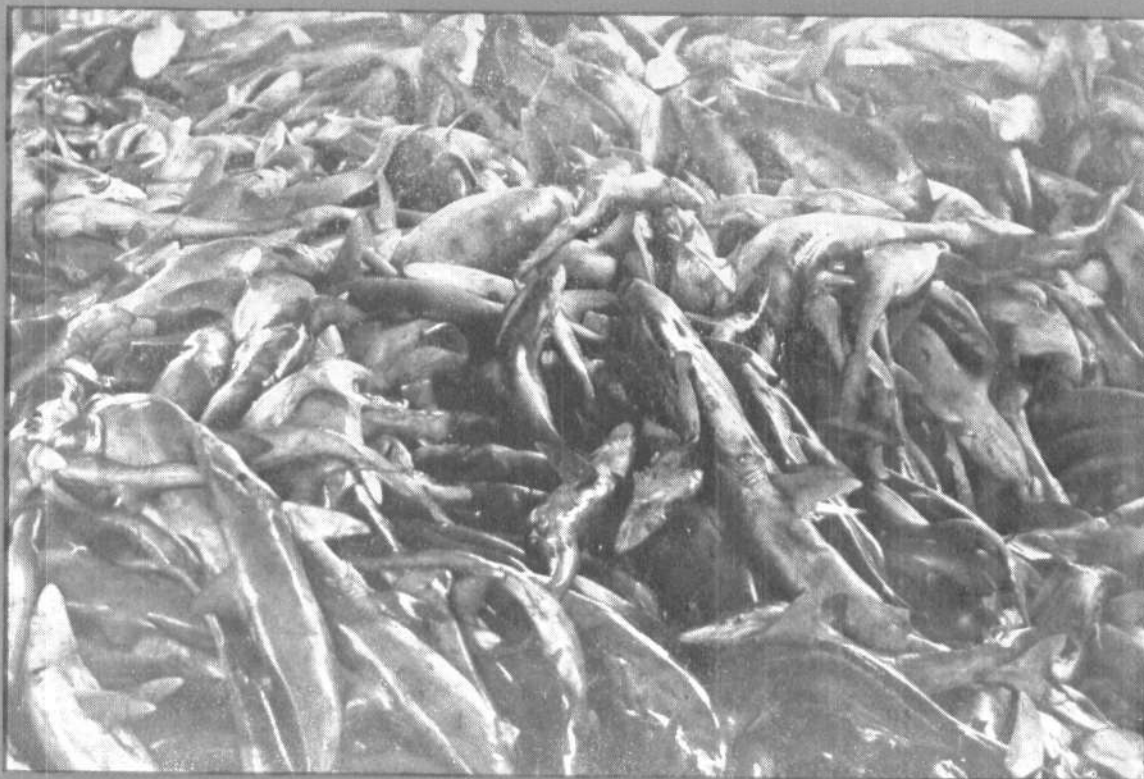




MARINE FISHERIES INFORMATION SERVICE



No. 88
OCTOBER 1988

Technical and Extension Series

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
COCHIN, INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

OIL SARDINE, AN EMERGING NEW FISHERY RESOURCE ALONG THE EAST COAST*

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The oil sardine (*Sardinella longiceps*) (Fig. 1) is known to occur in the Indian waters from Maharashtra to Orissa. Large schools of the fish are encountered in the inshore waters, sustaining a traditional commercial fishery along the coasts of Kerala and Karnataka. Its occurrence along the east coast was considered to be only sporadic and rare. In recent years, however, there has been an increase in the landings of this species along the east coast. This report gives a brief account of the present status of the oil sardine fishery along the east coast.

Statewise production

Statewise annual landings of the oil sardine for the east coast for a period of 26 years (1961-'86) are given in Table 1. Oil sardine did not find a separate entry into fishery prior to 1961 in the records published on the marine fish production in the east coast states. It may be seen from the Table that along the southern section of the east coast (Tamilnadu including Pondicherry), the oil sardine is being recorded in the fish landings more or less continuously since 1961 with breaks in 1962 and 1974-'76. In Andhra Pradesh oil sardine was recorded only during 1966, 1973-'76 and 1985-'86. Along the Orissa coast, however, the fish was noticed in the landings in two periods; during 1969-'74 (with breaks in 1970 and 1972) and from 1984-'86.

*Basic data and information were furnished by Sri. P. Sam Bennet for Tuticorin; Shri J. C. Gnanamuthu and Shri P. T. Meenakshisundaram for Cuddalore, Mahabalipuram and Madras; K. Ramasomayajulu, and K. Dhanaraju for around Gopalpur (Ganjam district); Shri S. Satya Rao for Visakhapatnam and Vizianagaram districts; C. V. Sheshagiri Rao for East Godavari district; and Shri G. C. Lakshmiah for Nellore district. Shri M. S. Sumithrudu assisted in the collection of oil sardine samples and analysis of data at Visakhapatnam and Shri K. V. Somasekharan Nair made available a sample of oil sardine from Cochin.

Considering the oil sardine landings along the east coast it is seen that the landings were low during the period 1961-'81, ranging from one tonne to 1,011 tonnes with the annual average at 215 tonnes, and relatively high during recent years (1982-'86) ranging from 1,084 to 9,157 tonnes with the annual average at 3,797 tonnes.

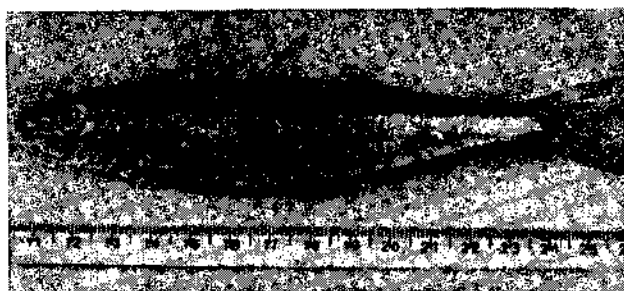


Fig. 1. *Sardinella longiceps*

Thus, in recent years the landings of oil sardine along the east coast have shown a marked increase. Over the 26 year period under consideration, Tamilnadu and Pondicherry together accounted for 85% of the oil sardine catch landed along the east coast followed by Andhra Pradesh 11% and Orissa 4%.

Regional distribution

District-wise landing figures of oil sardine along the east coast states for the period 1983-'86 were examined. In Orissa about 99% of the oil sardine catch was recorded from the southernmost district namely, Ganjam and the rest from Puri and Cuttack in 1984, and none in the northernmost district of Balasore. During 1985 and 1986 the entire catch in Orissa was from Ganjam district. Oil sardine was absent in the

Table 1. *Statewise oil sardine landings (in tonnes) in the east coast during 1961-'86*

Year	Orissa	Andhra Pradesh	Tamilnadu & Pondicherry	Total
1961	—	—	1	1
1962	—	—	—	—
1963	—	—	1	1
1964	—	—	134	134
1965	—	—	32	32
1966	—	61	37	98
1967	—	—	32	32
1968	—	—	412	412
1969	247	—	18	265
1970	—	—	46	46
1971	2	—	45	47
1972	—	—	146	146
1973	38	125	45	208
1974	4	564	—	568
1975	—	131	—	131
1976	—	112	—	112
1977	—	—	714	714
1978	—	—	36	36
1979	—	—	1,011	1,011
1980	—	—	320	320
1981	—	—	195	195
1982	—	—	1,084	1,084
1983	—	—	1,461	1,461
1984	539	—	2,115	2,654
1985	96	263	4,270	4,629
1986	12	1,255	7,890	9,157
Total	938	2,511	20,045	23,494
Percentage	3.99	10.69	85.32	

catches along the Orissa coast during 1983. In Andhra Pradesh oil sardine was recorded from Vizianagaram and Visakhapatnam in the north and from Prakasam and Nellore districts in the south during 1985. But in 1986 the fish was recorded only from Vizianagaram, Visakhapatnam and East Godavari districts. Over the two year period (1985-'86), bulk of the catch was recorded only in Visakhapatnam and East Godavari districts. Only stray specimens were observed in Srikakulam district during March-April, 1986. Earlier, oil sardine was observed in the landings on a single occasion (18-5-1983) at Lawsons Bay, Visakhapatnam. An estimated 765 kg of the fish was caught in a single

haul of shore seine. The fish measured 145-165 mm in total length. Thereafter oil sardine was noticed in the inshore catches, only in 1985; in the 1st quarter in Nellore and Prakasam districts, from the 2nd quarter in Visakhapatnam district and from 3rd quarter from Vizianagaram district. In Tamilnadu including Pondicherry the oil sardine catches were mostly obtained from South Arcot district (37%) and Pondicherry (27%) followed by Chingelpattu (18%), Kanyakumari (5%), Tirunelveli, Ramanathapuram and Tanjore districts (each 4%) and Madras (1%). There was no record of the fish from Pudukkottai district during the period 1983-'86.

Seasonal distribution

Quarterwise oil sardine landings, in the east coast states for the different years during 1983-'86 are given in Table 2. During this period the oil sardine first appeared in the landings along Orissa coast in March 1984. Thereafter, the catches improved considerably but declined in 1986. Over the period 1984-'86 oil sardine catches were obtained mostly during the second quarter followed by the third, fourth and first quarters. In Andhra Pradesh, over the period 1985-'86, the bulk of the catch was obtained during the fourth quarter followed by third, together accounting for 88% of the annual landings. Catches during the second quarter were very poor. Along the Tamilnadu-Pondicherry coast also the third and fourth quarters yielded the bulk (80%) of the annual landings during the period 1983-'86. Considering the district-wise landings over the period, either the third or the fourth quarter witnessed the maximum landings in the different districts. However, fairly good catches were obtained during the second quarter in Chingelpattu, Tanjore, Ramanathapuram and Kanyakumari districts, and during both the first and second quarters in Tinneveli district. Thus best catches were witnessed during the third and fourth quarters along the Tamilnadu-Pondicherry-Andhra Pradesh coasts and during the second quarter along the Orissa coast.

Gear and catch per net

Gill nets, boat seines, bag nets, shore seines, drag nets and shrimp trawls landed the oil sardine along the east coast.

In Orissa state bulk of the oil sardine catch was landed by gill net ('Kotla vala') and the rest by shore seine and drag net. Around Gopalpur (Ganjam dis-

trict) gill nets landed 1-27 kg/net with the average around 14 kg. Boat seines landed 1-120 kg/net, but shore seine landed only stray specimens. Drag nets (with mesh size of 1-2 cm) obtained 5-140 kg of small sized oil sardine per haul during May and July, 1985.

Table 2. Quarterwise oil sardine landings (in tonnes) in the east coast states during 1983-'86

Quarter/ year	I	II	III	IV	Total
Orissa					
1983	—	—	—	—	—
1984	—	535	4	—	539
1985	—	33	47	16	96
1986	5	1	6	—	12
Total	5	569	57	16	647

Per- centage	0.77	87.95	8.81	2.47	
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Andhra Pradesh

1983	—	—	—	—	—
1984	—	—	—	—	—
1985	164	1	18	80	263
1986	2	16	499	738	1,255
Total	166	17	517	818	1,518

Per- centage	1.94	1.12	34.06	53.89	
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Tamilnadu & Pondicherry

1983	156	128	251	926	1,461
1984	627	159	57	1,272	2,115
1985	209	721	1,613	1,727	4,270
1986	909	322	4,366	2,293	7,890
Total	1,901	1,330	6,287	6,218	15,736

Per- centage	12.08	8.45	39.95	39.51	
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In Andhra Pradesh bulk of the oil sardine catch was recorded from shore seines ('Alivi vala' and 'Pedda vala') followed by boat seines/bag nets ('Iragavala'), gill nets ('Vaddi vala') and shrimp trawls. However,

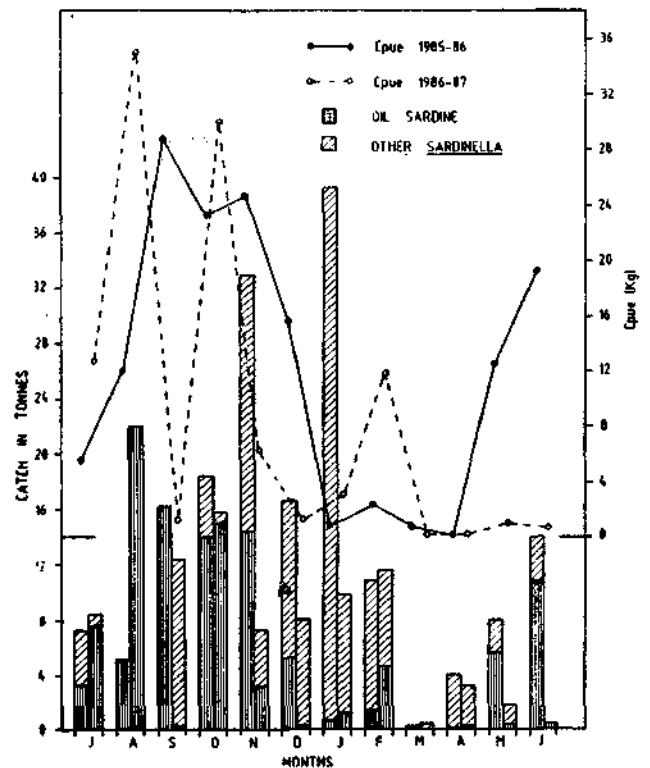


Fig. 2. Monthly trends in the catches of oil sardine *S. longiceps*, and of the other sardines (*S. fimbriata* and *S. gibbosa*) during 1985-'86 (left) and 1986-'87 (right) and CPUE (catch per net per trip) of oil sardine landed by boat seine at Visakhapatnam Outer Harbour.

at the Visakhapatnam Outer Harbour landing centre (Jalaripeta) 99.9% of the oil sardine catch was landed by boat seine ('Iragavala') and the rest by gill net. Occasionally, oil sardine was also met with in shrimp trawl landings. At Visakhapatnam this fish is being landed regularly by boat seine since July, 1985. Oil sardine was observed in the catches of boat seines operated both within the breakwater area where the depth varies between 15-25 metres and out at sea within 2-3 km from the shore. During July, 1985-June, '87 period, the fish was available in all the months except in March, 1987 (Fig. 2). In boat seines oil sardine catch amounted to 77.1 and 55.7 t forming 45 and 55% of the total sardine catch in the first and second year respectively. Out of the 310 units of boat seines sampled over the two year period, 83% had oil sardine, the catch varying around 0.25 to 100 kg per net. The monthly catch per boat seine ranged from 0.16 to 28.8 kg with the annual average at 12.31 kg during July, 1985-June, 1986 and from 0.29 to 35.15 kg with the average at 8.52 kg during July, 1986-June, 1987. Good catch rates were available during August-December and May-June in the first year and during July, August, October and February in the second year.

Only stray numbers were caught in gill net, the annual catch being 1.4 and 2.8 t forming 1 and 4% of the total sardine catch landed by this gear in the first and second years respectively.

However, at landing centres located 30 km south and 20 km north of Visakhapatnam (Outer Harbour) where gill net (10–40 mm mesh) is the dominant gear operated, about 35% of the gill nets sampled had oil sardine with a catch rate of 2–10 kg and average at 6 kg.

In the East Godavari district, oil sardine was recorded upto about 35 km north of Kakinada only. Absence of this fish in the catches towards south of Kakinada appears to be due to non-operation of small meshed gear. Along the coast north of Kakinada, oil sardine was reported to occur in at least 50% of the units of the indigenous gear and in most of the shrimp trawl during September–November, 1986. Oil sardine catches ranged between 0.5 and 8 kg with the average at 1 kg in gill net and between 1 and 20 kg in shore seine. In a single shore seine operation on 22–9–1986 (night) about 3.6 tonnes of oil sardine were landed at Kothapatnam located about 20 km north of Kakinada. In shrimp trawl the catch rate of this fish was 1.0–4.2 kg per net. The fish was caught in depths of 5–30 m by the indigenous gear and 15–40 m by shrimp trawl.

Along the Gangapatnam–Ramatheertham coast of Nellore district, dip nets ('Kudupu valai') operated by 4–5 catamarans within half a kilometre from the shore have obtained a catch of 200–3,000 kg per day during the first quarter of 1985.

In Tamilnadu and Pondicherry, gill nets ('Thattaku vala valai', 'Kavala valai' and 'Chala valai'), boat seines and bag nets ('Edava valai', 'Madi valai', 'Thattumadi') accounted for most of the oil sardine landings. Along the coasts of Cuddalore, Mahabalipuram and Madras some gill nets landed 5–320 kg per net and bag nets upto 900 kg per net. Bulk of the catch came from 12–20 m depth. At Parangipettai, oil sardine catch of about 80 tonnes was recorded during October, 1985–September, 1986, bulk of which (71 t) being obtained during July–September, 1986. 'Kavala valai' and 'Salangai valai' contributed to this catch.

At Tuticorin the oil sardine catch was mainly obtained by gill net though sporadically. The annual landings during 1972–'85 ranged between 3.2 t in 1972 and 529.3 t in 1980 with the annual average at 92.3 t. Bulk of the catch was obtained during November–

January accounting for 65.8% of the annual catch followed by August–October (21.8%) and February–May (12.43%). The ranges in catch (in kg) and their averages (given in paranthesis) for the above three periods were 0.4–21.3 (7.3), 0.2–17.1 (6.3) and 0.1–4.8 (1.4) respectively.

Table 3. District-wise oil sardine landings (in tonnes) in Karnataka, Kerala, Andhra Pradesh and Orissa during 1983–'86

S. No.	Districts	1983	1984	1985	1986
1.	N. Canara	4,061	6,087	11,651	11,370
2.	S. Canara	17,640	30,236	19,161	15,380
3.	Cannanore	9,748	8,216	3,445	880
4.	Kozhikode	12,309	13,348	16,237	13,839
5.	Malappuram	24,852	26,615	7,753	15,049
6.	Trichur	12,579	10,661	3,779	1,183
7.	Ernakulam	15,674	25,978	9,282	2,344
8.	Alleppey	21,623	23,296	12,159	6,677
9.	Quilon	53,493	38,596	25,801	624
10.	Trivandrum	4,594	420	769	890
11.	Kanyakumari	400	203	209	8
12.	Thirunelveli	1	—	494	183
13.	Ramanathapuram	312	262	—	—
14.	Pudukkottai	—	—	—	—
15.	Tanjore	—	2	69	564
16.	Pondicherry	141	920	1,374	1,797
17.	S. Arcot	511	718	1,282	3,316
18.	Madras	—	7	93	12
19.	Chingelpattu	96	3	749	2,010
20.	Nellore	—	—	131	—
21.	Prakasam	—	—	33	—
22.	Guntur	—	—	—	—
23.	Krishna	—	—	—	—
24.	West Godavari	—	—	—	—
25.	East Godavari	—	—	—	686
26.	Visakhapatnam	—	—	75	512
27.	Vizianagaram	—	—	24	57
28.	Srikakulam	—	—	—	—
29.	Ganjam	—	533	96	12
30.	Puri	—	4	—	—
31.	Cuttack	—	2	—	—
32.	Balasore	—	—	—	—

Length distribution

Oil sardine caught along the east coast ranged between 40 and 207 mm in total length. As gill

nets are the major gear landing this fish at most centres, large sized fish, from around 125 mm length onwards, formed the major catch along the east coast.

Around Gopalpur, 120-175 mm size was caught in gill nets. Similar large sized fish were also caught in boat seines and shore seines. Good quantities of fish measuring 50-100 mm were caught during May-July and December, 1985 in drag nets (10-20 mm mesh size), boat seines and shore seines.

At Kakinada and adjacent centres towards north (East Godavari district), size ranges of 170-195 mm in gill net, 125-198 mm in shore seine and 160-195 mm in trawl net were observed during September-November, 1986.

At Visakhapatnam, fish caught in gill nets and shrimp trawls ranged in size of 100-175 mm and 70-165 mm respectively. But in boat seines it occurred in the size range of 40-205 mm. Dominant size ranges in different periods were 100-160 mm during July, '85-April, '86, 40-145mm during July, '86 - February, '87 and 60-135 mm during April-June, '87. Examination of Fig. 3 would reveal that from the parental stock that started occurring in the area around July, '85 with the dominant sizes at 100-105 mm the first progeny was recruited to the inshore catches at 50-85 mm size during May-July, '86 and the second progeny at 60-95 mm size during April-May, '87, thus indicating that the oil sardine has successfully bred in the sea off Visakhapatnam and is establishing itself in this area.

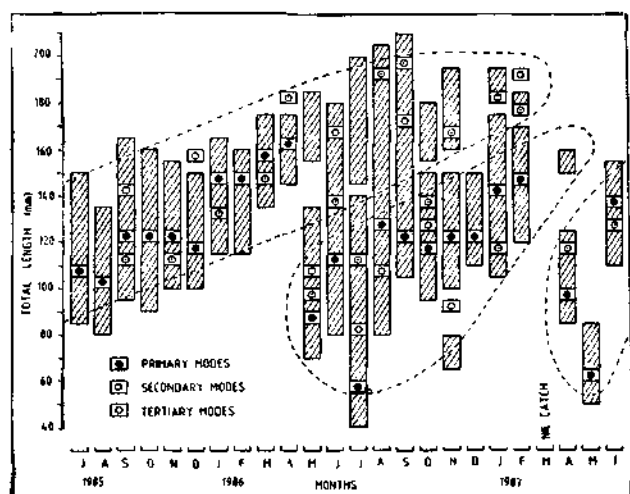


Fig. 3. Monthly total length ranges and length modes of oil sardine, landed by boat seine at Visakhapatnam Outer Harbour, during July, 1985 to June, 1987. (Length distributions of the parental stock and those of the two successive generations are delineated.)

In Tamilnadu-Pondicherry area the size range of 126-202 mm was recorded. At Pondicherry it was 140-202 mm in gill net landings during November-December, 1983 with bulk of the catch around 170 mm. At Madras during September, 1977 to March, '78 the size range of 126-195 mm with majority at 150-159 mm was met with in gill net catches. At Parangipettai fish of the size 102-193 mm, 60% of which being above 150 mm were recorded in 'Kavala valai' and 'Salangai valai' (both gill nets) during October, 1985 to September, '86. In the occasional samples examined during 1971-'73 and 1982-'84 at Tuticorin, the oil sardine occurred in the size range of 120-185 mm. Fish of 125-155 mm in size range with 135 and 140mm in modal lengths were common in the catches of both gill net (25 mm mesh size) and shore seine.

State of gonadal maturity

Information on this aspect is very scanty. Kuthalingam (*Treubia*, 25 (2): 202-213, 1960) reported on the eggs, newly hatched larvae, larvae upto 40 days after hatching and food of post-larvae of *Sardinella longiceps* from the Madras coast. Gnanamuthu and Girijavallabhan (*Indian J. Fish.*, 31 (3): 378-379, 1984) reported on the occurrence of mature oil sardine during January-March, 1978, off Madras. They have shown that ovaries in stage V possessed an advanced group of eggs measuring 0.63-0.648 mm and a less developed group measuring 0.37-0.396 mm. Males predominated the catches. At Pondicherry fish caught during November-December, 1983 had gonads in first and second stages of maturity and females outnumbered males (Srinivasarengan and Chidambaram, *Mar. Fish. Infor. Serv., T & E Ser.*, 61: 16-17, 1985).

At Parangipettai fish in advanced stages of maturity were observed during July-September, 1986 and at Tuticorin in September, 1982, May, 1983 and March, 1984.

At Visakhapatnam, fish with gonads in advanced stages of maturity (V-VII) were met with from January-September, 1986 and in January-February, 1987. They formed 55% of the catch in January, 1986, 79% in February, 1986, 91-100% during March-September, 1986, 7% in January, 1987 and 29% in February, 1987. In October and November, 1986, gonads upto stage III only were met with in adult fish (beyond 149 mm total length). In December, 1986 only stages I and II were observed. In March, 1987 oil sardine was absent in the catches. From April to June, 1987 fish with gonads in stages I-II only were met with. However, there is evidence

that the fish had spawned off Visakhapatnam during March–April, 1987 as juveniles in 50–80 mm size range formed the dominant catch of the species in May, 1987. According to Antony Raja (*Bull. cent. mar. Fish. Res. Inst.*, 16: 1–128, 1969) *S. longiceps* attains 60–95 mm length when it is one month old. It appears that adult moves away from the near shore waters for spawning. The so-called parental stock of the oil sardine had a size range of 115–170 mm during January–March, 1986. During this period, the minimum size of fish with gonads in stage V and beyond was 115 mm. Fish in maturity stages V–VIIa (partially spent) formed 57% in the size range of 115–145 mm in January, about 79% in 115–145 mm in February, and 100% in 135–145 mm in March, 1986. Thereafter gonads in the above stages of maturity were rarely met with in fish below 149 mm length, except in February, 1987 when only 13% of the fishes in 130–140 mm length had gonads in stages V–VIIa. But with regard to fish of the first generation from the

parental stock during July, 1986 to June, 1987 fish in advanced stages of maturity were not met with below 140 mm length group.

Concomitant observations on oil sardine catches

One or a few of the following species of fishes were caught along with oil sardine at different centres along the east coast. They were *Sardinella fimbriata*, *S. gibbosa*, *S. dayi*, *Rastrelliger kanagurta*, and species of *Dussumieria*, *Stolephorus*, *Thryssa*, *Leiognathus*, *Cynoglossus*, *Gerres*, *Nemipterus*, *Trichiurus* and *Sphyraena*.

In Orissa, the fishermen of Chatrapuri-Ganjam area state that they have observed on many occasions large schools of oil sardine at the surface of the sea very close to Rushikulya river mouth.

Around Kakinada, very good catches of oil sardine were obtained in artisanal gear and shrimp trawl soon after the severe cyclone in August, 1986. Similarly good catches of oil sardine were obtained off Penna

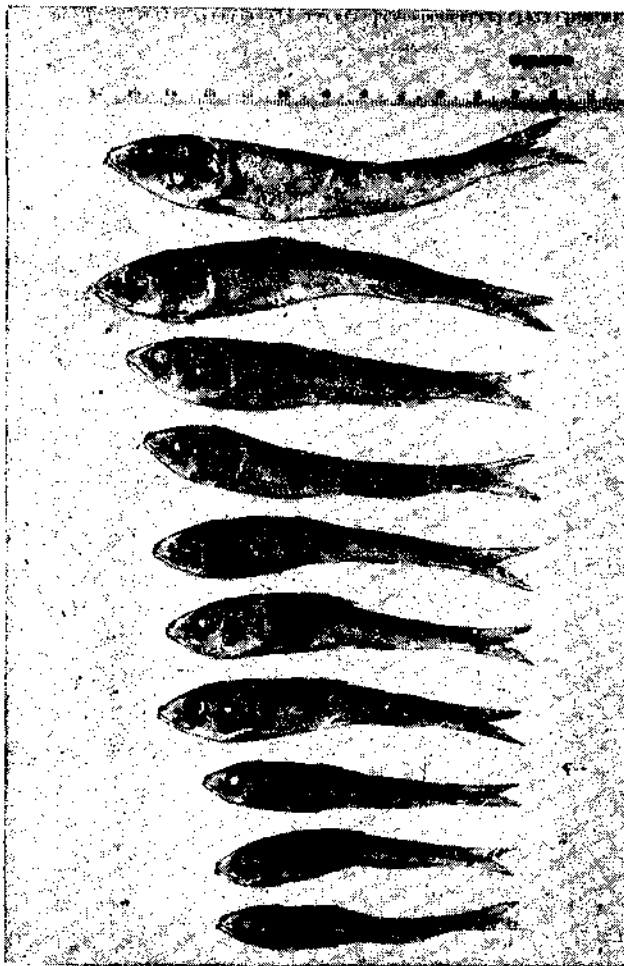


Fig. 4. Oil sardine *S. longiceps* in emaciated state met with during July–August, 1985 when this species made its debut into the regular fishery off Visakhapatnam.

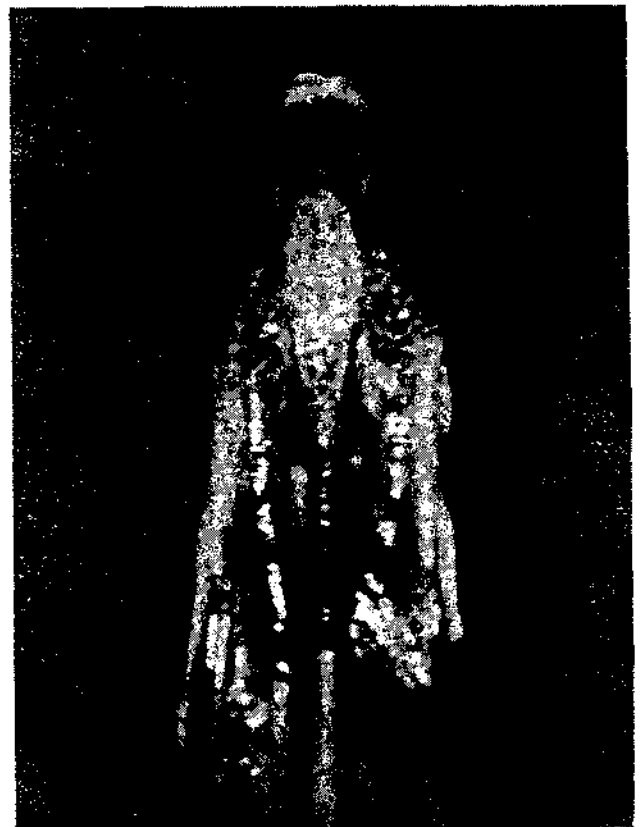


Fig. 5. Pattern of pigmentation on the tongue of *S. longiceps*, 140 mm total length.

river mouth in the Gangapatnam - Ramatheertham area in Nellore district.

Although the oil sardine has been occurring regularly in the catches of boat seines operated both within the break water area of the Visakhapatnam Outer Harbour and in the near-shore area since July, 1985, the extent of its distribution towards north (upto 50 km considered) and south (upto 44 km considered) of the harbour is rather restricted, to certain localities. Examination of the records of the fishery data of the Visakhapatnam and Vizianagaram districts reveals that oil sardine occurred in the catches of shore seine, boat seine or gill net (in which oil sardine is likely to be caught) in one out of 20 centres towards north and in four out of 13 centres towards south. They are Bheemunipatnam (22 km) in the north; four out of seven observations and in the south Dibbavalasa (6 km) two out of seven, Jalaripeta (Cheepurupalli, 22 km) one out of one, Thanthidi (26 km) one out of three and Poodimadaka (30 km) one out of ten observations. Interestingly, these landing centres are located in continuity with brackish water areas.

When the oil sardine occurred at Visakhapatnam, majority of fish were found to be very much emaciated, the prominent part of the fish being only the head (Fig. 4). Condition of feed of these fishes varied between 1/4 full to empty stomach.

Future Research

It is interesting to note that the oil sardine catches along the east coast are obtained mostly in areas close to harbours, backwaters and river mouths. This discontinuous distribution of the fish appears to indicate its affinity, particularly in its juvenile phase, to areas that have a certain admixture of fresh or brackishwater. Salinity as a limiting factor could perhaps be ruled out since the ambient salinity along the east coast is less than that along the west coast. Some other factor/factors associated with the brackishwater environment may have to be probed to explain this patchy occurrence of the oil sardine along the east coast. Intensive studies on the ecology of the oil sardine would help to elucidate and establish this relationship.

