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Traditional Practices for Resource Sharing in an Artisanal Fishery of a Sri Lankan Estuary

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Abstract

In the Negombo estuary of Sri Lanka, there is an artisanal fishery for penaeid shrimp locally known as stake-seine fishery. Stake-seine nets, which can be fixed in specific sites close to the sea mouth, are used for catching shrimp that migrate from the estuary to the sea. According to regulations imposed by the fishing communities, use-rights in the fishery are granted to descendants of certain fishing families in four villages. Among the stake-seine fishers who are organized into four rural societies, an effective mechanism has been evolved for resource sharing in the fishery over a period of several hundred years. For equity sharing of the resource, different fishing dates are assigned to the four rural societies, and fishing sites are allocated to individual fishers in each society using a lottery system. Sustenance of this traditional practice is due to the fact that the returns from the fishery are significant. Community-based management strategies for the fisheries in developing countries can therefore be defined by adopting relevant mechanisms found in these types of artisanal fisheries.

Introduction

In most fisheries, being renewable resources, declining trends are often explained by the theory presented by Hardin (1968) in his popular article, *The Tragedy of the Commons*. However Chapman (1989) has mentioned that Hardin's theory overlooks the following two important factors which affect exploitation patterns in some fisheries.

1) There exist some fisheries which are privatized for commercial use by those with privileged access.

2) There are many adaptations in traditional societies which mitigate the over-exploitation of common property resources.

Chapman (1989) has further shown that privatization of some fishery resources in Amazonia, which is often manifested by prevailing political ideology, affects the degree of exploitation of the resources due to the intensification of exploitation of the remaining portion which has open access.

In most estuarine fisheries, resource users impose certain management strategies (Kapetsky 1981) known as territorial use rights in fisheries (TURFs). The importance of TURFs for fisheries management has been emphasized in several publications (e.g., Christy 1982; Pomeroy 1994). There is a wealth of studies on traditional community-based management in the Asia-Pacific region, but this information is fragmentary and much remains anecdotal and unsynthesized (Ruddle 1994). Berkes (1994), on the other hand, has pointed out that there is a recent accumulation of a great deal of evidence on the potential sustainability of community-based fisheries management systems. According to the terminology presented by Feeny et al. (1990), Bromley (1992) and Berkes (1994) making a clear distinction between communal property and open-access, four basic kinds of property rights regimes in fisheries can be recognized:

- 1) Open access - access is free and open to all; property rights are absent.
- 2) Private property - claims rest with the individual or the corporation.
- 3) State property - claims and sole jurisdiction lie with the government.
- 4) Communal property - resource is controlled by an identifiable community of users.

In many coastal fisheries where community-based management or communal property systems provide a solution to the 'tragedy of the commons,' resource depletion due to overexploitation is not evident (Berkes 1985; Smith and Berkes 1991; Ruddle et al. 1992). Ali (1996) reported a community-based management strategy which was artificially imposed in a reservoir fishery in Malaysia where a middleman controlled entry into the fishery and determined landing size of fish by refusing to buy small fish or brooders. In some countries, due to the tendency to move from capture fisheries to aquaculture, a transformation in property rights from open-access to communal property systems is reported to be imminent (Berkes and Smith 1995). On the other hand, hitherto most fishery managers have been attempting to look at the problems of overfishing from the point of view of open access to the fishery. Ruddle and Johannes (1985) and Ruddle (1988) emphasized that there is an important need and a critical area for research to identify the nature and characteristics of the boundaries of traditional fishery resource territories in order to provide an effective legal basis for them. This is particularly important because Hardin's theory (Hardin 1968) that resources held in common are vulnerable to overexploitation, is shown to be not universally true (Berkes et al. 1989).

Atapattu (1987) mentioned that in an artisanal fishery for penaeid shrimps in the Negombo estuary of Sri Lanka, locally known as "stake-seine fishery," fishing communities have developed means for sharing the shrimp resources among users. In the present paper, community-based fishery management of the stake-seine fishery of Negombo estuary, Sri Lanka, is described with a view to identifying property right regimes in the fishery.

The Fishery

In the Negombo estuary of Sri Lanka, several islands are present close to the sea mouth (Fig. 1) so that the northern part of the estuary is segmented into a number of channels. In this channel segment of the estuary, stake-seines are operated by people living in surrounding areas. This fishery has been in existence for hundreds of years dating back to the 18th century (Atapattu 1987).

The stake-seine net consists of a bag (mesh size 10 mm) and two wings (mesh size 25 mm) made of nylon nets. The length of the bag is about 10 m and the wing is about 14 m (Fig. 2). Nets are fixed at specific sites in deeper areas of the channels using nine stakes driven into the muddy bottom of the estuary. Each net is fixed by two fishers working on a wooden outrigger canoe. A kerosene lamp is suspended to facilitate attraction of shrimps into the net. Fishers rely on tidal flow at the sea mouth to fix these stake-seine nets. Nets are fixed at night with the onset of tidal flow towards the sea. The shell- and finfish species caught in the net-bag are removed periodically and collected in a basket in the canoe. The fishery operation lasts until the tidal flow from the estuary to the sea ceases. Fishers in the area are organized into four rural fisheries societies for sharing fishing sites in the estuary. The organization and operation of these fisheries societies have been studied in detail in the present study.

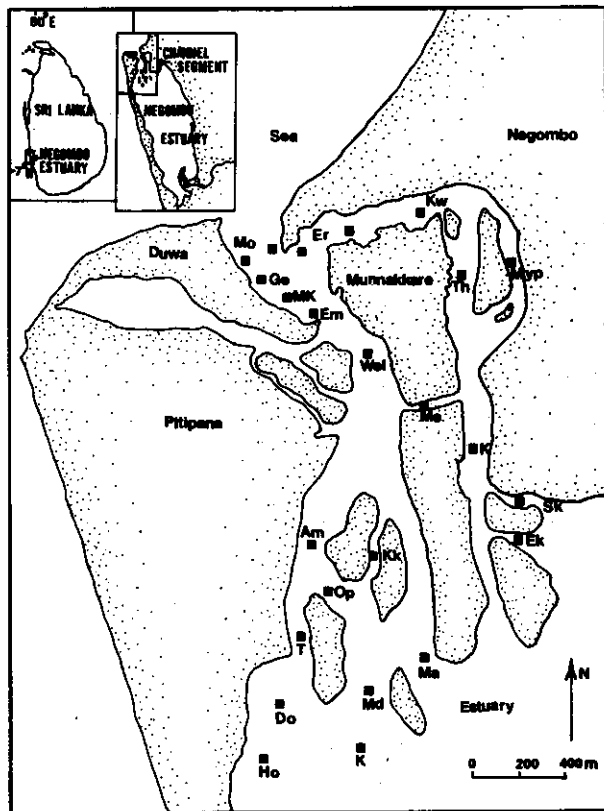


Fig. 1. Stake-seine sites in the channel segment in Negombo estuary. Insets show the locations of Negombo estuary in Sri Lanka and the channel segment in Negombo estuary. Abbreviations for stake-seine sites and range of daily shrimp catch per net (in kg) in each site: Er - Erakkattuwa (3.5 - 10); Em - Eramankuliya (5 - 7.5); Kw - Kawatiya (5 - 8); My - Maiyapitiya (5 - 6); Th - Thilliadiya (5 - 6); ME - Moda Ela (11 - 14); K - Kongaha (12 - 18); SK - Sai Kalvai (10 - 14); EK - Era Kalvai (7 - 10); K - Kattapadu (10 - 15); MO - Moya (5 - 7); Ge - Goda Elamaga (6 - 8); MK - Mankuliya (10 - 12); We - Wellakkalama (13 - 16); Kk - Keerikaduwa (6 - 8); Ma - Maneladiya (10 - 12); Am - Ambalampitiya (6 - 8); T - Thummodera (8 - 10); Op - Orappadu (6.5 - 8); Do - Diyabari Ode (6 - 9); Md - Mandagasalamba (6 - 9); Ho - Harak Oluwa (6 - 9).

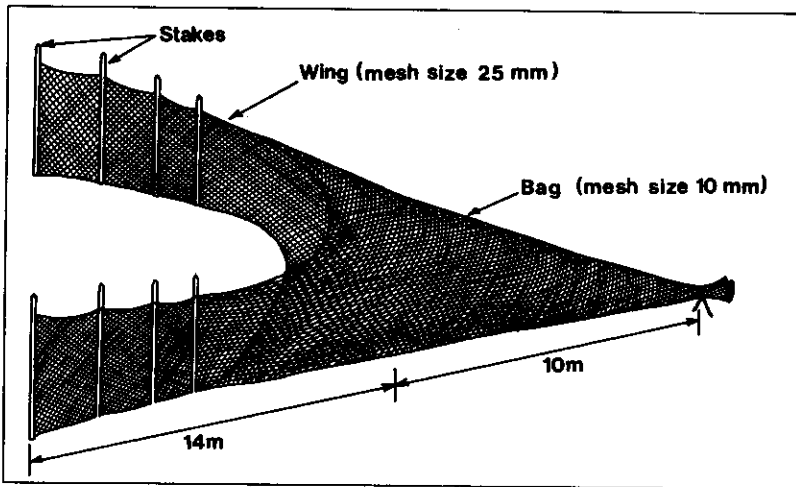


Fig. 2. Stake-seine net. Net is fixed using 8 stakes and the craft is tied to the ninth stake.

Materials and Methods

Information on the organization and operation of the stake-seine fishery in Negombo estuary was obtained by participant observation of meetings of the rural fisheries societies (RFS) during 1992-93. Casual conversations and interviews were also made with knowledgeable, active personnel of the fishing communities. Socioeconomic data of fishing communities were collected through interviews of household heads (53 fishers from the stake-seine fishing community and 22 household heads from other communities) in June-August 1993.

Data on seasonal variations in shrimp yields, the major constituents in the stake-seine fishery, species composition of catches, and value of catch were obtained from logbooks maintained by the auctioneers in each RFS. Data on species composition of catches were also obtained by sporadic inspection of landings and from an unpublished report (Jayasinghe 1987).

Results

All fishers in the stake-seine fishery are Roman Catholics so that organization and operation of the fishery is well-established through the active involvement of the Roman Catholic Church by which a welfare scheme for fishing communities is introduced. In each of the four RFS, the members appoint a faithful member as auctioneer at the annual general meeting (AGM), and the value of shrimp catch in each net as determined at the auction is distributed according to the following proportions: fisher - 90%; auctioneer - 3%; welfare fund at the RFS - 3%; welfare fund at the church - 4%. This fishery is in operation throughout the year except on Good Friday.

Stake-Seine Sites in Negombo Estuary

Stake-seine nets are fixed in channels where there is sufficient tidal flow bringing sub-adults of shrimp. Nets can therefore be fixed only in 22 sites in the channel segment of Negombo estuary (Fig. 1). Since the target species in the fishery are sub-adults of penaeid shrimp which migrate from the estuary to the sea, the stake-seine sites in the upper reaches at the eastern part of the estuary are more productive than those close to the sea mouth. The stake-seine site in the eastern part of the channel segment of the estuary, known as Kongaha (Fig. 1) is the most productive one. Ranges of shrimp catch per net per day in each stake-seine site are also indicated in Fig. 1.

Fish Production

According to records maintained by auctioneers of the landings, inspection of catches and unpublished information (Jayasinghe 1987), species caught in the stake-seine fishery in Negombo estuary are as given in Table 1. Sub-adults of penaeid shrimp which migrate to the sea for spawning formed about 82.5% of the catches, while finfish species formed about 17.5%. The monthly variations of shrimp catches from November 1992 to July 1993 are shown in Fig. 3. Data on species composition of different species of penaeid shrimps could not be obtained from the auctioneers' logbooks because those records were maintained as the total catch of all penaeid shrimps. According to data presented by Jayasinghe (1987), *Metapenaeus dobsoni*, which almost reaches adult size before migrating back to the sea for spawning, was the dominant species accounting for over 70% of the total penaeid catch in the stake-seine fishery. Also in shrimp catches of other fishing methods such as drag-netting in the estuary, *M. dobsoni* was less significant (<11%) while *Penaeus semisulcatus* and *P. indicus* formed over 69% of the catches (Jayasinghe 1987). The absence of conflicts between stake-seine fishing communities with other users of the shrimp fishery resource in the estuary is therefore obvious.

Table 1. Fish species caught in stake-seine fishery of Negombo estuary, Sri Lanka.

Finfish species	Shellfish species
<i>Acanthopagrus</i> sp.	<i>Metapenaeus dobsoni</i>
<i>Anchoviella</i> sp.	<i>Penaeus indicus</i>
<i>Anguilla</i> sp.	<i>P. merguensis</i>
Gobids	<i>P. monodon</i>
<i>Hemiramphus</i> sp.	<i>P. semisulcatus</i>
<i>Kowala coval</i>	
<i>Leiognathus</i> sp.	
<i>Opisthopterus</i> sp.	
<i>Siganus</i> sp.	
<i>Solea</i> sp.	
<i>Tachysurus</i> sp.	
<i>Therapon</i> sp.	

The average daily income for a stake-seine fisher, estimated by considering that the value of a kilogram of shrimp at the auction site is Rs. 100 (in 1993, US\$ 1 ≈ Rs. 40), is shown in Fig. 4 for 1992-93. There are about 10 fishing dates per month for each fisher (see below) so that the average monthly income per fisher is estimated to be about Rs. 7,750 (range Rs. 4,500-10,800). Since one third of the income is paid to the helper, the net average income for a stake-seine fisher is about Rs. 5,200 (range Rs. 3,000-7,200).

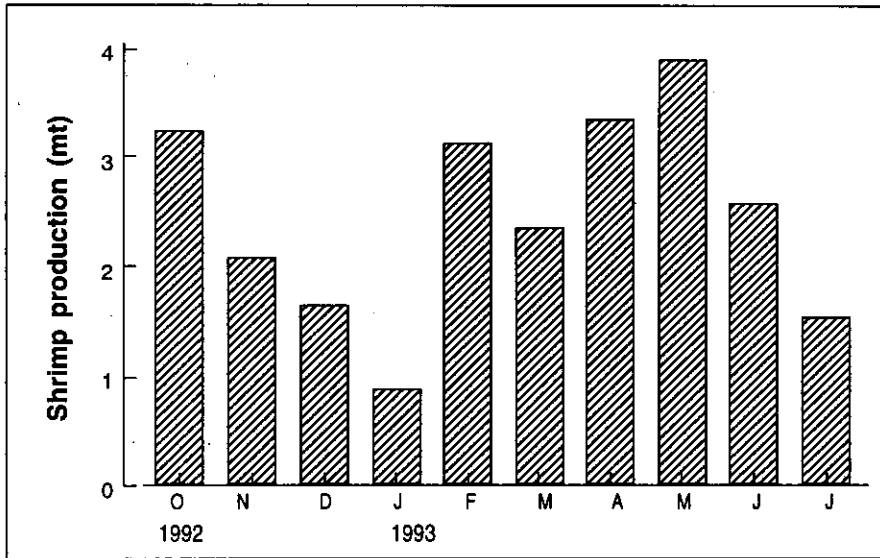


Fig. 3. Monthly variations of shrimp catches in stake-seine fishery during November 1992 - July 1993.

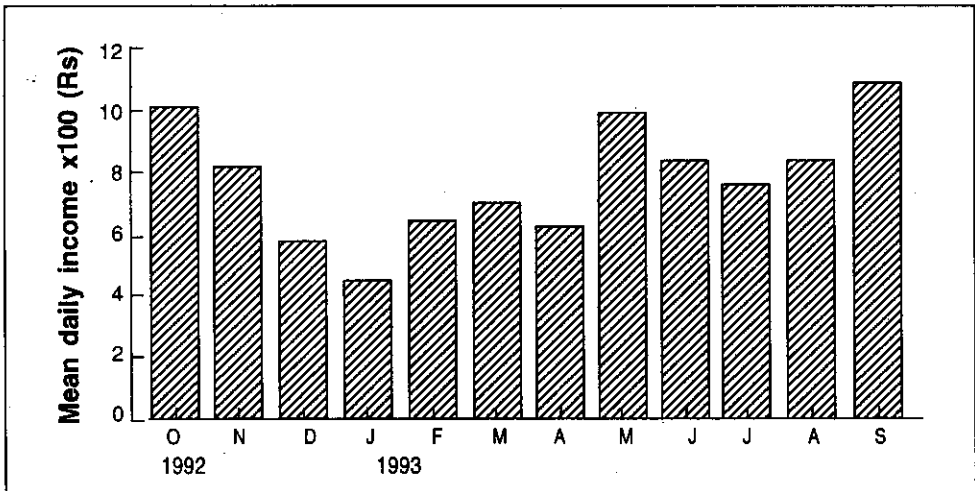


Fig. 4. The average daily income for a stake-seine fisher for 1992-93, estimated by considering that value of a kilogram of shrimps at the auction site is Rs. 100. (In 1993, US\$ 1 ≈ Rs. 40).

Rural Fisheries Societies in the Stake-Seine Fishery

The rights for resource-use in the stake-seine fishery are vested only to members of any of the four RFS. Descendants of the stake-seine fishing families have the right to become RFS members. Since there were disputes among resource users in 1940s, the Roman Catholic Church worked as a mediator to settle the disputes (Atapattu 1987). Subsequently the four RFS have been given legal status by the "Negombo (Kattudel) Fishing Regulations" which were gazetted in 1958. In Sri Lanka, fisheries inspectors have the power to implement fisheries regulations imposed under the Fisheries Ordinance. As the resource sharing procedure (described below) in the stake-seine fishery has been reinforced by government regulations, fisheries inspectors also have the power to get involved in monitoring activities. On the other hand, fishers do not tend to breach regulations so that there have been no disputes among fishers since 1958 (Atapattu 1987).

Only one male member (usually the household head) from each family can become a member of the RFS. Members of three of the RFS are further divided into two groups depending on their residence area around the estuary (Table 2).

Table 2. Average number of fishers in the four RFS of the stake-seine fishery.

RFS/group	No. of fishers
Duwa-Pitipana Street RFS	
Group A	50
Group B	50
Grand Street RFS	
Group A	51
Group B	44
Sea Street RFS	
Group A	36
Group B	36
Pitipana RFS	39

Organization and Operation of the Stake-Seine Fishery

At the 22 stake-seine sites which produce different shrimp yields, 65-68 stake-seine nets can be fixed. As such, fishers in the four RFS have arranged a procedure for sharing these stake-seine sites. The procedure for sharing stake-seine sites and fishing days among the four RFS is diagrammatically shown in Fig. 5. The procedure for equity sharing of resources in the fishery has existed at least since 1721, as is attested by deeds preserved in local Roman Catholic churches (Atapattu 1987).

		Assigned dates to four RFS									
Sites		1	2	3	4	5	6	7			
Eastern sites (Kongaha area) Erakkattuwa (2) Eramankuliya (2) Kavaiya (2) Maivapiya (1) Thilliadiya (1) Moda Ela (1) Kongaha (6-7) Sai Kalvai (1) Era Kalvai (1) Kattapadu (1)	Duwa-Pitipana Street RFS		Sea Street RFS	Grand Street RFS	Duwa-Pitipana Street RFS	Sea Street RFS	Grand Street RFS	Duwa-Pitipana Street RFS			
	Group A	Group A	Group A	Group B	Group B	Group B	Group B	Group A			
	Western sites (Mankuliya area) Moya (3-4) Goda Elamaga (3) Mankuliya (6-7) Wellakkalama (3) Keerikaduwa (5) Maneladiya (4)	Duwa-Pitipana Street RFS		Sea Street RFS	Grand Street RFS	Duwa-Pitipana Street RFS	Sea Street RFS	Grand Street RFS	Duwa-Pitipana Street RFS		
		Group B	Group B	Group B	Group A	Group A	Group A	Group A	Group B		
		Ambalampitiya (5) Thummodera (5) Orappadu (6)	Pitipana RFS				Pitipana RFS			Pitipana RFS	
			Diyabari Ode (2) Mandagasalmba (2) Harak Oluwa (1)								

Fig. 5. The procedure for sharing stake-seine sites and fishing days among the four RFS. Maximum number of stake-seine nets that could be fixed in individual sites are given in parentheses. The procedure in the first seven days indicated here is repeated thereafter.

The members of Duwa-Pitipana Street RFS, Sea Street RFS and Grand Street RFS meet on 3 consecutive days in March every year. At these annual general meetings (AGM), members of each of the three RFS (groups A and B) are assigned numbers from 1 to n (n = number of fishers attending the AGM) using a lottery system. The fisher assigned serial number 1 in group A is permitted to bid for a stake-seine site in the eastern part (Kongaha area); and the fisher with serial number 1 in group B is permitted to bid for a site in the western part (Mankuliya area). The fishers with subsequent serial numbers in groups A and B are then allowed to bid for any of the stake-seine sites in the Kongaha and Mankuliya areas, respectively. Fishers usually gather information from others about the sites with high yields during the period in order to prepare for the bidding.

Similarly members of Sea Street RFS and Grand Street RFS share the site at their AGM on the subsequent days. On the fourth day, members of Duwa-Pitipana Street RFS meet again, and fishers in groups A and B interchange bidding rights for stake-seine sites in the Kongaha and Mankuliya areas. Likewise this procedure is rotated among the two groups of each of the three RFS, namely Duwa-Pitipana Street, Sea Street and Grand Street.

In Pitipana RFS, a slightly different procedure is in practice for sharing resource-use rights in six stake-seine sites (Fig. 5). Members of this RFS have rights to fix 19 nets in six sites, three (Ambalampitiya, Thummodera and Orappaduwa) (Fig. 1) of which are used by Sea Street RFS and Grand Street RFS on the dates assigned to the two RFS. The AGM of Pitipana RFS is held on the AGM date of Duwa-Pitipana Street RFS. The 39 members in Pitipana RFS are assigned serial numbers using a lottery system. The top 19 members in the list can bid for fixing nets in the six sites assigned to them on the date that other stake-seine sites are used by members of Duwa-Pitipana Street RFS. As mentioned above, on the next 2 days, three of the sites are used by the RFS of Sea Street and Grand Street. Once again on the fourth day, 19 members of Pitipana RFS depending on the serial numbers share the stake-seine sites.

In all four RFS, resource-use rights are guaranteed in a particular year only to members who are present at the AGM in March every year. It should be noted that not all the fishers who are present at the meetings of their pertinent RFS bid for stake-seine sites. Generally those who are at the bottom of the list refrain from bidding for stake-seine sites due to the obvious reason that they have no opportunity to bid for productive sites.

Under the Negombo (Kattudel) Fishing Regulations which came into operation in 1958, the boundaries of the territory of the fishing community were defined and 17 stake seine sites were demarcated. As mentioned above, resource-use rights have been vested to members of the four RFS. In addition, the RFS have imposed certain regulations to control the exploitation levels of the resources. The important regulations are as follows:

- 1) Only married males who are descendants of stake-seine fishing families have rights for new entry into the fishery. Resource-use rights are not transferable. In the absence of a male descendant, the right of inheritance in a family is automatically discontinued with the death of the male member.

2) The stake-seine nets must be fixed not to exceed the 15 m width of the wings of the net. Those who flout this regulation are prosecuted by the RFS by charging a fine of Rs. 100 for every 0.5 m beyond the permitted width.

These regulations are enforced by the fishing communities. When anyone tends to flout these regulations, other RFS members bring such cases to the notice of the RFS President at the meetings held every 3 days. New entrants to the fishery must convince the other RFS members that they are capable of fixing stake-seine nets using the wooden poles and that they are experienced in mending damaged fishing nets.

Socioeconomics

The total number of fishers in Negombo estuary is reported to be about 3,000 (Anon. 1994). As such, stake-seine fishers (306 fishers; Table 2) form about 10.2% of the total active fishers in the estuary. Nevertheless the extent of their fishing grounds (about 162 ha; Atapattu 1987) covers only 5.5% of Negombo estuary. Education levels and income derived from various occupations in the rural communities in four fishing villages of the estuary where stake-seine fishing families reside are given in Table 3.

Table 3. Educational levels and monthly household income of stake-seine fishing families and other fishing communities in four villages at Negombo estuary.

	Stake-seine community	Other
Education level of family members (%)		
School drop-outs	16.0	21.4
Primary education	53.7	42.9
Secondary education	30.0	35.7
Tertiary education	0.3	-
Monthly household income (Rs.)		
Stake-seine fishing	5,200 (3,000-7,000)	-
Other employments	650 (0-5,000)	4,000 (1,500-10,000)

As stake-net fishers are engaged in fishing once in 3 days, many of them have alternative sources of income. Their secondary employments are carpentry, selling household goods, government jobs such as teaching, office work, etc. However, on average about 89% of their monthly income is derived from the stake-seine fishery (Table 3). As revealed during the interviews, less than 12% of stake-seine fishers rely on this fishery as their livelihood. The average monthly household income of stake-seine fishing community is appreciably higher than that of other rural communities in the area. Since most of the fishers are part-time fishers, the income levels of those who do not bid for the less productive sites, are not severely affected. Also, in spite of the resource-use rights, some descendants from the stake-seine fishing families do not enter

the fishery. As such, the problem of increased numbers of fishers has not arisen.

The fishery is well-organized due to the active involvement of the Roman Catholic Church in the area. Through religious influence, such an organization has become feasible as 100% of the stake-seine fishers are Roman Catholics.

During the interviews, it was noted that the living standards of the stake-seine fishing community were better than those of other fishing communities in the area. This is reflected by various socioeconomic indicators such as higher levels of education (Table 3), good housing conditions, the presence of well-disciplined people living in harmony in the community, etc.

Discussion

In the Asia-Pacific tropics, information on community-based fishery management strategies is virtually non-existent for some countries such as Bangladesh, and is fragmentary and mostly out-dated for Sri Lanka (Ruddle 1994). However in the Sri Lankan fisheries sector, studies on community-based management are reported such as fishing rights in a beach seine fishery in the south coast (Alexander 1977, 1982).

The present case-study reports the existence of a management strategy in the stake-seine fishery of Negombo estuary, Sri Lanka, which has been evolved over a long period. The sustainability of such traditional practices for resource sharing in this fishery is obviously due to the significant returns from the fishery. The net average monthly income per fisher derived from the stake-seine fishery is considerably high (Rs. 3,000-7,200). According to Central Bank sources, at present in Sri Lanka, families with a total monthly income of Rs. 750 are regarded as being below the poverty line.

High shrimp yields can be considered as one of the major outcomes of resource sharing practice in the stake-seine fishery of Negombo estuary because they are directly responsible for the living standards of fishing community. The cost of equity sharing procedure in the fishery is manifested by regular attendance at meetings, compliance with the regulations, etc. The benefits enjoyed by the fishing community, such as good income, cooperation among members, and social welfare, surpass the cost of maintenance of the traditional practice. Biological sustainability of the shrimp fishery resource can be considered a reliable measure of the performance of the community-based management strategy. Also the equity sharing procedure in the fishery which has evolved over a long period and has been reinforced recently by the government regulations, has nullified the disputes among fishers. This is also an indication of the performance of the traditional practice for resource sharing because fair treatment of all members in the community is assured through the system.

The monthly variations of shrimp yields in stake-seine fishery (Fig. 3) indicate that April-May and October-November which coincide with the inter-monsoonal rainy seasons are the most productive periods in the fishery. Similar trends were obtained by Jayasinghe (1987). During the inter-monsoonal rainy seasons, salinity levels in the estuary decline (Samarakoon 1983; De Silva and

De Silva 1984) which facilitates emigration of shrimp to the sea. As such, mitigatory measures to maintain the present patterns of salinity changes in the estuary is necessary especially since there are proposals to develop fisheries harbours in the area (Anon. 1994) which might alter hydrological patterns in the estuary and result in salinity changes. Collapse of the organization and operation of the stake-seine fishery in Negombo estuary at any cost might lead to severe sociological problems because this fishery has brought about social stability in the fishing community.

One of the most interesting features in the stake-seine fishery in Negombo estuary is that these resource-sharing procedures have been devised by the community itself which uses the resource. Community-based management strategies for artisanal fisheries in developing countries which are considered as effective means for resource management (Aguero and Lockwood 1986), can therefore be defined by adopting relevant mechanisms found in traditional fisheries such as stake-seine fishery in Negombo estuary. The present case study is therefore a useful extension to identify the mechanisms of community-based management strategies in the artisanal fisheries, due to the existence of traditional practices for the exploitation of a shrimp fishery resource which have been reinforced by the legal setup.

Acknowledgements

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