

# Structure of a coastal fishing community and the economical implications of coastal fisheries in Thampalakamam Bay

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## Abstract

Kinniya is one of the 11 Divisional Secretary Divisions in Trincomalee District populated with 96% of Muslims. Traditionally, the livelihoods of about 450 fishers in Kinniya are supported by Thampalakamam Bay. In the past, civil war and the tsunami of 2004 affected the socio-economic conditions of this fishing community. Although the impact of these effects has been documented, social aspects of this fishing population and the economical implications of coastal fishing have not been studied in detail. This study was designed, therefore, to obtain this information. A questionnaire survey was conducted in five Muslim Grama Niladhari Divisions bordering the Thampalakamam Bay of Kinniya. A total of 135 fishers were randomly selected and data was collected on their social structures, fishing activities and constraints in fisheries. All the data were analyzed using SAS software. Results showed that due to combined family structure, there was a strong kinship links among the fishers. Age of fishers ranged from 15 to 73 years. Majority of the fishers had only primary educational qualification. The average family size of the fishers was 6.2. All the fishers used non-motorized outrigger canoes with a variety of fishing gear for coastal fishing. However, 83% of the fishers engaged in gillnet fishing while others used cast net, push net and crab pots. Only 10% of the fishers involved their wife to assist in fishing related activities. Fishing effort and the CPUE of the crab pot and gillnet fishers were higher ( $P < 0.05$ ) than that of the cast net and push net fishers. The fish marketing channel was dominated by middlemen. Though all type of fishers earned positive gross profits, they were not satisfied with their income due to current high cost of living in Sri Lanka. Increasing numbers of fishers, the use of monofilament nets, dynamiting and the imposition of a security zone limiting the area available for fishing were identified as the major constraints to these coastal fisheries. Despite these problems, however, 95% of the fishers wished to continue fishing as their main livelihood. Access to credit facilities and provision of suitable training on coastal aquaculture and agriculture will help to improve the livelihoods of the fishers.

**Keywords:** Coastal fishing, Socio-economic condition, Gillnet

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## **Introduction**

Coastal inhabitants of Sri Lanka generally exploit the resources close to their settlement (Wijayaratne and Maldeniya, 2003), and engage in coastal fishing for their livelihood (Nevil, 2007). According to the Department of Census and Statistics (2013), Sri Lanka's coastal fisheries sector provided 257,540 MT of fish in 2012, which was 61.7% of the total marine fish production of the country in 2012. The coastal fisheries have historically been viewed as the backbone of the fisheries sector of Sri Lanka (Wijeyatilleke, 2006). In addition to the fisheries potential, the coastal region of the country consists of around 24% of the country's entire land area, has 25% of the population, 70% of the tourist hotels, 67% of industrial units, 17% of agricultural lands and 20% of home gardens (IUCN, 2007). These facts illustrate the socio-economic potential of coastal areas in Sri Lanka. Within this context, Thampalakamam Bay, an estuary located in Trincomalee and lined by a part of the Kinniya coastal area, is extensively utilized by coastal dwellers of Kinniya as their main avenue of livelihood (Nafees *et al.*, 2009). According to the Kinniya Divisional Secretariat (2009), there were 1, 234 people employed in fishery related activities in Thampalakamam Bay.

The lives and livelihoods of coastal dwellers are often threatened by the natural environment with its various ecosystems and by anthropogenic activities (Abdrabo and Hassaan, 2003). The vital role of the fisheries sector to global food security and economic growth is continuously constrained by poor governance, weak fisheries management regimes, conflicts over the use of natural resources, the persistent use of poor fishery and aquaculture practices, failure to incorporate the priorities and rights of small-scale fishing communities, and injustices relating to gender discrimination and child labour (FAO, 2012). In addition, coastal fisheries of Sri Lanka are often interrupted by seasonality in production due to the monsoonal climatic patterns and natural disasters (Arunatilake *et al.*, 2008). In this context, the Tsunami that hit the country in 2004 disrupted the social structure and economic stability of the coastal community in many parts of Sri Lanka (Nayanananda, 2007). The coastal fisheries in the Eastern Province of Sri Lanka were adversely affected by both the civil war since 1981 and, by the Tsunami of 2004 (Jayamanne *et al.*, 2010). In Trincomalee District, out of the six Tsunami-affected Divisional Secretary (DS) Divisions, the most affected was the Kinniya DS

Division. In total, around 73% of the fishers and 67% of fishery-related employees from Kinniya lost their livelihood due to the Tsunami (Department of Census and Statistics, 2005). Hence, socio-economic distortions of the fishing community in Kinniya can be expected. However, fishers continue to fish in the bay for their livelihood. Although the impact of these anthropogenic and natural constraints in Thampalakamam Bay of Kinniya have been documented (Nafees *et al.*, 2009), the effects on the fishing population and the economical implications on coastal fishing have not been studied in detail. The present study was carried out, therefore, to analyze the social structure of the coastal fishing community and to investigate the economic importance of the coastal fisheries in sustaining the livelihoods of the coastal fishing community in Thampalakamam Bay in Kinniya.

### **Materials and Methods**

Kinniya is one of eleven Divisional Secretary Divisions in the Trincomalee District, and has an extent of 14,690 ha. There are 31 Grama Niladhari (GN) Divisions under two Local Governmental Jurisdictions *viz.*, Kinniya Urban Council (UC) and Kinniya Pradeshiya Sabha (PS). The UC area comprises of 17 GN Divisions while the PS area comprises of the remaining 14 GN Divisions. The population of Kinniya is 74,903 made up of 95.5% Muslims, 4.4% Tamils and 0.1% Sinhalese. The Kinniya UC covers 55% of the population with 9,967 families, while the PS covers 45% of the population having 7,690 families. The, livelihood of the Kinniya coastal dwellers has traditionally been supported by two major fishing grounds, namely, Thampalakamam Bay which forms the Northern boundary of Kinniya and Koddyar Bay in the East. The study was carried out in the coastal area of Thampalakamam Bay of Kinniya, and included five GN Divisions under both the UC and the PS areas. There were 450 active fishers, all of whom belonged to the Muslim religion, involved in coastal capture fisheries in the study area (Kinniya Divisional Secretariat, 2009).

Socio-economic data were collected from a randomly selected sample of 135 fishers in the study area using a pre-tested structured questionnaire, during August 2009 to August 2010. The questionnaire consisted of socio-economic information about the fisher, labour usage by the fisher, gender role in fishing, gear usage, conflicts in resource use, prevailing constraints for fishing and future planning.

Family members with some formal education were categorized according to the level reached; Primary education - up to grade 5, Secondary education - grades 6 to 10, GCE (O/L) - formally educated up to Ordinary Level of the General Certificate of Education and GCE (A/L) - formally educated up to Advanced Level of the General Certificate of Education, while the family members who did not obtain any formal education (never schooled) were considered as uneducated.

The data were entered into MS Excel spreadsheets and statistically analyzed using SAS software package (SAS Institute Inc., 1999 – 2000) with PROC GLM procedure for continuous data and PROC FREQ and CATMOD procedures for categorical data.

## **Results and Discussion**

### ***Fishing community***

The fishers in the study area live as communal groups along the coastal area with their neighbours, who were close-relatives. Majority (62%) of the fishers were descended from fishing families showing that fishing has been their traditional form of livelihood. Their lifestyle ensures transfer of fishing knowledge and experiences from one generation to another. As the family members live together, younger generations easily learn fishing techniques, experiences and attitudes from their elders and are able to continue to engage in fishing as their form of livelihood. Past studies have also revealed that Sri Lankan fishers have a strong ancestral relationship with the occupation of fishing (Wijayarathne and Gudmundsson, 2001; Wijayarathne and Maldeniya, 2003). It also been pointed out that fishing is not only an occupation for fishers, but is a way of life (Amarasinghe, 2009) that unites fishing communities together by establishing and passing on community bonds, values, knowledge, language and traditions (Brookfield *et al.*, 2005). The current study shows that the fishing community of Thampalakamam Bay of Kinniya is united by strong socio-cultural bonds gained through fishing practices and existing social structures.

### ***Age structure of the fishers***

Average age of the fishers in the study area was  $39 \pm 13$  years, with a range from 15 to 73 years. Around 13% of the fishers were youth (15 to 24 years of age) and only 2% of the fishers were elders (older than 64 years of age); none of the fishers were younger

than 15 years of age. The youths in the study area engaged in fishing to help their parents as family labour and reduce the family burden, while some youths do so to earn money for their own expenses. Past studies also revealed that youths in some fishing communities are attracted by earning money through fishing (Bhuiyan, 2008). However, a majority of youths in the study area are attracted by non-fishing enterprises. The modern trends in lifestyles entice youth to migrate from rural areas to urban areas for employment (Brookfield *et al.*, 2005; Abeykoon and Elwalagedara, 2008) in non-fishery sectors (Al-Marshudi and Kotagama, 2006). Moreover, fishers also encourage their sons to seek jobs in non-fishery enterprises (Jiménez, 2008).

Average age at first entry into fishing for male fishers who descended from non-fishing families ( $18 \pm 7$  years) was 3 years older ( $P < 0.05$ ) than for male fishers who descended from fishing families ( $15 \pm 5$  years). Since males from fishing families gain fishing experience early from their parents, they are able to enter the fishery at a younger age than the males from non-fishing families. In contrast, past studies report that the age at entry into stake net fisheries in the Western coast of Sri Lanka is 18 years (Kurukulasuriya, 1996) although this seems particular to stake net fishery.

### ***Educational status of the fishers***

Around 83% of the fishers in the study area had attended school; 36% had studied up to primary education, 33% up to secondary education, 10% up to GCE (O/L) and 4% up to GCE (A/L). Educational status of the fishers plays an important role in their ability to access relevant technical information and to make rational economic decisions. However, due to poverty and lack of motivation toward education, more than half the fishers in the study area being either uneducated or only primary educated. When male fishers fail to continue school education, they enter the fishery as a readily available occupation and livelihood. Past studies show that due to attractive income from fisheries (Wijayarathne and Gudmundsson, 2001) and lack of role models for education in fishing villages (Wickramasinghe, 2009), most fishers in Sri Lanka remain poorly educated and cannot find sufficient job opportunities in non-fishery sectors. Thus the current study shows that the male fishers with primary or secondary educational qualifications enter the fishery as an easy livelihood option.

### ***Family structure of the fishers***

The average family size of the fishers was  $6.2 \pm 2.6$  with a range of 2 to 13 and a dependency ratio of 84%. Wickramasinghe (2009) has reported that the average family size of small-scale fishers in Southern part of Sri Lanka is 4.7. However, majority of fishing families in Sri Lanka are with 4 to 5 family members (Wijayarathne and Gudmundsson, 2001). Though a high dependency ratio is generally considered to be an economic burden, fishers in the current study area ignore family planning due to the belief that having more children helps to spread the family and ensure care for them when they are aged. Abeykoon and Elwalagedara (2008) reported that in rural areas of Sri Lanka, traditional family with a large family size is valued as an important economic asset to work in farm and household enterprises. Olatunji and Olah (2012) reported that a large family size offers free and cheap labour for the fishing households.

### ***Role of women in fishing***

All the active fishers in the study area were males. A tenth of the spouses of the active fishers, however, assisted their husband in fishing activities such as loosening gillnet into the water, removing fish from the net, cooking during night fishing and in pushnet fishing. This indicates that the women are responsible mainly for routine household chores and childcare whereas the men take on the task of earning the income for their family's needs. This finding is consistent with the study of Dissanayaka and Wijeyaratne (2009) that women engage in harvesting of shellfish using small traps and pushnets, and assist their spouse in post-fishing activities. Wijayarathne and Maldeniya (2003) also reported that women are active in collection of fish from the net, net mending and fish marketing as unpaid family labour.

It should also be noted that in the present study area, the prevalent Islamic culture only allows Muslim women to do field-work in the company of their spouse or son. However, contribution of women in fishing ensures sharing of catches within the family to sustain their family income.

### ***Coastal fishing in Thampalakamam bay***

Traditionally fishers exploited finfish and shellfish, namely, shrimps and crabs from Thampalakamam Bay. Peak catches of finfish occur during the months of February to

October. In addition, regular cyclic seasons are observed for *Amblygaster sirm*, *Sardinella albella* and *Stolephorus* species each year. Although coastal fishing operations are confined to non-monsoonal periods, fishers in Thampalakamam Bay used different strategies to sustain their income throughout the year. During rainy and windy seasons, fishers used to catch shrimps (*Penaeus indicus*, *P.monodon*, *P.semisulcatus*) and crabs (*Portunus pelagicus*, *P.sanguinolentus*, *Scylla serrata*) respectively. In addition, fishers alternatively used gillnet of different mesh size, gillnet with handline, castnet, pushnet, and crab pot based on the available fish species in different seasons. Campbell *et al.* (2006) reported that poor people in coastal areas try to diversify their income-earning activities both to supplement their income and reduce risk and that they may even take up new alternatives.

### ***Fishing craft and gear***

All fishers in the study area used non-motorized outrigger canoe (*thony*) made from either wood or fibre. The majority of the fishers (63%), however, leased the craft from fish merchants (*mudalali*) to whom they sell their catch. Majority ( $P<0.05$ ) of the fishers (83%) used gillnets while others used castnet, pushnet and crab pot. Moreover, 75% of the gillnet fishers owned fishing gear while others leased the crafts from fish merchants. However, castnet, pushnet and crab pot fishers owned their fishing gear. Fish merchants who lease out fishing gear and crafts in the study area purchase the catch from their dependent fishers at wholesale prices after collecting their rent. In contrast, Amarasinghe (2009) found that fish merchants ensure that the fishers will supply them with their catch by giving advance payments rather than leasing gear or crafts.

### ***Fishing duration and fish catch***

Majority of the fishers (42%) engaged in only night fishing, while 10% of the fishers stayed out for two to three days. Around 29% of fishers changed their fishing time alternatively from day to night and *vice versa* according to the seasonal productivity, while around 19% of fishers engaged only in day fishing. A majority ( $P<0.05$ ) of fishers (83%) in the study area refrained from fishing on Fridays to attend the special Friday afternoon prayers in Mosques. The other 17% of the fishers engaged in Friday-fishing but for a limited time period in the mornings (*Vellaapu*) or evenings (*Sekkal*).

Fishing effort and the catch per unit effort (CPUE) significantly varied with the type of fishing (Table 1). Fishing effort of the crab pot and gillnet fishers were higher ( $P < 0.05$ ) than that of the castnet and pushnet fishers. This is due to the time taken to deploy their net and wait until they harvest the catches.

The fish marketing channel in the study area was dominated by middle men and all fishers sold their catches to their usual fish merchants. Though this type of transactions may fetch lower prices for the fisher's catch than elsewhere, the fishers are kept satisfied by the direct and immediate cash payment they receive from the merchants.

**Table 1.** Average fishing effort and Catch Per Unit Effort (CPUE) of different types of coastal fishers in Thampalakamam Bay

<i>Type of Fishers</i>	<i>Fishing Effort (h/d)</i>	<i>CPUE (kg/h)</i>
Crab Pot	14.0 ± 0.0 <sup>a</sup>	0.4 ± 0.0 <sup>a</sup>
Gillnet	11.2 ± 2.5 <sup>a</sup>	0.6 ± 0.3 <sup>a</sup>
Pushnet	6.0 ± 0.0 <sup>b</sup>	0.3 ± 0.0 <sup>b</sup>
Castnet	6.0 ± 0.0 <sup>b</sup>	0.3 ± 0.0 <sup>b</sup>

Means with different superscript letters within the column are significantly different ( $P < 0.05$ ).

***Profitability of coastal fishing in Thampalakamam bay***

The variable costs of coastal fishing operations included costs for food, fuel, bait and other costs such as for cigarettes. The total variable cost of crab pot fishers was 250% higher than that of gillnet fishers (Table 2) due to high cost of bait - skate fish and rumen of cattle - which are used in crab pots to target *S. serrata*. The cost of bait incurred for gillnet fishers is due to usage of handline with gillnet to diversify the fishing effort. However, cost for food, fuel and others did not differ between gillnet and crab pot fishers due to a similar ( $P > 0.05$ ) fishing effort. The castnet fishers and pushnet fishers did not incur any variable cost due their shorter fishing effort.

Table 2 shows that the average monthly revenue of crab pot fishers was 8.3 times and 7.8 times higher ( $P < 0.05$ ) than that of castnet and pushnet fishers respectively. Furthermore, the average monthly gross profit of crab pot fishers was 3.2 times and 3 times higher



( $P < 0.05$ ) than that of castnet and pushnet fishers, respectively. This was due to higher prices fetched for crabs than finfish and the comparatively smaller fishing effort of castnet and pushnet fishers. The average monthly revenue of gillnet fishers was 4.8 times and 4.5 times higher ( $P < 0.05$ ) than that of castnet and pushnet fishers, respectively. The average monthly gross profit of gillnet fishers was 3.4 times and 3.2 times higher ( $P < 0.05$ ) than that of castnet and pushnet fishers, respectively. This was due to a wide range in the mesh size of gillnets that target a higher catch of finfish and shellfish while the castnets and pushnets with a narrower range of mesh sizes target fewer catches.

**Table 2.** Average monthly variable costs and revenues (in Rs.) associated with coastal fishing

Type of Fishers	Cost					Total	Gross
	Food	Fuel	Bait	Other	Total Variable	Revenue	Profit
Gillnet	2,853 <sup>a</sup>	1,250 <sup>a</sup>	1,618 <sup>a</sup>	482 <sup>a</sup>	6,203 <sup>a</sup>	21,651 <sup>a</sup>	15,448 <sup>a</sup>
Crab Pot	3,600 <sup>a</sup>	1,920 <sup>a</sup>	16,800 <sup>b</sup>	480 <sup>a</sup>	22,800 <sup>b</sup>	37,200 <sup>a</sup>	14,400 <sup>a</sup>
Pushnet	-	-	-	-	-	4,800 <sup>b</sup>	4,800 <sup>b</sup>
Castnet	-	-	-	-	-	4,500 <sup>b</sup>	4,500 <sup>b</sup>

Means with different superscript letters within the column are significantly different ( $P < 0.05$ ).

Since all type of fishers in the current study area get positive gross profits, they can continue fishing at least in the short-term. However, fishers are not satisfied with their earnings due to frequent hikes in the cost of living in Sri Lanka.

### ***Constraints to fishing activities***

The major constraint to fishing in the study area was the increasing number of fishers. Around 65% of the fish merchants, who lease fishing craft and gear, were businessmen and had no history of fishing but were eager to access a bulk and guaranteed supply of fish. Hence, new entrants, who were resource-poor with lack of fishing experiences, easily enter the coastal fishing each year for their livelihood. The educational background of the fishers also contributed to the increased number of fishers. When male members from the fishing community failed to complete their school education, they entered the fishery as an easily accessible job and livelihood. As a result of increased number of new fishers, the usage of illegal fishing gear including even small mesh

monofilament nets and use of dynamite have also increased due to their inability to handle environmental friendly traditional fishing gear such as handlines, longlines, castnets and traps. This trend contributed directly to reducing the catch of traditional fishing gear users and the destruction of biodiversity.

Despite the ban imposed by the Government of Sri Lanka on monofilament nets, fishers widely used these nets with different mesh sizes. Although the fishers understand the bad effects of using such monofilament nets, they continue to use them because of the higher catch. When such fishers continue to use these nets, the other fishers are also compelled to use such nets to sustain their catch.

Some fishers in the current study area were also using dynamite for fishing. Perhaps, due to the low intensity of dynamiting, however, fishers did not consider the dynamiting as dangerous as monofilament nets. In spite of fishers' views, blast fishing is most dangerous to the sustainability as they destroy the juveniles and breeders of many species of fish.

The Sri Lanka Navy has declared a part of Thampalakamam Bay as a security zone, where fishing has been completely prohibited. Fishers claim that large cockles and fishes are often trapped within the security zone. Whenever the security forces need sea food, however, selected fishers are allowed to fish within the security zone and to share the catch between the fishers and the security forces.

### ***Future of the fishers***

Around 95% of fishers wished ( $P < 0.05$ ) to continue coastal fishing in the future while only 3% of fishers expected to move to non-fishing activities. Two percent of the fishers, who were unmarried but had studied up to secondary, Ordinary Level or Advanced Levels, wished to continue their studies further. The majority of fishers, with poor educational qualifications, however, are unable to find alternative livelihood options in non-fishing sectors, have little choice but to continue their current employment despite the existing constraints in coastal fishing operations.

Because of easy access and inability to exit from the coastal fishing due to the investment made on it, 78% of the fishers in the study area were reluctant ( $P < 0.05$ ) to

practice aquaculture in the future. However, around 22% of the fishers expressed their willingness to engage in aquaculture, if all the required inputs were provided. Christy (1996) has reported that the open access regime of coastal fisheries prevents fishers to exit from fishing due to the massive investment made on it.

### ***Suggestions for the future***

Access to credit facilities will facilitate the fishers to own required fishing gear and craft rather than depending on the fish merchants. The fishers could then earn higher gross profits, which in turn could be utilized for the educational development of their children. This will enhance the new generation of the fishing community to get suitable job opportunities in non-fishery enterprises and will reduce the fishing pressure on the bay.

Access to training facilities on sustainable coastal aquaculture for the interested fishers and engaging them in aquaculture activities will also reduce the fishing pressure on the bay. Moreover, providing training on coastal agriculture techniques including home gardening in polythene bags or pots, with the help and collaboration of Agricultural Officers can increase the income while improving the livelihood of the fishers.

### **Conclusions**

Fishers in the study area are Muslims who traditionally involve in coastal fishing as their main livelihood. A majority of them are descendants of fishing families. Male fishers involve in fishing as their main occupation while female fishers assist their husband in fishing. A majority of fishers in the study area are formally educated but mostly with primary school educational qualifications.

The average family size of fishers is 6.2, which is larger than the average family size in Sri Lanka. The dependency ratio of the fishing families is 84%. Though the large family size is an economic burden, fishers in the current study area ignore family planning due to the belief that having more children helps to spread their family and care for them in their old age. Average age of a majority of fishers ranged between 25 and 63 years; only 2% of fishers were elders, while 13% of fishers were young.

Traditionally fishers exploit finfish, shrimps and crabs from the bay with the use of outrigger canoe and a variety of fishing gear such as gillnet, castnet, pushnet and crab pot. However, majority of the fishers use gillnet with a variety of mesh size according to the type of catch species. Around 63% of the fishers lease the crafts from fish merchants to whom they sell their catch. The fish merchants purchase the catch from their dependent fishers at wholesale price after deducting their rent.

In addition to non-monsoonal periods, coastal fishing operations in the study area are carried out during monsoonal periods by diversifying the fishing gear according to different species available in different seasons to sustain the incomes throughout the year. Fishing effort and the CPUE were significantly higher with gillnet and crab pot fishers than that of pushnet and castnet fishers.

The average monthly gross profit of crab pot fishers is significantly higher than that of castnet and pushnet fishers due to higher sale prices for crabs than finfish and comparatively smaller fishing effort of castnet and pushnet fishers. The average monthly gross profit of gillnet fishers were also significantly higher than that of castnet and pushnet fishers due to a wide range of mesh size of gillnets that are used to target more catch. Although all types of fishing operations in the study area run with a positive gross profit, managing the household expenses is difficult under the prevailing cost of living.

Major constraints in coastal fishing operation are increased number of fishers, use of illegal fishing gear, and the declaration of a security zone in Thampalakamam Bay by the Sri Lanka Navy. Despite these problems, however, a significant proportion of the fishers wish to continue coastal fishing as their preferred livelihood. Access to credit facilities, provision of training in sustainable coastal aquaculture and home gardening can help to diversify their means of livelihood during the off-seasons and increase the income of the fishers.

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