OIL SARDINE FISHERY AT KOZHIKODE DURING THE SEASONS 1959-60 to 1962-63

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Introduction

Judged from the magnitude of the oil sardine catches constituting over 20% of the total marine fish landings in India during some years (Table I), the

Table I

Oil sardine and total marine fish landings (tonnes) in India from 1950–1963

Year	Total marine fish	Oil sardine	Percentage of oil sardine
1950	580021	34420	5·9
1951	533916	17240	3·4
1952	528346	13895	2·5
1953	581460	51831	8·9
1954	588257	33952	5·8
1955	595722	30447	5·1
1956	718702	77412	0·1
1957	875420	191469	21·2
1958	755774	123730	16·4
1959	584193	69234	11·8
1960	878242	189016	21·5
1961	683569	167884	24·6
1962	644244	110229	17·1
1963	655484	63647	9·6

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importance of this eryfish particularly along the Kerala and Mysore coasts can hardly be overestimated. The oil sardine fishery is known for the serious set-backs it had suffered at irregular intervals during the last few decades (Nair and Chidambaram, 1951; Nair, 1958), but the revival of the fishery, especially during the late fifties and early sixties, has been remarkable. Although the fishery in general is spread over the Kerala and South Kanara coasts, yet even within this region a zonal distribution in the intensity of occurrence of shoals, particularly in the Malpe and Kozhikode zones, has been reported by Nair (1952). He has further stated that between these two zones, Kozhikode is the better region for this fishery. Therefore, the observations on some aspects of the oil sardine fishery at Kozhikode for four consecutive seasons presented here, in addition to highlighting the salient features of the oil sardine fishery in this zone, would perhaps reflect the general conditions concerning this fishery during these years.

Methods

The data presented here were collected from the Vellayil fish landing centre at Kozhikode. For estimating the total landings, only the catches landed by gears operated for oil sardine were taken into consideration. During the period of this study, the gears which accounted for the oil sardine landings were the following: *Pattenkolli vala*, *Mathikolli vala*, *Paithu vala*, *Thattum vala*, *Nethel vala* (boat-seines), *Mathichala vala* (gill-net) and cast-net. In addition to these, stray catches of oil sardine were occasionally landed by *Odam vala*, *Aila vala* and *Urukku vala* (boat-seines) which have been included under 'others' for the sake of convenience in grouping. On an average, about 20% of the number of gears operated each day were examined for recording the catch statistics based on which the total landings by each gear for a day/month were calculated. In order to find out the efficiency of the different types of gears, the quarterly and annual CPN (catch-per-net) and CPUE (catch-per-unit of effort) of the different nets have also been worked out from the total estimated catch. For size frequency studies, measurements (total length) recorded from samples drawn from different gears were pooled and analysed for getting a clear picture of the size composition of the oil sardine population (Nair, 1952). In the figures showing the size frequency distribution, frequencies of individuals grouped at 5 mm intervals (*e.g.*, 50–54 mm group is termed as 50 mm group) have been converted into percentages and plotted.

Trend of Oil Sardine Fishery During the Seasons 1959–63

It is apparent from Table II that there was a steady improvement in the oil sardine fishery at Kozhikode from 1959–60 to 1961–62 followed by a

TABLE II

Total oil sardine landings at Kozhikode 1959–1963 (*in tonnes*)

	1959–60	1960–61	1961–62	1962–63
April ..	..	..	79·01	78·63
May ..	97·71	53·76	18·80	94·37
June ..	1·42	2·29	49·97	..
July ..	13·18	245·79	228·45	553·41
August ..	136·36	851·02	929·09	420·44
September ..	33·56	791·20	979·30	119·37
October ..	539·70	1729·30	1295·83	249·74
November ..	290·46	477·31	913·72	520·06
December ..	111·45	1006·00	1263·79	331·47
January ..	314·59	1268·69	1216·26	590·17
February ..	21·73	995·40	798·90	281·96
March ..	..	256·62	233·42	97·57
TOTAL ..	1560·16	7677·38	7998·54	3337·19

decline in 1962–63. The data clearly indicate the typical fluctuating nature of the oil sardine fishery. During the period under investigation the poorest season was in 1959–60, when only 1950·16 tonnes of oil sardine were landed as against the record catch of 7998·54 tonnes in 1961–62. It could be seen from Table II that during most of the years over 90% of the oil sardine landings were made between July and February, the commencement of the oil sardine fishery being mostly in July following the onset of the south-west monsoon.

Among the different gears, *Pattenkolli vala* had landed the highest percentage of oil sardine in 1959–60 and 1960–61 and *Mathikolli vala* in 1961–62 and *Nethel vala* in 1962–63, the quantity of oil sardine caught by the rest of the gears being negligible. Taking into consideration all the gears operated for oil sardine and the percentage of oil sardine caught by them on an annual basis, it is seen (Table III) that the highest percentage

(96·9) was recorded in 1960–61, followed by 94·2% in 1961–62, 87·4% in 1962–63 and 83·9% in 1959–60. It may be stated here that the low percentage of oil sardine during 1959–60 and 1962–63 was mainly because of the fact that some of the gears operated for oil sardine had caught good quantities of other fishes such as mackerel and white bait also during these years.

TABLE III

Annual catch (tonnes) of oil sardine by different gears (percentage of oil sardine caught by each gear is shown in brackets)

	1959–60	1960–61	1961–62	1962–63
Pattenkolli ..	1135·53 (72·8)	6767·03 (88·13)	1676·55 (20·96)	1334·52 (39·99)
Mathikolli ..	..	..	4643·34 (58·05)	1874·78 (56·17)
Mathichala ..	9·49 (0·6)	35·14 (0·46)	50·81 (0·63)	25·32 (0·76)
Paithu vala ..	18·30 (1·17)	18·54 (0·24)	139·02 (1·75)	13·84 (0.41)
Thattum vala	391·45 25·09)	807·89 10·53)	1192·26 14·90	..
Nethel vala ..	..	48·67 (0·63)	292·06 (3·65)	87·81 (2·63)
Cast net ..	5·16 (0·33)	..	4·50 (0·05)	0·92 (0·03)
Others ..	0·24 (0·01)	0·11 (0·001)	..	..
Total oil sardine	1560·16	7677·38	7998·54	3337·19
Total all fish ..	1858·12	7919·61	8487·83	3817·33
Percentage of oil sardine ..	83·9	96·9	94·2	87·4

CATCH-PER-NET AND CATCH-PER-UNIT OF EFFORT

Comparing the annual catch-per-net of the different gears, it could be seen (Table IV) that the catch-per-net of boat-seines was generally higher than

either gill-net or cast-net. Among the boat-seines, in 1959–60 *Thattum vala* (350·76 kg.) had the highest catch-per-net followed by *Pattenkolli vala* (294·63 kg.). In 1960–61, the catch-per-net of *Pattenkolli vala* (818·46 kg.) was the highest, the other gears in the order of importance being *Thattum vala* (397·12 kg.) and *Nethel vala* (178·28 kg.), whereas in 1961–62 *Mathikolli vala* (683·95 kg.), *Thattum vala* (530·37 kg.), *Pattenkolli vala* (441·41 kg.), *Nethel vala* (398·95 kg.), *Paithu vala* (308·94 kg.) were the important gears which accounted for the oil sardine landings. In 1962–63 also *Mathikolli vala* (415·42 kg.) had the highest catch-per-net followed by *Pattenkolli vala* (373·5 kg.), *Paithu vala* (200·58 kg.) and cast-net (102·22 kg.). Judged from the variations in the catch-per-net of the gears operated for oil sardine, it is seen that the catch-per-gear varied from year to year. Thus, the highest catch-per-net for *Pattenkolli vala* (818·46 kg.) was recorded in 1960–61, *Thattum vala* (530·37 kg,), *Nethel vala* (398·95 kg.) and *Paithu vala* (368·94 kg.) in 1961–62 and cast-net (184·28 kg.) in 1959–60.

However, comparing the catch-per-unit of effort of the different gears it is seen (Table V) that high values were recorded by *Pattenkolli vala* (9·35 kg.) and cast-net (9·15 kg. and 8·21 kg.) in 1959–60, *Pattenkolli vala* (18·27 and 15·33 kg.), *Thattum vala* (6·45 kg.) and *Nethel vala* (5·22 kg.) in 1960–61, *Mathikolli vala* (15·00 kg.), cast-net (13·75 kg.) and *Thattum vala* (10·47 kg.) in 1961–62 and cast-net (8·57 kg.) and *Mathikolli vala* (8·32 kg.) in 1962–63. Thus it is seen that the catch-per-unit of effort of the boat-seines *Pattenkolli vala* and *Mathikolli vala* was generally high during all the years. It may be stated here that although the catch-per-unit of effort of cast-net was seen to be higher during certain years, the percentage of oil sardine landed by this gear was generally low as compared to the other gears. Another point of interest was that the catch-per-net or catch-per-unit of effort of the selective gear *Mathichala vala* was comparatively lower than all the other gears throughout the period. Considering the density of oil sardine landings on a quarterly basis the fishery appears to have been confined mostly to the October-December quarter during all the years but extending into January-March quarter in 1960, 1961 and 1962 and commencing from July-September quarter in 1963. The intensity of the fishery during these quarters was generally reflected on the catch-per-net and catch-per-unit of effort of the important gears although there were a few exceptions. Variations in the catch-per-net and catch-per-unit of effort are only to be expected since the oil sardine fishery is exploited mostly by specialised types of gear such as boat-seines and cast-nets (non-selective gear) and gill-nets (selective gear) which are operated depending upon the average size of fish constituting a shoal. In fact, *Nethel vala*, a small-meshed boat-seine usually

TABLE

Quarterly and annual catch-per-net in kg. (catch in kg. and number of

	Pattenkolli	Mathikolli	Mathichala	Paithu vala
April–June 1959	605·64 (94480/156)	..	20·94 (4650/222)	..
July–Sept. 1959	193·03 (156740/812)	..	..	6·71 (1020/152)
Oct.–Dec. 1959	304 (553890/1822)	..	3·54 (750/212)	454·74 (17280/38)
Jan.–March 1960	310·53 (330410/1064)	..	7·78 (4090/526)	..
Annual 1959–60 ..	294·63 (1135520/3854)	..	9·88 (9490/960)	96·36 (18300/190)
April–June 1960	334·18 (43110/129)	..	22·25 (12370/556)	...
July–Sept. 1960	531·79 (1034780/1946)	..	..	164·53 (17440/106)
Oct.–Dec. 1960	939·31 (3189900/3396)	..	13·83 (1300/94)	91·67 (1100/12)
Jan.–March 1961	893·54 (2499240/2797)	..	38·75 (21470/554)	..
Annual 1960–61	818·46 (6767030/8268)	..	29·18 (35140/1204)	157·12 (18540/118)
April–June 1961	532·06 (48950/92)	988·37 (48430/49)	55·51 (50400/908)	..
July–Sept. 1961	436·38 (1161200/2661)	833·83 (217630/261)	10·00 (190/19)	308·94 (139020/450)
Oct.–Dec. 1961	454·80 (463900/1020)	700·06 (2156190/3080)	110·00 (220/2)	...
Jan.–March 1962	100·00 (2500/25)	653·45 (2221090/3399)	..	..
Annual 1961–62	441·41 (1676550/3798)	683·95 (4643340/6789)	54·69 (50810/929)	308·94 (139020/450)
April–June 1962	220·37 (76690/348)	355·87 (83630/235)	44·65 (12680/284)	..
July–Sept. 1962	439·22 (963190/2193)	615·61 (65870/107)	..	170·59 (5800/34)
Oct.–Dec. 1962	285·73 (293730/1028)	311·74 (756900/2428)	340·27 (12590/37)	229·71 (8040/35)
Jan.–March 1963	227·00 (910/4)	555·59 (968380/1743)	7·14 (50/7)	..
Annual 1962–63	373·50 (1334520/3573)	415·42 (1874780/4513)	77·19 (25320/328)	200·58 (13840/69)

IV

units shown in brackets) and total catch (tonnes) by the different gears

Thattum vala	Nethel vala	Cast net	Others	Total catch (tonnes)
..	..	..	..	99·13
74·04 (25100/339)	..	..	4·14 (240/58)	183·1
471·49 (366350/777)	..	175·79 (3340/19)	..	941·61
..	..	202·22 (1820/9)	..	336·32
350·76 (391450/1116	..	184·28 (5160/28)	4·14 (240/58)	1560·16
..	7·91 (570/72)	..	..	56·05
406·86 (787690/1936)	239·30 (48100/201)	..	..	1888·01
206·12 (20200/98)	..	..	1·83 (110/60)	3212·16
..	..	..	..	2520·71
397·12 (807890/2034)	178·28 (48670/273)	..	1·83 (110/60)	7677·38
..	..	..	..	147·78
542·07 318740/588	398·95 292060/762	..	..	2128·84
520·07 (884750/1632)	..	54·19 (4280/79)	..	3473·34
884·64 (24770/28)	..	220·00 (220/1)	..	2248·58
530·37 (1192260/2248)	398·95 (292060/732)	56·25 (4500/80)	..	7998·54
..	..	..	..	173·00
..	65·49 (58360/891)	..	..	1093·22
..	310·00 (29450/95)	93·33 (560/6)	..	1101·27
..	..	120 (360/3)	..	969·70
..	89·05 (87810/986)	102·22 (920/9)	..	3337·19

TABLE V

Quarters, gears, total effort (in man hours), estimated landings of oil sardine and all fish (in tonnes), percentage of oil sardine in the gear, percentage of oil sardine caught by the gear during the buarter, catch-per-unit of effort (in kg.) of oil sardine and all fish

Quarter	Gear	Total effort (man hr.)	Estimated landings (in tonnes)		Percentage of sardine in the gear	Percentage of sardine caught by the gear during the quarter	*n*(kg.)	
			oil sardine	All fish			Oil sardine	All fish
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
April–June 1959	Pattenkolli	10,108	94·48	94·48	100·00	95·31	9·35	9·35
	Mathichala	2,466	4·65	4·76	97·69	4·69	1·89	1·93
July–Sept. 1959	Pattenkolli	55,707	157·74	185·65	84·97	85·68	2·83	3·33
	Paithu vala	7,759	1·02	6·77	15·09	0·55	0·13	0·87
	Thattum vala	41,276	25·10	58·51	42·89	13·63	0·61	1·42
	Odam vala	5,542	0·24	10·17	2·39	0·14	0·04	1·84
Oct.–Dec. 1959	Pattenkolli	172,289	553·89	666 ·56	83·10	58·82	3·21	3·87
	Thattum vala	67,284	366·35	442·40	82·81	38·91	5·44	6·58
	Paithu vala	3,557	17·28	21·01	82·22	1·84	4·86	5·91
	Cast net	407	3·34	3·34	100·00	0·35	8·21	8·21
	Mathichala	4,941	0·75	3 62	20·72	0·08	0·15	0·73
Jan.–March 1960	Pattenkolli	87,149	330·41	342·68	96·42	98·24	3·79	3·93
	Mathichala	14,431	4·09	16·36	25·00	1·22	0·28	1·13
	Cast net	199	1·82	1·82	100·00	0·54	9·15	9·15
April–June 1960	Pattenkolli	7,786	43·11	43·11	100·00	76·91	5·54	5·54
	Mathichala	9,158	12·37	12·96	95·42	22·07	1·35	1·42
	Nethel vala	2,026	0·57	2·52	22·43	1·02	0·28	1·24
July–Sept. 1960	Pattenkolli	140,575	1034·78	1135·21	91·15	54·81	7·36	8·08
	Thattum vala	122,190	787·69	796·38	98·91	41·72	6·45	6·52
	Nethel vala	9,218	48·10	54·81	87·76	2·55	5·22	5·95
	Paithu vala	6,214	17·44	21·97	79·42	0·92	2·81	3·53
Oct.–Dec. 1960	Pattenkolli	208,137	3190·50	3258·50	97·91	99·29	15·33	15·66
	Paithu vala	656	1·10	2·80	39·29	0·03	1·68	4·27
	Thattum vala	13,855	20·20	53·90	37·48	0·63	1·46	3·89
	Mathichala	863	1·30	1·80	72·22	0·04	1·51	2·09
	Others	4,400	0·11	27·90	0·39	0·01	0·03	6·34
Jan.–March 1961	Pattenkolli	136,815	2499·24	2553·53	99·04	99·15	18·27	18·44
	Mathichala	8,020	21·47	21·83	98·36	0·85	2·68	2·72

April–June 1961	Pattenkolli	8,444	48·95	48·95	100·00	33·12	5·80	5·80
	Mathichala	14,062	50·40	50·73	99·34	34·10	3·58	3·61
	Mathikolli	13,428	48·43	48·43	100·00	32·78	3·61	3·61
July–Sept. 1961	Pattenkolli	150,192	1161·20	1250·58	92·85	54·55	7·73	8·32
	Mathikolli	14,512	217·63	217·63	100·00	10·22	15·00	15·00
	Mathichala	378	0.19	0·19	100·00	0·01	0·50	0·50
	Paithu vala	27,398	139·02	172·14	80·76	6·53	5·07	6·28
	Thattum vala	34,179	318·74	312·78	99·06	14·97	9·33	9·41
	Nethel vala	49,551	292·06	298·32	97·90	13·72	5·89	6·02
Oct.–Dec. 1961	Pattenkolli	57,637	463·90	704·26	65·87	13·35	8·04	12·22
	Mathikolli	196,525	2156·19	2180·51	98·88	62·08	10·97	11·10
	Mathichala	28	0·22	0·29	75·86	0·01	7·86	10·36
	Thattum vala	81,035	848·75	916·23	92·64	24·44	10·47	11·31
	Cast net	995	4·28	5·81	73·667	0·12	4·30	5·86
Jan.–March 1962	Pattenkolli	3,831	2·50	4·90	51·02	0·11	0·65	1·28
	Mathikolli	241,816	2221·09	2242·09	99·06	98·78	9·19	9·27
	Thattum vala	2,828	24·77	24·77	100·00	1·10	8·76	8·76
	Cast net	16	0·22	0·22	100·00	0·01	13·75	13·75
April–June 1962	Pattenkolli	16,865	76·69	78·79	97·33	44·33	4·55	4·67
	Mathikolli	14,511	83·63	83·63	100·00	48·34	5·76	5·76
	Mathichala	5,287	12·68	13·80	99·88	7·33	2·40	2·61
July–Sept. 1962	Pattenkolli	161,246	963·19	1227·24	78·48	88·11	5·97	7·61
	Mathikolli	8,607	65·87	65·87	100·00	6·02	7·65	7·65
	Paithu vala	2,015	5·80	5·90	98·31	0·53	2·87	2·93
	Nethel vala	56,756	58·36	226·07	25·82	5·34	1·03	3·98
Oct.–Dec. 1962	Pattenkolli	70,339	293·73	308·87	95·10	26·67	4·18	4·39
	Mathikolli	150,062	756·90	759·04	99·72	68·73	5·04	5·06
	Mathichala	2,824	12·59	13·42	93·82	1·14	4·46	4·75
	Nethel vala	4,680	29·45	41·96	70·19	2·67	6·29	8·97
	Paithu vala	2,555	8·04	8·04	100·00	0·73	3·15	3·15
	Cast net	96	0·56	0·56	100·00	0·06	5·83	5·83
Jan.–March 1963	Pattenkolli	480	0·91	1·92	47·39	0·09	1·89	4·00
	Mathikolli	116,357	968·38	981·76	98·64	99·86	8·32	8·44
	Mathichala	158	0·05	0·10	50·00	0·01	0·32	0·63
	Cast net	42	0·36	0·36	100·00	0·04	8·57	8·57

operated for whitebaits, has also been successfully employed for catching larger quantities of small-sized oil sardine during the July-September and October-December quarters.

Size Composition

The data on size composition of oil sardine during the years 1959–63 are presented in Figs. 1 to 4. The following interpretation on size composition and year-classes is based on the author's observations on the occurrence of different size groups and their progression during the period of the present

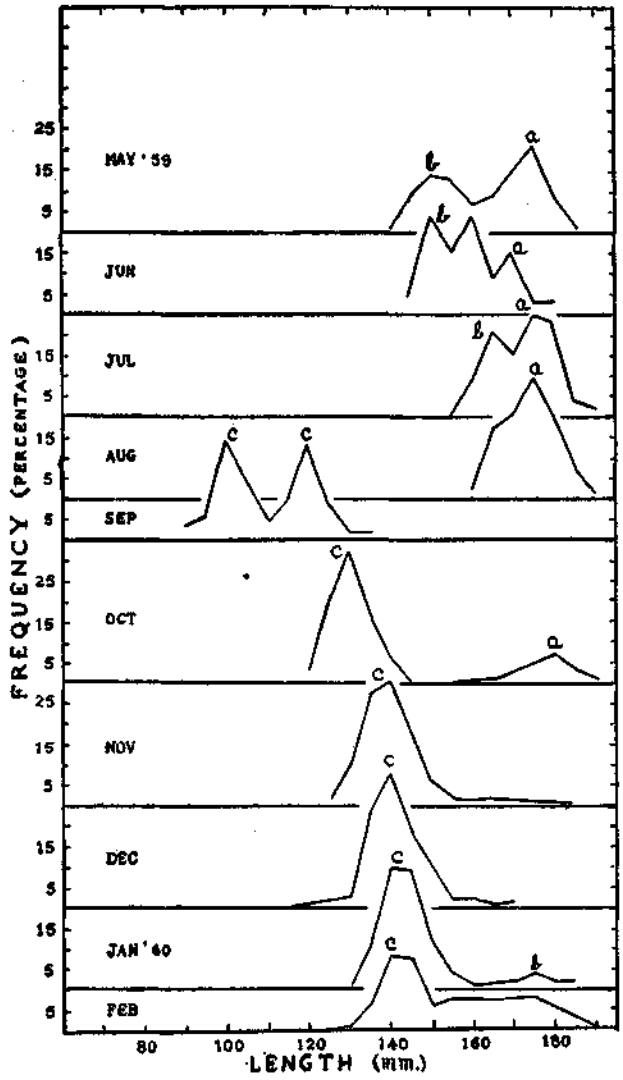

Fig. 1. Length frequency of oil sardine from May 1959 to February 1960.

study. The data clearly indicate that the fishery was dependent on more than one year-class every year and that each year-class was constituted by more than one brood throughout the period. Modes remaining constant or sometimes seen shifting towards the left (Figs. 1 to 4) have been taken as those

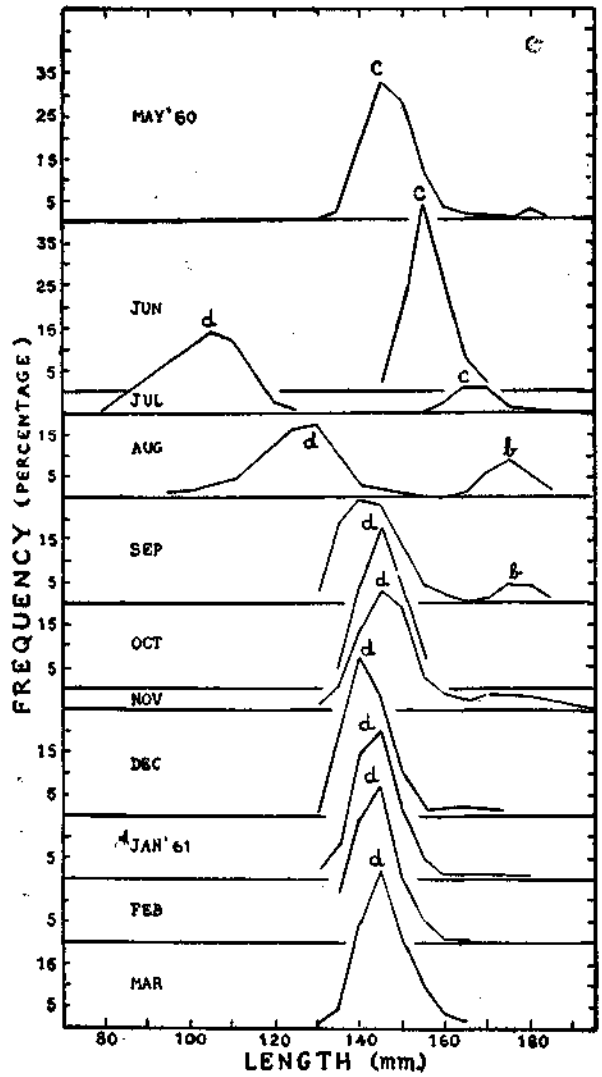

FIG. 2. Length frequency of oil sardine from May 1960 to March 1961.

representing different broods belonging to the same year-class whereas year-classes themselves were differentiated from one another based on the occurrence of juveniles (modes *e* in August 1961 and *g* in September 1962) which are evidently the products of spawning during the respective years, and also

the progression of modes corroborating the earlier finding that oil sardine attain the average size of 10, 15 and 19 cm at the end of first, second and third year of life respectively (Nair, 1953). The view that 1- and 2- year old sardine grow to a size of 10 and 15 cm respectively is also supported by Sekharan

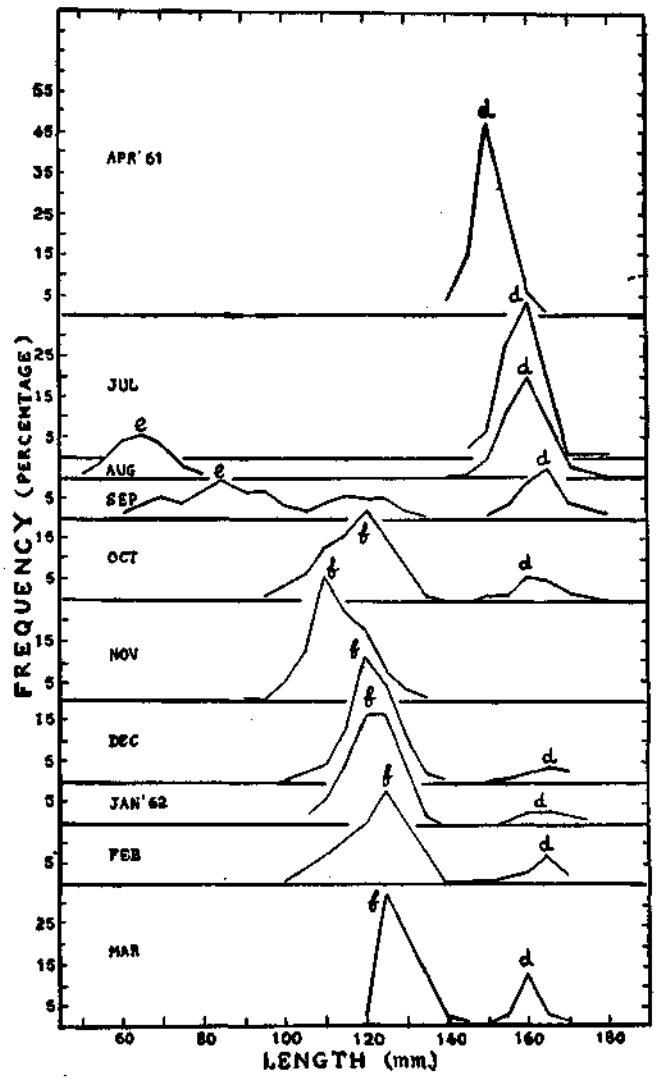

FIG. 3. Length frequency of oil sardine from April 1961 to March 1962.

(1962). He has designated the modes at 130–34 mm in October 1957 and 145–49 mm in November 1958 as representing the 1956 and 1957 year classes respectively. During the present study covering a period of four years,

0-year-class fish measuring 65–85 mm were seen entering the fishery in August 1961 and September 1962. Since it is known that oil sardine spawn during the June-October period it is only reasonable to designate the modes at 100 and 120 mm in September 1959, 105 mm in July 1960, 115, 120 and 110 mm in September, October and November 1961 respectively and 115 mm in October 1962 as representing 1-year-olds.

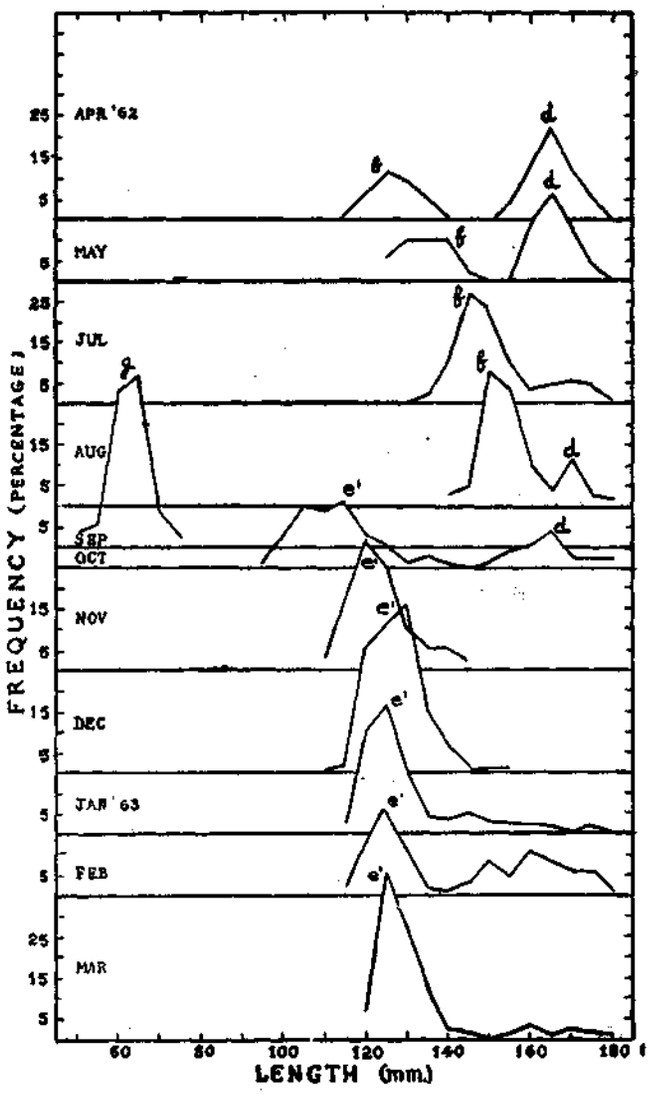

FIG. 4. Length frequency of oil sardine from April 1962 to March 1963.

From Fig. 1, it could be seen that in 1959–60 the fishery was supported by 1-year-old fish represented by the modes *c* from September 1959 to February 1960. There is a clear indication of the entry of two broods of the 1958-year-class into the fishery in September 1959 as shown by the modes at 100 and 120 mm, although during the subsequent months only one mode is seen. During the earlier months the fishery appears to have been dependent on older fish represented by the modes *a* and *b*. In the 1960–61 season also there were three year-classes represented by the modes *b*, *c* and *d* (Fig. 2). The most outstanding feature of this season was the entry of several broods of the 1959 year-class, represented by the mode *d*, from October 1960 to March 1961 during which period this mode was seen to be either stationary or moving towards the left as in December 1960. Such occurrence of several broods of an year-class is further proof that spawning in oil sardine is protracted. The continued dominance of the mode *d* representing 1-year-old fish from July 1960 to February 1961 when over 90% of the season's catches were landed appeared to have been responsible for a good fishery during the 1960–61 season.

The composition of the catches in 1961–62 was slightly different from that of the earlier years. In addition to the 1959 year-class (mode *d*) the fishery was supported by the 1960 and 1961 year-classes represented by the modes *f* and *e* (Fig. C) respectively. The entry of young oil sardine belonging to the 0-year-class with modes at 65 and 85 mm in August and September was of interest, as such a phenomenon was not noticed during the earlier years. However, this year's bumper fishery was mainly supported by the 1-year-old fish measuring 115 to 125 mm from September 1961 up to March 1962. This lends support to the view that the success of the oil sardine fishery depends upon the availability of 1-year-old fish in the inshore waters.

The picture in 1962–63 was almost similar to that of the previous year. Juveniles represented by the mode *g* at 65 mm (Fig. 4) had entered the fishery in large numbers in September 1962. A slight decline in the fishery during this year may be attributable to the occurrence of older fish from April to August 1962 after which the fishery was as usual supported by the 1-year-olds represented by the mode e^1. Presumably the modes *e* in August and September 1961 and e^1 from October 1962 to March 1963 may be independent broods. Since the earlier size groups of the mode e^1 are missing and as this mode could not have in any case come from the mode *g* seen in September 1962, it is quite probable that it might have been derived from a brood of the late spawning of the previous year.

Small-sized oil sardines were seen to enter the fishery in August 1961 (mode *e*) and September 1962 (mode *g*), both groups having a modal size of

65 mm. Evidently, these groups belonging to the 0-year-class were the products of early spawning during 1961 and 1962. It is interesting to note that both these groups could not be traced during the subsequent months. The mode *c* at 120 mm in September 1959 representing the one-year-old sardine belonging to the 1958 year-class had shifted to 155 mm in June 1960 indicating a growth of 35 mm in 9 months. From the growth observed among the 1959 broods (mode *d*) it can be seen that the rate of increase in size is higher among the smaller size groups. Older oil sardine represented by the mode *a* have been observed to grow only 5 mm in 5 months. A similar slow rate of growth was seen among the individuals represented by the mode *b* also. However, because of the entry of several broods of the same year-class into the fishery during certain years, this study of tracing any particular mode through an entire season has obviously its own limitations.

Remarks

If the availability of one-year old fish in the inshore waters is an index of the success of the oil sardine fishery during a season, the four-year period from 1959 to 1963 can unequivocally be considered as a favourable one for the oil sardine fishery as judged from the occurrence of smaller size groups ranging from 105 to 149 mm during these years. The data presented here also indicate that the success of the fishery is also dependent to some extent on the early entry of the one-year-old fish during a season. Thus it is seen that the dominance of older groups over a longer period up to August 1959 had resulted in a comparatively lean season in 1959–60. In fact, the strength of the 1957 year-class which supported the fishery in 1958–59 with a modal size of 145–49 mm in November 1958 (Sekharan, 1962) appears to have been so great that the same year-class had continued to support the fishery until August 1959. The entry of the 1958 year-class into the fishery in September 1959 obviously resulted in the increased yield during the period September 1959 to January 1960 when over 80% of the season's catches were landed. During this year dense shoals of oil sardine appeared generally within the 20-metre area but mostly in the 10 to 15 metre region during the peak period.

In 1960–61 a fivefold increase in the oil sardine landings was noticed. The fishery during this year was practically supported by the 1959-year-class which appeared to have dominated throughout the season extending from July 1960 to February 1961. Judged from the magnitude of the fishery supported by one-year-old fish, there is every reason to believe that the rate of recruitment was good during the previous year. During this year though

the regions fished for oil sardine extended from 5 to 45 metres, heaviest concentrations appeared to be in the 15–25 metre region.

In 1961–62 the oil sardine fishery continued to be good giving a slightly better yield than in 1960–61. The 1959 year-class had continued to occur till August 1961 after which the one-year-old fish belonging to the 1960 year-class had supported the fishery up to March 1962. The entry of the 0-year-class in August and September 1961 and the unrestricted catching of this smaller size groups recruited probably during the early part of the current year's spawning appears to have adversely affected the fishery in the 1962–63 season when the catches were less than half of the 1961–62 season. Fishing was confined to the 5–20 metre region but dense shoals appeared mostly in the 5–10 metre area.

The 1962–63 season also witnessed the entry of juveniles with a modal size of 65 mm in September 1962. The exploitation of this 0-year-class seems to have affected the oil sardine fishery in the following year when the total oil sardine landings at Kozhikode were as low as 221 tonnes (Annual Report of the Central Marine Fisheries Research Institute for 1962). This year also the fishery was dependent on the 1962 year-class which had entered the fishery in October 1962 and continued up to March 1963. The fishery in general was confined to the 5–30 metre area during the peak period.

Comparing the dominant modes supporting the oil sardine fishery at Kozhikode during the peak period (October–November) and the total annual yield over a period of 8 years, it could be seen from the Table below that the fishery had been dependent on size groups ranging from 105 to 145 mm during the different years. Since all these are evidently the groups recruited during the previous spawning season it is apparent that the 1956, 1959 and 1960 year-classes were strong enough to yield bumper catches during the 1957–1958, 1960–61 and 1961–62 seasons. From Table IV it can be seen that the annual catch-per-net of the non-selective gears (boat-seines) was very high during the years 1960–61 and 1961–62 when these gears were presumably operating mainly on one year-old sardines belonging to the 1959 and 1960 year-classes respectively.

Year	Dominant mode* mm	Annual catch (tonnes)
1955–56	135–39	502·45
1956–57	105–09	1042·07
1957–58	130–34	8424·24
1958–59	145–49	2865·29
1959–60	140–44	1516·16
1960–61	145–49	7677·38
1961–62	120–24	7998·54
1962–63	120–24	3337·19

* Figures for 1955–59 from Sekharan, 1962.

Summary

The oil sardine fishery at Kozhikode showed an upward trend from 1959–60 to 1961–62 followed by a decline in 1962–63. Non-selective gears, namely, *Pattenkolli vala*, *Mathikolli vala*, *Thattum vala* and *Nethel vala* (all boat-seines) were the main gears which accounted for the major part of the oil sardine landings. Variations in the quarterly and annual catch-per-net and catch-per-unit of effort of the different gears have been discussed. The fishery was confined mostly to the October-December quarter when generally size groups ranging from 105 to 149 mm contributed to the bulk of the landings. From the occurrence and progression of the different modes it was inferred that the fishery is dependent on more than one-year-class every year and that during certain years several broods of the same year-class enter the fishery. Growth among juveniles was observed to be at a higher rate than among the bigger and older size groups. A special feature of the 1961–62 and 1962–63 seasons was the entry on a large scale of smaller size groups ranging from 65 to 85 mm into the fishery during August and September. Although oil sardine shoals occur within the 45 metre region, heavy concentrations were recorded in the 5 to 25 metre area.

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