FURTHER OBSERVATIONS ON THE FISHERY AND BIOLOGY OF '*CHOODAI*' (*SARDINELLA* spp.) OF MANDAPAM AREA

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Introduction

The sardines, locally called *Choodai*, constitute one of the important groups of fishes supporting the fisheries of the Mandapam area. *Sardinella albella* and *Sardinella gibbosa* are the two important species forming the fishery. Previous studies on sardines in the area include observations made by Devanesan (1932) on the food and feeding habits and Chacko (1946) on the bionomics of *S. gibbosa*. Investigations have been in progress since 1952 at the Central Marine Fisheries Research Station (Sekharan, 1955 and 1959) on the *Choodai* fishery. The present study was undertaken from May 1958 to March 1960 as a continuation of the work.

Material and Methods

Random samples of *Choodai* from commercial catches were obtained from Pullamadam, Thangachimadam and Dhanushkodi in the Palk Bay and from Rameswaram Road and C.M.F.R.S. area in the Gulf of Mannar. It may be pointed out here that " torch fishing " with handnets were sparingly operated in the fishing centres during the period of study and the gillnets accounted for a very insignificant proportion of the total catch. Bulk of the sardine catch were landed by shore seines operating within two miles from shore. The fishery usually starts in April in the Palk Bay and lasts till October. From November to March it is continued in the Gulf of Mannar coast.

All random samples taken from the commercial catches were measured for length frequency observations and detailed study was done only on selected samples. The standard length, *i.e.*, the length from the tip of the snout to the end of the silvery area on the caudal peduncle was recorded in millimetres. Head length was measured from the tip of the snout to the posterior edge of the operculum. In many cases the fishermen's records of catch have been used while calculating the monthly landings. Gut contents of 580 specimens preserved in 5% formalin as soon as they were landed were studied. After

noting the fulness of the gut the contents were analysed for the various food items present.

Composition of Commercial Landings

(*a*) *Length frequency composition.*—Length frequency data are available for the period between June 1958 and February 1960. Standard length is considered as the linear measurement for this analysis. To minimise the effect of gear selection only shore seine samples are included.

It has been observed earlier that the fishing season was not the same for Palk Bay and Gulf of Mannar. Consequently the size range of fish occurring in the two coasts vary greatly. Figures 1 and 2 illustrate the length frequencies and modes for samples from the two regions. When the fishing started at Palk Bay in June 1958, the size range of *S. albella* was from 35 mm. to 110 mm. standard length, showing two distinct modes. This bi-modality was due to the presence of fish belonging to two age groups, namely the 0-year group and 1-year group. Mode '*a*', for the 0-year group was at 60 mm. in June. At the same time mode '*b*', representing the one-year group, was at 100 mm. Succeeding months showed a progressive growth of mode '*a*' and it had shifted to 85 mm. in October 1958 when the fishery at Palk Bay came to a close. The range of size of the commercial catch in October was from 75 to 100 mm. Mode '*b*' was at 100 mm. in June 1958 and remained constant during July also. Subsequently mode '*b*' showed a backward movement and came down to 95 mm. in August and September. In October it had merged with the size groups in the 0-year group fish. This backward shifting of mode '*b*' might be due to the non-availability in sufficient numbers of larger size groups in the shoals that had entered the fishing grounds.

In October 1958 the fishery had shifted to the Gulf of Mannar coast. The size groups in the commercial catches fall mainly within the limits of 65 to 110 mm. standard length. The dominant size group which was at 85 mm. at the commencement of the season had moved to 90 mm. in November and December 1958 and to 95 mm. in January 1959. At the end of January *S. albella* had ceased to appear in the catches.

In the 1959 season also the length-frequency disposition for the Palk Bay fish showed two separate modes. Fish in mode '*a*' was at 45 mm. in May 1959 and reached to 65 mm. at the end of September. Mode '*b*' was at 95 mm. from May to August and had grown to 100 mm. in September, when the Palk Bay fishery stopped for the season.

Fishing in Gulf of Mannar commenced in November 1959 and the sample obtained at that time showed the major length group to be at 80 mm. This

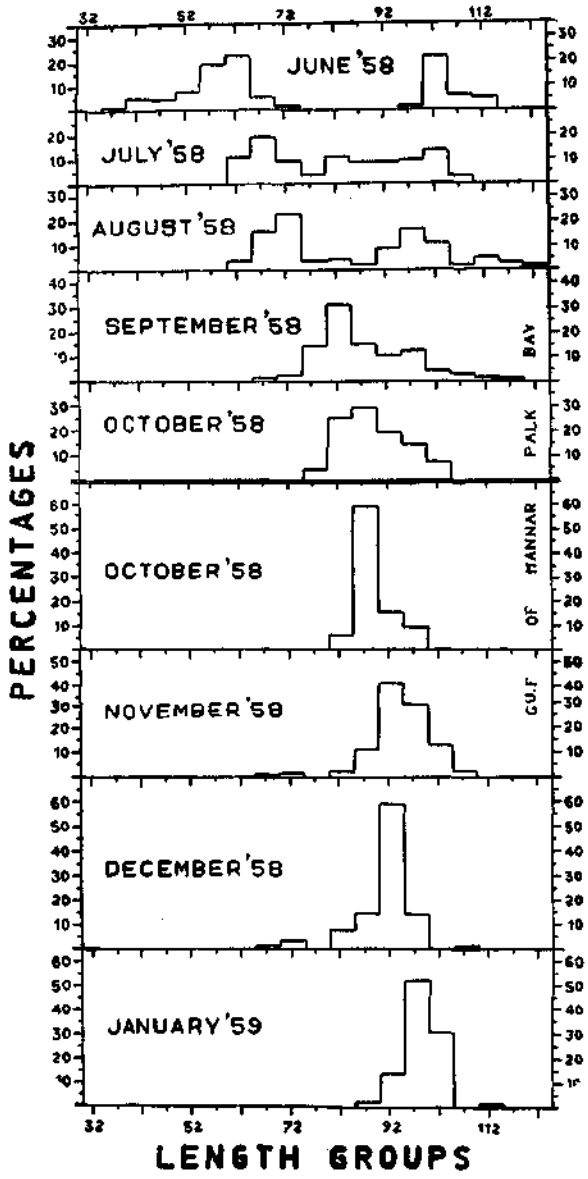

FIG. 1. Length frequency distribution of *S. albella* during 1958–59.

had shifted to 90 mm. in January 1960. After January adequate samples of *S. albella* could not be obtained from the Gulf of Mannar catches.

(*b*) *Age composition.*—Only *Sardinella albella* belonging to 0-year, one-year and two-year groups have been met with in the course of this study. Table I shows the age composition of commercial landings from the two coasts. Well over 50% of the Palk Bay fishery was formed of 0-year group

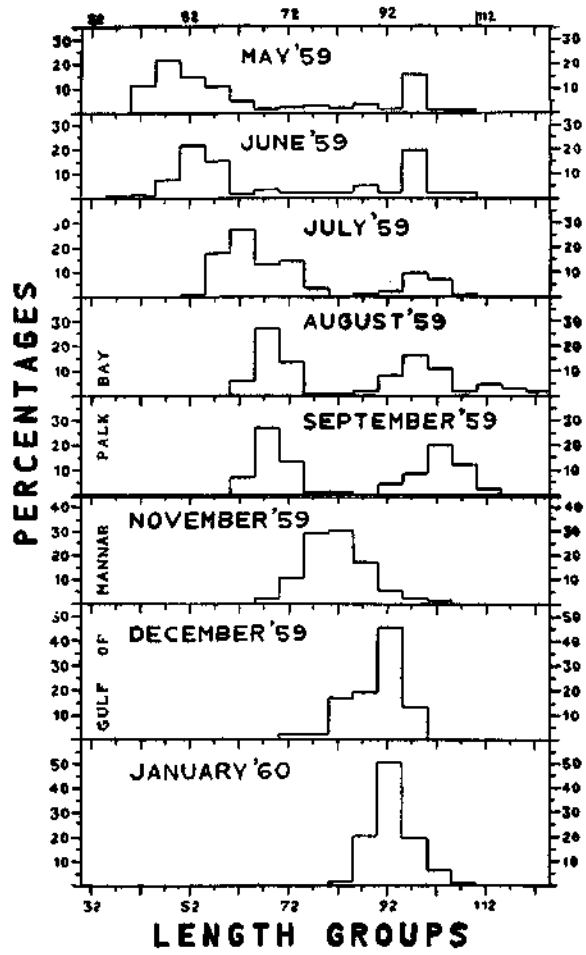

FIG. 2. Length frequency distribution of *S. albella* during 1959-60.

and fish of 1-year and 2-year groups occupied the remaining portion. The Gulf of Mannar fishery was formed only of fish belonging to 0-year group.

Rounsefel and Everhart (1953) point out that fish tend to mingle more or less according to size with different age groups schooling together. However the present knowledge of the behaviour of *S. albella* does not provide

TABLE I

Age composition of commercial catches (in per cent.)

Age group	1958–59 Season		1959–60 Season	
	Palk Bay	Gulf of Mannar	Palk Bay	Gulf of Mannar
0–Year	60·7	100	58·4	100
1–Year	35·3	..	41·6	..
2–Year	4·0	..	..	..
Number of fish examined ..	987	579	659	421

any explanation for the absence of 1-year and 2-year old fish in the Gulf of Mannar commercial catches. Jayaraman (1954) observed marked differences in the values of salinity, dissolved oxygen and nutrient salts between Palk Bay and Gulf of Mannar. Prasad (1956 and 1958) observed variations in the Plankton crop in the two areas.

(*c*) *Sex composition.*—An analysis of the ratio of sexes in the commercial catches shows that there was an initial predominance of females over males up to 80 mm. standard length. Subsequently the sexes tended to be equally represented. The sex composition of the commercial catches was 40·8% females, 31·3% males and 27·9% indeterminates. The large percentage of indeterminates was due to their greater representation (over 50%) in the Palk Bay landings.

RELATIVE ABUNDANCE OF SPECIES

The proportion of *S. albella* and *S. gibbosa* entering into the commercial fishery is determined from information gathered from the catch statistics records maintained by the Central Marine Fisheries Research Station and from the registers of individual fishermen.

An accurate measure of the catch of the two species per unit effort was not obtainable from the commercial catch. Because the fishermen neither employed fixed number of men for each type of unit nor were they able to give adequate information about the effort expended for each operation. Therefore, only the relative abundance of the individual species on the total monthly catch could be made (Table II).

TABLE II

Indices of relative abundance of Sardinella albella *and* Sardinella gibbosa *from Palk Bay and Gulf of Mannar (represents data from Pullamadam, Dhanushkodi, Rameswaram Road and C.M.F.R.S. Area)*

(*a*) *Palk Bay*

Months	1958 Season			1959 Season		
	Index for *S. albella*	Index for *S. gibbosa*	Total fish landed (kg.)	Index for *S. albella*	Index for *S. gibbosa*	Total fish landed (kg.)
April ..	..	..	..	2·3	0·1	84554
May ..	20·6	10·2	95865	39·6	20·9	88514
June ..	52·9	16·4	84578	30·3	7·9	127567
July ..	38·0	7·3	30119	41·4	5·6	85957
August ..	33·4	4·3	24764	43·3	14·8	47463
September ..	44·4	7·5	49831	42·8	6·4	88953
October ..	36·0	17·2	37216	57·1	40·6	26535
Totals ..	37·1	11·5	322373	33·7	10·4	549543

(*b*) *Gulf of Mannar*

Months	1958–59 Season			1959–60 Season		
	Index for *S. albella*	Index for *S. gibbosa*	Total fish landed (kg.)	Index for *S. albella*	Index for *S. gibbosa*	Total fish landed (kg.)
1958						
October ..	15·7	30·7	1789	..	..	..
November	14·8	22·0	1777	7·3	27·5	5187
December	7·9	24·0	18703	16·4	25·1	5395
1959						
January ..	10·2	19·6	25965	1·8	22·0	6569
February	1·7	19·6	94730	0·4	40·5	7236
March ..	5·8	18·2	6580	..	..	..
April ..	2·3	78·8	21260	..	..	..
Totals ..	4·2	27·6	170804	5·8	29·4	24387

Assuming that the commercial catch represent the composition of fish in that area in that period, it is thought that the size of the proportions of a certain species in the total catch could be an index to denote the relative abundance of that species in that area at that period. The index of relative abundance therefore is

$$A = \frac{T \times 100}{W}$$

where A is the index of relative abundance, T, total catch of a particular species and W is the total weight of the fish landed.

It may be seen from Table II that in the Palk Bay *S. albella* was represented more than *S. gibbosa* in the catches. The greatest amount of *S. albella* was taken during the months of May and June. The index for *S. gibbosa* was lower in comparison with that for *S. albella*. A reverse trend has been evident in the Gulf of Mannar, where, as against the observations in Palk Bay, *S. albella* was poorly represented whereas *S. gibbosa* was relatively abundant.

The abundance of fish populations at a given period may be controlled by physical, chemical and biological factors of the environment. The periodical fluctuations in catch of the two species can be explained in terms of environmental influence on the fish at various stages of its life. On the other hand, the differences in relative abundance of *S. albella* and *S. gibbosa* in the two coasts indicate not only that the factors favouring the availability of rich *S. albella* stock in the Palk Bay were inoperative in the Gulf of Mannar, but that each species entered the fishery independent of the other.

Rate of Growth

The mean length of different age groups of *S. albella* for the successive months are contained in Table III. Growth curves for the two seasons between June 1958 and Janaury 1960 are shown in Fig. 3. Three age groups, 0-year, 1-year and 2-year groups, were noted during the 1958–59 fishing season. However, fish in the 2-year group was comparatively few in the commercial catches and had occurred only at Dhanushkodi. Catches of the 1959–60 season comprised only of fish belonging to 0-year and 1-year groups.

It will be apparent from a study of Table III, that, the 1958 year class had a higher growth rate than fish of the 1959 year class. The mean length for the 1958 year class was at 61 mm. in June 1958 and had shifted to 98 mm. at the end of January 1959 indicating a growth of 37 mm. for that period. On the other hand, the 1959 year class fish was at 51 mm. in

TABLE III

Mean length in millimetres of successive age groups examined (All samples are combined)

Months	1958–59 Season			1959–60 Season		
	Age groups			Age groups		
	0–year	1–year	2–Year	0–year	1-year	2-year
March	..	..	..	..	93·74	..
April	..	..	..	..	..	..
May	..	..	..	50·80	93·61	..
June	60·99	102·70	111·33	52·64	91·17	..
July	74·47	98·30	..	61·98	98·21	..
August ..	68·24	97·57	115·10	67·92	101·08	..
September ..	82·44	97·39	115·20	67·94	101·39	..
October ..	88·79	..	..	..	..	..
November ..	93·99	..	..	81·11	..	..
December ..	90·22	..	..	83·03	..	..
January ..	97·91	..	..	92·48	..	..

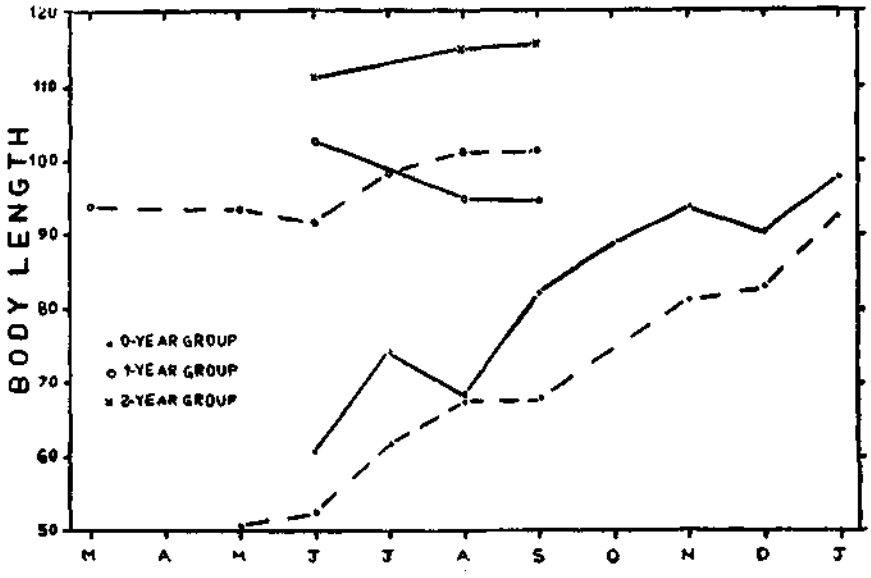

FIG. 3. Rate of growth in length of *S. albella* during 1958–60. Continuous and broken lines represent 1958–59 and 1959–60 seasons respectively.

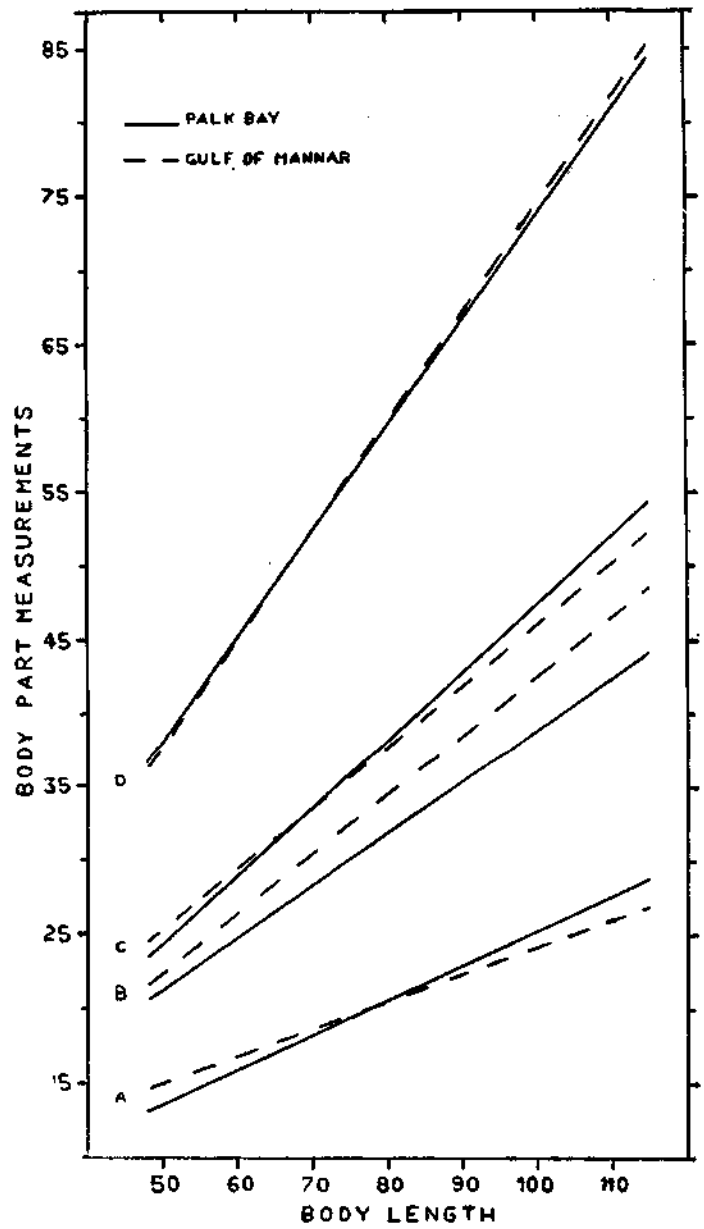

FIG. 4. Regression of different body measurements on standard length of *S. albella* from Palk Bay and Gulf of Mannar (A, head length ; B, snout to dorsal insertion ; C, snout to ventral insertion ; D, snout to anal insertion).

May 1959 and had grown to 92 mm. at the end of January 1960 showing an increase in length of 33 mm. in nine months. During June 1958 fish of the 1957 year class had a mean length of 102·7 mm. Mean length values for this group came down to 97·6 mm. in August and to 97·4 mm. in October 1958. After October the 1957 year class did not appear in the fishery. The gill net catches of March 1959 contained mainly fish of the 1958 year group. At that time the mean length of this group was 93·7 mm. This had shifted to 101·4 mm. in September, when the 1-year group stopped entering the fishery of 1959–60 season. The 2-year fish that were landed in the commercial catches had the mean length of 111·3 mm. in June 1958. It had grown to 115·2 mm. at the close of September 1958.

Homogeneity of Samples

The commercial catches of *S. albella* from Palk Bay and Gulf of Mannar show differences in size-group composition, in the occurrence of various age groups and in the relative abundance in relation to the other important species, *S. gibbosa*, in the fishery. It is important to determine whether the fish occurring in the two coasts belong to a homogeneous population or are derived from different racial stocks. Morphometric characters like head length, snout to dorsal insertion, snout to ventral insertion and snout to anal insertion of *S. albella* collected during 1959–60 were compared by methods of regression analysis similar to the methods employed by Godsil (1948), Schaefer (1955), Sarojini (1957 and 1958) and Pillai (1957) in racial studies. Comparisons were made based on samples from Pullamadam and Dhanushkodi in the Palk Bay and from Rameswaram Road and C.M.F.R.S. area in the Gulf of Mannar. Due to change in fishing seasons samples of fish of the same length range were not available from all the localities. Samples from Dhanushkodi, Rameswaram Road and C.M.F.R.S. area had little difference in size range. However, the mean size of the Pullamadam sample, which is composed mainly of fish of smaller size groups, was far below the mean size of fish from other localities.

Altogether 497 fish were observed for morphometric analysis. Significance of differences between samples were tested by the method of analysis of covariance (Snedecor, 1946). Linear regressions were employed in relating the independent variable (standard length) to the dependent variable (various body lengths). Scatter diagrams of the measurements of each sample, after being fitted with the line $\hat{Y} = a + bX$ were checked for linearity. Tables IV to VI show the details relating to regression analysis.

TABLE IV

Statistics describing regressions of body measurements of Sardinella albella *from Mandapam area*

(Independent variable x = Standard length)

Dependent variable y	N	$\bar{x}$	$\bar{y}$	Sx^2	Sy^2	Sxy	b	a
(*a*) *Pullamadam sample*								
Head length ..	121	63·5123	16·7024	6808·2315	451·2893	1669·4477	·2452	1·1292
Snout to insertion of dorsal ..	121	63·5123	27·3388	6808·2315	1325·1075	2931·0000	·4305	·0032
Snout to insertion of ventral ..	121	63·5123	39·5123	6808·2315	1624·2315	3252·2315	·4776	·1789
Snout to insertion of anal ..	121	63·5123	46·8016	6808·2315	3959·2397	5008·2973	·7356	·0884
(*b*) *Dhanushkodi sample*								
Head length ..	108	93·0000	23·5000	20506·0000	1163·0000	4733·0000	·2308	2·0449
Snout to insertion of dorsal ..	108	93·0000	39·9629	20506·0000	3803·8519	8801·0000	·4291	·0566
Snout to insertion of ventral ..	108	93·0000	44·2592	20506·0000	4498·7408	9189·0000	·4481	2·5859
Snout to insertion of anal ..	108	93·0000	69·7129	20506·0000	12016·1019	15532·0000	·7574	·7160
(*c*) *Rameswaram Road sample*								
Head length ..	102	91·7647	22·7549	1914·3530	98·8726	371·1177	·1938	4·9710
Snout to insertion of dorsal ..	102	91·7647	39·2058	1914·3530	422·6765	791·9412	·4136	1·2153
Snout to insertion of ventral ..	102	91·7647	42·9019	1914·3530	395·0197	754·6471	·3942	6·7100
Snout to insertion of anal ..	102	91·7647	68·6274	1914·3530	1211·8432	1411·0589	·7370	·9785
(*d*) *C.M.F.R.S. area sample*								
Head length ..	166	89·0542	22·1506	7212·5121	277·2350	1292·6446	·1792	6·2010
Snout to insertion of dorsal ..	166	89·0542	38·2108	7212·5121	1223·6205	2873·1025	·3983	2·7406
Snout to insertion of ventral ..	166	89·0542	41·4578	7212·5121	1385·2049	2991·8796	·4148	4·5271
Snout to insertion of anal ..	166	89·0542	66·1325	7212·5121	3925·0844	5139·8073	·7126	2·6725
(*e*) *Pooled Palk Bay sample*								
Head length ..	229	77·4192	19·9082	76933·7557	4251·0743	17840·8035	·2318	1·9625
Snout to insertion of dorsal ..	229	77·4192	33·2925	76933·7557	14283·3974	32974·9127	·4286	·1107
Snout to insertion of ventral ..	229	77·4192	36·9956	76933·7557	16906·9564	35573·4193	·4623	1·2048
Snout to insertion of anal ..	229	77·4192	57·6069	76933·7557	45930·6289	54614·2808	·7098	2·6548
(*f*) *Pooled Gulf of Mannar sample*								
Head length ..	268	90·0858	22·3805	9591·0262	399·1792	1767·2463	·1842	5·7867
Snout to insertion of dorsal ..	268	90·0858	38·5895	9591·0262	1708·8508	3835·4403	·3998	2·5732
Snout to insertion of ventral ..	268	90·0858	42·0074	9591·0262	1911·8508	3993·8284	·4164	4·4957
Snout to insertion of anal ..	268	90·0858	67·0820	9591·0262	5530·1940	6978·1120	·7275	1·5446

First, the samples from the two localities in Palk Bay were compared. It can be seen from Table V that regression analysis did not show any significant difference between the samples from Pullamadom and Dhanushkodi even in spite of the great size difference of fish in the two samples. In the second place, comparisons were made between the two samples from the Gulf of Mannar. No significant difference was noticed in the regression of body characters from samples of fish from Rameswaram Road and C.M.F.R.S. area. Based on the above comparisons it may be assumed that the Palk Bay samples are all derived from a single homogeneous stock and, similarly, the two samples from the Gulf of Mannar belong to one single racial stock. The pooled samples of Palk Bay and Gulf of Mannar were then compared. The regression analysis showed that they are significantly different. Individual samples of each locality were then compared with the individual samples of the other locality. The results of the comparisons between individual samples are given in Table VI.

The Pullamadam sample shows significant statistical difference with the Rameswarm Road sample in the regressions of head length and snout to ventral insertion. In the regressions of snout to dorsal insertion and snout to anal insertion the differences are not significant. Significant statistical differences are noticed in the regressions of head length, snout to dorsal insertion and snout to ventral insertion when the Pullamadam sample is compared with fish from C.M.F.R.S. area. Pullamadam and C.M.F.R.S. area samples do not show any significant difference in regard to the regression of snout to anal insertion. Dhanuskhodi sample differs significantly from Rameswaram Road sample only in the regression of head length on body length. On the other three characters the differences are statistically non-significant. Dhanushkodi fish differs significantly from the C.M.F.R.S. area sample in three characters—head length, snout to dorsal insertion, and snout to anal insertion. Only in the case of snout to insertion of ventral fin the difference between Dhanushkodi and C.M.F.R.S. area fish is not significant.

It appears that Palk Bay fish are different from those of the Gulf of Mannar coast as is seen from foregoing analysis. Even though the fish samples in the two localities in Palk Bay were of different size class, the regression analysis did not show any significant difference, but comparison betwen localities between Palk Bay and Gulf of Mannar showed significant difference. It is likely that some of the differences between fish from Palk Bay and Gulf of Mannar could have originated from the changes in the environment.

TABLE V

Test of heterogeneity of regressions within samples of Sardinella albella *from Mandapam area*

Characters	Deviations from average total regressions		Deviations from individual regressions within samples			Difference			Observed F	5%
	Degrees of freedom	Sum of squares	Degrees of freedom	Sum of squares	Mean square	Degrees of freedom	Sum of squares	Mean square		
(*a*) *Pullamadam and Dhanushkodi samples*										
Head length ..	226	113·5575	225	112·4978	·4999	1	1·0597	1·0597	2·1198	3·89
Snout to insertion of dorsal ..	226	149·8346	225	149·8257	·6658	1	·0089	·0089	74·8089	254
Snout to insertion of ventral ..	226	456·1374	225	451·7024	2·0075	1	4·4350	4·4350	2·2092	3·89
Snout to insertion of anal ..	226	529·0412	225	526·6093	2·3404	1	2·4319	2·4319	1·0390	3·89
(*b*) *Pullamadam and Rameswaram Road samples*										
Head length ..	220	72·7923	219	68·8513	·3143	1	3·9410	3·9410	12·5389	3·89
Snout to insertion of dorsal ..	220	158·7721	219	158·3473	·7230	1	·4248	·4248	1·7019	254
Snout to insertion of ventral ..	220	178·6183	219	168·2039	·7680	1	10·4144	10·4144	13·5604	3·89
Snout to insertion of anal ..	220	446·7793	219	446·7761	2·0400	1	·0032	·0032	637·5000	254
(*c*) *Pullamadam and C.M.F.R.S. area samples*										
Head length ..	284	102·7379	283	87·4878	·3091	1	15·2501	15·2501	49·3371	3·88
Snout to insertion of dorsal ..	284	146·0305	283	142·4086	·5032	1	3·6219	3·6219	7·1977	3·88
Snout to insertion of ventral ..	284	228·6336	283	214·7891	·7589	1	13·8445	13·8445	18·2428	3·88
Snout to insertion of anal ..	284	529·2049	283	537·3523	1·8987	1	1·8526	1·8526	1·0248	254

(*d*) *Dhanushkodi and Rameswaram Road samples*											
Head length	..	207	99·8919	206	97·5015	·4733	1	2·3904	2·3904	5·0504	3·89
Snout to insertion of dorsal	..	207	182·0203	206	181·5994	·8815	1	·4209	·4209	2·0943	254
Snout to insertion of ventral	..	207	483·6552	206	478·5671	2·3231	1	5·0881	5·0881	2·1902	3·89
Snout to insertion of anal	..	207	424·0769	206	423·3524	2·0551	1	·7245	·7245	2·8365	254
(*e*) *Dhanushkodi and C.M.F.R.S. area samples*											
Head length	..	271	130·3385	270	116·1380	·4301	1	14·2005	14·2005	33·0167	3·88
Snout to insertion of dorsal	..	271	170·7342	270	165·6587	·6135	1	5·0755	5·0755	8·2730	3·88
Snout to insertion of ventral	..	271	531·0672	270	525·1523	1·9450	1	5·9149	5·9149	3·0410	3·88
Snout to insertiou of anal	..	271	524·6440	270	513·9286	1·9034	1	10·7154	10·7154	5·6296	3·88
(*f*) *Rameswaram Road and C.M.F.R.S. area samples*											
Head length	..	265	72·8157	264	72·4915	·2745	1	·3242	·3242	1·1810	3·89
Snout to insertion of dorsal	..	265	174·5381	264	174·1823	·6597	1	·3558	·3558	1·8541	254
Snout to insertion of ventral	..	265	242·2965	264	241·6538	·9153	1	·6427	·6427	1·4241	254
Snout to insertion of anal	..	265	435·0012	264	434·0954	1·6443	1	·9058	·9058	1·8153	254
(*g*) *Pooled Palk Bay and Pooled Gulf of Mannar samples*											
Head length	..	494	206·7218	493	187·3689	·4206	1	19·3529	19·3529	46·1260	3·86
Snout to insertion of dorsal	..	494	331·9708	493	324·9389	·6591	1	7·0319	7·0319	10·6689	3·86
Snout to insertion of ventral	..	494	724·9496	493	696·6156	1·4130	1	28·3340	28·3340	20·0523	3·86
Snout to insertion of anal	..	494	7616·4726	493	7614·1071	15·4444	1	2·3655	2·3655	6·5290	254

Food and Feeding Habits

The food contents were very often in the form of a semi-digested slimy mass and so only a rough generic identification of the components were possible. The following food organisms were found in the gut contents of *S. albella*: *Rhyncalanus*, *Labidocera*, *Eucalanus*, *Euterpina*, *Lucifer*, *Acetes*, *Mysis*, *Megalopa* larva, bivalve shelled larva, *Pteropoda*, flat fish larva, *Thallasiothrix*, *Bacteriastrum* and *Triceratium*. Copepods form the bulk of the gut contents. Bapat and Bal (1950) showed that larva and post-larva of *S. albella* feed mainly on copepods. Vijayaraghavan (1959) observed that *S. albella* is a surface feeder and plankton predator. The prevalence of larger crustaceans like *Lucifer* and *Acetes* shows that the fish to a certain extent is not an indiscriminate filter feeder.

Table VI

Differences in morphometric characters between localities

Localities	Characters			
	Head length	Snout to insertion of dorsal	Snout to insertion of ventral	Snout to insertion of anal
Pullamadam and Dhanushkodi ..	NS	NS	NS	NS
Pullamadam and Rameswaram Road	S	NS	S	NS
Pullamadam and C.M.F.R.S. area	S	S	S	NS
Dhanushkodi and Rameswaram Road	S	NS	NS	NS
Dhanushkodi and C.M.F.R.S. area	S	S	NS	S
Rameswaram Road and C.M.F.R.S. area	NS	NS	NS	NS

S, Significant; NS, Non-Significant.

Prediction

Movement of shoals towards the inshore waters is generally predicted by fishermen based on the direction and intensity of the prevailing winds. During May to September the wind blows from the south and when there is a strong south-northerly wind *Choodai* from the northern waters move southwards and enter into the Palk Bay fishing waters. South-westerly wind moves the fish away from the fishing grounds. During October to April the wind blows from the north. When there is strong wind in north-southerly direction

fish shoals come close to the shore in the Gulf of Mannar coast. When the incidence and velocity of winds are high, mostly connected with the north-east and south-west monsoons, *Choodai* are absent from the fishing grounds.

Summary

The paper deals with a general account of the *Choodai* fishery in the Mandapam area, with particular reference to data on *Sardinella albella* collected during May 1958 to March 1960. Age and size groups of fish occurring in the commercial landings of Palk Bay and Gulf of Mannar are discussed. Old large fish and young small fish predominated in commercial catches from the Palk Bay; commercial catches from the Gulf of Mannar are mainly composed of young fish of medium size.

There is a slight predominance of females over males up to 80 mm. The sex composition of catches during the period may be stated as 40·8% females, 31·3% males and 27·9% indeterminates.

The index of relative abundance of *Sardinella albella* is more than that of *Sardinella gibbosa* in the Palk Bay; in the Gulf of Mannar *S. gibbosa* is relatively more abundant than *S. albella*.

Growth rates of different age groups are discussed. Slight difference in the growth rates of 1958 and 1959 year classes are indicated.

Morphometric characters like head length, snout to insertion of dorsal, snout to insertion of ventral and snout to insertion of anal of fish collected from the two coasts during 1959–60 season are compared by methods of regression analysis. It is suggested that difference observed between *Sardinella albella* from Palk Bay and Gulf of Mannar centres may have originated from the changes in the environment.

Sardinella albella is a plankton feeder. Copepods form the major food item. The prevalence of larger crustaceans like *Lucifer* and *Acetes* suggests that the fish is not an indiscriminate filter feeder.

Wind direction and velocity appear to be important in contributing to good fishery of *Choodai* in the region.

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