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Seasonal Growth and Instability of Ring Seine Fishery in Kerala

P. H. Dhiju Das*, P. Sruthi, Nikita Gopal and Leela Edwin
ICAR-Central Institute of Fisheries Technology, P. O. Matsyapuri, Cochin - 682 029, India

Abstract

Ring seine, which is the major fishery of Kerala, contributes 55.7% of the state's total marine fish production and contributes 21.31% of the total marine landings of the country, out of which 73.4% is of pelagic resources. Even small fluctuation in the annual output of ring seine reflects on the total fish production of the state. Two types of ring seine systems are operating in Kerala, namely, mechanised (fitted with inboard motors or IBM) and motorized (operated with outboard motors or OBM). This paper examines the growth and instability of fish production from the ring seiners operating from central Kerala, India during the period 2002-2011. Time series data on daily landing from 36 fishing vessels, including 27 mechanised and 9 motorized ring seine units were used for the study. The results reveal that there is a positive growth in the production from the mechanised ring seiners while the growth from the motorized sector has been falling over the period under study. The overall instability ranged from 36-38% and was more prominent in motorized vessels.

Keywords: Ring seine, growth rate, instability, Kerala

Introduction

The ring seine was first designed and introduced for the traditional fishery in the mid 1980s as a new gear by ICAR-Central Institute of Fisheries Technology, Cochin to help the traditional fishermen from being sidelined by the mechanised sector and eventually the ring seines came to replace the erstwhile *kollivala* and *thanguvala*. A number of variations have occurred in the design of the gear due to innovations by the traditional fishermen (Rajan, 1993). Ring seine is today widely used by fishers all through the state (Edwin & Hridayanathan, 1996; SIFFS, 1999; Vijayan et al., 2000).

Ring seiners can be classified based on the mode of propulsion and the two types of ring seine fishing crafts operating along the Kerala coast are mechanised craft using an inboard motor and motorized craft using outboard motor, henceforth referred to as mechanised ring seiner and motorized ring seiner respectively. The mechanised vessels are 12-24 m in length and are wooden/ steel/ FRP vessels with 120-440 hp engines whereas 7- 16 m FRP or wooden vessels with one or two 25 and/or 40 `hp engines are used for motorized ring seine operation. The ring seiner use a small craft called skiff with 6–15 m in length is used for assistance in fishing operation and transfer of catch to the landing center. The ring seine fishery is important with respect to its contribution to the marine fish production of the state. Ring seine contributes 55.7% of the total production of Kerala and contributes 21.31% of the total marine landing of the country, out of which 73.4% is of pelagic resources. The major pelagic species harvested are oil sardine (64.9%), Indian mackerel (6.5%), white baits (6.3%), carangids (9.5%), tunas (2.7%), ribbonfish (2%) etc. Out of this, 97.9% of oil sardine 68.3% of mackerel and 71.1% of whitebaits landings were contributed from ring seine fishery in Kerala (CMFRI, 2012). Hence a small change in production in the ring seine might have a significant impact on the total state fish production. This paper examines the overall and seasonal growth and instability of fish production from the ring seiners operating from central Kerala, India during the period 2002-2011.

Materials and Methods

The study was conducted in 36 ring seine units operated from Mattancherry (9°572 503 N 76°152

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*E-mail: dhijudas@gmail.com

263 E) during the period 2002 to 2011. Throughout the period of study, the number of operational units varied from 9 to 29 annually. Some of these units stopped operation during this period whereas new units were added to the fleet.

Data was collected on daily fish catch for 36 ring seiners (27 mechanised and 9 motorized), in the study area, along with the total number of operations per day which were sourced from secondary sources like records of Fishermen Cooperative Societies, and onboard daily log book maintained by fishermen. Errors in reported data were minimized by periodic ground level validation of landing data at the fish landing centers. The most prominent feature of the pelagic fishery of Kerala is its seasonal migration and annual fluctuations (Pillai & Ganga, 2008; Pillai & Nair, 2010). Thus the analysis was done at the seasonal level, *viz.*, pre-monsoon (February-May), monsoon (June-September) and post-monsoon (October-January).

One important parameter reflecting the efficiency of the fishing unit is the catch per unit effort or CPUE. The CPUE expressed as catch in MT (Metric Tonne) $boat^{-1} day^{-1}$ was calculated separately for motorized and mechanised vessels in the study.

The Growth rate of ring seine landing was calculated using the formula:

$$Gr_t = \{(Y_t/Y_{t-1})^{1/n} - 1\}*100 \quad \text{.............................(1)}$$

Where,

Gr_t = Growth rate for the year 't'
Y_t = Production in the Current year 't'
Y_{t-1} = Production in the Previous year 't-1'
n = Number of years

The instability has been evaluated using an instability index developed by Chand & Raju (2009) using the formula:

Instability index = Standard deviation of natural logarithm (Y_{t+1}/ Y_t)........................(2)

where,

Y_t = Total production in the current year
Y_{t+1} = Total production for the next year

According to Chand & Raju (2009) this index which is unit free and very robust, measures deviations from the underlying trend.

Results and Discussion

The total landing recorded in the study was 619 MT in 2002 and it has been consistently above 3000 MT from 2007 and reached a peak of 4504 MT in 2010 (Fig. 1). The percentage share of mechanised ring seine which was 51.30% during 2002 has been increasing ever since. In 2011, 96% of ring seine production in the area under study was by the mechanised ring seine fishing craft. The contribution of motorized fishery to the total ring seine landings reduced during the period from 49% in 2002 to 4% in 2011. This was because, the number of mechanised ring seiners increased by 83% during the period whereas, the number of motorized ring seiners increased only by 25% and the size and power of the craft, gear and engine increased two to three times with respect to mechanised ring seine units. By virtue of their increased horse power and large gear size, the mechanised fishing fleets exploit more areas and the success of this fishery attract more investors to this fishery. The size of the gear has increased gradually from 250 m in length and 30 m in depth to a length of more than 1000 m and a depth of 100 m (Edwin et al., 2014).

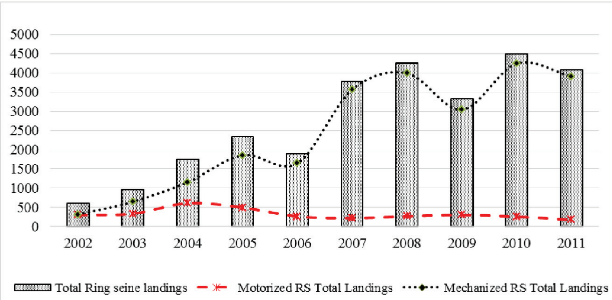

Fig. 1. Ring seine fish landing of the study area (MT)

In case of the motorized ring seiners, 60% of the total landing was contributed from the monsoon fishery when compared to 35% in case of mechanised ring seiners. Seasonal landings of mechanised and motorized ring seines are given in Fig. 2 and 3. Fluctuations in the monsoon fishery affected the total landing from the motorized ring seiners. The motorized fishing crafts are powered with smaller engines and they are not capable of deep water and long duration fishing because of the lack of endurance at sea, durability and safety issues. Mechanised crafts are powered with higher capacity engines and are capable of long duration fishing in deeper waters upto 40 m in depth. During the monsoon, strong coastal upwelling leads to high

production along the Somalian coast, Arabian coast, and the southwest coast of India (Kumar et al., 2001; Wiggert et al., 2005; Levy et al., 2007). During the south west monsoon season the southern side of Kerala coastal area shows a unique nature of fish aggregation phenomenon known as *chakara* (mud bank formation) (Damodaran, 1972; Mathew & Gopinathan, 2000). This area is an active feeding and breeding site for many of the pelagic fishes and crustaceans. Compared to other seasons the occurrence of fish shoals in monsoon season is closer to the shore and these are the main reason for the high landings of motorized ring seine in monsoon season. According to Pillai & Nair (2010) pelagic fish exhibited vertical migration in post-monsoon and pre-monsoon seasons for avoiding the comparatively warmer surface water and the behavior is observed during all seasons except the monsoon season. This type of migration influences the occurrence of surface fish shoal thus reducing the motorized fishing landings.

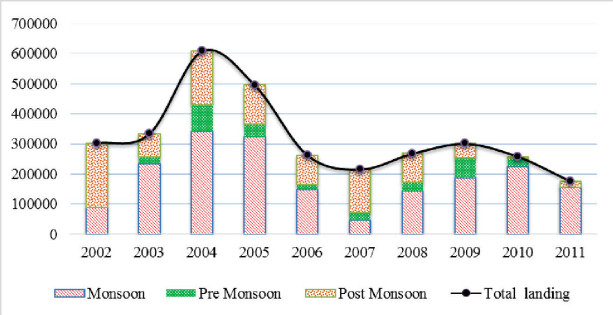

Fig. 2. Motorized ring seine landings (Kg)

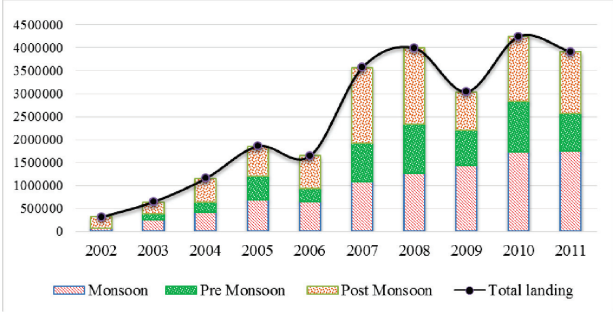

Fig. 3. Mechanised ring seine landings (Kg)

The trend in production was also reflected in the CPUE, which has been steadily increasing for the mechanised ring seiners and declining for the motorized ring seiners. The CPUE which was 2554 MT boat^{-1} day^{-1} in 2002 for the motorized ring seiners fell to 1779 MT boat^{-1} day^{-1} in 2011 and that of mechanised ring seiners rose from 1080 MT boat^{-1} day^{-1} in 2002 to 3061 MT boat^{-1} day^{-1} in 2011.

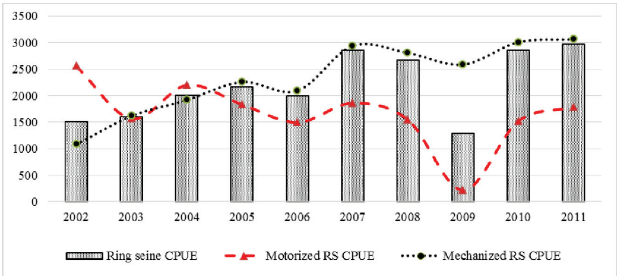

Fig. 4. CPUE of mechanised and motorized ring seines (Kg)

It can be observed from Fig. 4, that there is a clear pattern of fall in the landings of motorized ring seiners and increase in the landings from mechanised ring seiners. This is because, the increase in size of the mechanised ring seiners (both craft and gear) helped in effective scouting and subsequent capture. Increased size of fishing gear also enabled the units to encircle large shoals efficiently in shorter time span. Enhanced storage capability also was an added advantage. The structural changes in the units also increased the durability and enabled them to operate all-round the year.

In 2009, both mechanised and motorized ring seine landings showed a declining trend. This could be attributed to the delayed onset of monsoon during the year. Francis & Gadgil (2009) reported the delayed onset of monsoon coupled with massive deficit in the all India rainfall of 54% of the long term average. CMFRI (2012) also reported a decline in the total marine landings and percentage contribution of ring seine to the total marine landings of Kerala during 2009 compared to the adjacent years (Fig. 5 and 6).

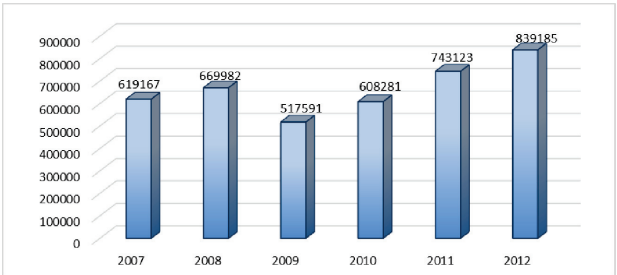

Fig. 5. Total marine fish landings of Kerala during 2007-2011 (Source: CMFRI, 2012)

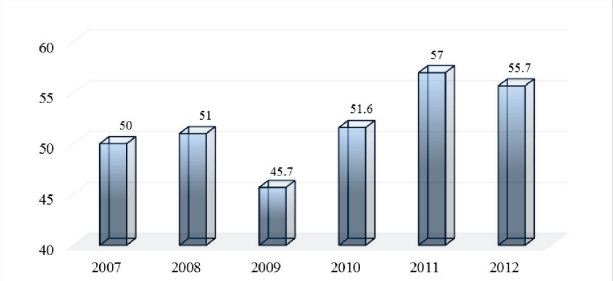

Fig. 6. Percentage contribution of ring seine to the total marine landings of Kerala (Source: CMFRI, 2012)

Analysis of growth in ring seine landings during the three seasons (pre-monsoon, monsoon, post-monsoon) revealed that mechanised ring seine fishing fleet showed positive growth rate during all the seasons at an average of 25% where as in motorized ring seine fishing fleet showed negative trend in growth rate during monsoon and post-monsoon period and in pre-monsoon season it shows 3.5% growth (Table 1). Compared to the mechanised fishing fleet the pre-monsoon growth rate in motorized fleet is less. The higher growth rate in the mechanised ring seiners, could be attributed to the increased number of fishing trips that has been possible for the mechanised units. This has also led to an overall increase in production.

The Coefficient of Variation is high, because the individual ring seine fishing units have very large variations in catch from 0.01 to 12.3 MT. The catch obtained in the individual ring seiners is not directly proportional to the total landings per day. An analysis of the daily landings has shown that there is wide fluctuation among landings by individual units. Factors like water current, wind direction, experience of the crew, skill of the *sarang* (captain), etc. have an impact on catches (Das et al., 2012).

Annual and seasonal indices of instability showed that the growth rate of landings in mechanised ring seiner was 25.3% for the period 2002-11, showing a negative growth rate of -3.20 for motorized ring seiners. Instability index of mechanised and motorized ring seine fishery were observed to be 38 and 36% respectively for the overall period 2002 to 2011. With respect to seasons, however, there is fluctuation. For motorized ring seine fishery the instability, was 92, 75 and 97% during pre-monsoon, monsoon and post-monsoon periods respectively. In mechanised ring seine fishery, the instability was 37, 61 and 46% for pre-monsoon, monsoon and post-monsoon periods respectively. In all the seasons the instability of the motorized ring seine fishery was higher than that of the mechanised ring seine fishery. This can be due to sustained and better landings during monsoon season, the instability was less during this period when compared to the pre and post-monsoon period for motorised ring seiners. Since the mechanised units could go fishing round the year including trawl ban period and were contributing more than 60% to the total landings from the fishery, the instability also tend to be lower than that of the motorized ring seiners

During 2002, motorized ring seine fishery was the dominant fishery with 60% of the craft being motorized and contributing 50% to the total ring seine landings. By 2011, motorized ring seines contributed only 5% to the landings and the number of vessels had reduced to 22% of the total ring seine units that existed in 2002.

Though the capital investment of a large motorized ring seine unit was ₹ 2.5 -4.5 million and that of a mechanised ring seine unit was ₹ 6.5 to 9.5 million, fishermen were reluctant to invest on motorized ring seine units because of high operational expenses. The

Table 1. Relationship between growth rate, coefficient of variation and Instability Index

	Period	Pre-monsoon	Monsoon	Post-monsoon	Total
Mechanised Ring seine					
Growth Rate (%)	2002-11	24.30	27.60	23.30	25.30
Coefficient of Variation	2002-11	56.94	64.46	59.03	60.87
Instability Index	2002-11	0.37	0.61	0.46	0.38
Motorized Ring seine					
Growth Rate (%)	2002-11	3.50	-0.60	-27.10	-3.20
Coefficient of Variation	2002-11	88.42	49.78	66.09	40.90
Instability Index	2002-11	0.92	0.75	0.97	0.36

use of outboard engines that are comparatively less fuel efficient and frequent repair work of the wooden vessels are major reasons for this. In addition, each fishing unit is owned by 3-15 members who are shareholders and get 40% of the returns. Besides this, all the operational expenditure is also deducted before giving the crew share, making it unattractive to labour working onboard. Reduced number of fishing days due to bad weather conditions in the peak season (monsoon) and comparatively less catch for the same effort and time also makes motorized ring seine fishing uneconomical. This has resulted in falling contribution of the motorized fishery.

An attempt has been made in this study to examine the growth and instability of the traditional (outboard) and mechanise (inboard) ringseine fishery of Kerala in the period characterised by relatively high growth rate in the context of mechanization of the fleets. Growth rate from the mechanised ring seine sector was high during the study period with an average of about 25%. The motorized ring seine sector showed negative trends in the monsoon and post-monsoon period. The instability index was almost similar in both the sectors though there are seasonal variations.

The negative growth rate for motorized ring seiners can be attributed to the gradual withdrawal of motorized crafts from the fishery and entry of new mechanised units. High instability in motorized ring seine units was due to the more number of fishing days with poor or no fish catch, mainly because of heavy competition from the mechanised units for the same target species *viz.,* sardines and mackerel. The high instability of mechanised ring seiners in monsoon period can be accounted for by reduced number of effective fishing days due to bad weather and net damage. Better utilization of information from Potential Fishing Zone advisories and weather forecasts may improve fish finding and reduce uncertainties and loss.

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