

Wadge Bank Trawl Fishery Studies

Part III. Nature and Composition of the resident population

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INTRODUCTION

The demersal stock of the Wadge Bank is known to be made up of two major groups, namely the resident and migrant stocks (Sivalingam 1966b). It is necessary to analyse the two groups separately in order to correctly interpret the changes in relative abundance of the demersal fish stocks of the Bank. The object of this paper is to present the nature of the resident stock and discuss its changes in composition from 1945 to 1960. That of the migrant population will be presented later. The significance of this analysis has been discussed earlier (Sivalingam 1966a).

ACKNOWLEDGEMENTS

The author is indebted to Dr. K. K. Nair, Fisheries Biologist, FAO, for the many suggestions made by him in the preparation of this manuscript.

DATA

Details of the trawler catch records and fish landing records available for analysis have been given earlier (Sivalingam 1966b). To work out the percentage species composition of individual categories by numbers and by weight the data obtained while taking length measurements (Sivalingam 1969) were used. As a result of large number of commercially important species involved and lack of adequate facilities at the time when data were collected it was not possible to obtain information on all commercially important species. The chief omissions in the resident stock were *Lutianus rivulatus* (Day), *Epinephelus aerolatus* (Day), *Ephippus orbis* (Bloch) and *Platax tiera* (Forsk.) It has also not been possible to identify all the species that occur on the Bank specially those which are not of economic importance. The primary objective of this study, limited the analysis to the species of economic importance only.

NATURE OF THE RESIDENT POPULATION

It has been observed during the first commercial fishery (Sivalingam 1966a) that some of the varieties were caught throughout the twelve months of the year on the Bank, while the increase in the total catch during the southwest monsoon months was primarily due to the appearance of other varieties that are not present on the Banks during the northeast monsoon months. This nature of the population has continued to remain the same throughout the period of the present study. The commercial categories (page 28) that have been recorded on the Banks throughout the year are "bigfish", "small-fish" and "leatherjackets" (Figs. 1 and 2). It will be observed from Figure 1 that though the category "bigfish" is present on the Bank throughout the twelve months of the year the relative abundance of this category as indicated by the catch per hour, fluctuated during certain months. These fluctuations were not regular. The heaviest catches for the year were obtained during the northeast monsoon months for certain years (1951, 1954 and 1955) and southwest monsoon months for some others (1952, 1953 and 1958). Heaviest catches have also been recorded for the intermonsoon months (1956). It is also observed that during 1957 and 1960 the catch per hour remained more or less even throughout the year without any evidence of fluctuation.

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In the case of the category "smallfish", unlike in the case of "bigfish", the catch per hour remained fairly steady throughout the twelve months of the year (Fig. 1) indicating the constant nature of their relative abundance on the Bank. However the percentage of the sea bream (*Lethrinus nebulosus* (Forsk.) within this category did show irregular fluctuations within the year as will be seen from Table I. The sea bream is the most important member of this category (page 29).

TABLE I

FLUCTUATIONS WITHIN THE YEAR, IN THE PERCENTAGE OF *Lethrinus nebulosus* IN CATEGORY "SMALLFISH" BY NUMBERS FROM 1954 TO 1958. DASH INDICATES NO SAMPLING

Month	1954	1955	1956	1957	1958
	%	%	%	%	%
January ..	15	21	—	47	—
February ..	7	15	32	27	—
March ..	12	13	—	4	—
April ..	10	18	—	22	—
May ..	20	18	32	15	—
June ..	17	26	29	37	—
July ..	16	19	43	22	—
August ..	18	21	12	7	26
September ..	8	24	6	40	8
October ..	—	8	8	—	—
November ..	20	—	28	—	—
December ..	15	—	26	—	—
Annual ..	13	20	20	23	17

The category "leatherjackets" unlike the former categories, though present on the Bank throughout the twelve months of the year, exhibited greater fluctuations (Fig. 2). These fluctuations were quite irregular without any definite trend or pattern. The time of greatest abundance within the year was sporadic.

COMPOSITION

Commercial Categories

The resident species landed at the jetty are recorded in five main categories, namely "bigfish" "paiyinthy", "kossa", "smallfish" and "leatherjackets" (Appendix I). The first four categories are made up of more than one species, but the sale price per pound was generally the same for all the species of any particular category. In the catch records maintained by the trawlers some of these categories were subdivided into varieties (Appendix I). Each variety often consisted of related species of one genus or family. The deck crew was familiar enough to sort out the varieties without much difficulty. In the case of the category "smallfish" however, the specimens were sorted out by size and not by species.

In the following analysis the categories "bigfish", "paiyinthy" and "kossa" are all grouped together and treated as "bigfish", since they were all priced equally. Also the percentage of the last two are too small to be treated separately. Further "Kossa" is a member of the same family as variety "laweya" (Epinephelidae) which is in the "bigfish" category.

In all more than 75 species have so far been recorded from the resident stock. Of these only about a dozen species are of commercial importance.

In this study the demersal fish population is being analysed by categories, since records have not been maintained for individual species.

Category "bigfish" Within the resident stock, economically, this category is the most important one. For sales purposes this category is classified as Grade II (Sivalingam 1966b). It is made up of more than 20 species, 9 of which form a major proportion. They are :—

<i>Ephippus orbis</i> (Bloch)	<i>L. malabaricus</i> (Day)
<i>Epinephelus undulosus</i> (Forsk.)	<i>L. rivulatus</i> (Day)
<i>Lethrinus nebulosus</i> (Forsk.)	<i>Platax tiera</i> (Forsk.)
<i>L. miniatus</i> (Herre and Montalban)	<i>Plectorhynchus pictus</i> (Tanaka)
<i>Lutianus dodecanthus</i> (Day)	

It has not been possible to obtain information on the species composition of this category by weight for the full period. But according to the figures available for 1957 and 1958 (Table II) and the trawler catch data (Figs. 3 and 4) *L. nebulosus* is the most important member of this category, followed by *E. undulosus*.

TABLE II
SPECIES COMPOSITION OF CATEGORIES "BIGFISH" AND "SMALLFISH" BY WEIGHT

Category	Species	1957 %	1958 %
Bigfish*	<i>Lethrinus nebulosus</i>	50	59
	<i>Epinephelus undulosus</i>	23	30
	<i>Plectorhynchus pictus</i>	12	4
	<i>Lutianus dodecanthus</i>	6	0
	<i>Lutianus malabaricus</i>	3	2
	Others	6	5
		Total weight sampled	5,013 lbs.	1,497 lbs.
	Number of samples	7	2
Smallfish	<i>Lethrinus nebulosus</i>	26	19
	<i>Lutianus rangus</i>	7	7
	<i>Lutianus marginatus</i>	23	7
	<i>Scolopsis bimaculatus</i>	10	15
	<i>Parupeneus sp.</i>	4	2
	Others	29	51
		Total weight sampled	755 lbs.	490 lbs.
	Number of samples	4	2

*Excludes *Epinephelus sp.* (kossa), *Lutianus rivulatus*, *Ephippus orbis* and *Platax tiera*

Category "smallfish" Among the residents this category has the largest number of species and includes all specimens which are less than about 30 cm. in length. In this category, in addition to the species belonging to the "bigfish" category, more than 35 species have so far been recorded. Though made up of so many species, only 4 of them, individually contributed 5% or more by weight and number (Tables II and III). They are :—

<i>Lethrinus nebulosus</i> (Forsk.)
<i>Lutianus rangus</i> (Cuvier and Valenciennes)
<i>L. marginatus</i> (Day)
<i>Scolopsis bimaculatus</i> (Day)

TABLE III

PERCENTAGE SPECIES COMPOSITION OF THE CATEGORY "SMALLFISH" BY NUMBERS FOR 1956 AND 1957
1957 FIGURES IN BRACKETS. DASH INDICATES NO SAMPLING.

SPECIES	MONTH											
	J	F	M	A	M	J	J	A	S	O	N	D
	%	%	%	%	%	%	%	%	%	%	%	%
<i>Lethrinus nebulosus</i>	— (47)	32 (27)	— (4)	— (22)	32 (15)	29 (37)	43 (22)	12 (7)	6 (40)	8 —	28 —	26 —
<i>Lutianus marginatus</i>	— (10)	14 (15)	— (23)	— (28)	15 (27)	24 (24)	25 (22)	35 (11)	12 (25)	9 —	24 —	28 —
<i>Lutianus rangus</i>	— (2)	7 (12)	— (28)	— (10)	13 (4)	21 (5)	6 (7)	14 (6)	20 (6)	16 —	13 —	18 —
<i>Scolopsis bimaculatus</i>	— (24)	20 (15)	— (15)	— (11)	5 (14)	11 (14)	12 (15)	11 (7)	4 (14)	2 —	16 —	11 —
Others	— (17)	27 (31)	— (30)	— (29)	35 (40)	15 (20)	14 (34)	28 (69)	58 (15)	65 —	19 —	17 —

It is important to note that the most prominent member of this category *L. nebulosus* grows into the "bigfish" category when it is more than 30 cm. and becomes the most important member of this group. The smaller sized members of the other species of the "bigfish" category have been recorded in the "smallfish" category, but not in any appreciable quantity and the majority of the species recorded as "smallfish" do not occur in sizes longer than 30 cm. on the fishing grounds frequented by the trawlers. Because of the small size they are stored ungutted (Sivalingam and Medcof 1957) and sold in that condition. They are low priced and are classified as Grade III (Sivalingam 1966b).

Category "leatherjackets" This group is made up of one species only, *Balistes stellatus* (Bleeker). This species is not popular for edible purposes and is classified in Group III for sale.

CHANGES IN THE COMPOSITION FROM 1945 TO 1960

Category "bigfish"

From the initial stages in 1945 up to 1951 when only one trawler was working and that too only during the northeast monsoon months (Sivalingam and Medcof 1957) a major percentage of the total landings was made up of category "bigfish" which showed a decline from 89% in 1945 to 55% in 1951 (Table IV). Subsequently the fishing effort more than doubled from 2,124 hours trawling in 1951 to 4,446 hours in 1953 when the original one was replaced by two other vessels. Fishing was then continuous throughout the year including the southwest monsoon months when the migrant varieties appear on the fishing grounds (Sivalingam and Medcof 1957). In 1954 immediately after

this increase in fishing effort there was a sudden drop in the percentage of the "bigfish" category in the total catch down to 38%. This was followed by a further decline with minor fluctuations and finally in 1960 the percentage of "bigfish" was only 31% of the total landings. The pattern of change in the percentage of "bigfish" did not have any relationship to changes in the total landings which increased to a maximum of 3.141 million pounds in 1957 and later was reduced to 2.323 million pounds in 1960 (Table IV).

TABLE IV

CHANGES IN THE PERCENTAGE COMPOSITION OF THE RESIDENT CATEGORIES IN THE TOTAL LANDINGS FROM 1945 TO 1960

Year	Fishing effort	Total landings	Category			Total residents	Others
			Big fish %	Small fish %	Leather jackets %		
	hours	million lbs.	%	%	%	%	%
1945	346	0.166	89	6	—	95	5
1946	1,064	0.568	72	14	—	86	14
1947	947	0.542	76	13	—	89	11
1948	1,108	0.586	66	12	3	81	19
1949	808	0.424	64	12	8	84	16
1950	1,209	0.791	59	11	10	80	20
1951	2,124	1.102	55	9	7	71	29
1952	2,344	1.295	53	5	3	61	39
1953	4,446	2.567	52	7	3	62	38
1954	5,590	2.998	38	14	4	56	44
1955	4,814	2.734	38	16	3	57	43
1956	4,910	3.114	42	14	2	58	42
1957	5,388	3.141	34	13	1	48	52
1958	4,525	2.601	36	8	1	45	55
1959	4,327	2.400	33	10	1	44	56
1960	3,682	2.323	31	8	1	40	60

Though the category "bigfish" as a whole showed a distinct decline, in percentage none of the varieties that made up this category showed any such conspicuous decline within this category. (Figs. 3 and 4) The decline in percentage of this category as a whole therefore appears to be due to a decline in percentage of all the varieties.

Category "smallfish"

Throughout the period of this study the percentage of this category in the total landings fluctuated between 10 and 15% except for occasional dips below 10% (Table IV). As in the case of "bigfish" the fluctuations do not appear to have any relationship to the pattern of change in the total landings.

The catch per hour of this category varied little between 1954 and 1957 (Table V). Further during the same period the annual percentage of *L. nebulosus* within the category "smallfish" was on the increase (Table I). It can therefore be inferred that the recruitment of this species to the fishery slightly improved between 1954 and 1957 and if so then the continuous decline in the percentage of adults of this species has not in any way affected its recruitment between 1954 and 1957. It is not known as to whether the young specimens that move on to the fishing grounds from the shallower

waters (Sivalingam 1969) are the offsprings of the adults on the Bank. If they are, then the smaller percentage of the adults which were found on the fishing grounds, coupled with the stock in rocky areas where fishing is avoided, appears to be sufficient to provide the required replacements.

TABLE V

VARIATION IN CATCH PER HOUR OF TRAWLING OF CATEGORY SMALLFISH BETWEEN 1945 AND 1960

Year	Catch per hour lbs.	Year	Catch per hour lbs.
1945 ..	32	1953 ..	42
1946 ..	76	1954 ..	74
1947 ..	76	1955 ..	91
1948 ..	64	1956 ..	91
1949 ..	66	1957 ..	76
1950 ..	70	1958 ..	48
1951 ..	49	1959 ..	54
1952 ..	25	1960 ..	48

Category "leatherjackets"

This category does not appear to have been recorded separately from 1945 to 1947 (Table IV). It was first recorded in 1948. Like the category "bigfish" this category too showed a decline in percentage and finally contributed a mere 1% of the total catch from 1957 to 1960. Since this category is not in popular demand and the sale price is low, the decline does not seriously affect the economics of the fishery.

General

The annual total landings from the Wadge Bank increased from 0.166 million pounds in 1945 to 3.141 million pounds in 1957 and later declined to 2.323 million pounds in 1960 (Table IV). But the percentage of the resident stock (i.e., all resident categories combined) in the total catch declined continuously throughout the period and in 1960 was less than 50% of what it was when the fishery started. This decline was continuous without any relationship to the changes in the total landings. This decrease in percentage of the resident stock was compensated for, by the increase in the percentage of the migrant varieties from 29% in 1951 to 60% in 1960. Prior to 1951 fishing was limited to one season only. During this season the migrant varieties were present on the Banks in smaller quantities. The migrant stock was made up of both Grade I and Grade III categories which were priced differently. The effect of these changes on the economics of the fishery will be discussed in future papers.

SUMMARY

1. The commercial categories "bigfish", "smallfish" and "leatherjackets" are present on the fishing grounds for the twelve months of the year and form the resident stock of the Wadge Bank.
2. Of these three categories, "bigfish" forms the largest percentage, is most important commercially and includes more than 20 species. *L. nebulosus* is the most important resident species.
3. Category "smallfish" is made up of more than 35 species, 4 of which are prominent members. *L. nebulosus* (<30 cm.) again forms the largest percentage within this category.
4. Category "leatherjackets" is of minor importance commercially and forms a small percentage of the total catch. It is made up of one species.

5. Category "bigfish" showed a constant decline in the percentage of total landings from 1945 till 1960. This decline had no relationship to the pattern of changes in the total landings.
6. Percentage of category "smallfish" in the total landings fluctuated within narrow limits.
7. A decline in the percentage of category "bigfish" did not affect the recruitment of the sea bream to the fishing grounds between 1954 and 1957. In fact recruitment did improve.
8. Percentage of the resident categories as a whole, in the total landings, declined and in 1960 was less than 50% of what it was in the initial stages.

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- 1969. Wadge Bank trawl fishery studies, Part IV. An analysis of the length frequency measurements of the sea bream (*Lethrinus nebulosus*) made in 1949 and 1953 to 1958. *Ibid.*, Vol. 20, pp. 39-50
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APPENDIX I

<i>Commercial category (fish landing records)</i>	<i>Variety (Trawler catch records)</i>	<i>Scientific names of species making up each variety</i>
Bigfish ..	.. Mivatiya	.. <i>Gymnochraneus griseus</i> (Schlegel) <i>Lethrinus nebulosus</i> (Forsk.) <i>L. miniatus</i> (Herre & Montalban)
	Laweya ..	.. <i>Epinephelus undulosus</i> (Quoy & Gaimard)
	Red snappers	.. <i>Lutianus argentimaculatus</i> (Day) <i>L. dodecanthus</i> (Day) <i>L. erythropterus</i> (Day) <i>L. malabaricus</i> (Day) <i>L. sebae</i> (Day) <i>Pinjalo pinjalo</i> (Bleeker) <i>Pristiopomoides typus</i> (Bleeker) <i>Sparus spinifer</i> (Forsk.)
	Tholan ...	.. <i>Gaterin ceylonensis</i> (Smith) <i>G. sivalingami</i> (Smith) <i>Plectorhynchus pictus</i> (Tanaka)
	Kuruvili ..	.. <i>Lutianus rivulatus</i> (Day)
Kossa ..	.. Kossa ..	.. <i>Epinephelus aerolatus</i> (Day) <i>Epinephelus</i> spp.
Paiyinthi ..	.. Paiyinthi (Moonfish)	.. <i>Ephippus orbis</i> (Bloch) <i>Platax tiera</i> (Forsk.)
Pothupora ..	.. Leatherjackets	.. <i>Balistes stellatus</i> (Bleeker)
Smallfish ..	.. Smalls ..	.. <i>Acanthurus matoides</i> (Valenciennes) <i>Balistes</i> sp. <i>Drepane punctata</i> (Linnaeus) <i>Evocoetus</i> sp. <i>Gerres filamentosus</i> (Day) <i>Heniochus macrolepidotus</i> (Day) <i>Holocentrus rubrum</i> (Forsk.) <i>Johnius carutta</i> (Bloch) <i>Lactarius lactarius</i> (Schneider) <i>Leiognathus</i> sp. <i>Lethrinus mahsenoids</i> (Valenciennes) <i>Lutianus kasmira</i> (Forsk.) <i>L. rangus</i> (Cuvier & Valenciennes) <i>L. marginatus</i> (Day) <i>Mene maculata</i> (Day) <i>Monocanthus monoceros</i> (Day) <i>Myripristis murdjan</i> (Forsk.) <i>Nemipterus tolu</i> (Cuvier & Valenciennes) <i>Otolithes ruber</i> (Schneider) <i>Parupeneus luteus</i> (Bleeker) <i>Parupeneus</i> sp. <i>Platycephalus</i> sp. <i>Polynemus sextarius</i> (Day) <i>Pomadourys argyreus</i> (Valenciennes) <i>P. maculatus</i> (Bloch)

APPENDIX I—(contd.)

<i>Commercial category (fish landing records)</i>	<i>Variety (Trawler catch records)</i>	<i>Scientific names of species making up each variety</i>
Sunallfish	.. Smalls	.. <i>Priacanthus humrur</i> (Forskål) <i>Priacanthus</i> sp. <i>Psettodes erumei</i> (Day) <i>Saurida tumbil</i> (Bloch) <i>Scarids</i> (various species) <i>Scolopsis bimaculatus</i> (Day) <i>S. vosmeri</i> (Bloch) <i>Siganus oramin</i> (Bloch & Schneider) <i>Sparus berda</i> (Forskål) <i>S. spinifer</i> (Forskål) <i>Stromateus</i> sp. <i>Therapon jarbua</i> (Forskål) <i>Velifer</i> sp.
Miscellaneous	.. Miscellaneous	.. <i>Aprion viricens</i> (Valenciennes) <i>Elops</i> sp. <i>Echeneis remora</i> (Linnaeus) <i>Fistularia petimba</i> (Lacepede) <i>Megalops</i> sp. <i>Muraenids</i> <i>Pleuronectids</i> <i>Pseudosciaena</i> sp. <i>Rachycentron canadus</i> (Linnaeus) <i>Trichiurus savala</i> (Cuvier)
Inedible varieties thrown overboard		<i>Balistes erythrodon</i> (Day) <i>Hemibalistes chrysopterus</i> (Bloch) <i>Ostracion</i> sp. <i>Pterois</i> sp. <i>Tetradontids</i> <i>Uranoscopus</i> sp.

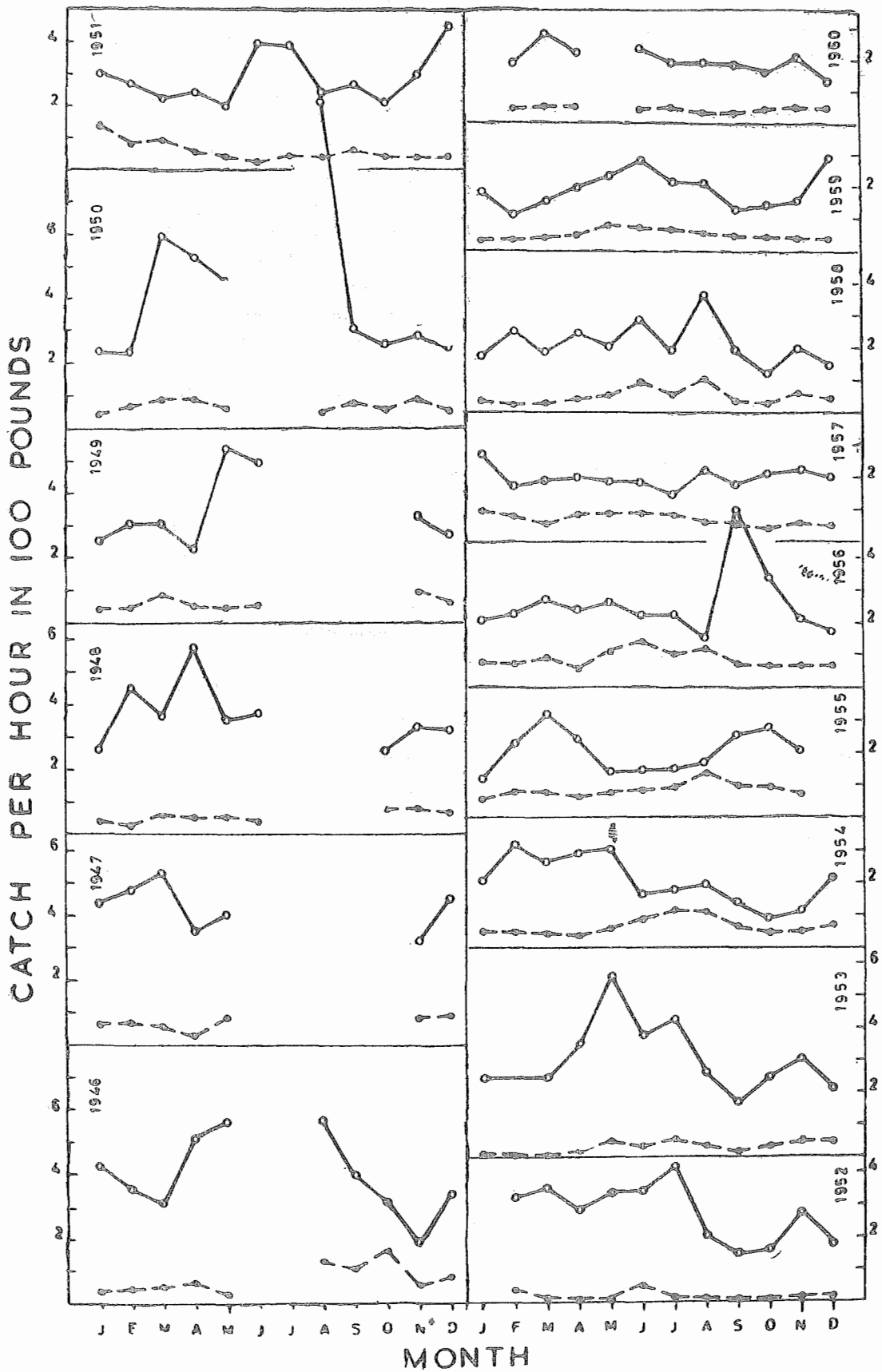


Fig. 1. Catch per hour of trawling by months of categories "bigfish" (circles) and "smallfish" (dots) for the years 1945 to 1960, indicating availability on the fishing grounds throughout the year.

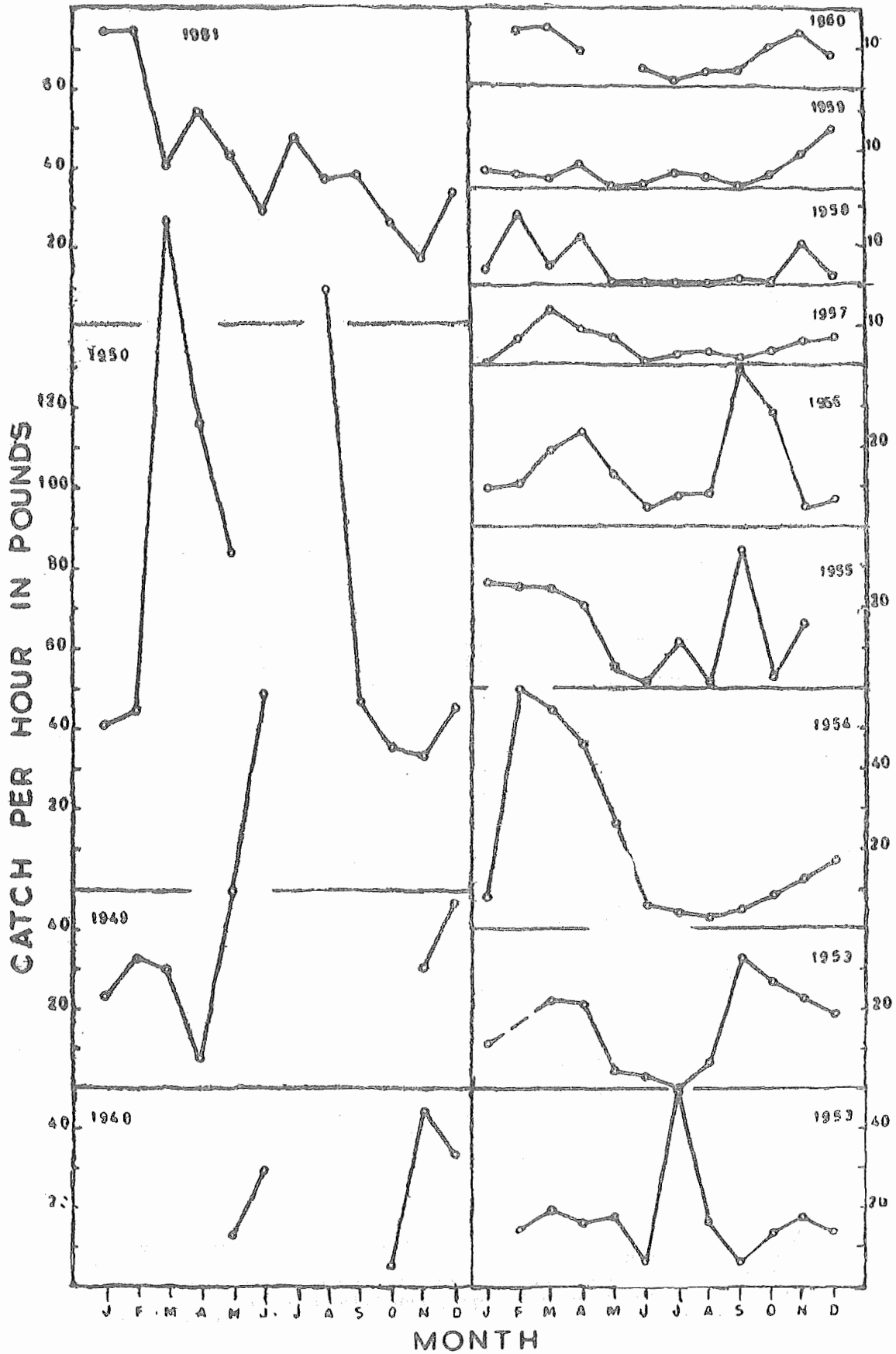


Fig. 2. Catch per hour of trawling by months of category "leatherjackets", for the years 1945 to 1960 indicating availability on the fishing grounds throughout the year.

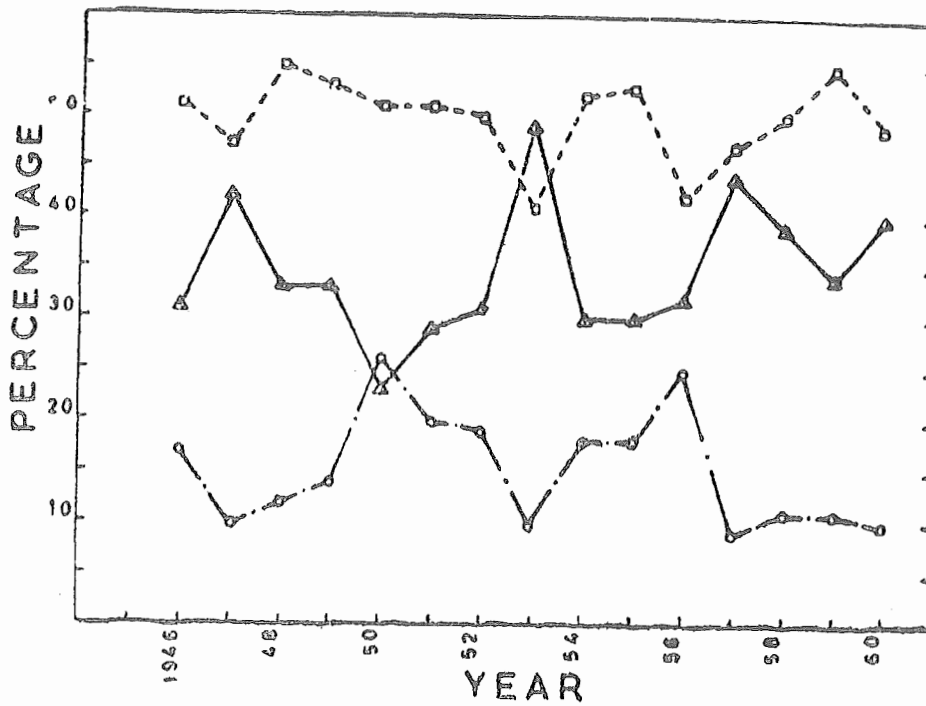


Fig. 3. Changes in the percentage composition of the varieties "mivatiya" (triangles), "red snappers" (circles), and "blacks" (squares) from 1945 to 1960. Percentage worked out from trawler records in number of baskets.

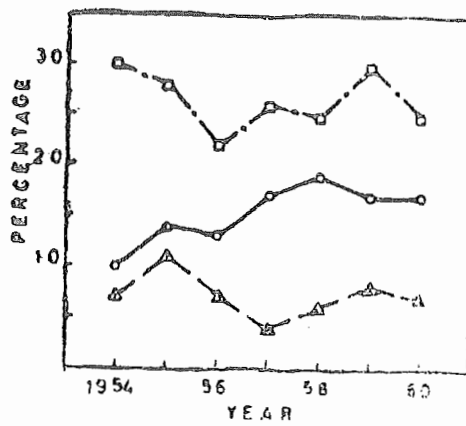


Fig. 4. Changes in the percentage composition of the varieties "laweya" (squares), "tholan" (circles) and "kuruvili" (triangles) from 1954 to 1960. Percentage worked out from trawler records in number of baskets. All these three varieties together form the larger group "blacks" mentioned in fig. 3.