA* (FORSKAL) IN COASTAL AREA OF PAKISTANI WATERS

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**ABSTRACT:** *Terapon jarbua* is a widely distributed species in Pakistani inshore waters. It is well cherished by local coastal population. Present study is an attempt to determine some parameters of the population dynamics of the species in Pakistani waters. Analysis of data shows that the species attains asymptotic length ( $L_{\infty}$ ) at 33.2 cm and have growth curve ( $K$ ) of 0.62. Total mortality coefficient ( $Z$ ) comes to 1.67 per year, natural mortality coefficient ( $M$ ) is estimated as 1.23 per year. The fishing mortality ( $F$ ) is about 0.44 per year; whereas exploitation rate  $E = 0.26$ .

**KEY WORDS:** Population dynamics, *Terapon jarbua*, Pakistani waters.

### INTRODUCTION

The fishes of family Teraponidae constitute a substantial portion of marine fish landings on the coast of Pakistan. Three species of terapons namely *T. jarbua*, *T. puta* and *T. theraps* are common in Pakistani waters (Bianchi, 1985). Among these *T. jarbua* is widely distributed in inshore waters and is much appreciated by the population in the coastal region. Locally terapons are known as "Ginghra" and Kablosh". These are caught mainly as shrimp by-catch and in Hella fishery (one day fishing conducted by the boats with gillnet, handline, and longline in the near-shore waters). It is observed that the boats conducting fishing in inshore waters with rocky bottom area get large quantities of this species than those fishing in offshore waters.

No work has been done on the population dynamics of this species. However, some biological work has been done by various authors such as Khan *et al.*, (1994, 1996), Khan and Hoda (1998), Sanjeevan and Ali (1982-83). They studied the morphometrics and length-weight relationship. Studies on early life history were conducted by Thangaraja and Ramamoorthi (1983). Liu (1979) studied the reproductive cycle of this species.

This paper is based on the data collected from the commercial landings at Karachi Fish Harbour. It describes the growth parameters, mortality coefficients of *T. jarbua* in Pakistani waters.

### MATERIALS AND METHODS

The length composition of *T. jarbua* from commercial fisheries was recorded on monthly basis at Karachi Fish Harbour from September 1990 to August 1991. For this purpose the landing site was visited at least twice a month. Fish samples for length frequency measurements were obtained randomly from commercial landings. The length frequency data were aggregated into bimonthly intervals, then they were split into their component of normal distribution applying the Bhattacharya's method (1967)

incorporated in the LFSA computer programmes of Sparre (1987). Where temporal progression of the means was visible the Von Bertalanfy growth parameters  $L_{\infty}$  (asymptotic length) and  $K$  (growth curve) were estimated using the Gulland and Holt plot of LFSA. The data was also summed up for whole study period and it was also treated with Bhattacharya's method (1967) to identify the peaks. The peaks observed by summed data was used in Ford Walford plot to estimate the  $L_{\infty}$ . This value of  $L_{\infty}$  was then fitted in Beverton and Holt plot for estimation of  $K$  and  $t_0$  with the assumption that each peak obtained by Bhattacharya's analysis represent a cohort, each with equal intervals between them.

An estimate of asymptotic length ( $L_{\infty}$ ) was also obtained using the modified Wetherall *et al.* (1987) method, using this value of  $L_{\infty}$  an estimate of  $K$  was obtained through Von Bertalanfy plot (Sparre *et al.* 1989). A non linear least square regression method was also used for estimating these parameters. The procedure was carried out by micro computer using LFSA packages 1987. The growth performance in terms of length was also calculated for all methods described here by the index of Pauly and Munro (1984).

The estimates of total mortality coefficient ( $Z$ ) was estimated from a length converted catch curve analysis. The natural mortality coefficient ( $M$ ) was estimated using Pauly's empirical formula (Pauly, 1983)

$$\log_{10}(M) = 0.006 - 0.279\log_{10}(L_{\infty}) + 0.6443\log_{10}(K) + 0.4634\log_{10}(T)$$

For this purpose  $T$  was set at 26°C (Anon, 1986)

## RESULTS AND DISCUSSION

### a) Growth Parameters:

Percentage length frequency distribution for *T. jarbua* is presented in table 1. The mean length obtained from the Bhattacharya's analysis for length frequency data of table 1 are presented in table 2. There were several modal values ranging from 12cm to 32cm during the different periods without showing any consistency in modal progression. Growth parameters *i.e.*  $L_{\infty}$  and  $K$  were estimated by using four different methods are given in table 3. It is observed that set of estimates obtained by different methods are very close and are comparable except the one obtained by Gulland and Holt plot, where the value of  $K$  comes to 1.67 per year which is on high side. In Wetherall plot (Fig. 1) alongwith Von Bertalanfy plot, the value of  $K$  is reasonable but the value of  $L_{\infty}$  appears to be on lower side. In least square non linear regression procedure and Ford Walford plot alongwith Beverton and Holt plot, the estimates of two parameters are close and acceptable. Growth performance index ( $O'$ ) for different methods is presented in table 3 which also shows very close relationship between the parameters by these two methods. However for the estimation of other parameters in this study the values obtained by Ford Walford plot alongwith Beverton and Holt plot has been used.

### b) Mortality:

The value of  $Z$  comes to 1.67 per year. Figure 2 shows these analyses, the length range included in the analysis is 23 to 27 cm. From Fig. 2 it appears that the species have at least two cohorts in a year. It is also observed that specimens as small as 12 cm are also

recruited to the fishery.

The natural mortality coefficient (M) at a mean temperature of 26°C already said in “Materials and Methods Section” is 1.23 per year and fishing mortality (F) is estimated as 0.44 per year by using following equation.

$$F = Z - M$$

Hence exploitation rate  $E = F/Z$  comes to 0.26

Table 1. Percentage length frequency distribution of *Terapon jarbua*.

| Length<br>(cm) | Percentage Frequency in different months |         |         |         |        |         |
|----------------|--|---------|---------|---------|--------|---------|
|                | Sept. 90                                 | Nov. 90 | Jan. 91 | Mar. 91 | May 91 | Jul. 91 |
| 12             | 0.9                                      | 0.6     | 4.1     | 1.6     | 0.9    | 2.8     |
| 13             | 5.5                                      | 0.0     | 1.4     | 4.0     | 0.9    | 5.0     |
| 14             | 9.2                                      | 1.2     | 4.1     | 8.0     | 0.0    | 3.3     |
| 15             | 11.9                                     | 1.8     | 6.1     | 0.8     | 0.0    | 8.3     |
| 16             | 9.2                                      | 3.0     | 8.8     | 6.4     | 1.8    | 4.4     |
| 17             | 12.8                                     | 5.4     | 10.1    | 4.0     | 0.0    | 14.4    |
| 18             | 14.7                                     | 4.8     | 0.0     | 10.4    | 4.0    | 0.0     |
| 19             | 17.4                                     | 6.0     | 0.0     | 0.0     | 0.0    | 2.8     |
| 20             | 8.3                                      | 3.0     | 0.7     | 0.8     | 4.0    | 0.0     |
| 21             | 0.0                                      | 7.8     | 4.1     | 0.0     | 4.4    | 1.7     |
| 22             | 0.9                                      | 9.6     | 9.5     | 5.6     | 4.0    | 6.6     |
| 23             | 0.0                                      | 12.0    | 12.8    | 7.2     | 4.4    | 8.3     |
| 24             | 8.3                                      | 0.0     | 14.2    | 5.6     | 7.9    | 9.9     |
| 25             | 0.0                                      | 7.8     | 4.1     | 8.8     | 12.8   | 5.5     |
| 26             | 0.0                                      | 9.0     | 0.0     | 11.2    | 8.8    | 0.0     |
| 27             | 0.0                                      | 9.6     | 5.4     | 3.2     | 0.0    | 0.0     |
| 28             | 0.0                                      | 9.6     | 7.4     | 4.8     | 10.6   | 1.1     |
| 29             | 0.0                                      | 3.0     | 0.0     | 6.4     | 13.2   | 5.5     |
| 30             | 0.0                                      | 1.8     | 2.0     | 7.2     | 20.3   | 8.3     |
| 31             | 0.9                                      | 0.6     | 2.7     | 0.0     | 2.2    | 10.5    |
| 32             | 0.0                                      | 3.0     | 2.7     | 4.0     | 0.0    | 1.7     |

Majid *et al.* (1992) and Bianchi (1985) reported that this species attains a maximum length of 30 cm and is common to 25cm. Therefore, the estimates of Loo 33.2 cm obtained in this study are quite close to the actual Loo. The value obtained through Gulland and Holt plot of LFSA package is close to the formula described by Pauly (1984) for the first estimation of Loo, but the value of K is rather high and shows a characteristic of “r” selected species (Gjoseater and Dalpadado, 1988), while we consider it as a “k” selected species keeping in view the fishing ground habitat reported and other characters of the fish. Thus the estimates of this method are not acceptable.

Table 2. Mean modal length obtained from Bhattacharya's analysis for *Terapon jarbua*.

| Period              | L1<br>(cm) | L2<br>(cm) | L3<br>(cm) | L4<br>(cm) |
|---------------------|------------|------------|------------|------------|
| Sept. 90 to Oct. 90 | 15.40      | 19.20      |            |            |
| Nov. 90 to Dec. 90  | 17.83      | 22.24      | 28.00      | 30.89      |
| Jan. 91 to Feb. 91  | 12.00      | 18.13      | 26.30      | 29.31      |
| Mar. 91 to Apr. 91  | 13.86      | 23.50      | 26.30      | 29.31      |
| May 91 to Jun. 91   | 21.50      | 30.16      |            |            |
| Jul. 91 to Aug. 91  | 13.59      | 24.00      | 30.60      |            |
| Summed Data         | 17.42      | 24.78      | 28.98      | 30.94      |

Table 3. Estimates of L<sub>∞</sub> and K by different methods in Pakistani waters for *Terapon jarbua*.

| Method  | L <sub>∞</sub> (cm) | K     | t O    | O'<br>(Phi prime) |
|---|---------------------|-------|--------|-------------------|
| Ford Walford plot & Beverton & Holt plot          | 33.200              | 0.620 | -0.180 | 2.835             |
| Gulland & Holt plot                               | 33.830              | 1.670 | -      | 3.281             |
| Least Square non linear regression method         | 33.460              | 0.624 | -0.176 | 2.844             |
| Wethrall <i>et al.</i> plot & Von Bertalanfy plot | 32.700              | 0.723 | -0.013 | 2.888             |

The values for total mortality coefficient (Z) and natural mortality coefficient (M) are reasonable as there is no target fishery for this species and the fish is caught incidentally. There are possibilities that the value of M may be slightly on higher side but in the absence of catch and effort data, and other related information, this value is acceptable. Values estimated for F (fishing mortality) and E (exploitation rate) are also reasonable and acceptable in the absence of any regular fishery for the species.

These preliminary analysis suggests that *T. jarbua* in Pakistani waters is in under exploited stage, although it is very difficult to evaluate the results presented here as no previous studies of this type appear to have been undertaken for *T. jarbua*.

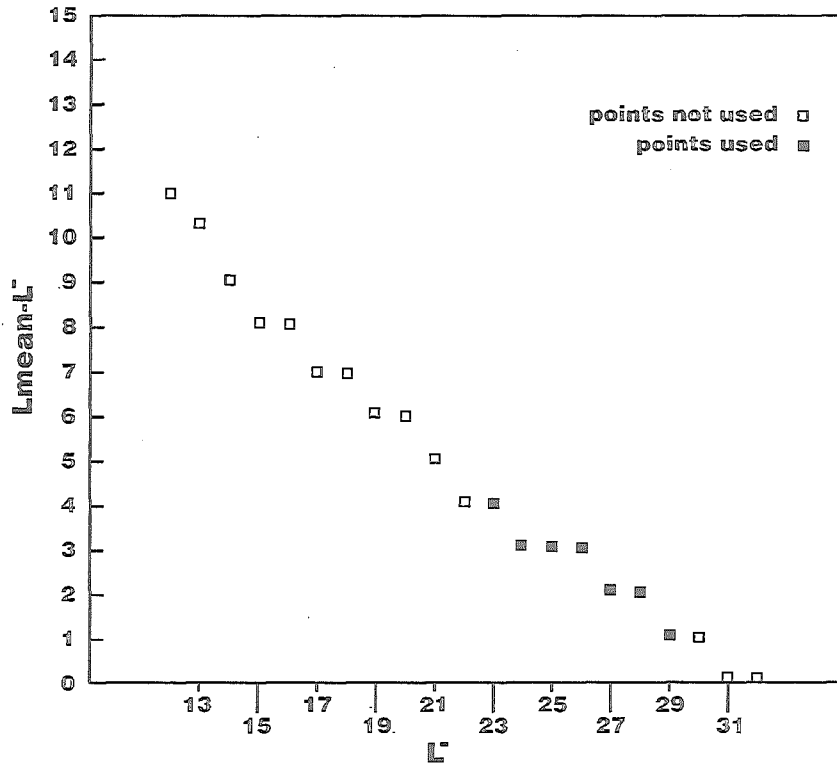


Fig. 1. Wethrall plot for *T. jarbua* in Pakistani waters.

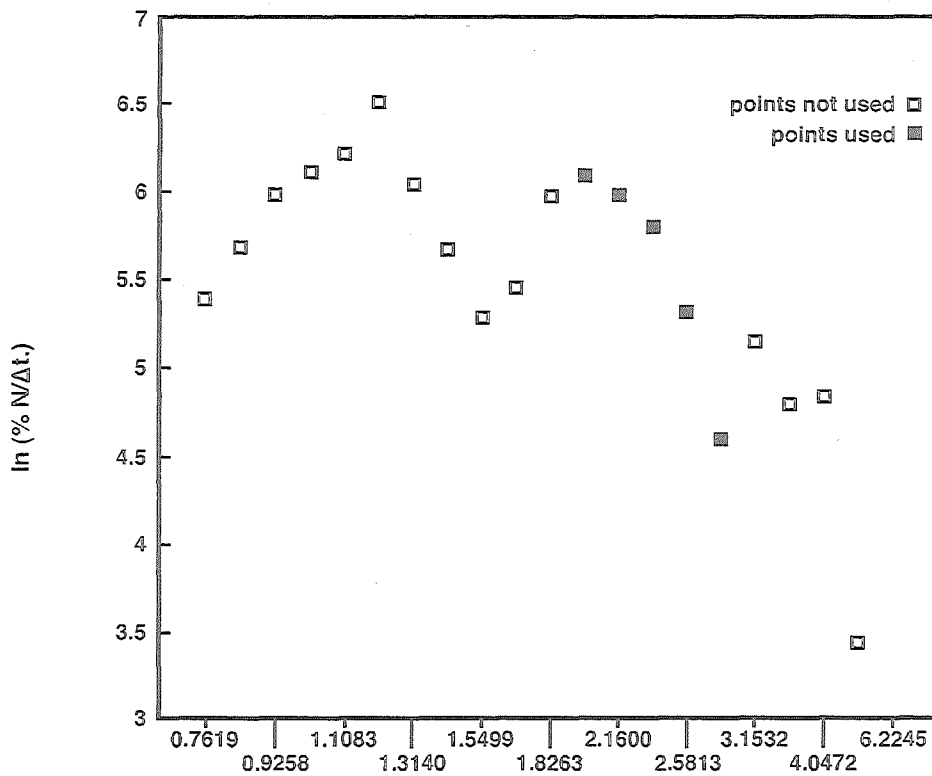


Fig. 2. Catch curve analysis of *T. jarbua* in Pakistani waters.

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