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POPULATION DYNAMICS OF *COILIA DUSSUMIERI* FROM THE KUTUBDIA CHANNEL OF BANGLADESH COASTAL WATER

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Elefan I and Elefan II were used to estimate the population parameters and length-frequency-based cohort analysis of *Coilia dussumieri,* collected from Kutubdia channel of Bangladesh coastal water. The Von Bertalanffy growth parameters $L\infty$ and K for the species were 16.80 cm and 1.30 $year^{-1}$, respectively. The annual rate of M,F and Z were found to be 2.49, 2.30 and 4.79, respectively. The exploitation rate (E) was estimated as 0.48. This fish was recruited in the fishery during April-June and August-October. Peaks appeared in the months of May and September. E_{max} was found to be 0.602. From the analysis *Coilia dussumieri* showed below optimum fishing pressure (i.e. E<0.50) in the coastal water of Bangladesh.

Key words: Population dynamics, *C. dussumieri,* Kutubdia channel, Bangladesh coast.

Introduction

Coilia dussumieri is popularly known as gold spotted grenadier anchovy in England and as mandeli in Bombay. It is locally familiar as "olua mach" in the coastal districts of Bangladesh and is commonly found in the shallow coastal waters and estuaries. The gold spotted grenadier anchovy, *Coilia dussumieri* is widely distributed in the Indian Ocean (coast of India from Bombay to Calcutta, probably also Myanmer, Thailand and Malaysia) and western pacific area (Thailand to Java, presumably also Kalimantan).

Ancyovy is a very soft fish of low standing quality. Due to its perishable body composition, a large part of the catch, particularly during peak season, is sundried and a small portion is sold fresh in the markets. The highest percentage of carbohydrates (0.06%), fats (2.38%) and ash (3.48%) were observed in the maturing fish while the highest percentage of proteins (16.85%) and moisture (78.24%) were observed in the gravid and spent fishes respectively (Towhid 1994). The fresh fish has great demand among the people of coastal districts. Due to lack of proper transport and processing facilities, the fish is not very well known to the people of the interior districts.
It is caught mainly with beach seines, purse seines, bamboo-stake traps and incidentally with bottom trawls. It is marketed in fresh, dried salted forms or made into fish sauce or fish balls (Quddus and Shafi 1983). In India it is caught with a variety of other fishes by the indigenous dolnets (fixed bagnets) and Set Bag Net (S.B.N.) on the coast of Bombay, Maharashtra and Gujrat (Fernandez and Devaraj 1989).

Although *Coilia dussumieri* is an economically important fish and has a gradually increasing demand in fresh and dry conditions at home and abroad, there is no published work on the population dynamics. The present investigation has been made for the first time from the coast of Bangladesh.

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Materials and Methods

Fortnightly samples of *Coilia dussumieri* were collected from August 1995 to July 1996 from the Kutubdia channel (Fig 1) of Bangladesh coastal water. Fishes were collected by the Set Bag Net S.B.N.) locally called Behundi jal (mesh size: at mouth 10 cm, in the middle 5 cm and at the cod end 1.5 cm). Total length (TL) of 1260 specimens was measured at 0.5 cm interval and length frequency data were pooled monthwise.

Length-frequency based computer program ELEFAN 1 and ELEFAN II were used to estimate the population parameters. As explained in detail by Pauly and David (1981) and Saeger and Gyanilo (1986), the growth parameters $L\infty$ and K of the

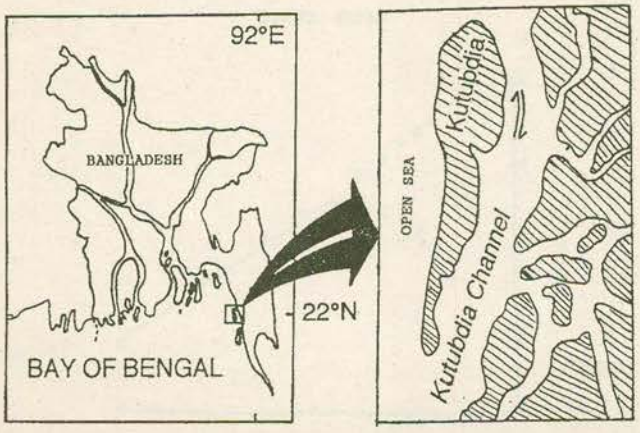


Fig 1. Investigated area of Kutubdia channel in the coastal water of Bangladesh.

Von Bertalanffy equation were estimated by ELEFAN 1. An additional estimate of the $L\infty$ and Z/K value was obtained by plotting $\bar{L}$-L' on L (Wetherall 1986) as modified by Pauly (1986) i.e.

$$\bar{L}\text{-}L' = a + bL' \quad \text{where } L\infty = -a/b \text{ and } Z/K = -(1+b)/-b$$

where L is defined as the mean length, computed from L' upward, in a given length frequency sample while L' is the limit of the first length class used in computing a value of L.

The growth performance index (ϕ') of *Coilia dussumieri* population in terms of growth in length was calculated using the formula of Pauly and Munro (1984):

$$\phi' = \log_{10}K + 2\log_{10}L\infty$$

where $L\infty$ is the asymptotic length in cm and K is the growth constant per year.

The ELEFAN II estimates total mortality (Z) from catch curve based on the equation.

$$Z = \frac{K(L\infty - \bar{L})}{\bar{L} - L'} \quad \text{.....(i)}$$

where $\bar{L}$ is the mean length in the sample, computed from L' upward and L' is the lower limit of the smallest length class used in computation of $\bar{L}$ (Beverton and Holt 1956).

Natural mortality (M) was estimated using the empirical relationship derived by Pauly (1980) i.e.

$$\log_{10}M = -0.0066 - 0.279\log_{10}L\infty + 0.6543\log_{10}K + 0.4634\log_{10}T \quad \text{.....(ii)}$$

where $L\infty$ is expressed in cm (total length), T is the mean annual environmental temperature in °C (here it was taken as 28°C).

The estimate of fishing mortality (F) was taken by subtracting natural mortality (M) from total mortality (Z). The exploitation rate (E) was then computed from the Gulland's expression (Gulland 1971):

$$E = F/Z = F/(F+M)$$

"Gear Selection Pattern" was determined using the routine ELEFAN II i.e. plots of probability of capture by length (Pauly 1984) by extrapolating the catch curve and calculating the number of fish that would have been caught.

Recruitment pattern is obtained by backward projection on the length axis of a set of length frequency data (seasonal growth curve) according to the routine ELEFAN II.

Relative yield-per-recruit ($Y R^{-1}$) and biomass-per-recruit) B R^{-1}) was obtained from the estimated growth parameter and probabilities of capture of length (Pauly and Soriano 1986). Here, yield (Y)-per-recruit (R) is calculated as relative yield per recruit ($Y R^{-1}$). The calcualtions were carried out using the "Compleat ELEFAN" software package developed at ICLARM (Ingles and Pauly 1984).

Results and Discussion

Gorwth parameters. Growth parameters of von Bertalanffy formula were estimated as $L\infty$=16.80 and K=1.30 per year. For these estimates through ELEFAN 1 and response surface (Rn) was 0.324 for the main curve (solid line) and 0.138 for the secondary line (dotted line). The computed growth curves produced with those parameters are shown over the restructured length distribution in Fig 2. The t_o value was taken as zero.

The Powell-Wetherall plots are shown in Fig 3. The corresponding estimates of $L\infty$ and Z/K for *Coilia dussumieri* are 15.761 cm and 2.333, respectively. This additional estimate of $L\infty$ is slightly lower than the $L\infty$ estimated through ELEFAN 1. The correlation coefficient was 0.983 (a=4.73 and b=-0.30). Islam (1995) reported $L\infty$=20.00 cm and K=0.65 per year from Karnafully river estuary of Chittagong growth performance index (ϕ') was found to be 2.56

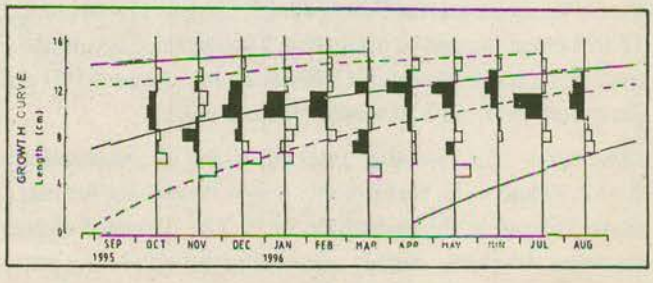
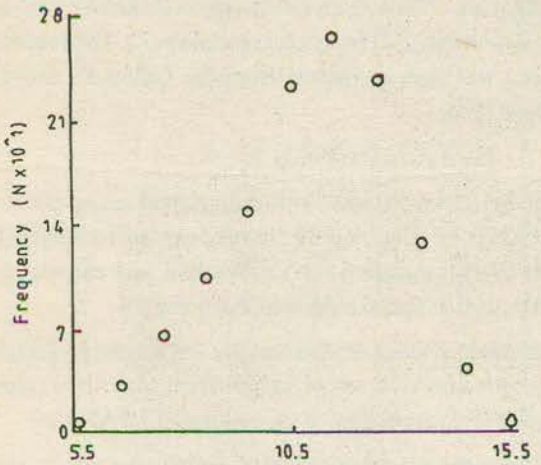


Fig 2 Growth parameters of *Coilia dussumieri* estimated by ELEFAN ($L\infty$=16.80 cm and K=1.30 $year^{-1}$).



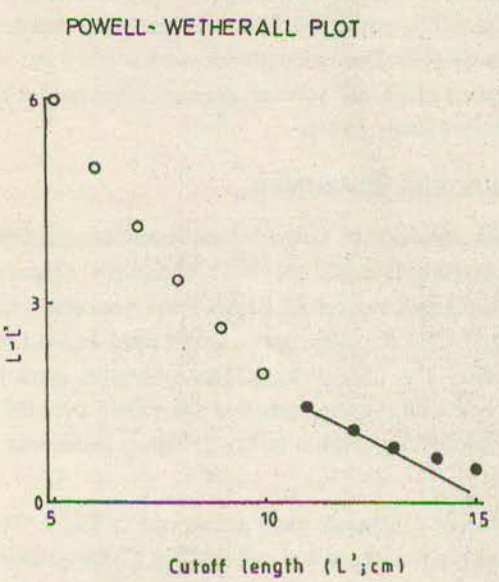


Fig 3 Estimation of L_o and Z/K using the methods of Powell-Wetherall plot for *Coilia dussumieri*; the estimated L∞=15.761 cm and Z/K = 2..333.

It is assumed in the ELEFAN 1 analysis that the value of the third parameter of the Von Bertalanffy growth function, t_o is zero (Pauly and David 1981). Therefore, the sizes attained by the *Coilia dussumieri* are 8.029 cm 12'.221 cm, 14.409 cm and 15.073 cm at the end of 6,12,18 an 21 months of age, respectively. The growth rates of *Coilia dussumieri* were 0.901 cm per month from sixth to seventh month of age.

Mortality. The mortality rates M, F and Z computed are 2.49,2.30 and 4.79, respectively. Fig 4 represents the catch curve utilized in the estimation of Z. The darkened circles represent the points used in calculating through least square linear regression. The blank circles represent point either not fully recruited or nearing to L∞ and hence discarded from the

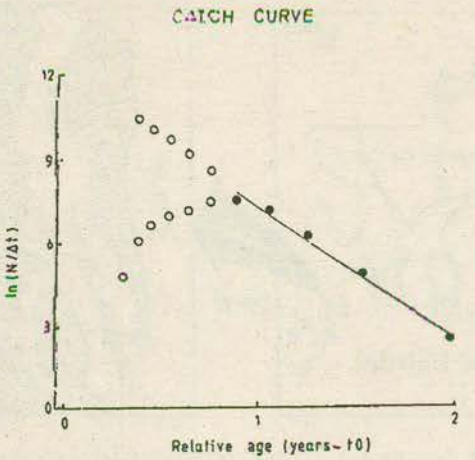


Fig 4 Length - converted catch curve of *Coilia dussumieri.*

calcualtion. Good fit to the descending right hand limits of the catch curve was considered. The correlation coefficient was 0.982 (a=8.32 and b=4.79).

The natural mortality rate was estimated from the empirical equation. According to Pauly (1980) this method gives a reasonable value of M. This method of estimating M is widely used throughout the tropics where time series or reliable catch and effort data and several years of Z values are not available. The fishing morality rate (F) was taken by subtracting M from Z and was found to be 2.30.

Exploitation rate. The rate of exploitation (E) was 0.48. It seems that the stock of *Coilia dussumieri* in the Kutubdia channel, Cox's Bazar is not under fishing pressure. The assumption is based on Gulland (1971) who stated that suitable yield is optimised when F = M and when E is more than 0.5, the stock is generally subjected to over-fishing. The present study showed the under exploitation (E<0.50) of *Coilia dussumieri* in the Kutubdia channel of Bangladesh coastal water.

Selection pattern. It is evident from Fig 5 that the resultant curve derived from the probablities of capture curve provided an estimate of length at first capture (Lc) of 10.486 cm on the basis of present net used.

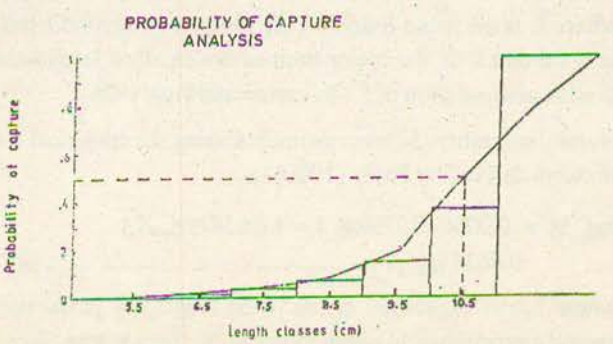


Fig 5 Selection pattern of *Coilia dussumieri.*

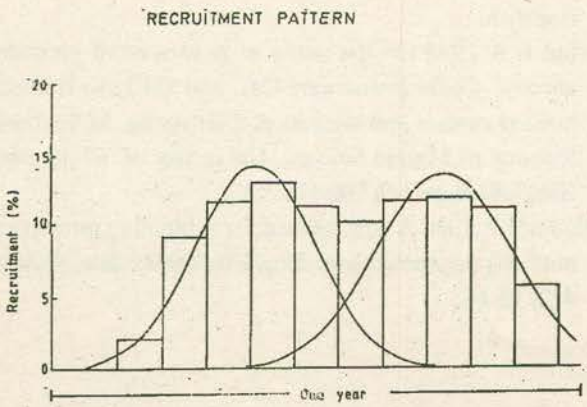


Fig 6 Recruitment pattern of *Coilia dussumieri.*

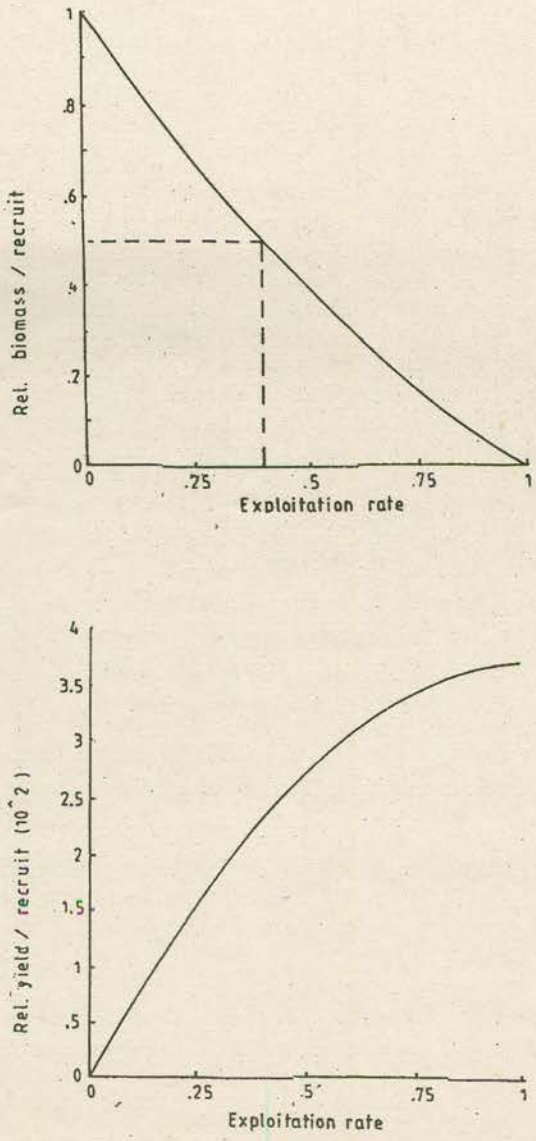


Fig 7. Relative yield per recruit and biomass per recruit of *Coilia dussumieri* (Lc/L∞ = 0.62, M/K = 1.91).

Recruitment pattern. The recruitment pattern (Fig 6) was determined through ELEFAN II analysis (Pauly *et al* 1981) with the separation of the normal distribution of the peaks by means of the NORMSEP program. It shows that this species was recruited in the fishery during April to June and August to October. Peaks appeared in the month of May and September.

Yield-per-recruit and biomass-per-recruit. The relative yield-per-recruit and biomass-per-recruit were determined as a function of Lc/L∞ and M/K are 0.62 and 1.91, respectively. Fig.7 shows that the present exploitation rate (E = 0.48) does not exceed the optimum exploitation rate Emax = 0.607.

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