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# STATUS OF *PENAEUS INDICUS* (H. MILNE EDWARDS) STOCKS FROM NEGOMBO AND CHILAW, SRI LANKA

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**Abstract :** The relative yield per recruit isopleths were derived for *Penaeus indicus* stocks from Negombo and Chilaw areas respectively based on the trawl fishery data collected from July 1984 to June 1986. A maximum relative yield of around 0.041 per recruit can be obtained when the length at first capture is around 11 cm. Although it appears that the fishing intensity can be increased considerably, it should be carried out concurrently with an increase in minimum mesh size.

## 1. Introduction

The Penaeid prawns (Family – Penaeidae) are important as a commercial fishery resource in Sri Lanka as well as in India. Prawns contribute to 3% by weight to the total marine landings of the whole island. Out of this about 20% comes from Negombo and Chilaw which are the major prawn landing centres of the west coast of Sri Lanka. Among marine products exported from the country "frozen prawns" is a major item; well preferred by U.S.A. and many European countries. Value wise, earning from exports of prawns is 70 – 80% of the total foreign exchange obtained from marine products exported from Sri Lanka.

Thirty one species of penaeid prawns have been recorded off Sri Lanka[4], out of which four commercially important species are caught in Negombo and Chilaw. These are *Penaeus indicus, P. monodon, P. semisulcatus* and *P. merguiensis*. *P. indicus* dominates in these two areas contributing to 60% of the total annual catch. This species too shows migratory behaviour like most other penaeid prawns. *P. indicus* spawns in deeper areas of the ocean[9] and eggs and larvae are found in surface and sub–surface waters.[13] According to Manisseri and Manimaran,[8] the juvenile stages of this species are spent in the estuaries and they move out to sea at the sub–adult stage.

Many workers have previously studied the panaeid prawns from Sri Lankan waters. De Bruin[3,4,5] described their distribution and fluctuation patterns off Sri Lanka. Population sizes of *Parapeneopsis stylifera, P. cornuta, P. coromandelica* and *Metapenaeus dobsoni* from Chilaw area were estimated by Siddeek.[12] Jayakody and Costa[6] examined the growth, recruitment pattern, mortalities and yield per recruit in terms of weight for *P. indicus* from the west coast of Sri Lanka during 1979–1981.

The present paper describes the yield per recruit isopleths in terms of length (relative yield per recruit) for *P. indicus* from Negombo and Chilaw areas based on the data collected between July 1984 and June 1985, with the aim of finding out a proper management strategy for this valuable prawn species.

## 2. Experimental

Materials for this study were collected from commercial shrimp bottom trawlers operating in Negombo and Chilaw areas of the west coast of Sri Lanka (Figure 1). Samples were taken during the period July 1984 to June 1985.

In Negombo prawn trawling is carried out by sail driven out–rigger canoes where as in Chilaw this is done by mechanized 3.5 ton, 8.6 m boats. The trawling speeds of the sail driven canoes are highly variable. But on an average the speed is lower than the mechanized boats which is 1.2 knots.

Each landing site was visited four times a month and every fifth boat according to landing time was sampled.

The relative yield per recruit (Y'/R) which is proportional to the yield per recruit in units of weight was calculated using a modified version of the yield equation.[1]

$$Y'/R = E(1-C)^{M/K}\left[1 - \frac{3(1-C)}{\frac{1+(1-E)}{M/K}} + \frac{3(1-C)^2}{\frac{1+2(1-E)}{M/K}} - \frac{(1-C)^3}{\frac{1+3(1-E)}{M/K}}\right]$$

Where,

| | | |
|---|---|---|
| Y'/R | = | Relative yield per recruit |
| C | = | $L_c/L_\alpha$, E = F/Z |
| M | = | Natural mortality |
| F | = | Fishing mortality |
| Z | = | Total mortality |

K & $L_\alpha$ are the parameters of the von Bertallanffy growth equation. The values for *P. indicus* as obtained by analysing length frequency data collected during this period using the ELEFAN pragram[11] are as follows.[7]

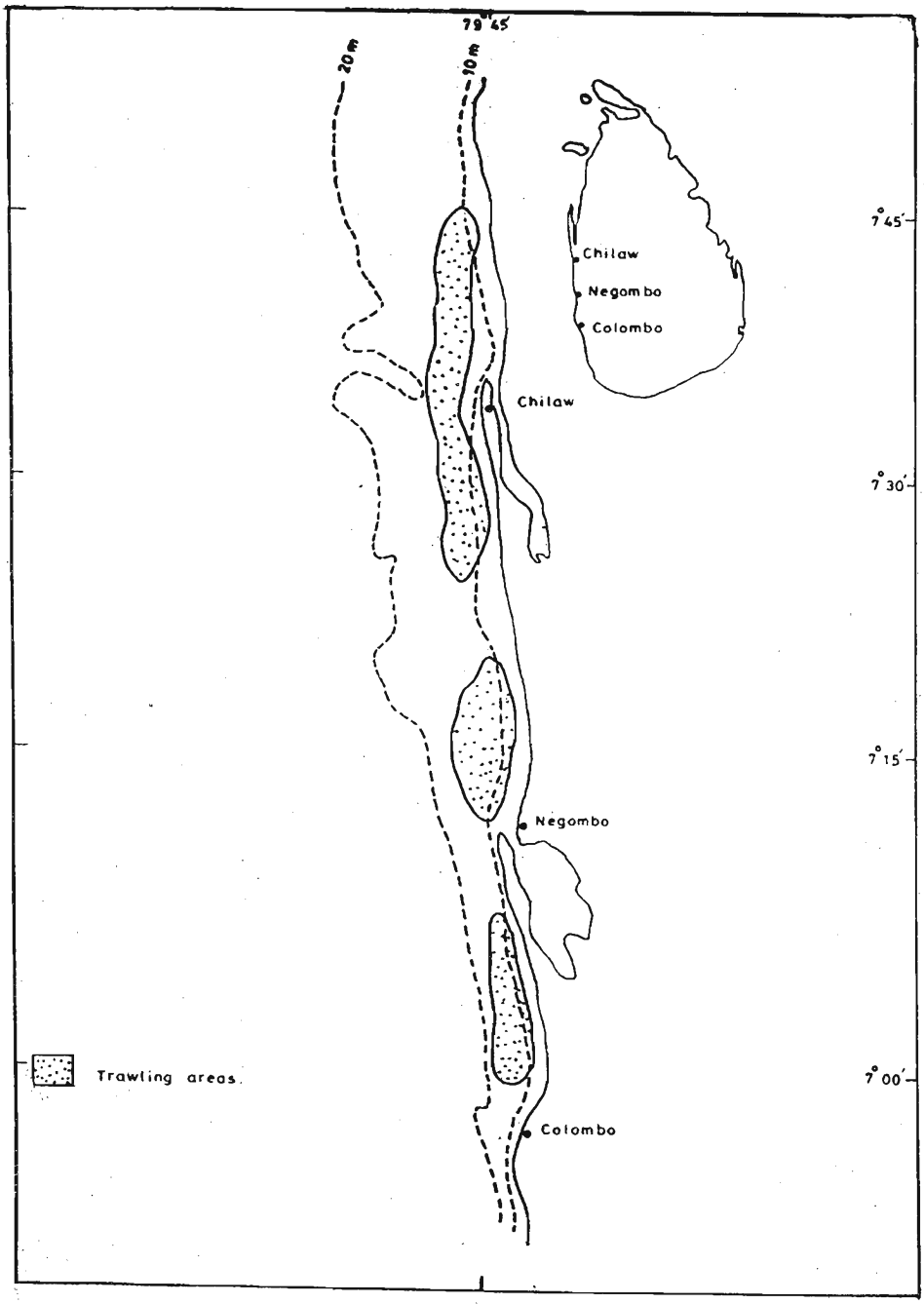


Figure 1 : Map showing Trawling Areas from Colombo to Chilaw.

| | Negombo | Chilaw |
|---|---|---|
| K (per year) | 1.5 | 1.5 |
| $L_\alpha$ (Total length in cm) | 20.5 | 20.0 |

These growth parameters were utilized to calculate the annual mortality values and the exploitation rates.[7]

| | Negombo | Chilaw |
|---|---|---|
| M | 2.61 | 2.60 |
| Z | 3.16 | 2.90 |
| F | 0.55 | 0.30 |
| E | 0.17 | 0.10 |

Once all parameters of the yield equation were available the yield isopleth diagrams were drawn separately for both Negombo and Chilaw areas varying $L_c$ from 8.5 cm to 18.5 and F from 0.5 to 5.0.

## 3. Results

The yield isopleth disgrams are presented in Figures 2 and 3 for *P. indicus* stocks from Negombo and Chilaw areas respectively. The smallest total length of *P. indicus* recorded during the study period in these two areas is around 8 cm. In the case of Negombo $L_c$ of 8.5 cm and F of 0.55 which is the fishing mortality during this period gives a relative yield of 0.02 per recruit (Figure 2). In Chilaw, $L_c$ of 8.5 cm and present fishing mortality value of 0.30 gives a relative yield of around 0.01 per recruit (Figure 3).

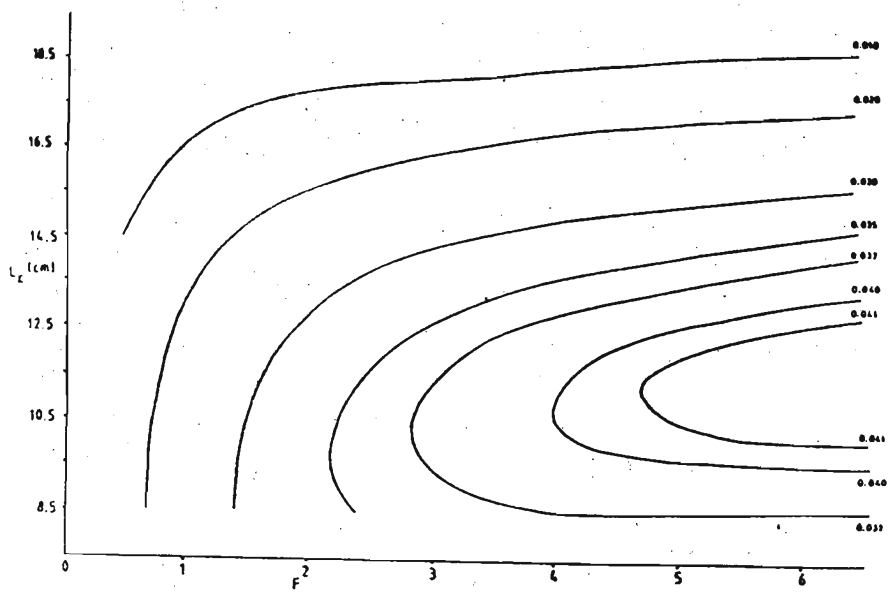


Figure 2: Yield isopleth diagram for *P. indicus* from Negombo ($L_c$ = Mean length at first capture, F = Fishing mortality)

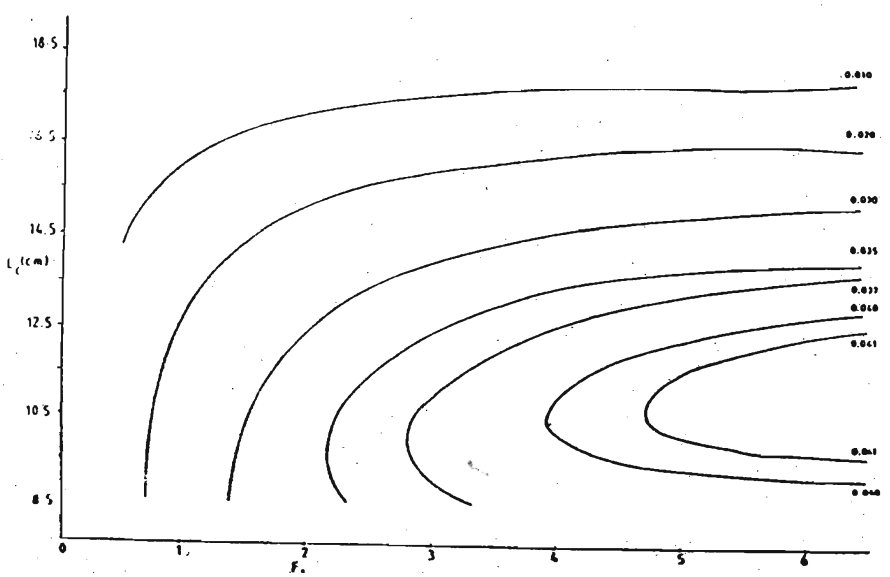


Figure 3: Yield isopleth diagram for *P. indicus* from Chilaw ($L_c$ = Mean Length at first capture, F = Fishing mortality).

## 4. Discussion

According to the results of this study, the maximum yield of around 0.041 in both areas can be obtained only when the fishing mortality reaches around 5 per year and with a $L_c$ value of around 11 cm. Since the exploitation rates are still low, it appears that the fishing mortality and hence the fishing effort can be increased. But as the results (Figures 2 and 3), indicate the fishing effort should be increased concurrently with an increase in the $L_c$ value to get a higher yield.

An increase in $L_c$ (the length at first capture) can be obtained by a mesh regulation ie. by increasing the minimum mesh size of the cod end of the trawl net. But this fishery is a multi–species fishery where shrimps smaller in size than *P. indicus* which are of commercial importance for local consumption are also caught. Therefore a calculation of a single optimum mesh size should be determined as an average weighted according to the weight and economical value of each species.[10]

Jayakody and Costa[13] recorded a yield of 4.5 g per recruit with a fishing mortality value of 1.37 and a $t_c$ (mean age at first capture) value of 0.46 years for *P. Indicus* collected from Negombo and Chilaw areas during the period of 1979 to 1981. The values recorded by them for certain parameters of the yield equation such as for natural mortality, fishing mortality etc. are higher than those obtained for the present study which was carried out from 1984 to 1985. The prawn trawling grounds in Negombo and Chilaw areas are very well separated (Figure 1) and fishermen of these two areas do not encroach into each other's areas when trawling for prawns (personal communication with fishermen).

As trawling is carried out by mechanized 3.5 ton boats in Chilaw and in Negombo trawling is carried out by non–mechanised out–rigger canoes, the trawling speeds are different in these two areas. The dimensions of the trawl net are also different.

According to Minisseri and Minimaran[8] the juvenile stages of this species are spent in the estuaries. The prawns belonging to stock of Negombo spend their juvenile stage in the Negombo estuary, where as prawns of the Chilaw stock spend their juvenile stage in the Chilaw estuary. The highly variable environment of these different estuaries can bring about changes in growth parameters. Even if it is the same estuary the runoff and the river inflow can vary on yearly basis which influence the recruitment strength by affecting the number or size of recurits or both[2] which can also be reflected in growth parameters.[7] Due to these reasons it is more correct to present the picture of prawn fishery for these two areas separately.

The fishermen start exploiting these prawns as soon as they start migrating to the sea when the sub adults are well below the said $L_c$ value. Therefore fishing at higher intensities could lead to a decrease of spawning stock of this valuable prawn species below the level where recruitment is affected adversely.

## Acknowledgement

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