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Over fishing -a study with reference to the ring seine fishery

LEELA EDWIN AND *C. HRIDAYANATHAN
Central Institute of Fisheries Technology, Cochin-682 029
**Cochin University of Science and Technology, Cochin, India*

ABSTRACT

The problem of overfishing along the inshore waters of Kerala has been reported to be aggravated by the introduction of the ring seines. In the context of indiscriminate proliferation and use of ring seines this study is made with reference to the changes in the species composition, length of important species and biomass landed. The data for this study were collected from Ambalapuzha and Cochin, two major centres of ring seine activity of the state. The species selected for this investigation were makerel, oil sardine and other sardines. The results of the study show the likelihood of overfishing in the ring seine fishery

Introduction

The improvements made to fishing gear and techniques have definitely made fishing more efficient but unfortunately little attention has been given to conservation of marine resources. This has led to over fishing in the Kerala coast. The problem and consequences of overfishing and strategies for development have been discussed by several authors (Kurian, 1985; Achari, 1987; Kurian and Achari, 1990; James, 1993). The government of Kerala appointed several expert committees to study the conservation and management of marine fishery resources of Kerala (Kalawar *et al*., 1985; Nair, 1989). While discussing the theory and practice of overfishing in south east Asia, Pauly (1987) points out some effects of biological and economic overfishing in single and multi species stocks. According to him the reduction of biomass at high levels of effort, massive change in species composition and disappearance of previously important species, increase of unmarketable species and reduction in average values of species mix, reduction in size of fish and increased fluctuations of stocks (more frequent occurrence of periods of extremely low catches and increasing risk of occasional recruitment failure) and lowered income were signs of ecological overfishing.

In the context of indiscriminate proliferation and use of ring seines along the Kerala coast, an attempt is made here to study the species composition of the ring seine landings and its changing pattern, change in length, if any, of important species landed by ring seines, and change in biomass.

Materials and methods

The data for this study were collected from Ambalapuzha and Cochin, two centres of intense ring seine fishing activity. The species selected were the important species landed by the ring seines viz. Indian mackerel (*Rastrelliger kanagurta*), anchovies/white baits (comprised mostly of *Stolephorous devisi*, *Stolephorous bataviensis*), and other sardines coming under Clupeidae and Dussumieridae. The lesser sardine *Sardinella fimbriata* commonly called fringe scale or chalamathi and the *Dussumeiria hasseltti*, rainbow sardine or *kokan chala* were the two other species selected for the study. Oil sardine *Sardinella longiceps* was sampled as and when landed. The methodology for the collection of the data from selected fishing units on species-wise catches, effort details, area of fishery, and total catch were followed as per Alagaraja (1984). The species composition was studied from selected units. The changing pattern of species composition of ring seine landing for the ten years period from 1986-95 was studied using the Markov chain model. The transition probabilities are estimated as per Formacion and Saila (1994).

The length frequency data were collected from September 1994 to August 1995. The samples were taken for the five species of fishes mentioned at the beginning of this section. About 200-250 samples of each species were measured per month. The length ranges at the maximum and minimum length of the species and predominant size groups was noted as far as possible. The length was measured as per Sparre *et al*. (1989). The small practical class interval of one full centimeter was selected. Maximum effort was taken to reduce errors in data collection like bias, variance and other sources of inaccuracy.

The data regarding the quantity of fish landed by ring seines since its time of introduction up to 1995 were analysed. The catch and effort details for the same period collected on a quarterly basis were analysed and the secondary data used for comparing the catch per unit in ring seines, in other gears and all the gears together. The effort was estimated with reference to the number of units operated. The data required for this purpose was collected from the Marine Data Centre of the Central Marine Fisheries Research Institute (CMFRI).

Results and dicussion

Species composition of ring seine landings and its changing pattern

The of ring seine landings from Cochin and Ambalapuzha showed that mackerel formed the major portion contributing 39 % in 1995 and 42 % in 1996 when data from both centres were pooled together, while other sardines contributed 18 and 15 % respectively. Anchovies landed by *choodavala* contributed 18 % and 15 % respectively in 1995 and 1996. The oil sardine, which formed major portion of the ring seine landings, formerly could contribute to only 7% in 1995 and 6% in 1996. Prawns though contributing sizably to the returns could contribute only 3 and 6% of the total landings in 1995 and 1996 respectively. The miscellaneous species of fishes comprising of carangids, lizard fishes, pomfrets etc. contributed to 7% of the landings in 1995 and 13% in 1996.

The data when compared to the landings of 1990-1991 (Anon, 1992) show that oil sardine landings have come down drastically from 49% in 1990-1991 to 6.5% in 1995-1996. The catches of oil sardine fell from 72% in 1981 to 1% in 1994, however during the same period

TABLE 1. *Length range of important species landed by ring seines*

Species	year	Post monsoon (mm)	Pre-monsoon (mm)	Monsoon (mm)
Mackerel	1984-88	160-240	210-270	70-110
	1994-95	160-215	115-210	155-215
Anchovies	1984-88	70-94	65-89	50-54
	1994-95	45-95	55-85	45-80
Other sardine	1984-88	90-175	95-170	95-100
	1994-95	145-200	110-190	110-190
Oil sardine	1984-88	105-220	135-210	105-205
	1994-95	140-195	150-195	Not landed

TABLE. 2 *Ring seine Landings during 1986 – 1994 (catch in metric tones)*

Years	Quarter I	Quarter II	Quarter III	Quarter IV	Total Ring Seine landings	Total Pelagic landings	% of Pelagic *landings*	Total *landings*	% of Total
1986	—	—	3793	18705	22498	218000	10.3	383000	50.9
1987	3948	2147	21816	3647	31558	153000	20.6	303000	10.4
1988	677	7769	25599	47841	81886	266000	30.8	469000	17.5
1989	18655	50890	86635	114723	270903	440000	61.6	647000	41.9
1990	27767	33217	94752	102117	257853	433000	59.6	663000	38.9
1991	59659	37943	87646	41082	226330	357000	63.3	564000	40.9
1992	27853	11785	109072	47706	196416	320000	61.3	607000	32.2
1993	6814	37804	79182	35972	159772	315000	50.8	575000	27.8
1994	2425	22095	102310	27789	154619	290000	53.4	565000	27.4

contribution of mackerel and carangids improved (Srinath, 1996). Other sardines which did not form a major contribution in the ring seine landings played an important role during the period under report. Anchovies and prawns tend to show a uniform trend in landings.

There is perhaps a change in the species composition as reflected by the results. These changes were analysed using the Markov Chain model. The process of dynamic change taking place in the fishing with respect to the most abundant species was studied through transition probabilities computed using the maximum likelihood approach. It is seen from the transition probability matrices that if the present pattern of effort expended were to continue and if oil sardine is the dominant species, the probability that next year the dominant group will still be the oil sardine is 0.415. The probability that the oil sardine will dominate the fishery from the dominance of the other sardines is 0.384. It is also seen that from the transition probability matrices of the present and one year ahead, the probability of oil sardine occurrence has decreased considerably. In the long run it is seen that oil sardine has the maximum likelihood of dominating the ring seine landings with a limiting probability of 0.523. The present likelihood has been found to decrease significantly. But in the south west coast of India the pelagic groups viz.

oil sardine and mackerel has been observed to follow long-term cycle with either of the two dominating the landings. In the case of gears other than ring seines, the likelihood of being the most dominant species is taken up by carangids with a limiting probability of 0.625. When all gears were considered together, the likelihood of oil sardine being the most dominant group has reduced further and the likelihood of carangids have increased. Srinath (1996) has also concluded that in the long run small carangids will contribute significantly to the pelagic fish assemblage.

The important criterion of any model to succeed is that important results should agree with actual observation. The study of Formacion and Saila (1994) on pelagic fishery in the Visayan Sea of Philippines through the Markov chain model shows that the family Clupeidae will probably become dominant among the six families exploited. These results were found consistent to biological observation. It has been observed that the chances of oil sardines dominating the landings and sustaining the fishery will decrease considerably if the ring seine fishery is left unregulated (Srinath,1996).

Length frequencies of important species landed by ring seines

The data collected by the Central Marine Fisheries Research Institute during the period from February1984 to August 1988 nearly a decade ago, was used for comparison. For the present purpose the periods of study was classified into post monsoon (September –January) pre-monsoon (February – May) and monsoon (June-August). The result of the study is given in the Table 1. It is seen that there has been no drastic change in the minimum length of any of the important species landed by ring seines.

Biomass landed by ring seines

Ring seine started operation in Kerala in the third quarter of 1986 (Alagaraja *et al.*, 1994). During the period 1986-1995 the ring seine landings of Kerala varied from 22,498 tonnes in 1986 to 2,13,546 tonnes in 1995. The landings from ring seines increased steadily up to 1989 when it reached an all time high of 2, 70,903 tonnes (Balan and Andrews, 1995). But, even though, a ban on trawling was implemented since 1988 with minor changes in the period of ban the catch landed by the ring seines have declined at a steady rate. It can be seen from the Table 2 that maximum landings occur during the monsoon and post monsoon seasons. The table shows the maximum landings during the third quarter of the years 1986-1995 when the availability of the pelagic species were comparatively high. Maximum effort was expended during this quarter of the year. The percentage contribution of pelagic landings increased from 10% to 63% between 1986 and 1991 but by 1994 declined to 53%. The contribution of the ring seines towards the total landings of the state was a mere 6% which increased to 40% in1989-1991 period but decreased to 27% by 1994. The decline in the ring seine landing was the maximum (40%) when compared to the total pelagic landings (33%) and the total landings of the state (14%) from the year of 1990 with increase in effort expended in this fishery. It is estimated that there has been an increase in the fishing effort of about 8 times between 1986 and 1994 (Balan and Andrews, 1995). It is seen that the number of ring seine units as per estimates of 1992 was 2229 as against the 300 recommended by the Central Institute of Fisheries Technology (Panicker *et al.*,1985). It is also seen from the present study that the dimension of the gear and the length of the craft also doubled since its introduction. This type of increase may be the reason for the non-

commensurate decline in the quantity landed as against the total pelagic landing of the state.

The analysis of the data presented under the different heads is indicative that there is likelihood of overfishing in the ring seine fishery as exemplified by the studies on the species composition of ring seine landings and its change, the length frequencies of important species caught in ring seine, and the change in the biomass of ring seine landing. A conscious reduction in the fishing effort may help to reduce the adverse effects of overfishing by ring seines.

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