A Preliminary Analysis of the Reef Fishery in the Associated Coastal Waters of the Puttalam Estuarine System

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Abstract

A study was conducted on the Reef Fishery in the coastal waters off Puttalam estuarine system from October 1993 to September 1994. Fishing operations were mainly carried out by using 5-5.5 m FRP boats. In addition a few traditional log rafts were also engaged in exploiting the resource.

Bottom set gillnets are the most widely used gear in the reef fishery. The other fishing gear such as trammel nets and handlines are also used seasonally in the study area to exploit the demersal fish resources. The mesh size of the bottom set gillnets used ranged from 31-178 mm while that of the trammel nets 22-100 mm.

Total catch, effort and catch per unit effort showed seasonal variations. The highest average catch rate of 40.2 kg boat⁻¹ day⁻¹ and the highest total catch of 77.3 kg boat⁻¹ day⁻¹ was recorded in February for FRP/Handline combination. During the study period, the highest monthly production was observed in February 1994 (190 tonnes). February to June could be considered as the peak period for the fishery.

Except for the handlines target species of the most of the gear (gillnets, trammel nets) is lobsters. However along with the lobsters, emperor fishes, sweetlips and carangids made significant contribution to the total production of the reef fishery.

Introduction

Coral reefs are regarded as one of the most highly productive ecosystem in the world. They have high rates of gross primary productivity (Odum & Odum 1955; Grigg et al. 1984; Polovina 1984; Kinsey 1985), and therefore are capable of sustaining highly productive fisheries. Smith (1978) estimated the global fisheries potential of coral reefs to be 6x10⁶ t yr⁻¹. However, Longhurst & Pauly (1987) have stated that the yield from coral reefs in 1983 was 0.48x10⁶ t.

Fishing is a predominantly coastal economic activity in the north-western region of Sri Lanka. A considerable portion of the fishing community in this region depends for their livelihood on the high rate of production of the coastal reefs in the region. Fishing activities targeting reef fish resources in the north western coastal waters are taken place throughout the year more or less on a continuous basis. Fishing operations are carried out mainly by 5-5.5 m FRP boats. Few traditional log rafts are also engaged in exploitation of the resource. Although a number of gear are used in the process, the bottom set gillnets seem to be the most widely used gear in the study area. The use of other gear such as trammel nets, handlines in the reef fishery seems to be seasonal.
The reef fishery in Puttalam area

Fig. 1. Map showing fish landing centres and sampling stations.
Table 1. Specifications of the fishing crafts and gear used in the reef fishery. FRP - Fibre-reinforced on plywood boats; LR - Log rafts; DC - Dug-out canoes; BSGN - Bottom-set gillnets; TN - Trammel nets; HL - Hand-lines. For each craft/gear combination there was only one fishing trip per boat per day.

<table>
<thead>
<tr>
<th>Fishing craft/Gear combination</th>
<th>No. of net pieces per operation ± SD (range)</th>
<th>Range of stretched mesh sizes (mm)</th>
<th>Depth of operation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRP/BSGN</td>
<td>9.56 ± 3.87 (4-22)</td>
<td>55-178</td>
<td>5.5-31</td>
</tr>
<tr>
<td>LR/BSGN</td>
<td>5.38 ± 3.05 (2-15)</td>
<td>31-178</td>
<td>2.7-5.5</td>
</tr>
<tr>
<td>FRP/TN</td>
<td>7.67 ± 4.69 (4-18)</td>
<td>22-100</td>
<td>3.6-6.4</td>
</tr>
<tr>
<td>LR/TN</td>
<td>6.80 ± 4.82 (1-20)</td>
<td>25-88</td>
<td>1.8-4.6</td>
</tr>
<tr>
<td>FRP/HL</td>
<td>-</td>
<td>-</td>
<td>10-68.3</td>
</tr>
<tr>
<td>LR/HL</td>
<td>-</td>
<td>-</td>
<td>4.6-15.5</td>
</tr>
<tr>
<td>DC/HL</td>
<td>-</td>
<td>-</td>
<td>17.3-54.6</td>
</tr>
</tbody>
</table>

A wide range of hook sizes (3-9) are used in the handline fishery depending on the type of the fish species that are aimed at. The type of bait used depends on the type of fish caught. Squids and sardines are frequently used as the handline bait to catch demersal fish such as emperor fishes, carangids and snappers.

Monthly variation in the effort

Bottom set gillnets operated by FRPs and log rafts are used throughout the year, while the other craft/gear combinations are used seasonally (Table 2; Fig. 2a). Almost all the craft/gear combinations are operated from February to June. The average numbers of fishing crafts operated/day with respect to the major craft/gear combinations engaged in the reef fishery, i.e., FRP/bottom set gillnet, FRP/handline and FRP/trammel net, were 30 (range 12-128), 58 (range 27-78) and 14 (range 4-27) respectively.

Catch per unit effort (CPUE)

The highest mean CPUE was recorded for the FRP/Handline combination (40.2 kg boat⁻¹ day⁻¹) with a peak catch in February 1994 (77.3 kg boat⁻¹ day⁻¹) (Table 2; Fig. 3). The CPUE for FRP/bottom set gillnets was high from March to August.
The reef fishery in Putalum area

Fig. 2. (a) Monthly variation in the effort of the reef fishery; (b) Contribution of major gear types to the effort of the reef fishery. The abbreviations are as given in Table 1.
Table 2. Monthly variation in the (a) effort, average number of crafts operated per day; (b) catch rates (in kg per boat per day); and (c) total production (MT). The abbreviations are as given in Table 1.

<table>
<thead>
<tr>
<th>Month</th>
<th>FRP/BSN</th>
<th>LR/BSN</th>
<th>FRP/TN</th>
<th>LR/TN</th>
<th>FRP/HL</th>
<th>LR/HL</th>
<th>FRP/GN.H</th>
<th>LR/GN.H</th>
<th>DC/HL</th>
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<tr>
<td>Oct '94</td>
<td>16</td>
<td>11.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nov</td>
<td>19</td>
<td>5</td>
<td>8.5</td>
<td>2.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Dec</td>
<td>23</td>
<td>11</td>
<td>11.0</td>
<td>3.0</td>
<td>25.1</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
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<td>12</td>
<td>14</td>
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<td>7.5</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
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<td>6.7</td>
<td>14</td>
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<td>78</td>
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<td>20</td>
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<td>13.4</td>
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<td>90.6</td>
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<td>2.2</td>
<td>27</td>
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<td>27</td>
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<td>-</td>
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<td>Jun</td>
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<td>7</td>
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<td>14</td>
<td>7.8</td>
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<td>16.3</td>
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<td>7.4</td>
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<td>-</td>
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<tr>
<td>Aug</td>
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<tr>
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<td>-</td>
<td>-</td>
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</tr>
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</table>

**Monthly variation in the total production**

The variation pattern of the total production seems to differ depending on the craft/gear combination (Table 2; Fig. 4). During the survey period, the highest monthly production was observed in February 1994 (190 tonnes). The period from February to June could be considered as the peak period for the fishery.
The reef fishery in Putalum area

Species composition of the catch

A total of 55 fish species belonging to 15 families were identified in the catches (Appendix 1). Of these, only 8 fish species significantly contribute to the total production of the reef fishery. This fishery is mainly carried out to catch demersal fishes that live in association with the coral reefs. Except for the handlines, target species of the most of the gear (e.g., gillnets, trammel nets) is lobsters (Fig. 5).

Discussion

The history of Sri Lankan fisheries over the last seven decades or so highlights the rise and fall of the demersal fishery. The demersal fishing methods such as bottom set gillnets (made up of natural fibres) and bottom handlining were very common in the northern part of the country and occasionally practised in the Trincomalee and Putalum districts six decades ago. Bottom handlining was directed mainly at the emperor fishes (Lethrinidae) and snappers (Lutjanidae) (Sivasubramaniam 1983). In addition, as revealed during the present investigation in the north western coastal waters of Sri Lanka, the contributions of the major fishing gear engaged in exploitation of the demersal fish resources (bottom set gillnets, handlines and trammel nets) to the fishing effort were 47, 35 and 12% respectively.

The seasonal variation pattern of the catch rates appears to vary depending on the craft/gear combination. During the present study, the highest catch rate was recorded for the FRP/handline combination in the month of February 1994 (77.3 kg boat$^{-1}$ day$^{-1}$) and the average catch rate was significantly decreased as the fishing season proceeds. It was also revealed that the period of high effort coincided with the period of high catch rates. Although handlining seems to be the most efficient fishing method in exploitation of the reef fish resources in the study area, use of gear was restricted to a very short period (February to April). On the other hand, peak catches in bottom set gillnets, the most widely used gear in exploitation of the reef fish resources in the study area, were obtained in March 1994. Research surveys carried out by R/V "Dr. Fridjof Nansen" have shown more complex fluctuations of demersal and semi demersal fish stocks where the demersal fish groups were found to be slightly abundant after the south-west monsoon (Bleindheim & Foyn 1980).

The average catch rate recorded for FRP/bottom set gillnet during the present investigation was 17.8 kg boat$^{-1}$ day$^{-1}$. This value was low when compared with the average catch rate recorded for the same craft/gear combination in the coastal waters around Negombo which was 29.5 kg boat$^{-1}$ day$^{-1}$ (Maldeniya, pers. comm.). However, the estimated average catch rate for the FRP/handline combination during the present study (20.2 kg boat$^{-1}$ day$^{-1}$) was higher than the average catch rate estimated for the same craft/gear combination in the coastal waters around Negombo which was 18 kg boat$^{-1}$ day$^{-1}$ (Dayaratne & Amarasinghe 1991).

The total annual production of the reef fishery during the study period was estimated to be 491 tonnes. The contribution from the handlines and the bottom set gillnets was 447 tonnes which was almost 91% of the total fish production. Handlines alone contributed to almost 50% of the total demersal fish production. However, it is quite low when compared with that of Negombo where total production from the handline fishery was around 367 ton yr$^{-1}$ (Dayaratne & Amarasinghe 1991).
Fig. 3. Seasonal variation in the catch per unit effort of the reef fishery. The abbreviations are as given in Table 1.

Fig. 4. Monthly variation in the total production of the reef fishery. The abbreviations are as given in Table 1.
Fig. 5. Monthly variation in the species composition of the catch of major craft/gear combinations in the reef fishery. The abbreviations are as given in Table 1.
Although a considerable portion of the fishing community in the study area depend for their livelihood on the high rate of production of the coastal reefs in the region, the major fishing activities carried out on the reefs as well as in the adjacent areas are destructive to the marine environment. Particularly the bottom set gillnets and trammel nets used in exploitation of the demersal fishery resources in the study area, seem to be destructive to the coral reefs and this in turn would have harmful effect to the marine life since the coral reefs act as the breeding and nursery grounds for most of the demersal fish species (Rajapakse 1992). Considering the ecological and the economic significance of the coral reefs for reef dwelling organisms including the ornamental fish groups and their importance as a natural protective measure against the coastal erosion in the study area, it is advisable to introduce management measures to the reef fishery such as banning the use of bottom set gillnets and trammel nets on coral reefs, encouraging the use of handlines and the introducing alternative fishing methods such as use of traps to exploit the lobster resources to ensure the sustainable utilization of the demersal fishery resources as well as to conserve the marine environment.

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