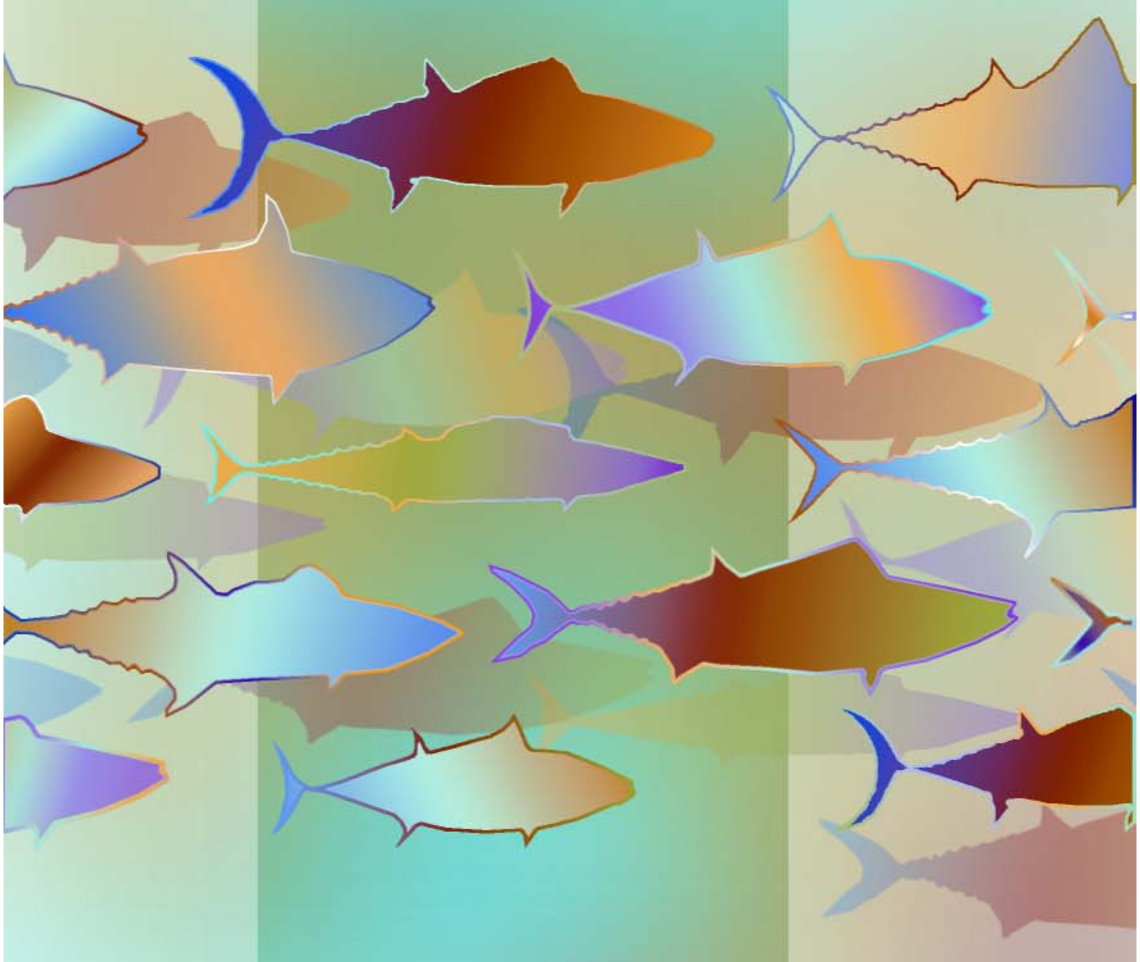
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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Indian Oil Sardine

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1. Introduction

The Indian oil sardine, Sardinella longiceps (Fig. 1) is a very important pelagic fish species which contributes to about 15% of the total marine fish production in India. Local names of oil sardine are, Mathi, Nalla mathi, Nei chala (Malayalam); Bhutai (Kannada); Tarli (Marathi and Hindi); Nonalai, Peichalai (Tamil); Noona-Kavallu (Telugu); Nna Kavala, Disco kabala (Oriya). Besides being a favoured, nutritionally rich and affordable table fish occurring abundantly almost throughout the year, it also serves as a source for valuable by-products like sardine oil used in several industries and fish-meal for cattle and poultry feed production. Its fishery is characterised by remarkably wide fluctuations on a seasonal, annual and decadal scale. The successful years of oil sardine fishery bring as much prosperity to the fishing community as its failure a major economic setback.

Fig. 1. Sardinella longiceps

Along the Indian coast, it is distributed on the entire west coast from Gujarat to Kerala and also on the Tamil Nadu, Andhra Pradesh and Orissa coasts in the east but highest abundance and large scale shoaling are observed off Kerala and Karnataka coasts. Although oil sardine is available up to 50 m depth, the maximum abundance is within 30m, where it forms a major inshore fishery exploited by both traditional and mechanised gears.

2. Production trends

The fishery was exceptionally good during 1923-24 season (57,000 t) along the west coast after which it showed declining trend for subsequent 22 years with catches reported at less than 500 t during 1943-47 period. Revival of the oil sardine fishery was observed from 1950 and the landings improved tremendously during 1964-68 period with a record yield of 3.01 lakh t in 1968 after which it again showed a declining trend. The catches peaked in 1989 (2.89 lakh t) and gradually declined thereafter till 1994 (47,000t) subsequently showing a progressive increase with a record landing of 3.63 lakh t during 2000 (Fig. 2).

Until the 80's, the southwest coastal states of Kerala and Karnataka accounted for nearly 95% of the oil sardine landings. But since 1988, there has been a steady decline in the catches along the Karnataka coast where its contribution to the total fish landings decreased from 33% (1980s) to 7% (1990s), while wide annual fluctuations have been observed along the Kerala coast. Since 1986, vis- a- vis the decline of oil sardine fishery along the southwest coast, there has been a phenomenal rise in the landings along the southeast coastal states of Tamil Nadu and Andhra Pradesh while in the northeastern states of West Bengal and Orissa, a new fishery has emerged from a position of almost no landings. (Figs. 2, 3 & 4)

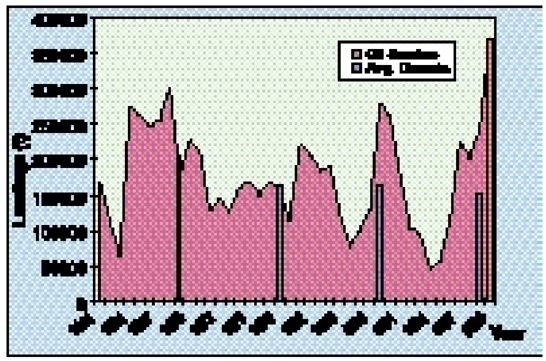

Fig. 2. Annual and decadal trend of oil sardine production in India (1951-2000)

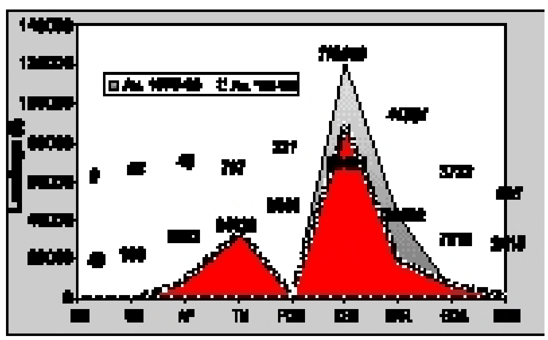

Fig. 3. Statewise production of oil sardine during 1986-2000 as compared to 1976-85 period

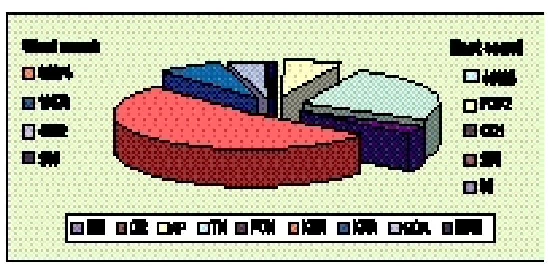

Fig. 4. Statewise average catch trend (tonnes) during [illegible]

Fishing season

On the southwest coast, the oil sardine fishery commences soon after the outbreak of monsoon in June and continues till March-April. Along the Kerala coast catches are fairly high throughout the year except during March-May, while in the Karnataka-Goa belt, the season starts in September/October with peak fishing during October to January period. On the southeast coast, the fishing season is from April to December with peak catches during April-June on the Tamil Nadu coast and July-October along the Andhra coast (Table 1).

Table 1. Seasonal landing pattern of oil sardine (in %) along the southwest coast of India prior to and consequent to introduction of new fishing technologies and facilities

Quarterwise % contribution	Artisanal Fishery Phase Av. 1960-66			Motorisation/Mechanisation Phase Av. 1985-93		
	Kerala	Karnataka	SW Coast	Kerala	Karnataka	SW Coast
Q1 (Jan. - Mar.)	25.6	32.6	29.1	27.3	35.4	31.3
Q2 (Apr. - Jun.)	5.2	3.2	4.2	14.2	9.1	11.7
Q3 (Jul. - Sep.)	34.2	8.4	21.3	29.9	12.5	21.2
Q4 (Oct. - Dec.)	35.0	55.8	45.4	28.6	43.0	35.8

Mode of exploitation

Till the close of 1970s, artisanal fishing gears mostly boat and beach seines (Mathikolli, Thangu vala, Kollibale, Rampani) cast nets (Veesuvala) and small meshed gill nets (Mathichala vala) were major gears operated along the southwest coast. With the introduction of mass harvesting gears like purse seines in the late 70's and ring seines in the late 80s along with a steady rise in the motorization of traditional fishing crafts, many of these traditional fishing methods have become redundant. Along the southeast coast, traditional gears, mainly boat seines (Karavala, Peddavala) gill nets (Chalavalai) and bag nets (Edavalai) dominate. In Tamil Nadu, pair trawlers are also operated at 12-16 m depths in Pamban-Rameswaram area while ring seines have been recently introduced in the Palk Bay.

Prior to1975, fishing operations by the artisanal units on the southwest coast were confined to within the 20 m depth zone. The fishing activities during those periods were controlled by the effect of strong monsoon winds on the small boats and canoes. Practically there was no fishing during the monsoon, which had the effect of a closed fishing season and protected the spawners and juveniles in the fishing grounds. Since late 70s, a mechanised purse seine fleet has been introduced which is sufficiently equipped and capable to operate at 30-40 m depths almost throughout the year, while motorised ring seine units specifically targeting small pelagics like oil sardine (Fig. 5) and mackerel fish in inshore waters during the monsoon season also. This has caused major changes in the pattern of exploitation of oil sardine on a temporal scale along the southwest coast, where a fishery is pursued during the main breeding and recruitment season also.

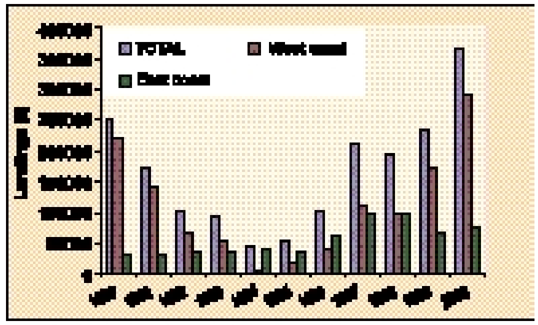

Fig. 5. Trend of oil sardine landings along the Indian coast during 1990-2000

Size composition

Along the west coast, the length composition of catches ranges between 50-220mm. Virgin spawners (140-160 mm) enter the fishery on the Malabar coast during June/July and as the season progresses to September-December, adults occur in reduced quantities and catches are dominated by juveniles (120-140 mm). On the Karnataka coast, spawners enter the fishery during July-September, while new recruits (100-120 mm) and juveniles (120-140 mm) dominate the fishery during August to October and October to February respectively. On the east coast, the size of oil sardine varies between 50-207 mm. Small size groups 50-100 mm are landed in bag nets, shore seines and trawl nets while size above 125 mm occur in gill nets and boat seines. Virgin spawners (150-165 mm) dominate in February-April while juveniles (95-110 mm) occur during May-September and 175-180 mm group during September to October.

In the ring seines operated along the Kerala coast, a significant portion of the catch during the May-July period is composed of young fishes of size 50-90 mm, which occur along with spawners in the inshore fishing grounds. The estimated landings of young fish (<150 mm) in this gear during May-July 2000 period along the Kerala coast was 11,138t which formed nearly 38% (in weight) of the total sardine catch of the period, the rest being constituted mainly by virgin spawners. Currently, about 2,259 ring seines units (1992) are in operation against an optimum fleet of 1,178 units with bigger units being added to this fleet every year. Off Mangalore along the Karnataka coast, bull trawlers operated during September-November period have been reported to land young sardines of 45-77 mm size during the nineties. Considerable quantities of spawners also occur in purse seine catches here during April-June which could have an adverse effect on the fishery in the ensuing season.

3. Biology

Oil sardine grows rapidly during the first few months and matures early within its life span of about 2 ½ years. The age at first maturity occurs at less than one year, at about 150 mm size. Maturation is controlled by climatic factors like temperature and intensity of rainfall experienced by the prespawners. On the west coast peak spawning occurs during June-August, while on the east coast, intense spawning activity has been observed during December to February, April to June and August to October. Through collections of spawners in the oozing condition and planktonic eggs, spawning grounds have been indicated off Quilandy, near Kozhikode, Tanur-Tellicherry belt, Quilon and Mangalore at depths of 20-30 m and about 15 km from the shore. Planktonic eggs and larvae, indicating spawning sites off Chennai coast are also recorded. Seasons of feeble or severe rainfall cause recruitment failure, while a daily rainfall of 20-30 mm during June-August along the southwest coast may indicate a good recruitment to the fishery. As the success of commercial fishery for each season is determined by the number of juveniles recruited at the beginning of the same season, rainfall, which affects spawning success, has been used to forecast the strength of juvenile brood entering the fishery.

The oil sardine is a planktivore and diatoms, dinoflagellates and copepods are the favoured food items. The abundance of diatom *Fragilaria oceanica* is said to indicate abundance of oil sardine in coastal waters. The optimum temperature and salinity ranges for distribution and abundance of oil sardine is 27-28^{0}C and 22.8-33.5 ppt respectively although occasionally they have been observed to enter the estuaries along the southwest coast.

Decadal scale trends in some of the climatic parameters have been found to influence the cyclical pattern observed in many pelagic fisheries. The fluctuations in oil sardine fishery are believed to be due to fishery independent factors as its cyclic abundance pattern shows a striking similarity to the 10/11-year periodicity of sunspot activity. The El Nino phenomenon that might be directly or indirectly influenced by the 11-year solar activity cycle and manifested with an abnormal increase in sea temperature and related changes in hydrographic parameters may also be considered partly responsible for fluctuations in its abundance. Therefore, the size and time of appearance of oil sardine shoals and studies on climatic and hydrographic parameters in relation to spawning biology can all be meaningfully employed in predicting the fishery.

Market

Along the southwest coast, the fish has good demand in local and distant markets and the fishery is fully exploited. On the east coast, demand for local consumption is low and most of the catch is marketed outside the state particularly Kerala. During periods of heavy landings, they are also sun dried and supplied to manufacturers of poultry feed.

4. Stock assessment and management

The average yield during the nineties was 0.13 million tonnes while the estimated maximum sustainable yield is 0.21 million tonnes. Fisheries of small pelagics like oil sardine is characterised by high inter annual and decadal variability making management difficult. There was an unprecedented failure of oil sardine fishery during the forties which had disastrous effects on industries based on it, which provoked the British Administration to introduce restrictive legislation in 1943 to prevent capture of juveniles and spawners. More recently, under the Marine Fishing Regulation Act (MFRA, 1986) passed by various maritime states, fishing by mechanized vessels, especially purse seines during monsoon is banned to protect spawners, but the implementation of the same is not uniform in all the states. Moreover, traditional motorised crafts continue to engage in seining operations using extremely small meshed nets during this period, which destroy both spawners and young fish.

Any fishery which allows uncontrolled exploitation of both juveniles and adults from a stock is likely to experience stock decline. Also, survival of fisheries for juveniles will always depend on the availability of refugia, either geographical or resulting from harvest selectivity, which protects at least a minimum spawning biomass of older fish. Along the Indian coast, creation of infrastructure like harbours and jetties, introduction of motorised traditional crafts and mass harvesting gears like purse seines and ring seines in recent years have enabled fishing to be carried out through the year and entire distributional range of oil sardine, enhancing the chances for growth overfishing and recruitment overfishing to occur. It is imperative that destructive fishing practices using small meshed seines are effectively controlled by enforcing mesh size regulation (minimum 18 mm), closed season and restricted fishing (June-September) besides strict licensing and optimum deployment of fishing units especially ring seines and purse seines. In short, the present coastal fishery scenario demands responsible fishing by all sectors to sustain the fishery as well as ensure the socio-economic well being of the fishermen.

5. Suggested reading

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