RECENT DEVELOPMENT OF RINGNET FISHERY FOR SMALL TUNAS IN THE SOUTHERN COASTAL WATERS OF SRI LANKA

R. Maldeniya and P. Dayaratne

National Aquatic Resources Agency
Crow Island, Colombo 15
Sri Lanka

INTRODUCTION

The major contribution of the small tuna varieties (frigate tuna (*Auxis thazard*), kawakawa (*Euthynnus affinis*) and bullet tuna (*A. rochei*)) to the total tuna production in Sri Lanka comes from the southern coastal waters (Maldeniya *et al.*, 1987; Dayaratne and De Silva, 1991), where fisheries for small tunas have traditionally played an important role (Sivasubramaniam, 1965). Except for multiple-lure troll-lines, other fisheries target mainly the large varieties of tuna, such as skipjack and yellowfin; small tunas are landed as incidental catch.

The relative importance of the types of fishing gear used for catching tuna in this area has undergone changes over the past 3 or 4 decades. The introduction of synthetic gillnets has resulted in a reduction in landings of small tunas caught with multiple-lure troll lines and pole and line (Sivasubramaniam, 1965). There has also been a decline of fishing effort with gillnets in the coastal zone due to the expansion of the fishery further offshore and the increase in multi-day fishing . Ring nets have been in use on the south coast since the early 1980s for targeting small tuna. At present the tuna fisheries in the southern coastal areas are dominated by traditional boats vessels and 9-11 m unmechanised day boats using driftnets, troll lines and ring nets. Pole-and-line fishing is conducted seasonally. Offshore fishing uses mainly combination gears on modified 9-11 m boats and boats over 11 m (Dayaratne and Maldeniya, 1988; Dayaratne and De Silva, 1991).

Based on an assessment of frigate tuna stocks in the southern coastal waters of Sri Lanka, Dayaratne (1993)

Figure 1. *Study area in Sri Lanka with fish landing centres*.

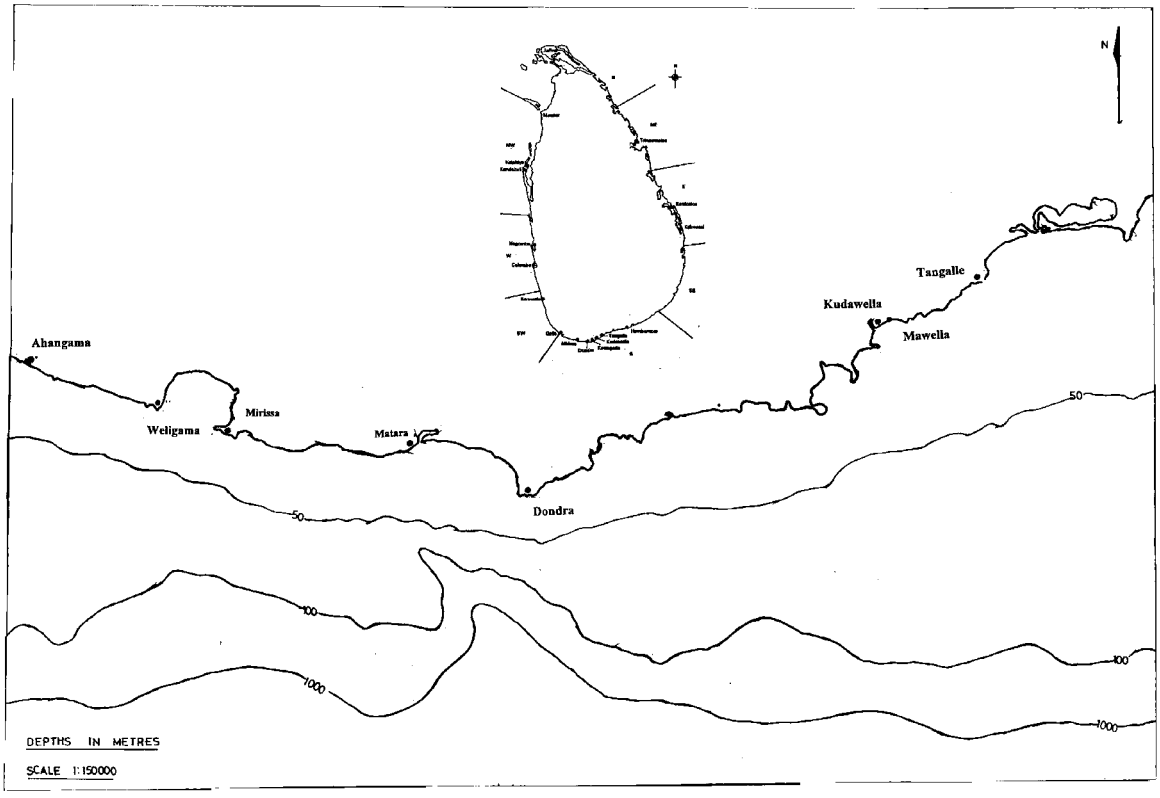


Table 1. Distribution of different types of vessels in the study area.

Landing centre	Vessel type	
	Canoes	9-m boats
Weligama	32	-
Mirissa	36	-
Dondra	20	18
Kudawella	40	-
Mawella	25	3
Total	153	21

Table 2. Average fishing depth and time spent searching

Landing centre	Depth range (m) Range (average)	Searching time (hours)
Weligama	42-69 (56)	6
Mirissa	40-60 (55)	6.10
Dondra	38-62 (54)	6.18
Kudawella	42-58 (52)	7.24

Table 3. Percentage of successful fishing trips, March 1994-February 1995.

Landing centre	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Weligama	85.2	73.9	100	45.5	66.0	43.7	50	86.7	50	57.1	25	72.7
Mirissa	62.6	24	95.6	77.1	71.1	31.6	78.9	71.4	94.1	68.4	81	52.5
Dondra	79.2	81.8	91.4	65.4	71.1	18.7	46.2	86.7	71.4	28.6	65.6	66.7
Kudawella	-	33.4	21.1	-	50	40	-	-	0	-	-	-

stated that there is a considerable potential for increasing the production by increasing fishing effort. However, the number of ringnets operated in the south coast has increased in recent years and the fishermen continue to show interest in the ringnet fishery. As a result, there have been many conflicts between ringnet fishermen and the other small-scale fishermen, such as gillnetters and trollers, competing for the same resources in the same area. The present study was therefore undertaken to understand this developing fishery.

MATERIALS AND METHODS

Data on catch and effort and information such as fishing area, craft type, fishing depth, fishing time and searching time, number of crew and the length frequency distribution of catches in the ringnet fishery were collected through random sampling and by interviewing fishermen from March 1994 to February 1995 at 4 major landing centres (Weligama, Mirissa, Dondra, Kudawella) on the south coast. Sampling was conducted on a weekly basis, covering 1-2 days in each landing centre.

The information on landings of small tunas by other fisheries in the area during 1994 was taken from the sampling programme conducted by the National Aquatic Resources Agency (NARA) (Williams, 1995).

RESULTS

Vessels and gear

Although there are many landing centres scattered along the south coast, ringnet fishing is carried out from only Weligama, Mirissa, Dondra, Kudawella and Mawella (Figure 1). The vessels engaged in ringnet fishing are mainly outrigger canoes called "Rignet Vallam," of 11-14 m LOA, powered by 25-hp outboard motors , with a few 9-m boats. Sometimes the canoes work together with a 9-m boat, which helps to load catches. These vessels generally have two types of ringnet, one for small tunas and the other for halfbeaks, garfish, and other small pelagics. The numbers of vessels of different categories involved in the ringnet fishery for small tunas in the south during the study period are given in Table 1.

During the poor fishing season (December to February), some of the vessels in Kudawella and Mawella migrate to Thotamuna in Matara and to Aluthgama on the southwest coast. Others fish for halfbeaks with ringnets or divert their effort to other fisheries, mainly small-mesh gillnetting and bottom longlining.

The ringnet used for small tunas is about 400 to 450 m long and about 30-35 m deep at its highest point. The webbing is 24-30 mm 6-ply mesh for the bunt in the centre. F-1 type floats are attached to the head rope at 60-70 cm intervals, with G-7 type buoys attached at 10-12 m intervals to provide additional buoyancy. Brass or lead rings of 10-cm diameter, each weighing 300-400 g, are attached to the bottom rope at intervals of 4 m. Purse rings are generally attached only in the middle section of the net, starting about 15 to 20 m from the ends. Two cement sinkers of about 2.5 to 3 kg are attached to each end of the net to increase its sinking power.

Fishing operations and fishing grounds

Fishing is conducted within 3-8 km of the coast and within a limited depth range. Vessels depart from port in the early morning, usually before dawn, and search over a wide area until they sight a free-swimming school. The average fishing depths and time spent searching are given in Table 2.

Fishermen from Kudawella spent more time on searching than the others.

Generally only a few vessels operate regularly at each centre. Others operate only when the landings of the regular vessels are good: if one boat makes a good catch, the others follow it to the productive grounds. All fishing is on free schools. Fishing success is quite irregular; the proportions of successful fishing trips made in the study area are given in Table 3.

The rate of success varies from month to month and area to area. Relatively low success rates were reported during the southwest monsoon season, August to September. The fishing success at Kudawella was poor, hence there was no fishing in most of the months.

Fishing effort and catch per unit effort (CPUE)

Table 5. Monthly variation in catch per unit effort (CPUE), in kg/trip and kg/searching hour, March 1994-February 1995

Landing centre	*CPUE (kg/trip)*											
	Mar	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*
Weligama	107.2	478.3	480	54.7	92.8	28.8	39.2	41.9	50.8	34.3	11.3	48.1
Mirissa	161.5	754.4	567.7	181.5	298.7	25.1	34.2	31	57.3	21.2	7.3	45.7
Dondra	79.1	224.6	480.4	194.2	183.1	5.6	33.5	35.9	26.6	16.4	52.3	63.5
Kudawella	-	32.6	160.8	-	63.2	80.5	-	-	-	-	-	-
	CPUE (kg/searching hour)											
Weligama	16.2	81.9	80	8.5	16.9	5.6	8.7	5.2	7.5	4.8	2.1	7.8
Mirissa	22.8	109.3	87.8	36.3	57.8	5.1	7.1	4	6.5	2.7	10.2	6.8
Dondra	13.2	31.7	69.8	34.3	33.3	1.3	5.9	5	3.8	2.4	7.1	8.9
Kudawella	4.6	22.2	8.8	11.1								

Table 4. Monthly fishing effort directed at small tunas by the ringnet fishery, in number of fishing trips, March 1994-February 1995.

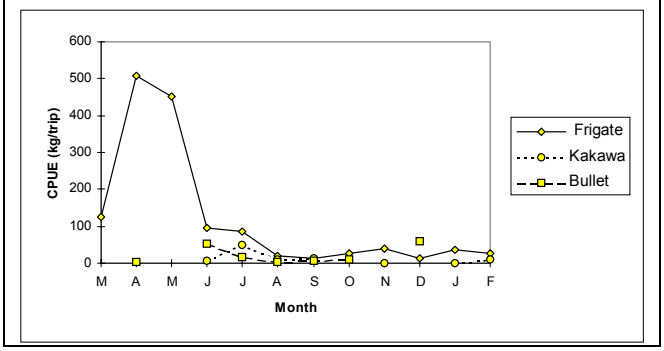
Landing centre	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*
Weligama	225	275	308	183	295	133	50	282	50	58	125	138
Mirissa	292	325	375	293	318	238	158	88	143	158	175	333
Dondra	150	183	293	218	318	133	108	125	58	58	258	100
Kudawella	-	36	204	-	165	60	-	-	-	-	-	-

As there was no information on the number of sets made during each fishing trip, the unit of effort is considered a complete fishing trip. The monthly fishing effort directed at small tunas by the ringnet fishery is given in Table 4.

In order o compare the performance of ringnet fishing with other fisheries that contribute to landings of small tunas in the area, the CPUE was estimated as catch per fishing trip. As the fishery depends on free-swimming schools, an estimate is also made of catch per unit of searching time. This gives a better indices of abundance. Monthly variation of CPUE is given in Table 5.

The highest CPUE for both methods was observed in April and May in all areas. This indicates a clearly defined seasonality.

Figure 2. *Monthly variation in CPUE of small tuna in the ring net fishery.*



The average annual catch rates of small tuna by gillnets (GN), troll lines (TR), and ringnets (RN) are as follows:

Landing centre	*Gear*	*CPUE (kg/trip)*
Weligama	TR	21.3
	RN	175.8
Mirissa	GN	147.7
	RN	244.5
Dondra	GN	29.2
	RN	140.9
Kudawella	GN	59
	RN	90

Catch and Species Composition

The percentage distribution in magnitude of the catch landed per trip is given in Table 6. About 50% of the settings yielded less than 100 kg. A maximum catch of 2779 kg was reported from an operation conducted in Weligama in May.

Species composition by weight is given in Table 7. About 99% of the ringnet catch consisted of small tunas, 90% of them frigate tunas, followed by kawakawa (5%) and bullet tuna (4.5%).

Seasonal variation in small tuna catch

The monthly variation in the CPUE of small tuna species in the study area is illustrated in Figure 2. Frigate tuna was landed throughout the year, but significantly higher catch rates were reported from March to May. Landings of kawakawa and bullet tuna were reported during the southwest monsoon season (June to September) and in some months during the northwest monsoon season.

Size composition

The length-frequency distribution of small tuna species caught with ringnets during the study period is shown in Figure 3. For comparison, the size distribution of frigate tunas in the troll-line catches are shown in Figure 4.

Estimated production

The monthly landings from the ringnet fishery are shown in Table 8. The total ringnet production in the south was

estimated on the assumption that the variations in fishing patterns and performance in Mawella during the study period was similar to those reported at Kudawella. The total production of small tuna was estimated as 1506 t, of which 99% was frigate tuna.

DISCUSSION

The production of small tuna in the fishery for large pelagic species in the south of Sri Lanka in 1994, estimated through the sampling programme for that fishery, was 2623 t (Williams, 1995). This includes the catches from both coastal and areas. As the ringnet fishery lands catches at various times of day, it is not properly sampled by the above sampling programme, so the present estimate of 1506 t for production from this fishery could be too low. However, these two estimates combined give a total production of small tunas in the south of around 4129 t. This amount is 2.3 and 1.8 times higher than the amounts landed in 1985 and 1991, respectively (Maldeniya *et al.*, 1988; Dayaratne, 1993). This increase is primarily due to the development since the early 1980s of the ringnet fishery, which mainly targets small tunas (Dayaratne and De Silva, 1991). The production of frigate tuna in the south in 1990 and 1991 was 421 t, while the present production is estimated to be about 3116.3 t.

The distribution of the size of the catch shows that the landings of large catches were exceptional. More than 70% of the landings were less than 100 kg. However, the success rate of fishing remained very high in most months in Weligama, Mirissa and Dondra.

Figure 3. *Size distribution of small tuna in the ringnet catches.*

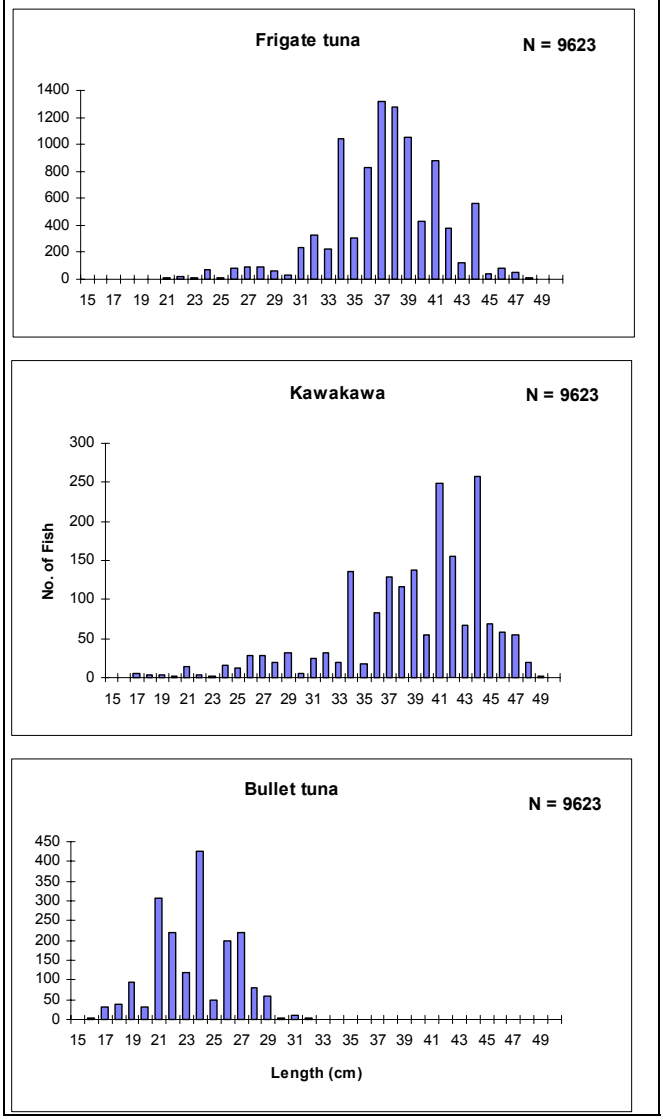


Table 6. *Percentage distribution of size of the catch*

Size of catch (kg/set)	*Percentage*
<100	49.5
100-199	20.2
200-499	16.9
500-999	9.8
1000-1499	2.9
1500-1999	0.7
>2000	0.3

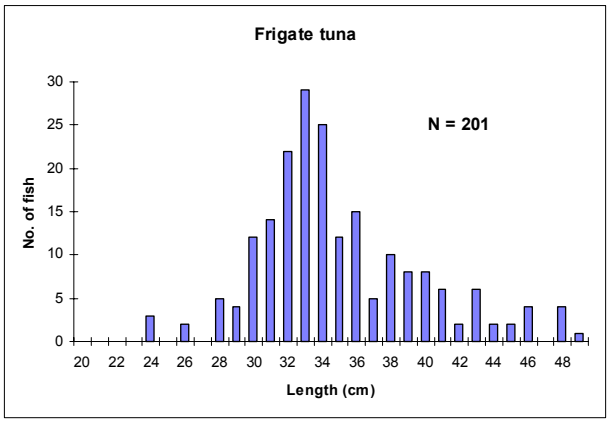
Table 7. Species composition of the ringnet catch

Species	*Percentage*
Frigate tuna	89.4
Kawakawa	5.0
Bullet tuna	4.5
Bolla	1.0
Sailfish	0.05

Table 8. *Monthly production from the ringnet fishery, March 1994-February 1995*

Landing centres	*Production (t)*											
	Mar	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*
Weligama	24.1	131.5	147.8	100.1	26.9	3.8	2	11.8	5.1	2	1.4	6.6
Mirissa	46.8	246.8	212.9	53.2	95	6	5.4	2.7	8.2	3.4	12.5	15.2
Dondra	11.9	41	140.8	42.3	14.8	.7	3.6	4.5	1.5	1	13.5	6.4
Kudawella	-	1.2	32.8	-	3	4.8	11	-	-	-	-	-

Figure 4. *Size distribution of frigate tuna in the troll-line catches.*



The catch rates of the troll-line fishery in 1985, when the ringnet fishery was not in operation, are no different from the present rates. Since both fisheries catch mainly frigate tuna, this could be an indication that the stocks of this species are in a healthy state, even with the present ringnet fishery. Dayaratne (1993) assessed the frigate tuna stock in the south and concluded that the fishing effort on frigate tuna could be increased for a better yield. However, the recently-developed ringnet fishery was not included in that study, and therefore its impact on the resource is not very clear.

The results of this study indicate that the ringnet fishery is 7.6 times more efficient than the troll-line fishery for small tunas and 2.1 times more efficient than the gillnet fishery. Uncontrolled expansion of this technique might therefore lead to resource depletion. The conflicts that have arisen may also lead to social problem, as the resources has to be shared among different users. Therefore, continuous monitoring of the fisheries and assessment of the major fish stock is absolutely essential.

Over 95% of frigate tuna caught with ringnets were mature (>30 cm), but the kawakawa and bullet tuna were mostly juveniles (Muthiah 1985). This is different from the size composition of the catches reported for the ringnet fishery in the southwest by Dayaratne & Sivakumaran (1994). On the southwest coast more than 95% of the frigate tuna caught with ringnets are immature.

REFERENCES

DAYARATNE, P. AND R. MALDENIYA 1988. The status of tuna fisheries in Sri Lanka. Report on the expert consultation on stock assessment of Tunas in the Indian Ocean held in Mauritius, 22 - 27 June 1988.

DAYARATNE, P. AND J. D. DE SILVA 1991 a. Recent trends in Fisheries for small tunas in Sri Lanka. Collective volume of working document No. 4. Indo-Pacific Tuna Development and Management Perogramme.

DAYARATNE, P. 1993. Assessment of Frigate tuna *Auxis thazard* stocks in the southern waters of Sri Lanka. Proceedings of the 5th Expert Consultation on Indian Ocean Tunas. Indo-Pacific Tuna Development and Management Perogramme.

DAYARATNE, P. & K.P. SIVAKUMARAN 1994. Bio-Socio-Economics of fishing for small pelagics along the southwest coast of Sri Lanka. Bay of Bengal Programme, BOBP/WP/96.

MALDENIYA, R., N. M. MOIYADEEN AND C. AMARASIRI. 1987. Present status of the fishery for small tuna species, billfish and seerfish in Sri Lanka. In report of workshop on small tuna, seerfish and billfish in the Indian Ocean, Indo-Pacific Tuna Development and Management Programme.

MUTHIAH, C. 1985. Maturity and spawning of Euthynnus affinis, Auxis thazard and A. rochei in the mangalore inshore area during 1979 to 1982. Tuna fisheries of the exclusive economic zone of India : Biology and stock Assessment Central Marine Fisheries Research Institute. CMFRI Bulletin 3.

SIVASUBRAMANIUM, K. 1965. Exploitation of tuna in Ceylon's coastal waters. Bull. Fish. Res. Stn., Vol 17.

WILLIAMS H. 1995. Establishment of a monitoring system for catches of artisanal driftnet and longline fishing Sri Lanka. Field document 3. Report prepared for the Government of Sri Lanka by the Food and Agriculture Organisation of the United Nations.