

MANAGEMENT OF LESSER SARDINE FISHERY RESOURCES ALONG NORTH ANDHRA COAST

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Kavvalli (in Telugu), the lesser sardines of the genus *Sardinella*, occupy a pride of place among the fishery resources of Andhra Pradesh. This fish having a compressed and moderately elongated form compensates for its small size by its numbers. As the fish is easy to sun dry, it supports a good dry fish trade in the interior markets. Being within the buying capacity of the coastal common folk it serves to their fresh fish needs over a large part of the year.

Prior to the past three decades, it used to be a sight to watch the huge numbers of this fish being landed by each haul of beach seines even though they were operated in quick succession. Then came the nylon gill nets. And now the overall picture of the sardine fishery along the Andhra Coast is appalling. This is mainly due to intensified fishing by gill netting on younger juveniles of lesser sardines as they appear in the early part of their season in the coastal waters. This mode of fishing gave no opportunity for the young fish to grow further in size and contribute to increased tonnage in their landings within the same fishing season. This article presents briefly some aspects of the resource characteristics of the lesser sardines of the Visakhapatnam area and proposes a management measure that may contribute to significant increase in their abundance in the coastal waters.

Sardines (*Sardinella* spp.) are the single largest group of marine fishery resources along the coast of Andhra Pradesh forming about 13% of the total marine fish landings in the State. In the past, the sardine fishery used to be supported by the lesser sardines *Sardinella fimbriata* and *S. gibbosa* along the coast of Andhra Pradesh as also along the coasts of Orissa and West Bengal. But in recent years the oil sardine *S. longiceps* also has been found to be contributing to the sardine landings of this coast as well as the rest of the east coast. But its concentration has been confined to area close to backwaters, rivermouths and harbours. Gill nets accounting for about 75% of their landings are now the chief gear for exploiting the lesser sardine fishery resources. They are operated close to surface and within 50-60 m depth zone. Boat seines also contribute (about 20%) to the landings of sardines, but they are operated in shallower waters. Shore-seines and shrimp trawl are the other gear that land sardines.

According to the accounts on the fishery and biological characteristics of the sardines of Visakhapatnam area available in the two articles in the *Mar. Fish. Infor. Serv. T & E* Ser No.133 (1994), the lesser

sardines and the oil sardine (*S. longiceps*) form about 85% and 4% of the gill net landings, and about 30% and 20% of the boat seine landings. *S. fimbriata* and *S. gibbosa* are the two species of lesser sardines occurring in the area, the former being dominant. Their relative composition in these two gears works out to roughly 70:30 and 90:10 respectively. These three species of sardines appear to form distinct schools, as evidenced by one of the species being dominant in the catches of one kind of fishing unit, on several occasions.

The main fishery season for lesser sardines generally extends from October to April and for the oil sardine it is from June to December. Whether the above details would apply to the resources available all along the rest of the coast of Andhra Pradesh is not known. However, it should be mentioned in this connection that the main fishery season for the lesser sardines at Visakhapatnam coincides with the major fishery season for total fish as a whole in Andhra Pradesh. In the context of the Visakhapatnam establishment of the CMFRI being elevated to the status of Regional Centre, it may be appropriate to extend observations on any fishery resource to other parts of the coast of Andhra Pradesh to make the results more comprehensive.

S. fimbriata occurs in the size range (total length) of 35-196 mm in the landings, the bulk of its catch lying in the size range of 52-112 mm in boat seine and 57-122 mm in gill net. This species is estimated to attain average lengths of 77, 117, 147 and 167 mm at completion of 3, 6, 9 and 12 months of life respectively. It is likely to mature and spawn for the first time in

size (attain size at first maturity) at 147 mm. This would indicate that the fish below this length are juveniles and those above the length are adults. The foregoing details indicate that mainly juveniles below 7 months of age (about 122 mm length) are exploited by the fishery. A study of the seasonal abundance of juvenile fish shows that early juveniles up to 107 mm size group are abundant during September-May and elder juveniles upto 147 mm are abundant during February-May. Adult fish with spent-resting, and maturing gonads forming about 2% of the landings of the species occur during December-August. Fish with mature gonads are rare in the catches. They being met with occasionally during July-August. However, based on the period of the entry of new brood and their growth rate the main spawning season has been adjudged to be during July-October followed by a minor spawning season around January.

S. gibbosa occurs in the size range of 35-183 mm in the landings. But the bulk of its catch lies in the size ranges of 42-97 mm in boat seine and 92-172 mm in gill net. The size at first maturity was estimated as 142 mm. Generally early juveniles upto 107 mm size group are met with in abundance in boat seine, adult fish being rare. In gill net, however, early juveniles are rare and they are met with mostly during September-December, older juveniles are encountered during August-May. Unlike in the case of *S. fimbriata*, adult fish of *S. gibbosa* formed about 50% in gill net landings of this species, and they are met with during November-August, through sporadically. Fish with mature and ripe gonads are encountered during January-April and August, which could represent the major and minor spawning months

respectively of this species. The foregoing details would indicate that *S. gibbosa* spawns in the inshore waters and during the lesser sardine fishery season, whereas *S. fimbriata* spawns mostly in the offshore waters and during the off season of the lesser sardine fishery.

The seasonal distribution and abundance of lesser sardines in the inshore waters of the Andhra coast appears to be influenced by the pattern of the sea-surface circulation of the water masses in the Bay of Bengal. During September-October the lesser sardine stock appears to be brought into the coastal waters from the southeastern parts of the Bay of Bengal through the straits of Sumatra by the counter clockwise circulation of water masses. In the subsequent months of November-January, the abundance of the fish in the coastal waters gets intensified on account of the predominantly west-drift of the surface currents. With the onset of clockwise circulation (that precedes the east-drift) during the succeeding period and its intensification during March-April, the surface coastal waters are deflected to the eastern and southern sections of the Bay of Bengal, and this coincides with the dwindling in the abundance of the lesser sardines along the north Andhra coast. And during May-August as the surface currents are essentially driven by the South-West monsoon, the sea surface circulation takes an easterly direction, then south and Southeasterly evidently transporting most of the adult stock of lesser sardines to the offshore waters coinciding with the end of the lesser sardine fishery season along the north Andhra coast. With the resumption of the northerly coastal surface circulation during September-October, the lesser sardine

fishery starts in the north Andhra coastal waters supported mainly by young juveniles in 50-67 mm length (below three months of age) accompanied by older juveniles and some adults of *S. fimbriata* in advanced stages of maturity. And this cycle appears to be repeated each year. The fresh brood of fish that enter the coastal fishing ground is likely to sojourn there for about seven months. This trend could apply to *S. gibbosa* also.

The period of entry of the lesser sardines into the coastal waters coincides with the period of the maximum biomass production of zooplankton and secondary production along the north east coast of India during November-February, which forms the food of the lesser sardines. And the off season of the sardine fishery coincides with the least biomass of the above plankton groups.

In recent years the lesser sardine landings as well as their relative contribution to the total fish landings of Andhra Pradesh have decreased considerably. The average annual landings have gone down from about 24,000 tonne in the period 1960-84 to a mere 17,000 tonne during 1985-92 period, and this trend is continuing. As the gill net is the chief gear used for the exploitation of the lesser sardines, the size composition of the two species of lesser sardines caught in gill net have been evaluated in an attempt to find the possible reason for this declining trend.

Gill net with mesh sizes 20, 23, 25, 28, 30 and 38 are operated during the lesser sardine fishery season. Operation of gill nets with small meshes gradually changes to those with larger mesh gill net as the season advances. Data on length ranges with mean lengths (mm) in

parenthesis and 95% length ranges of distribution [Mean \pm 1.96] given in vertical brackets for the two species of lesser sardines captured by the different mesh gill nets except the last one (38mm) are given below.

Mesh size(mm)	<i>S. fimbriata</i>	<i>S. gibbosa</i>
20	67-107 (85) [72-97]	102-117 (110) [103-116]
23	72-117 (94) [79-108]	92-137 (117) [100-134]
25	82-127 (105) [100-134]	117-147 (129) [89-120]
28	107-142 (124) [116-142]	112-152 (136) [113-136]
30	127-167 (144) [121-150]	132-177 (154) [140-168]
33	137-187 (163) [146-180]	137-182 (161) [147-175]

A study of these various length details in relation to the gonadal maturity state of the fish captured in the different mesh gill nets would show that in the case of *S. fimbriata* the entire catch of fish in mesh size up to 28 mm (inclusive) and fish up to the mean length (144 mm) in 30 mm mesh net comprise juveniles. In fact, it has been found that among fish caught in 30 mm mesh net, juveniles account for about 50%. But those caught

in 33 mm mesh net the juvenile component works out to about 5% only. In contrast to this, in the case of *S. gibbosa* juveniles comprise the entire catch upto 23 mm mesh size (inclusive) only. Thereafter, they form respectively about 90%, 70% and practically none in 25 mm, 28 mm, and 30 mm mesh gill nets.

To offset the declining trend of the lesser sardine landings the following three measures are proposed in respect of the capture of *S. fimbriata* which forms the dominant catch of lesser sardines and whose juveniles meet with greater mortality through gill netting.

1. Ban the use of gill nets with mesh sizes upto 24 mm (inclusive). This will include gill nets with mesh size 20 mm and 23 mm which at present are extensively used in the early part of the lesser sardine fishery season catching very young juveniles in the length range of 72-108 mm.

It may be mentioned here that this ban can provide only partial relief to young juveniles from mortality due to fishing because by allowing 25 mm and 28 mm mesh gill nets a great bulk of the juvenile fishable stock remains exposed to fishing (see Table). Further, *S. fimbriata* of the size range 52-112 mm is exploited by boat seine whose contribution to the lesser sardine landings, though, is relatively low.

Fish in the size range of 52-112 mm forms the dominant catch of lesser sardines during October-February, the peak fishery season for both the species and particularly so for *S.*

fimbriata by gill net. During the same period older juveniles up to 145 mm length in the case of *S. fimbriata* as well as adults upto 165 mm length in the case of *S. gibbosa* do also occur generally on the same fishing ground in sizeable amounts. These size groups are the right candidates to be targeted for capture by gill nets with 25 - 33 mm mesh sizes during October-February thus allowing the young juveniles to feed on the abundant zooplankton available during the period on the fishing ground, and to grow larger and fatter for a further period of time and become vulnerable to capture by 28-38 mm mesh gill nets during the latter part of the fishery season, before they get carried off the coastal waters during May-August due to

the influence of the southwest monsoon .

2. Employ the currently used larger mesh gill nets namely 25 mm, 28 mm, 30 mm, 33 mm simultaneously in the same fishing net (as multi-mesh gill net) with the extent of the fishing surface of the larger-mesh pieces increasing as the sardine fishery season progresses.
3. Explore the possibility of operating gill nets or midwater trawl nets beyond the present inshore fishing grounds during April-May through voyage fishing to capture sardines that may be carried off the coast by the water mass that is getting deflected from the coast from May onwards.