FISHERY AND POPULATION DYNAMICS OF THE WINDOWPANE OYSTER, *PLACENTA PLACENTA* (LINNAEUS), FROM KAKINADA BAY

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ABSTRACT

The catch trends of the windowpane oyster at Yetimoga landing centre during 1978-81 are described. The instantaneous rates of mortality of *Placenta placenta* are estimated as Z = 4.0, M = 1.3 and F = 2.7. The life-span is 3.4 years. The study on the yield in weight per recruit shows that under the current ft- of 0.89 year, the yield increases without reaching a maximum with increased F. It is also observed that maximum yield can be obtained at $t_c i$ = 0.8 which is close to the current value. It is recommended that the present tic and F can be maintained with advantage.

INTRODUCTION

The windowpane oyster *Placenta placenta* (Linnaeus) ranks first among a dozen species of molluscs being fished in the Kakinada Bay. While information on aspects of its fishery (Narasimham 1973), biology (Narasimham 1984), distribution and abundance (Murty et al 1979, Narasimham et al 1984) from the Kakinada Bay is available, there is no information on its population dynamics.

MATERIAL AND METHODS

Samples, of about 100 windowpane oysters, were collected at fortnightly intervals from the catches at Yetimoga during 1978-81. Of the 15 landing centres, Yetimoga was chosen because of year-round fishing at this centre and its proximity lo the fishing ground, which enables the fishermen to return daily to the village with the catch. Further, since the fishing ground and the fishing method being the same every where, the trends at Yetimoga can be taken as representing the trends at other centres. On each observation day, the catch of P. *placenta* and the effort expended were recorded. Men, women and children participate in handpicking molluscs without using any diving aids, though the oysters burrow in the soft mud and are not visible. Selection is not exercised when catching. The effort was standardised in terms of mandays. The average effort put in by a man during a single low tide is termed as a manday. The efficiency factors of a woman and a child were estimated to be 0.64 and 0.26 mandays, respectively. The length

antero-posterior axis) was measured to the nearest mm with a Vernier calipers and grouped into 4mm-class intervals. Monthly and annual estimates of catch, effort and length frequency were obtained from the data collected on observation days and effort was standardised as per the efficiency factors mentioned above.

The total mortality rate (Z) was estimated using the catch curve of Pauly (1983). For this purpose, the annual length composition of catch was converted into length composition of catch for 10 mandays. The natural mortality rate (M) was estimated following Sekharan (1975); an attempt was also made to estimate this by the Beverton and Holt (1956) method. The regression coefficient in the length-weight relationship of *P. placenta* from the Kakinada Bay at 3.4835 was found to be significantly different from 3 (Narasimham 1984). Hence, the yield in weight per recruit was calculated using the Beverton-Holt (1957) model as modified by Jones (1957).

FISHERY

Fishing area, fishing method and landing centres: The windowpane oyster is exploited throughout the year from about 40 sq. km area of the Kakinada Bay; the maximum depth at low tide is about 2 m in the fishing ground. The fishermen residing in 15 villages fish about a dozen species of molluscs, of which *Placenta placenta* and the blood clam, *Anadara granosa,* are the most dominant. About 300 non-powered plankbuilt boats are used for transport. Annually, an estimated 5000 t of the windowpane oyster are landed from the Kakinada Bay (Silas et al 1982). Further details of the fishery have been given by Narasimham (1975).

Catch trends at Yetimoga: In 1978 a total of 127 t of P. *placenta* were landed on expending 3414 mandays, giving an average of 37.2 kg|manday. The monthly catches varied from 1.3 t in January to 20.1 t in September (Fig. 1). The catches were high during March-April and August-September. The catch per unit effort (c.p.u.e,) varied from 24.4 kg in June to 49.0 kg in April. In addition to September, catch rates were high during March-May also.

Compared to the previous year, there was in 1979 an increase in the total catch (201.3 t), effort (4715 mandays) and the c.p.u.e. (42.7 kg). The monthly catches varied from 5.2 t in September to 38.3 t in April (Fig. 1). The catches were exceptionally high during March-April. The c.p.u.e. ranged from 36.0 kg in June to 50.2 kg in October.

In the following year (1980) there was a decline in the total catch (132.4 t), effort (4002 mandays) and c.p.u.e. (33.1 kg). The catch was low, being at 3.4 t, in December and touched a peak of 17.8 t in September; the landings were high during February-April and September-October (Fig. 1). The c.p.u.e. ranged from 21.9 kg in July to 40.8 kg in March.

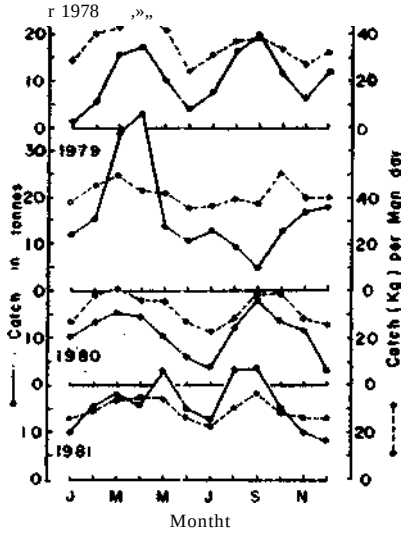

FIG. 1. Monthly catch and catch per man-day of *Placenta placenta* landed at Yetimoga during 1978-81.

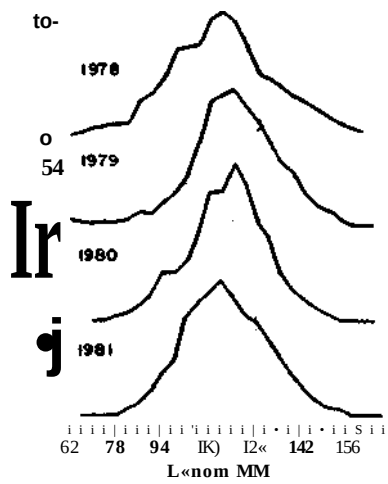

FIG. 2. Annual length frequency distribution of *Placenta placenta* landed at Yetimoga during 1978-81.

In 1981 a total of 192 t of windowpane oyster were landed, expending 6295 mandays, which gave a catch rate of 30.5 kg. The monthly catches varied from 8.3 in December to 24.1 t in September; the catches were high in May and again in August-September (Fig. 1). The c.p.u.e. was low at 26.2 kg in January and reached a maximum of 36.6 kg in September.

Data pooled for the study period showed that the catches were high in March-April and August-September. Low catches were recorded in January and June-July.

POPULATION DYNAMICS

Growth parameters: The parameters of the von Bertalanffy equation for growth in length of *P. placenta* from the Kakinada Bay were estimated as L_∞ = 186.6 mm, K = 0.7802 per year and t_0 = —0.3543 year (Narasimham 1984). Based on the length-weight relationship of this species (Narasimham 1984) the asymptotic weight W_∞ for the above value of L_∞ was estimated as 324.5 g.

Estimation of mortality rate: The length range of the catch during the four years was 62-172 mm (Fig. 2). The instantaneous rates of total mortality Z are estimated (Fig. 3) as 3.05 in 1978, 4.10 in 1979, 4.51 in 1980 and 4.29 in 1981, with an average of 4.0.

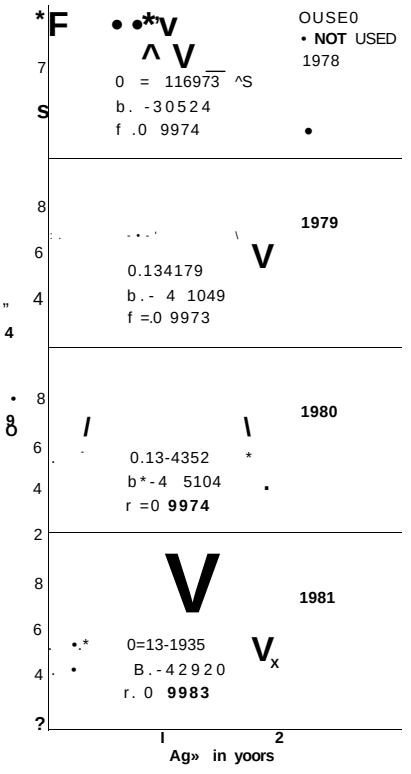

FIG. 3. **Pauly's catch curve of *P. placenta.***

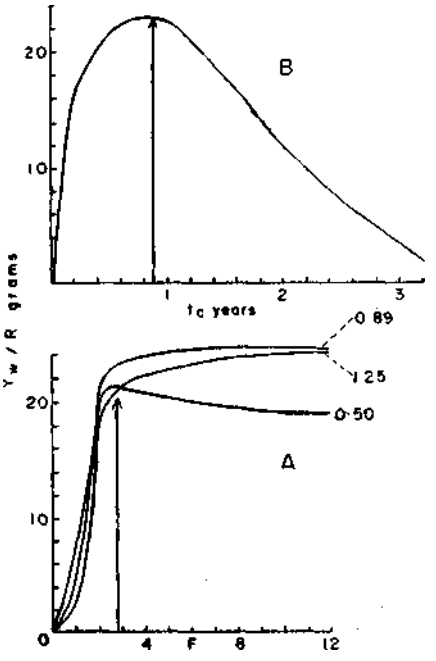

FIG. 4. Yield **in weight per recruit. A as a function of fishing mortality rate (F) when tc is O.SO, 0.89 and 1.2S years.** The vertical **line indicates the** current F. **B as a function of** age at first **capture (tc). The** vertical line **indicates the** current tc.

The regression of Z against corresponding effort gave an M value of 2.7 with the r^2 value at 0.3. Since the value of coefficient of determination for the regression is very low the above value of M = 2.7 cannot be taken as reliable. Considering the lifespan of the species also *{vide infra),* the above estimate of M cannot be considered as reliable. It is known that the maximum attainable length in a population is equal to 95% of L<» (Taylor 1962). The 95% of Li*, of P. *placenta* is 177 mm and the corresponding age can be calculated as 3.4 years. Assuming that in the unexploited state 99% of the windowpane oyster die before they attain 3.4 years, M can be calculated as 1.3; then the present F becomes 2.7.

Yield in weight per recruit: The smallest length in the catch was 62 mm (Lr) and its age (tr) is 0.1165 year. **The annual length-frequency distribution of the**

catch (Fig. 2) shows that the major modal lengths during the four years varied from 114 to 118 mm. The average of these values at 116 mm was taken as Lc ; and 1c is calculated as 0.89 year.

The yield in weight per recruit (Y_w/R) against F, keeping M constant at 1.3 and considering three values oftc at 0.5, 0.89 and 1.25 (corresponding to lo values of 90.8, 116.0 and 133.2 mm respectively), is shown in Figure 4A. With tc at 0.5 the yield increases attaining a maximum of 21.27 g per recruit when F is 2.6 and thereafter it declines. Under the current value oftc (0.89) the yield per recruit increases rapidly to 22.37 g against the F of 2.2; at higher levels of F also the yield per recruit increases but only a maximum of 24.46 g can be obtained with F at 12.0. In the present state of the fishery, with F at 2.7, the Yw|R is 22.9 g and further increase in the effort would therefore give only marginal increase in the yield which may not be remunerative, though the same does not affect the stock adversely. Increase in the value of tc to 1.25 years shows that the Yw|R increases till F reaches a value of, 11.2 and decreases thereafter. However, the yield is invariably less than the yield that is obtained with tc at 0.89 for any given value of F.

The estimaled values of yield per recruit against fc when M = 1.3 and F = 2.7 are given in Fig. 4B. The curve shows that yield increases to a maximum when tc is 0.8 and shows decline with further increase in tc. It may be noted that the present tc is close to this value.

DISCUSSION

As already stated, about a dozen species of molluscs are caught by handpicking in the Kakioada Bay; which means that the same effort is generating some fishing mortality in different species. Because of this the correlation between effort and Z of *P. placenta* is poor and the value of M thus obtained is not reliable (see Cushing 1981). Though there is no knowledge of tm&x of this species when there is no exploitation, the value of M at 1.3 on the basis of the life-span can still be considered as reliable in the present context.

Currently two factors, namely fishing by handpicking (which limits the catching efficiency) and the low market demand, insulate against overfishing windowpane oyster. However, any change in the pattern of fishing such as the introduction of dredge or other suitable gear is likely to affect the stock adversely. It may also be mentioned that the stock size of the windowpane oyster in the Kakinada Bay is small as evidenced by the estimated total population of 12,500 t during March|April 1983 (Narasimham et al 1984) and the present annual production is 5000 t (Silas et al 1982).

It is shown that the Yw|R against F with tc at 0.89 does not attain a maximum (Fig. 4B) even up to F = 12.0. Further, the present length at first

capture (116 nun) is much greaiter than the length at first maturity, which is S3 mm (Narasimham 1984). Hence there is no danger of over exploitation through recruitment overfishing even at higher levels of F. Thus, though increased effort has no adverse effect on the stock, it will not result in proportionate increase in the yield. Hence the present t_c and F can be maintained with advantage.

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