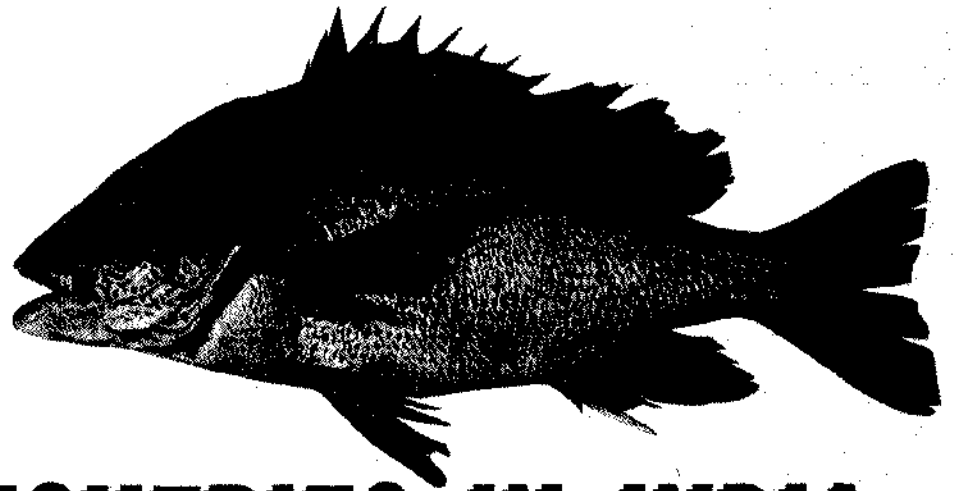
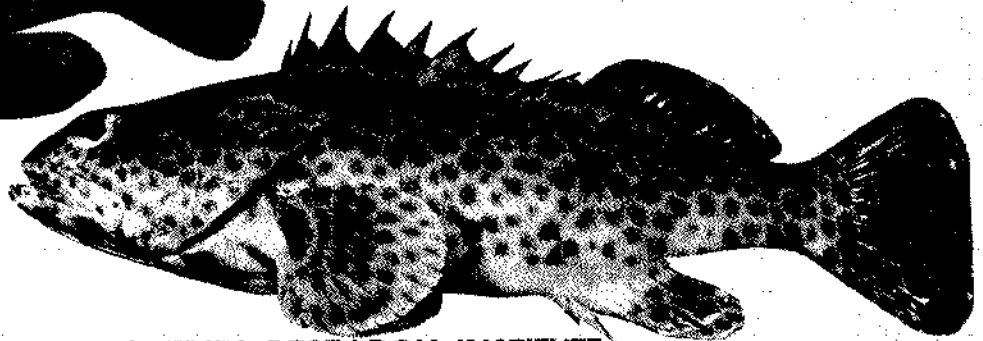


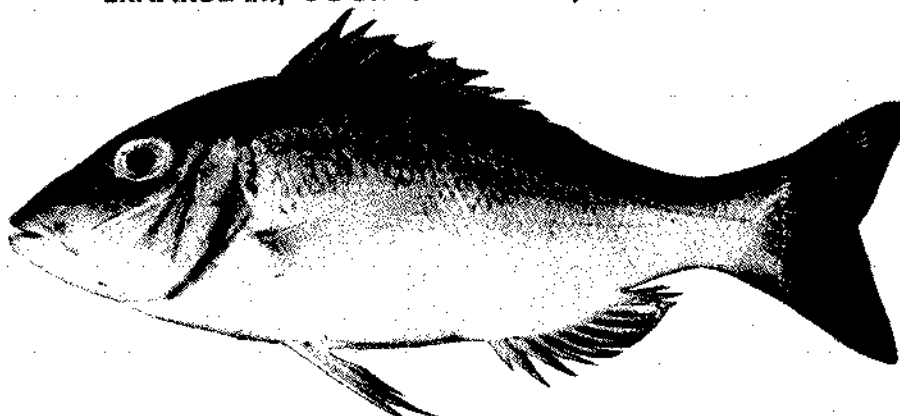
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PERCH FISHERIES IN INDIA



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PERCH FISHERY AT VIZHINJAM

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ABSTRACT

Perch fishery at Vizhinjam (76° 59' 15" E and 08° 22' 30" N) for a period of 9 years (1979 - '87) is presented here.

Rocky inshore realms coupled with offshore 'Kalava' grounds make the southwest coast of India a congenial habitat for perches and perch-like fishes. Vizhinjam, a fishing village situated right on this coast, hence, forms an important centre for any detailed study pertaining to this group in general. Fifty species of perches and perch-like fishes belonging to 8 families have been identified from the commercial landings at Vizhinjam. A preliminary analysis of the larvae and juveniles from this area shows that early stages of several species of this group occur almost throughout the year in the collections.

Fishing activities at Vizhinjam are now controlled by the artisanal sector and 9 different types of gears are employed in exploiting them; but none is specific to perches. The annual landings of perches fluctuate considerably from year to year and their percentage in total fish catches fluctuated from 3.78 to 8.37 during the above period. Maximum landing of perches at Vizhinjam is noted during postmonsoon (September - January) followed by the monsoon period (June - August). But taking the landing of each family individually it could be seen that 5 families showed peak landing in the postmonsoon. While assessing the total landing quantitatively the families Nemipteridae, Lethrinidae and Priacanthidae respectively occupied the first 3 ranks in the order of abundance. Landings of all the other families, their seasonality are also given in detail.

Though 9 different gears are in vogue at Vizhinjam, Hooks and line account for about 73% of the total perch landings. Landing of perch by all the other gears, their seasonality both quantity and quality-wise, are also discussed.

The first attempt to mechanise the traditional crafts was made at Vizhinjam in 1982 with five OBM (Yamaha, Kerosene, Model - 8 BE, 7 HP) fitted catamarans and canoes. Gradually their number swelled upto 500 by 1988. In this process many traditional crafts got converted into OBM units and this 'revolution' was silent as the beneficiaries were fishermen themselves. Fishermen at Vizhinjam accepted OBM fitted country crafts as an 'ideal unit' as it has considerably improved the daily income.

No doubt, OBM units have helped the fishermen a lot in cutting down the time spent for reaching to and from the fishing ground enabling them to avail more time in the distant virgin grounds in search of quality fishes. This has even prompted other country crafts concentrating in the inshore areas to switch on to OBM fishing. This, in turn, resulted in a drastic cut in the effort expended in the inshore realms and this directly ended up in an overall cut in landings. Families of perches which showed such a dip in landings were Lutjanidae, Theraponidae, Ambassidae and Siganidae while in the case of Nemipteridae, Priacanthidae, Serranidae and Lethrinidae, there was an improvement in the landings due to OBM fishing in the distant grounds.

The present account is of special interest since it covers the perch fishery of both pre- (1979-'82) and post- (1983-'87) mechanisation (OBM) periods. The fishery of premechanisation period was somewhat of a regular nature with common species constituting the catches year after year with CPUE fluctuating moderately, but the fishery of postmechanisation period witnessed a drastic change in the species composition and seasonality with invariably higher CPUE. Hence an account of this sort depicting the salient features of the perch fishery at Vizhinjam for 4 years prior to the introduction of OBM and then comparing it with the next 5 years during which the OBM fishery has gained considerable momentum, may serve as basic work on OBM introduction by the traditional fishermen of Vizhinjam. Future changes in the fishery pattern at Vizhinjam, if any, may be evaluated by comparing it with the presently reported results.

Suggestions are also made to monitor the productivity of the distant fishing grounds on a long-term basis and to adopt corrective measures as and when required. Some methods to improve the landing from the inshore realms are also briefly outlined.

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INTRODUCTION

Vizhinjam, a small village situated about 16 km south of Trivandrum (76° 59' 15" E 82° 2' 30" N) is an important fish landing centre. The protection offered by breakwaters makes it a weather proof landing and launching centre for any type of fishing craft that is in vogue at present. The completion of the proposed Fishing Harbour is expected to considerably improve the fishing activities at this centre.

The Research Project on "Resource characteristics of perches" was initiated at Vizhinjam in 1979 with a view to evaluating the relative abundance of perch resources and to study the growth, feeding and reproductive biology of important species of perches. The availability of perches throughout the year was monitored first and from this study it could be noted that even though perches constitute quantitatively a sizeable fraction in total landings, no species was available allthrough the year in appreciably good numbers, this condition rather renders difficult to proper biological sampling. Attempts were initiated to study the biology of atleast a few of the more common species, but these attempts were not fully successful as the composition changed at short intervals and also the numerical abundance of the given species was often not adequate to yield statistically sound samples. However, what data could be collected on the biology of Nemipterids and other perches were published later (Madan Mohan, 1983, Madan Mohan and Gopakumar, 1981; Madan Mohan and Velayudhan, 1984, 1988).

The studies on perches at Vizhinjam were therefore confined mainly to an assessment of the total landings, group-wise analysis, etc. The inconsistency of the component species in landings made a species-wise analysis and quantitative assessment rather difficult. This prompted an assessment of perch landings family-wise and this procedure has been followed at Vizhinjam from 1979 to 1987.

PERCH LANDINGS AT VIZHINJAM

The coast extending from Kovalam to Cape Comorin is rocky and the crevices and outcrops provided by this environment afford a congenial

habitat for many of the species of perches to dwell in. Exploratory fishing carried out by R. V. Varuna showed that the depth range 75 to 100 m along the southwest coast between 08° and 13° N has a hard bottom and many well known 'Kalava' grounds are located in this depth range. These 'Kalava' grounds are "small areas of hard bottom with shallow ridge-like features or outcrops which rise 2 - 5 m from the ground level and have a very irregular profile" (Silas, 1969). Such outcrops, according to the above author, do not form extensive beds, but occur in patches and this type of structure is seen only in the northern area of the southwest coast, but towards the southern part, *i.e.* 08° to 09° N, the 'Kalava' grounds tend to be "in the form of less elevated boulders or boulder-like formations and their numbers are also relatively more than the disjunct outcrops seen further north". The 'Kalava' grounds seen in this zone are smaller in area and are quite similar to those seen in the Wadge Bank. Several such 'Kalava' grounds could be located along the southwest coast. The 'Kalava' grounds off Kerala Coast are different from the perch fishing grounds on the Wadge Bank where trawling for perches is possible over a large portion of the Bank (Silas, 1969).

'Kalava' is a term used generally to include a heterogeneous group of percoid fishes popularly known as rock-cods, grunters, groupers, snappers, pig-face, etc. 'Kalava' fishing along the different areas of the southwest coast of India has been discussed at length in different works and in this context those of Hornell (1916), on 'Kalava' fishery on the Wadge Bank; of John (1948) dealing with 'Kalava' fishing off Anjengo and Chavara; of Gopinath (1954), on 'Kalava' fishing south of Alleppey and Wadge Bank and of Sivalingam and Medcof (1957) indicating the possibilities of trawling on the Wadge Bank are worth mentioning.

The above works provide the early information available on the perch resources in the offshore 'Kalava' grounds. But finding this to be insufficient for undertaking any systematic exploitation in these beds, the INP Vessel R. V. *Kalava* initiated the task of charting out the various 'Kalava' grounds located on the southwest coast of India between 08° N and 14° N.

The data collected by this vessel, as well as by R. V. *Varuna* on several previous occasions, have later been worked out by Silas (1969). The details on both quantitative and qualitative abundance of perches, their biology, number and extent of 'Kalava' grounds, etc. have been dealt with in detail by Silas (1969) (Fig. 1).

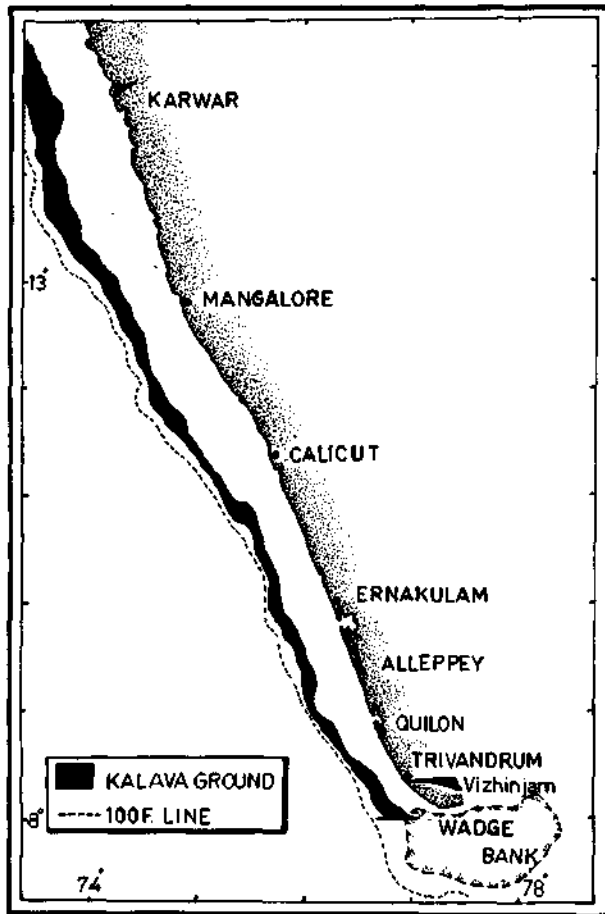


Fig. 1. Southwest coast of India showing the distribution of the offshore 'Kalava' grounds. Vizhinjam where the present studies were undertaken, is also marked (After Silas, 1969)

The survey had indicated good prospects for perch fishing along this coast. But, more data on recruitment, growth rate, age, etc. of different species of perches are needed for a proper estimation of the resource and its sustainable yield.

The inshore areas of the southwest coast between Vizhinjam and Cape Comorin is rich in young ones of both pelagic and demersal fishes. The third author could collect young ones of as

many as 50 species of fishes from the inshore landings. Several young ones of perches were in these collections and they are studied and published elsewhere.

The general pattern of water circulation on the west coast of India is well known through several works. It is clock-wise during the southwest monsoon and anti clock-wise during the northeast monsoon (Ramamirtham, 1967). Therefore, the currents off the west coast of India flow southward parallel to the coast during the southwest monsoon and postmonsoon months and mainly north ward from December to February (northeast monsoon). The reversal of currents, thus, has considerable influence on the breeding, larval abundance, migration of fish eggs and larvae, etc. of this coast (David Raj and Ramamirtham, 1981).

The above paragraphs will attest that the geographic setting of Vizhinjam is ideally suited for the exploitation of rock dwelling animals, especially perches. The most commonly employed gear at Vizhinjam is the Hooks and line, which accounts for a sizeable fraction of perch landings. Recently when mechanisation of traditional crafts such as catamaran and canoe, with OBM started at Vizhinjam, it became easier for the fishermen to cover the more distant fishing grounds. This trend which started by the end of 1982, gained momentum gradually. Now, such mechanised traditional crafts are able to explore deeper grounds (range 60 to 80 m) situated at a distance of 20 to 25 km off Vizhinjam that are well beyond the reach of traditional nonmechanised crafts. No doubt, this has considerably increased the catch per trip of all such mechanised units as it is true with any virgin ground, but a systematic study of these new grounds will have to be undertaken to see whether they are uniformly productive and at which level the fishing pressure could be maintained in future. Since mechanisation has just set in, it is possible to monitor the impact of mechanisation more closely at Vizhinjam than at any other place where mechanised vessels have been in operation for a considerably longer period.

The term Perch, as used here, includes fishes belonging to the following 8 families :

Serranidae, Lutjanidae, Lethrinidae, Theraponidae, Siganidae, Priacanthidae, Nemipteridae and Ambassidae. A list of more common species in the commercial landings at Vizhinjam is given below.

LIST OF SPECIES

Family SERRANIDAE (Groupers, rock-cods, etc.)

Cephalopolis boenack (Bloch)
C. sonnerati (Val.)
Epinephelus diacanthus (Val.)
E. chlorostigma (Val.)
E. areolatus (Forsskal)
E. bleekeri (Vaillant)
E. fasciatus (Forsskal)
E. flavocaeruleus (Lac.)
E. hexagonatus (Schneider)
E. merra Bloch
E. tauvina (Forsskal)
Promicrops lanceolatus (Bloch)
Plectropomus maculatus (Bloch)

Family LUTJANIDAE (Snappers, sea-perch, bass, etc.)

Lutjanus argentimaculatus (Forsskal)
L. biguttatus (Val.)
L. decussatus (Cuvier)
L. fulviflammus (Forsskal)
L. gibbus (Forsskal)
L. johni (Bloch)
L. lemniscatus (Val.)
L. lentjanus Bloch [= *L. lineolatus* (Ruppell)]
L. malabaricus (Bl. & Sch.) [= *L. sanguineus* (Cuv.)]
L. quinquelineatus (Bloch)
L. rivulatus (Cuvier)
L. russelli (Bleeker)
L. sebae (Cuvier)
Pristipomoides filamentosus (Val.)
P. typus Bleeker
Pinjalo pinjalo (Bleeker)

Family LETHRINIDAE (Pig-face breams, Emperors, large-eye, etc.)

Lethrinus mehsenoides Val.
L. nebulosus (Forsskal)
L. lentjan (Lacépède)
L. reticulatus Val.
L. elongatus Val. [*L. mineatus* (Bl. & Sch.)]
L. microdon Val.

Family THERAPONIDAE (Therapon perch, grunters, etc.)

Therapon jarbua (Forsskal)
T. theraps (Cuvier)
Pelates quadrilineatus (Bloch)

Family SIGANIDAE (Rabbitfishes)

Siganus canaliculatus (Park) [*S. oramin* (Bl. & Sch.)]
S. javus (Linn.)

Family PRIACANTHIDAE (Bulls-eye, big-eye, etc.)

Priacanthus hamrur (Forsskal)

Family NEMIPTERIDAE (Thread-fin breams)

Nemipterus bleekeri (Day) (= *N. delagoae* Smith)
N. japonicus (Bloch)
N. mesoprion (Bleeker ?)
N. metopias (Bleeker)
N. peronii (Val.) [(= *N. tolu* (Val.)]
Scolopsis bimaculatus Ruppell
S. vosmaeri (Bloch)

Family AMBASSIDAE (Perchlets)

Ambassis commersoni Cuvier
A. dayi Bleeker

TREND OF PERCH FISHERY AT VIZHINJAM

The data collected for 9 years (1979 to 1987) have been utilised in the present study. Details pertaining to catch, gear-wise C/E, group-wise composition, depth of operation of the gear, etc. were collected twice a week and

then computed for the month for all the 8 families dealt with here. The total annual catch varied from 169.967 t in 1979 to 541.245 t in 1987 with the average at 349.305 t (Fig. 3 A). The annual landings were below this average during 1979 to 1982 period and also in 1984.

The monthly variation in landings were quite considerable and hence, the months which recorded higher catch than the average monthly landings for the respective year, are given in Table 1.

TABLE 1. Variation in the monthly landings of perch at Vizhinjam

Year	Average monthly landings (Tonnes)	Months which recorded higher landings than the average
1979	14.16	Jan., Feb., Sept. and Dec.
1980	26.49	Aug. and Sept.
1981	15.00	Jan., Feb., Mar., Aug., Sept. and Dec.
1982	35.03	July, Aug., Sept. and Oct.
1983	36.97	July, Aug. and Sept.
1984	20.87	Jan., Aug., Sept. and Oct.
1985	42.85	July, Aug., Sept. and Dec.
1986	37.14	Jan., June, July, Aug. and Sept.
1987	45.10	Jan., Feb., July and Sept.

A perusal of the above Table 1, as also the graphic representation of the annual landings for the various years given in Fig. 2 indicates that the perch landings at Vizhinjam follow a bimodal pattern though in some years a multimodal pattern was also discernible. The main mode in the landings could be noted either during the monsoon (June to August) or postmonsoon. Out of nine years covered under the present study, the peak mode in landing could be observed in July on two occasions (1986 and 1987); in August on 4 occasions (1980, 1982, 1983 and 1985) and in September (post-monsoon period) on two occasions (1979 and 1984). In 1980, the peak landing occurred in January while that of September (postmonsoon period) was only a subsidiary one. The secondary peak in the landings could be noted during the postmonsoon months of January on 4 occasions (1979, 1980, 1984 and 1986); of December in 1985; in the premonsoon (February to May) month of April in 1983, of February in 1987 and of May in 1982. In 1981, the mode noted in

January was the dominant one while those of March and September were of secondary nature with almost of the same intensity.

The landings of perches for the various years were added together both monthwise and yearwise and from this the total for the 9 year period was calculated both year-wise and month-wise. In the present account they are referred to as "pooled total for the period 1979 to '87" and "pooled total for each month for the period 1979 to '87" respectively. The percentage landing were calculated from this pooled figures for each month. For the various groups dealt with, the same procedure is followed uniformly. The landings of the different perch groups are indicated below and in Fig. 3 B - I.

Nemipterids : In this case two peaks could be noted in the pooled monthly total landings for the entire period, the dominant being that of August, when 24.4% of the total landing was effected (Fig. 3 B). After this monsoon peak, the landings registered a sharply decreasing trend throughout the postmonsoon period. In the ensuing premonsoon period, however, the landings showed some improvement, resulting in another peak in March when about 3.6% of the total was registered. Though the above figure (3.6%) would appear to be quite unimpressive, it is dealt with as a distinctive peak, because this has got somewhat smothered in the pooling of the different years' values, as is clear from the fact that the peak is clearly seen during March in 1979, 1980, 1981, 1984 and 1986, but got shifted to April in 1983, 1985 and 1987 (no data for 1982). The monthly landings started showing a decrease after this peak, and this trend continued through May and June. By July the landings improved considerably registering 22.6% of the total landings. A further improvement in the landings could be noted in August and it was in this month the maximum catch for the year was registered. Here also the monthly landings for the various years were consulted to find out whether the hike in landings is specific to August alone or not. It was so except in September 1981 (Fig. 3 B).

Lethrinids : Here only one mode in landing could be noted, which was in January (postmonsoon period) in all years, except in 1985

and 1987 when this got shifted to February (premonsoon). In the pooled monthly total the landing effected in this month accounted for 33% of the total catch (Fig. 3 C). The monthly landings, thence, declined steeply and reached the lowest level (0.6%) by May. A secondary peak could be observed in July in the pooled total for each month (3.8%); but such an increase could not be detected in the monthly landings for the various years except in 1983. In 1983 an unusual landing of 11.15 t of Lethrinids took place by both Boat-seine and Hooks and line (mechanised sector), and this was responsible for the hike noted in July. From November onwards the catch started registering an upward trend finally resulting in a peak in January.

Priacanthids : The landings of Priacanthids were very poor allthrough the early period of this investigation (upto 1983). In the annual landings it could be seen that they were scarcely available or even absent. However, the condition changed considerably by the introduction of mechanised units at Vizhinjam.

In this case two peaks could be noted in the pooled monthly landings for the entire period (Fig. 3 D), and the one noted in October (postmonsoon) formed the dominant one followed by the other in July (monsoon period). The landing noted in October accounted for 26.5% of the total while that of July, only for 8.8%.

The landings recorded in January contributed to about 10% of the total, but dwindled thereafter and reached the lowest level of 0.4% by May. By July the landings improved registering about 8.8% of the total and this hike was found to be regular allthrough the different years. The landings then showed a sharp decrease and by August reached a lower level of 1.5% of the total. The landings from September onwards started registering an upward trend attaining a peak by October. This peak was rather well pronounced for the different years studied, except in 1986 and 1987 when it got shifted to December.

Lutjanids : The landings were rather regular throughout the period with occasional gaps in the monthly landings at the most for two months

at a stretch and this trend continued upto 1985. But afterwards the gap increased with nil landings for several months at a stretch.

Of the 3 peaks noted in the pooled monthly landings for the entire period, the postmonsoon peak of January was well demarcated in all the years examined except in 1981 when it got shifted to the premonsoon month of February. The landings registered in January accounted for 20.3% of the total (Fig. 3 E) forming the peak. From this month onwards the landings started dwindling and by May it reached the lowest level (1.8%). During the monsoon period, however, the landings registered some improvement forming a minor peak in July (5.3%). From August onwards the landings again increased resulting in another peak by October (postmonsoon peak). This peak accounted for 11.3% of the total landings. After attaining this peak the landings came down abruptly to 3.3% level by November. In the later half of the postmonsoon period there was an abrupt hike in the monthly landings which culminated in the most dominant peak of January.

Serranids : In this case the landings were rather irregular with little or no catches during certain months. However, in the pooled total landings for each month it could be noted that the postmonsoon peak of January was the most dominant among the three noted. The landings registered in this month accounted for about 20.4% of the total. The landings started showing a decreasing trend from January onwards and by May it touched a lower level (1.8%). The landings increased by June (4.5%), but by July it declined again to the lowest level for the year (0.09%). Fig. 3 F indicated another peak in landings during August, but this peak (13.9%) was observed only in 1985 when an unusual landing of serranids occurred (22.7 t totally, of which 19.2 by Boat-seine in August 1985). From August onwards the landings showed a decreasing trend upto November. After November the landings improved and the climax was attained by January.

Siganids : October to February recorded very poor landings (0.1% to 2.2%) and for the rest of the period as many as three peaks in the landings could be noted, the most dominant

being that of August with 27.6% of the total landings in pooled data. The other two were noted in April and June registering 9.8% and 13.3% respectively of the total landings (Fig. 3 G). This trend could be noted both in the separate and pooled landing data alike. Monsoon period may be said to be the best season for the landing of siganids as the most dominant and the next mode in landings could be observed during the monsoon period.

Theraponids : For this group the landings were rather regular upto 1982, but later showed an irregular trend with wide gaps, in landings, for one or more months in between.

The most dominant mode noted in the landings (pooled total for each month) was in May and this could be seen both in the monthly as well as in pooled landings alike. The monthly percentage of landing noted in May was 25.0%. Soon after this, the landings came down to 10.7% by June and remained more or less in the same level throughout the monsoon period. The catch decreased further by September to a 4.3% level. A postmonsoon peak of a minor intensity could be observed during October (11.0%), but afterwards decreased by November (6.7%). However, a slight improvement in the landing could be seen by December (second peak in the postmonsoon period, 7.5% of the total landings). After this hike in landings there was an obvious declining trend attaining the lowest figure of 1.5% by February. The increase in landings noted during the next two months of the premonsoon period was spectacular and this ultimately resulted in the premonsoon peak of May (Fig. 3 H).

Ambassids : The year 1979 was the only period when the landings, in this case, were protracted. In other years the landings became poor and the number of months with nil catches also increased considerably : landings were nil in 1985 and 1986 and were confined to a single month in 1987 and to two months in 1984.

In the pooled monthly total for the entire period, the minimum landings were recorded in February (3.7%) and thence the landings, for the rest of the premonsoon period, were on the increase until the monsoon peak of July was

attained (Fig. 3 I). This peak, which registered 14.1% of the total, was the dominant one. In August, however, a steep fall in the monthly landings could be noted (4.7%), but this was later made up in September with a minor peak (10.3%). From October onwards the increase in landings was gradual, ultimately resulting in a peak in December (11.1% of the total).

SEASONALITY IN PERCH LANDINGS

In order to find out the seasonality in perch landings at Vizhinjam the year was divided into 3 seasons as follows :

Premonsoon period	- February to March
Monsoon period	- June to August
Postmonsoon period	- September to January

The yearly as well as total (pooled) landings of different groups of perches for the entire study period (1979 to 1987) were computed both groupwise and gearwise. The same may be summarised as follows :

Seasonality : all groups combined

Taken for the entire 9 year period, the postmonsoon period accounted for the bulk in landings (41.2%), closely followed by the monsoon period (40.4%) (Fig. 3 A, 4 C). The landings recorded during the premonsoon period was low (18.4%). Quantitywise this may be expressed as follows :

Premonsoon period	- 579.9 t
Monsoon period	- 1220.4 t
Postmonsoon period	- 1293.3 t

Considered for individual years the maximum landing of perch occurred during the postmonsoon period except during the years 1982, 1986 and 1987 when this was noted in the monsoon period. The premonsoon period was generally characterised by low landings, except during 1979, 1981 and 1984 when the lowest landings were in the monsoon period.

Seasonality : groupwise

When, for each group, its landings were pooled for the various years, results indicated

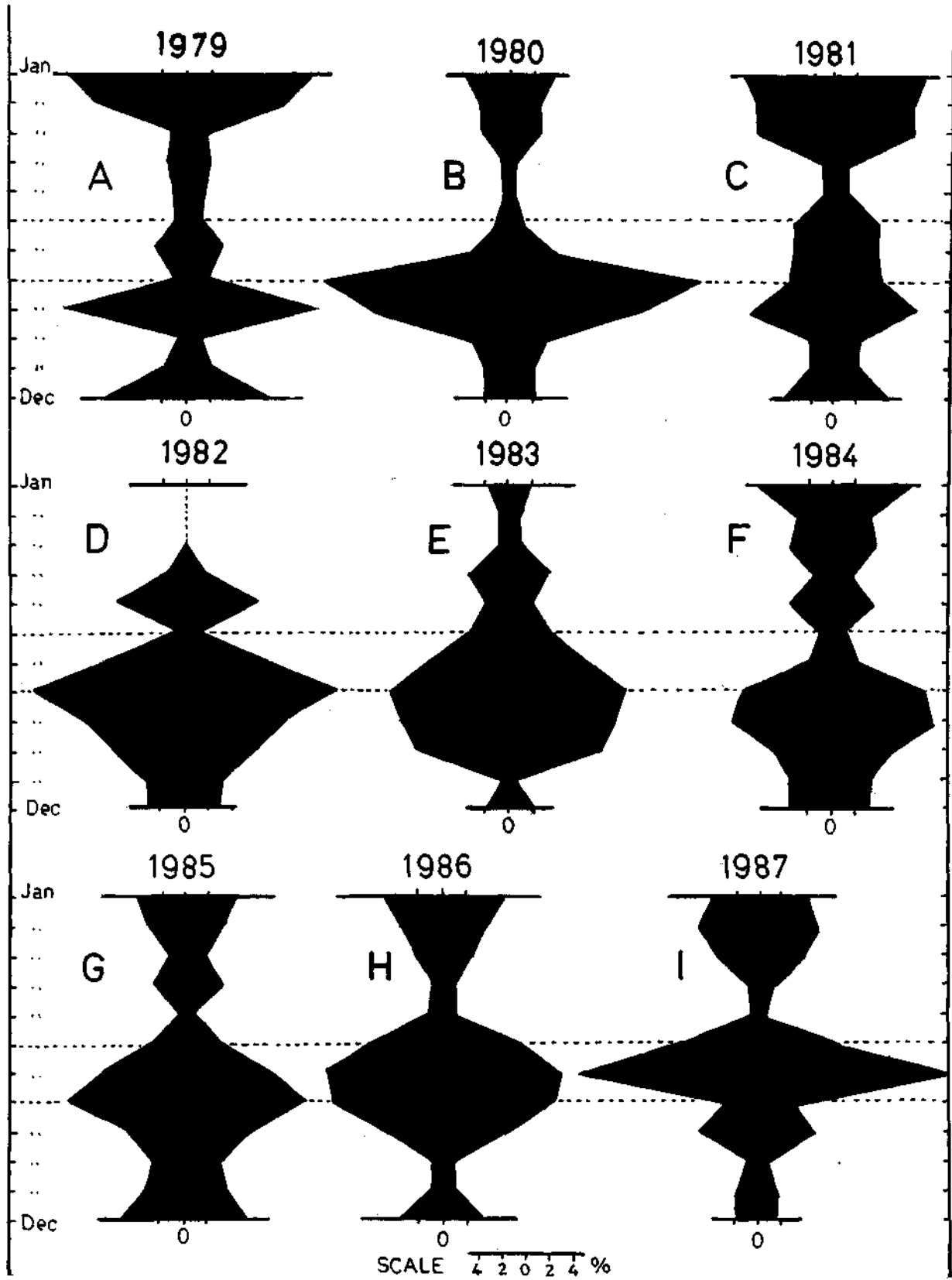


Fig. 2. A - I : Annual landings of perch at Vizhinjam from 1979 to 1987. The monthly landings (%) are also given.

that the maximum catch for 5 groups (Lithrinids, Lutjanids, Serranids, Ambassids and Priacanthids) was observed during the postmonsoon; for two groups (Nemipterids and Siganids) during the monsoon and for Theraponids, in the premonsoon. The period of minimum landings noted in the case of all the above 8 groups may be as follows :

Groups with monsoon minimum :

Lethrinids, Lutjanids, Serranids, Priacanthids and Theraponids.

Group with postmonsoon minimum :

Siganids.

Groups with premonsoon minimum :

Nemipterids and Ambassids.

Seasonality : operation of units

Here the number of units (%) that has been operated during each season is taken into consideration. The seasonality noted with reference to each gear may be given as :

Dominant during :

- Premonsoon - Konchu vala, Nandu vala and Chala vala.
 Monsoon - Boat-seine and Achil.
 Postmonsoon - Hooks and line (non-mech. sector), Drift net (both sectors), Hooks and line (mech. sector), Shore-seine and Trawl.

Least dominant

- Premonsoon - Boat-seine, Hooks and line (mech. sector) and Achil.
 Monsoon - Hooks and line (non mech. sector), Drift net (both sectors), Shore seine, Nandu vala and Chala vala.
 Postmonsoon - Konchu vala.

(Of the above gears some were operated for a particular period. For more details on seasonality in landings of individual group in relation to units see under "Gearwise perch production".

GROUPWISE PRODUCTION AT VIZHINJAM

Data collected (1979 to 1987) have been utilised here to assess the annual production, fluctuations in production, etc. The share of perch in total landings (of all fishes) for the above period at Vizhinjam ranged from 3.78% (1979) to 8.37% (1980) (Fig. 4 B).

The total production of perches for 1979 to 1987, was estimated at 3143.697 t. The composition of the various groups, their percentages, priority in the order of abundance (rank), etc. are furnished in Table 2.

TABLE 2. Average groupwise perch landings and their percentage at Vizhinjam

Groups	Total landings (t)	%
Nemipterids	1729.956	55.02
Lethrinids	332.464	10.60
Priacanthids	256.305	8.20
Siganids	223.894	7.11
Lutjanids	216.824	6.90
Serranids	189.931	6.01
Theraponids	161.666	5.13
Ambassids	32.857	1.03

Nemipterids : The yearly contribution by this group to the perch landings fluctuated between 50.4 t (1979) and 350.7 t (1987) with the average at 192.2 t and the percentage from 29.7 (1979) to 74.7 (1980). The landings were well above the average (i.e. 192.2 t) in 1980, 1983 and 1985 to 1987 (Fig. 5 A).

Species commonly met with in the commercial landings were *Nemipterus metopias* contributing to 83.8% of the total followed by *N. bleekeri* (13.06%) and *N. japonicus*. *N. metopias* and *N. japonicus* were available in landings from June to September, while *N. bleekeri*, in all months except June to August. August formed the peak period in the landings of *N. metopias*, September for *N. japonicus* and November for *N. bleekeri*.

Lethrinids : The annual landings of lethrinids ranged from 10.43 t (1982) to 56.58 t (1986) with the average at 36.9 t, and from 3.7% (1982) to 20.7% (1979). The annual landings were above

this average during 1985 to 1987 period (Fig. 5 B). Its position in the annual landings fluctuated considerably from year to year : this group occupied the second rank for 5 years (1979, 1980, 1981, 1984 and 1986), third rank for one year (1987), 5th rank for two years (1983 and 1985) and the 6th rank for one year (1982).

The landings were found through the year in the pooled monthly total for the entire period, but individual years were sometimes without any landings for several months at a stretch. The landings were poor during monsoon and only 5.2% of the total could be recorded during this period. During monsoon period of 1982 and 1985 lethrins were totally absent.

Only one mode in the landing could be observed and that was usually in January (postmonsoon) or occasionally in February (premonsoon) of 1985 and 1987. Postmonsoon accounted for the bulk in landings (61.4% of the total).

Priacanthids : The yearly landings of this group varied from 0.4 t (1980) to 85.9 t (1985) with the average at 28.47 t and from 0.1% (1980) to 16.7% (1987). The annual landings during 1984 to 1987 were well above this average, while they were poor in the initial years (1979 to 1981) (Fig. 5 D).

Similarly, despite its third rank when the entire period is taken together, its annual landings fluctuated from 8th and 2nd as detailed below : 2nd rank in 1987 and 1985; 3rd rank in 1986; 4th in 1983; 6th in 1983; 7th in 1979 and 8th in 1980 and 1981. The landing during the monsoon was very poor and contributed only 11.7% of the total (Fig. 5 D). The best period was the postmonsoon period (74.1%).

Siganids : The annual landings, in this case, varied from 3.2 t (1980) to 60.15 t (1985) with the average at 24.87 t (Fig. 5 E). It fluctuated between 1.8% (1981) and 11.7% (1985) and the landings were above the average of 24.87 t only during the years 1984 to 1986.

Its position fluctuated considerably in the annual landings : occupied the 3rd position during 1982 and 1983 period, 4th position

during 1984 to 1986 period, 5th position in 1987, 6th in 1980 and 7th in 1981.

March to September period formed the best period in their landings and as many as three peaks in the landings could be observed during this period. The monsoon accounted for the bulk in landings (65% of the total) (Fig. 3 G).

Lutjanids : The landings registered a decreasing trend in 1986 and 1987. The annual landings varied from 7.1 t (1986) to 47.3 t (1983) with the average at 24.0 t (Fig. 5 F) and from 1.6% to 18.9% (1979). The landings were above the average of 24.0 t during 1979, 1981, 1983 and 1985.

This group occupied the second rank in 1981 and 1983; third rank in 1979; 4th rank in 1980 and 1982; 5th rank in 1984 and 6th rank during 1985 to 1987 period. The postmonsoon period registered the bulk of the year's catch (56.1%), followed by the premonsoon period (29.5%).

Serranids : This group fluctuated between 3.3 t (1982) and 62.69 t (1985) with the average at 21.1 t and from 1.2 % (1982) to 12.2 % (1985). The landings were above the average (21.1 t) during 1985 to 1987 (Fig. 5 G). The maximum was registered during the postmonsoon period (49.7%) followed by the premonsoon period (31.9%).

Theraponids : The annual landings of theraponids varied from 2.9 t (1987) to 39.7 t (1982) with the average at 17.8 t and from 0.5% (1987) to 15.3% (1979). During 1979, 1980, 1982 and 1983 the annual landings were above the average of 17.8 t. Here also a downward trend in the annual landings could be noted from 1983 onwards (Fig. 5 H).

The landings, as seen in the pooled total for each month, were spread allthrough the year, but in the monthly landings for various years no such continuity could be observed. The number of months with no landings also increased towards the fag end of the period (1985 to 1987).

Its overall 7th rank varied considerably from year to year : 1979 to 1983 was from 2nd

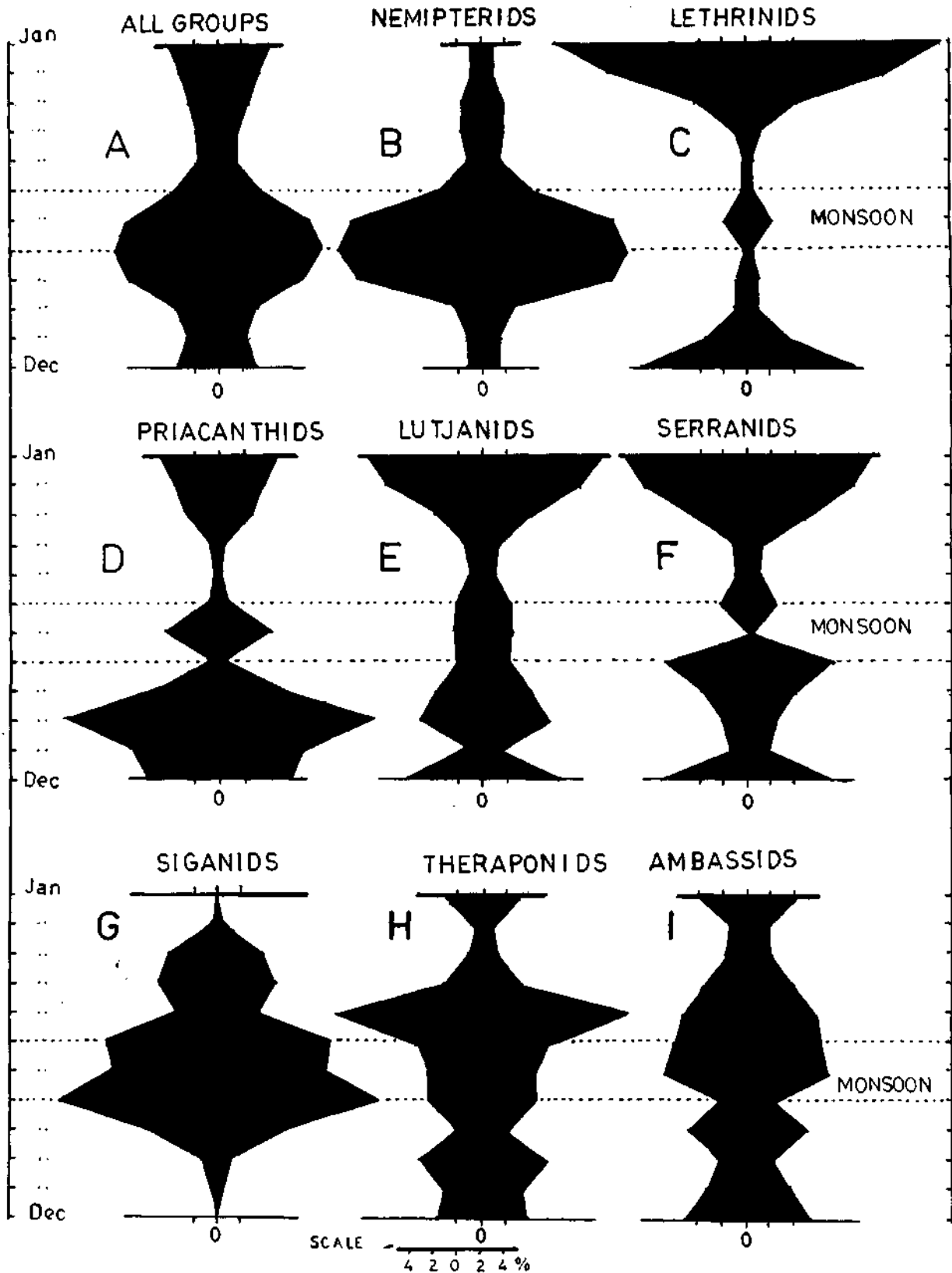


Fig. 3. A - I : The landing pattern of the different groups of perches are given based on pooled monthly total for the entire period. Monsoon period is indicated by two interrupted lines (For monthly landings only percentages are considered).

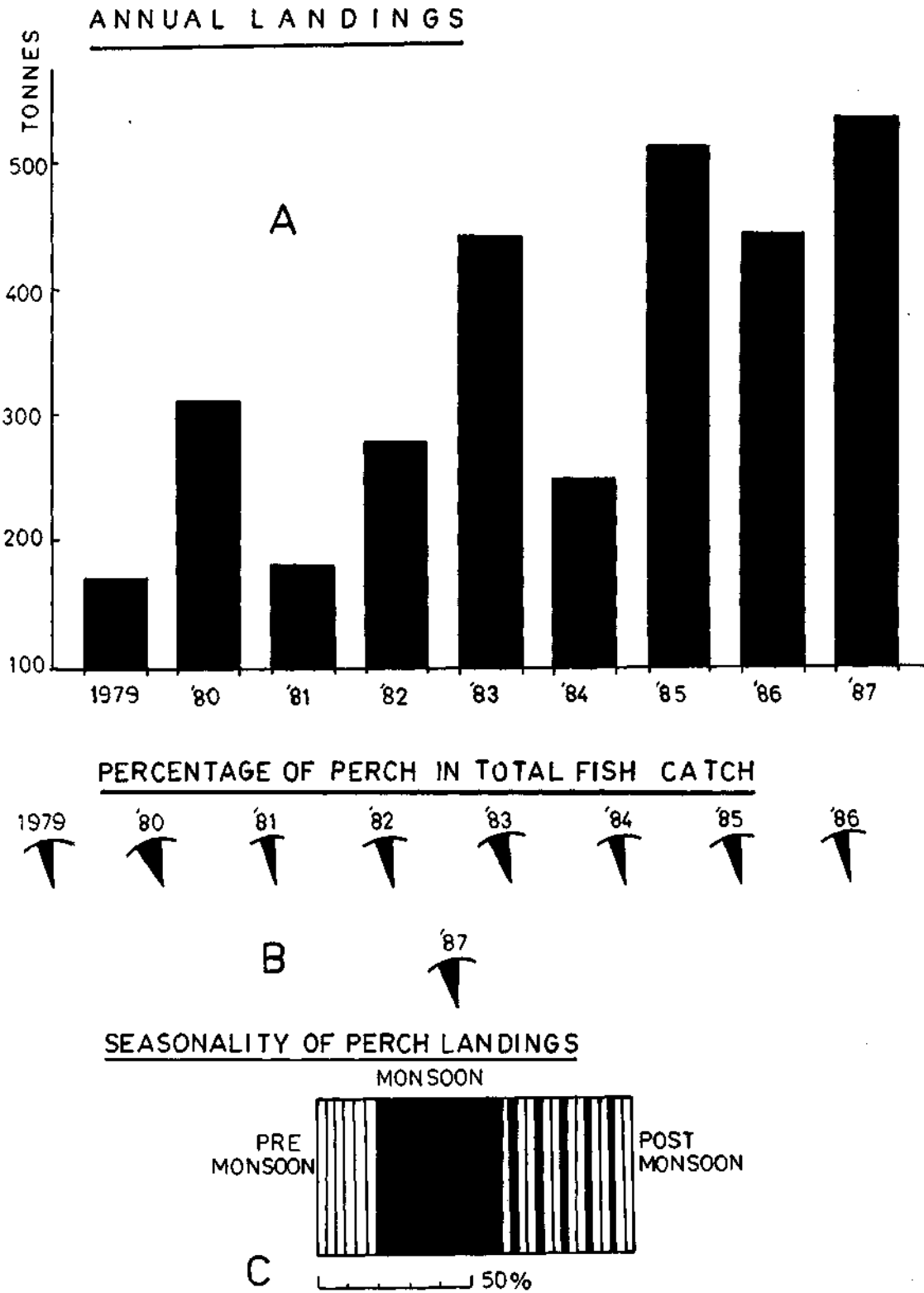


Fig. 4. A. Annual landings, B. Percentage composition and C. Seasonality of perch landings at Vizhinjam for the period 1979 to 1987 ; from pooled data.

to 4th and during 1984 to 1987 was from 6th to 7th. This clearly shows that the dominance of this groups diminished towards the fag end of the period. The seasonal landings fluctuated very little; the maximum was registered during the premonsoon (35.8%) and the minimum in the monsoon (28.6%)

Ambassids : The percentage fluctuated from 0.1% (1967) to 5.4% (1979) and the landings from 0.6 t (1987) to 9.1 t (1979) with the average at 3.6 t (Fig. 5 C). The annual landings were above this average in 1979, 1981 and 1982 with a decreasing trend after 1984.

This group occupied the overall 8th rank in the order of abundance, but it changed to 6th in 1979 and 1981 or to 7th (in 1980 and 1982) position, before being shifted to the last position after 1983.

In general, the landings increased as the period advanced in the case of Nemipterids, Lethrinids, Priacanthids, Siganids and Seranids, while a decreasing trend could be noted for Theraponids, Lutjanids and Ambassids. The probable reasons that govern this trend are discussed in a later section.

GEARWISE PERCH PRODUCTION

Craft : The most important craft employed for fishing in this area is the catamaran and next to it, in importance, comes the canoe. Recently a few mechanised boats have also been introduced on an experimental basis for fishing with traditional Drift nets. A recent trend that has been developed at Vizhinjam is the motorisation of traditional crafts (catamaran and canoe) with 'Yamaha' outboard motors.

Gears : Of the four principal fishing methods used *viz.* by seines, by drift nets, by trawls and by hooks. Fishing by trawls is not popular at Vizhinjam due to the rocky nature of the sea bottom. All the other three methods are now practiced, but among these the most popular is fishing by hooks and line.

Details relating to the various gears, their mode of operation, etc. are available in Nayar (1958) and Sam Bennet (1967).

During the present study 11 types of gears were in operation at Vizhinjam. No gear was specific in the landing of perches, but in each gear a fraction of the catch was perches.

The various gears, their category, total landing for the period, their percentages, position occupied (rank) by each gear in relation to the total landings etc. are given in Table 3.

TABLE 3. Gearwise landing and their percentage in total landings during 1979 - '87

Gear	Landing (t)	%
Hooks and line (non mech. Sect)	1365.710	43.44
*Hooks and line (mech. sector)	927.873	29.51
Boat seine	342.728	10.90
*Drift net (mech. sector)	215.107	6.84
Drift net (non mech. sector)	175.587	5.59
Konchu vala (gill net)	82.514	2.63
Achil (Hooks and line)	19.822	0.63 **
Shore seine	9.972	0.32 **
Nandu vala (gill net)	2.574	0.08 **
Trawl	1.303	0.04 **
Chala vala (gill net)	0.507	0.02 **

* Operated from 1983 to 1987.

** Given as 'others' in Fig. 6 A.

The various gears, based on their order of production (rank) are dealt with below:

Hooks and line (Non-mechanised sector)

Crafts that are not fitted with outboard motors and employing Hooks and line (called 'Choonda' in Malayalam) are considered first. This gear was operated allthrough the years 1979 to 1987. The number of units operated annually varied from 5184 (1983) to 71,782 (1984) amounting to 378,262 units with the average at 42,029 nos.

The total units operated during 1979-'87 was 378,262, with a total landing of 1365.710 t and this works out to a CPU of 3.61 kg. The pooled monthly CPU fluctuated considerably from month to month from 1.1 kg (May) to 7.32 kg. (Sept) (Fig. 7 A). The total effort expended in 1984, when mechanisation of traditional crafts was at the initial stage, was the maximum (71,782) and the number of units

started showing a decreasing trend from this year onwards and reached the lowest level (8540) by 1987.

In the pooled total landing, monthly landings (%) of perches by this gear varied considerably from 2.4 % (May) to 20.8 % (Aug.) (Fig. 7 A) with a bimodal pattern in landings. The monsoon peak of August was followed by another in January (8.1%, the postmonsoon peak).

The perch landings by this gear (1365.710 t) constituted 43.44 % of the total perch landings for 1979 to 1987 ranking the first in the order of abundance (Table 3, Fig. 6 A). In the annual landings for the various years the share by this gear in total landings fluctuated between 8.7% (1987) and 85.9% (1980) (Fig. 8) and the annual landings from 39.8 t (1987) to 291.6 t (1983) with the average at 151.7 t.

It could be noted that the contribution by this gear to the total perch landings was at a higher level during 1979 to 1984 [variation 85.9% (1980) to 64.1% (1984)], but later *i.e.* during 1985-87 period, it came down abruptly [variation 20.2% (1985) to 8.7% (1987) (Fig. 8)]. The reason could be the reduction in the effort, as increasing mechanisation of the traditional units by OBM resulted in a drastic cut in fishing by non-mechanised Hooks and lines. The distribution of units for the period 1979 to 1987 was assessed seasonwise from pooled total. This revealed that the maximum number (44.4%) was operated during the postmonsoon and the minimum during the monsoon period (21.4%). Landingwise, the postmonsoon period was the best as 47.2% of the total was landed, while the premonsoon period recorded the minimum (19.2%).

Perches in Hooks and line (Non-mechanised sector)

The total landing 1365.710 tonnes, was composed of the following groups (Fig. 6 B, Table 4).

Landing of individual group

Nemipterids : This group formed the most dominant one in the landings with 948.917 t

(69.48%) (Fig. 9 D, inset). The annual landings fluctuated from 27.04 t (1986) to 320.41 t (1980) with an average at 105.435 t. The annual landings registered a downward trend from 1984 onwards and it came down to 27.04 t by 1986.

TABLE 4. *Perches landed in Hooks and line (non-mechanised sector)*

Groups	Landings (t)	%
Nemipterids	948.917	69.48
Lethrinids	126.804	9.28
Lutjanids	107.169	7.85
Theraponids	73.996	5.42
Serranids	55.596	4.07
Priacanthids	52.330	3.84
Siganids	0.898	0.06

Nemipterids were available in the landings allthrough the different months. In January it contributed to 2.6% of the total while in August, 27.5 % in the pooled landings for the period 1979 to 1987. Two modes in the pooled monthly landings could be noted, the dominant one being that of August (27.5%) followed by another in March (5.3%) (Fig. 9 D). Monsoon was found to be the best season in the landings of Nemipterids by this gear with about 43.5% of the total followed by the postmonsoon (40.2%).

Lethrinids : With 126.804 t forming 9.28% of the total landings by this gear, this group formed the second dominant among the different groups (Fig. 13 D, inset). The annual landings fluctuated from 0.202 t (1987) to 28.7 t (1984) with the average at 14.08 t. Here also an abrupt decrease in the landings could be noted from 1984 onwards and this may be attributed to more and more fishermen resorting to mechanisation.

Lethrinids were caught by this gear throughout the year. In the pooled monthly total landings it fluctuated between 0.3% (July) and 36.0% (Jan.). The bulk of the landings was realised during the postmonsoon period (65.3% and the minimum in the monsoon period (2.7% of the total) (Fig. 13 D).

Lutjanids : This group constituted 7.85% of the total by this gear accounting to 107.169 t

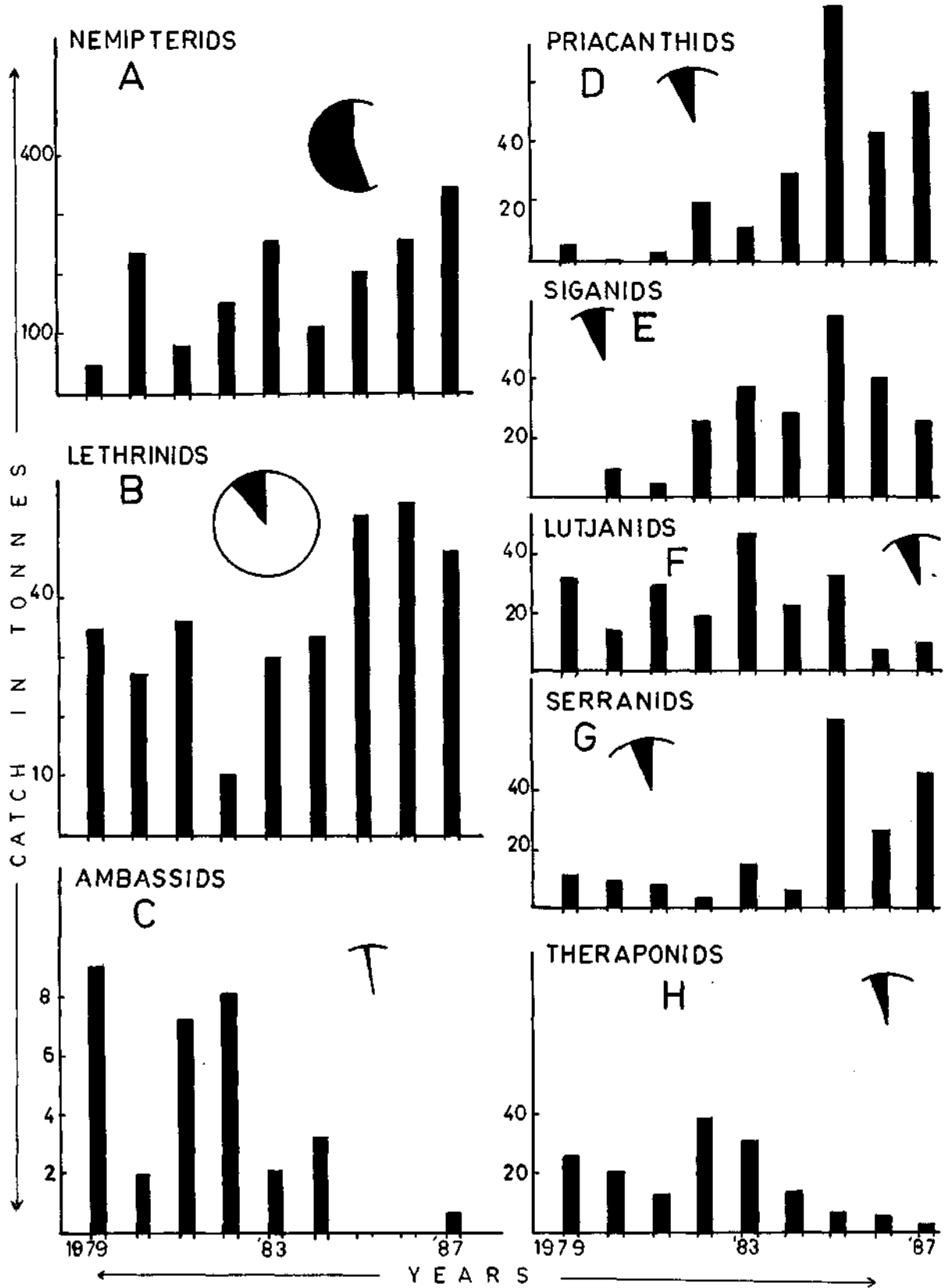


Fig. 5. Groupwise total landing of perch for the various years. The percentage contribution to total landings by each group is given (inset).

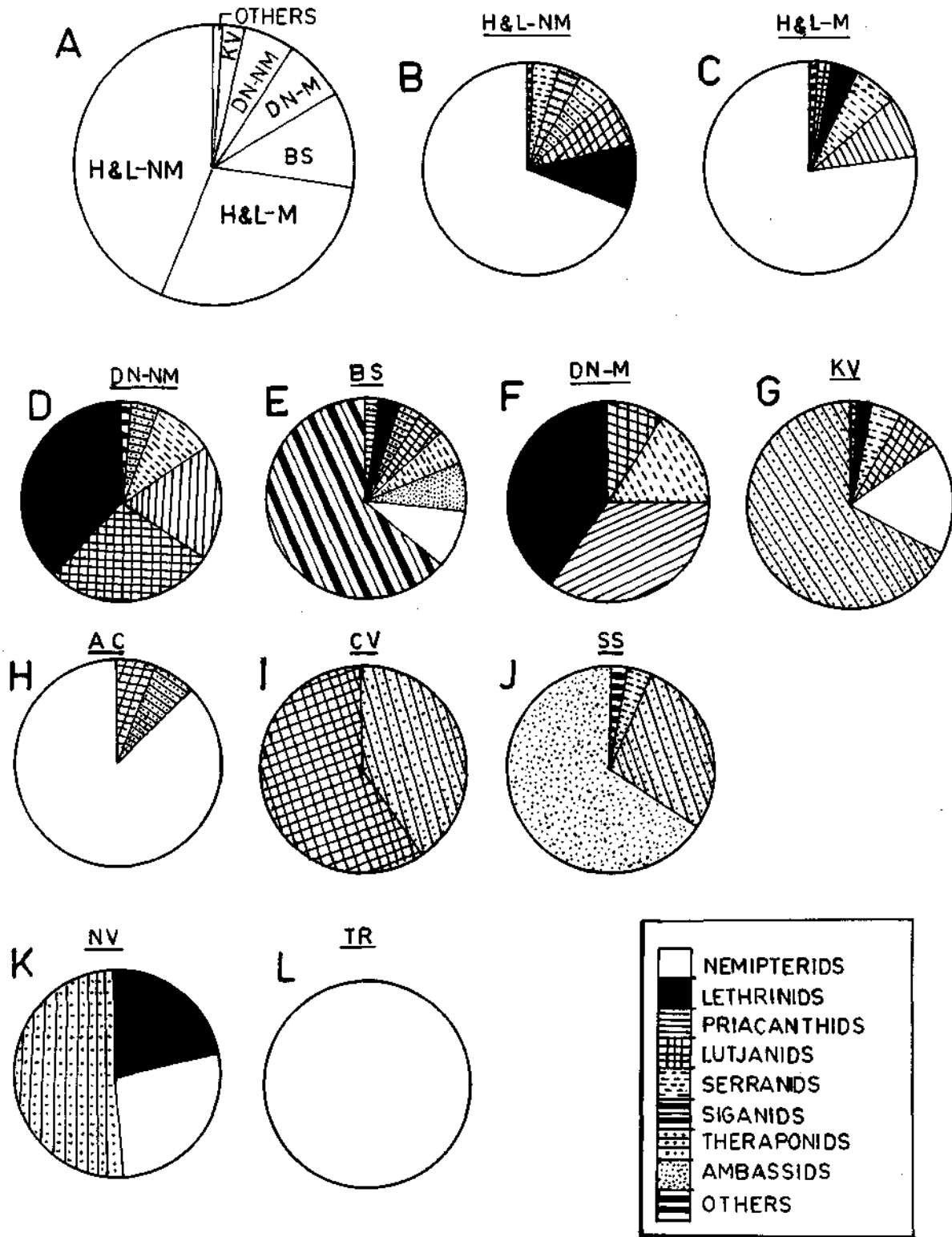


Fig. 6. A. The percentage contribution of each gear to the total perch landings at Vizhinjam (1979 to 1987) (from pooled data). Gears which contributed an insignificant quantity are grouped together under 'others' and B - L : The percentage contribution of each group in various gears. B. Hooks and line (non-mech. sector), C. Hooks and line (mech. sector), D. Drift net (non-mech. sector), E. Boat seine, F. Drift net (mech. sector), G. Konchuvala, H. Achil, I. Chala vala, J. Shore seine, K. Nandu vala and L. Trawl.

ranking third in the order of abundance (Fig. 12 E, inset). The annual landings varied from 1.39 t (1987) to 25.41 t (1983) with the average at 11.9 t

The landings could be seen spread out in all the months in the pooled total for the entire period, but in separate year's landings, their occurrence was interrupted. The monthly percentage of landings, in the pooled total, fluctuated between 1.8% (April) and 16.3% (Jan.) with two modes; a dominant in January (16.3%) and a minor in September (13.4%, both in the postmonsoon period, Fig. 12 E).

The postmonsoon period formed the best season in the landing of this group by this gear and 59.3% of the total landings was realised during this period. Monsoon period recorded the minimum landings (12.9%).

Here also the landings showed a decreasing trend after 1983 and the reason may be attributed to the conversion on non-mechanised units into mechanised ones.

Theraponids : With a total of 73.996 t (5.42% of the total by this gear), this group ranked 4th in the order of abundance (Fig. 11 D, inset). The annual landings fluctuated from 0.3 t (1987) to 20.12 t (1983) with the average at 8.2 t. The landings of this group showed a decreasing trend after 1983 : there was landing only for a month during 1987 while nil in 1986.

In the pooled total for each month the landings were seen throughout the year and the monthly landings varied from 2.5% (both in February and May) to 16.2% in August (Fig. 11 D). Four peaks in the landings could be noted, the one noted in August formed the dominant (monsoon peak, 16.2%) followed by the next in October (postmonsoon peak). The other two, one in April and the other in December were insignificant.

The best period of Theraponid landings by this gear was the postmonsoon (53.4%) followed by the monsoon (31.2%).

Serranids : The total landings of Serranids by this gear from 1979 to 1987 were estimated at

55.596 t (4.07% of the total) which marked 5th position in the order of abundance (Fig. 10 K, inset). The annual landings fluctuated between 1.3 t (1981) and 11.8 t (1985) with the average at 6.17 t. The landings were never spread allthrough the year in the annual landings, but in the pooled total for each month the landings were found throughout the various months. In the pooled estimations the landings varied considerably from month to month with in a maximum of 25.3% [January and a minimum of 0.09% (July)]. The peak landing, in this case, could be noted in January by this gear (Fig. 10 K).

The best period for Serranids by this gear was the postmonsoon period with 58.7 % of the total landing. The monsoon period registered very poor landings (5.3%).

Priacanthids : The total landings of Priacanthids by this gear was estimated at 52.330 t constituting 3.48% of the total and ranking 6th in the order of abundance (Fig. 10 D, inset). The annual landings, in this case, ranged from 0.31 t (1980) to 13.12 t (1985) with the average at 5.81 t.

Though no landings were registered for several months at a stretch in some years, in the pooled data for the entire period each month indicated some landings; the monthly landings fluctuating from 0.9% (June) to 34.0% (October) with two modes, the higher one in October (34.0%) and a lesser one in June (Fig. 10 D).

The postmonsoon period formed the best period with 82.9% of the total while the monsoon period was the lowest (4.8%).

Siganids : The total landings of Siganids by this gear was only 0.898 t (0.06%) ranking 7th in the order of abundance. The entire quantity was landed during January of 1984 and 1986 (Fig. 12 N).

Hooks and line : (Mechanised sector)

Crafts fitted with outboard motors and fishing by Hooks and line are considered under this section. Though mechanisation of this sort has been initiated by the end of 1982, its impact was felt fully in the landings only from 1983 onwards. Such units increased gradually from

5232 (1983) to 39,873 (1987). It is estimated that the total units employed at Vizhinjam during the period 1983 to 1987 was 122,094 with the average at 24,418. The total quantity of perch landed during the above period was 927.873 t against a total of 122,094 units with a CPU of 7.59 kg. The variation in CPU noted in the pooled total for each month was from 0.5 kg (May) to 23.2 kg (July) (Fig. 7 B).

The total perch landings by this gear accounted for 927.873 t forming 29.51% of the total perch landed at Vizhinjam for the period 1983 to 1987 (Fig. 6 A, Table 3). In the annual landings the share by this gear fluctuated between 52.4 t (1983) and 369.0 t (1987) and from 8.5% (1984) to 68.2% (1987) (Fig. 8). In the pooled total for each month the monthly landings varied from 0.5% (May) to 28.6% (July) (Fig. 7 B). Two peaks in the landings could be noted in the pooled total, the major being in July (monsoon period) followed by the other in December (postmonsoon) (Fig. 7 B).

The best season for this gear was the monsoon and 56.9% of the total was landed during this period. The minimum landing (9.3% of the total by this gear) was registered during the premonsoon.

The distribution of units during the various seasons was found to fluctuate considerably. The maximum number of units was operated during the postmonsoon months (50.26%) followed by the monsoon (26.8%).

Perches landed in Hooks and line (mechanised sector)

The total landing of 927.873 t was by the following groups of perches (Table 5, Fig. 6 C).

TABLE 5. *Perches landed in Hooks and line (Mechanised sector and their percentages)*

Groups	Landings (t)	%
Nemipterids	717.701	77.34
Priacanthids	86.350	9.31
Serranids	60.839	6.56
Lethrinids	38.641	4.16
Lutjanids	20.013	2.16
Theraponids	4.329	0.47

The groups Siganids and Ambassids were not represented in the landings.

Nemipterids : This group ranked first among the perches landed by this gear with a total of 717.701 t (77.34%) of the total landings (Table 5, Fig. 9 E, inset). The landings showed an increasing trend from 36.1 t (1983) to 310.6 t (1987) with an average at 143.57 t.

Nemipterids were present throughout the year and from the pooled monthly total, the best period was found to be June to September (Fig. 9 E). The landing by this gear during January to May was quite negligible, so also for October to December. During the above 8 month duration the monthly landing (in pooled total) seldom gone beyond 2.4%.

Regarding the seasonality of Nemipterid landings by this gear it could be noted that the monsoon was the best period as the landing recorded was 69.8% of the total. The landings in July (in pooled monthly total) formed 35.2%. The premonsoon period recorded only 4.2% of the total landings.

Comparing the landing pattern by this gear with that of non-mechanised Hooks and lines, it may be stated that the pattern was almost similar, the only difference being the period of peak landing: in the latter it was during August.

Priacanthids : With a total landing of 86.35 t (9.31%) for 1983 to 1987 (Table 5, Fig. 10 E, inset) this group formed the second dominant by this gear (This group occupied only the 6th rank in the non-mechanised sector). The annual landings of Priacanthids varied from 0.9 t (1983) to 41.0 t (1985) with the average at 17.3 t. This group was absent for several months at a stretch in various years.

In the pooled total, monthly landings ranged from 0.2% (March) to 17.0% (Nov.) of the total with 4 modes in the distribution and they were in the order of abundance, in November (postmonsoon), July (monsoon), February (premonsoon) and April (premonsoon). A similar trend in the landings, though with some minor changes, could be noted in the case of Hooks and

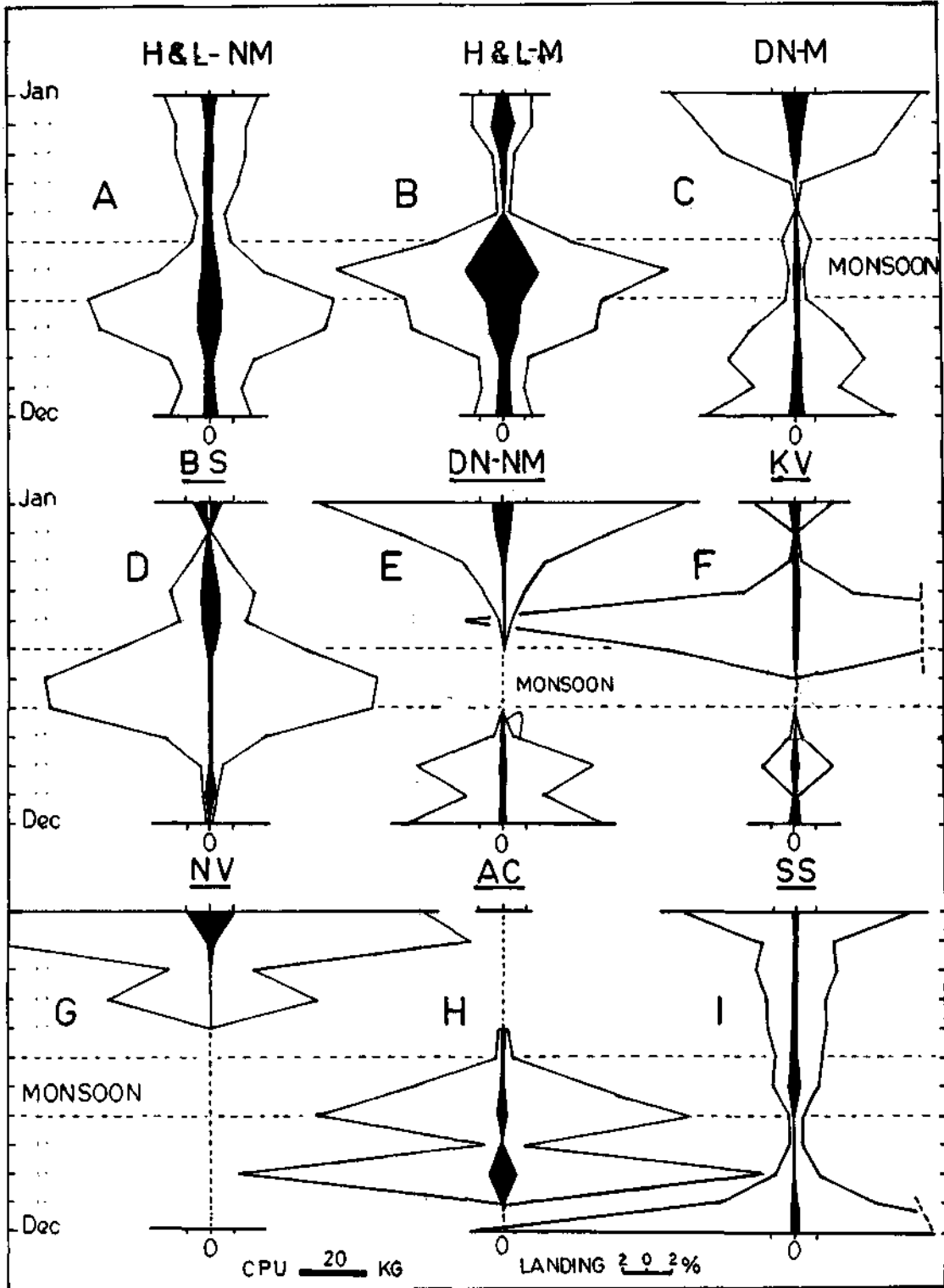
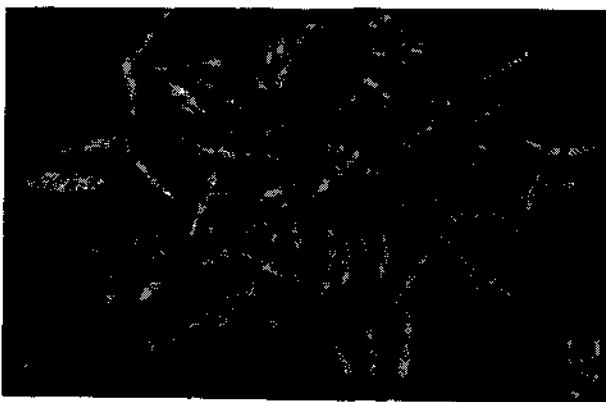
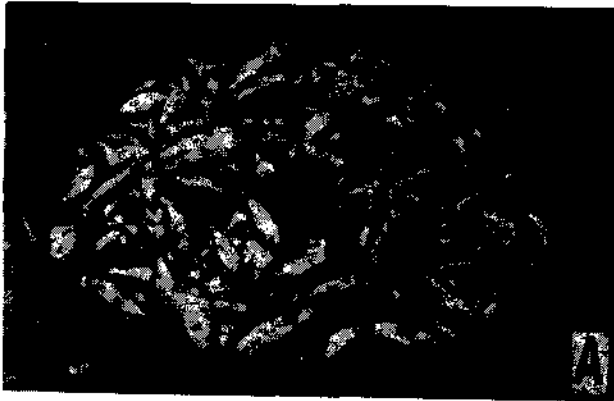


Fig. 7. Gearwise monthly landings (%) of perch at Vizhinjam from 1979 to 1987 and the actual CPU (shaded area) noted during the different months (based on pooled monthly total). The monsoon period is indicated by interrupted lines.

A. Hooks and line (non-mech. sector), B. Hooks and line (mech. sector), C. Drift net (mech. sector), D. Boat seine, E. Drift net (non-mech. sector), F. Konchu vala, G. Nandu vala, H. Achil and I. Shore seine).



A. *Nemipterus metopias*, B. *Larger perches*, C. *Lethrinus nebulosus*, D. *Epinephelus* spp., E. *Therapon jarbua* and F. *Lethrinus lentjan*.

lines operated from non-mechanised crafts also (Fig. 10 E). The postmonsoon registered the maximum landings by this gear (67.0%), followed by the monsoon (18.0%).

Serranids : This group occupied the third position with a total of 60.839 t (6.56%) (Table 5, Fig. 10 L, inset).

The annual landings (1983-1987) showed an increasing trend with an exception in 1984. It fluctuated between 0.36 t (1984) and 19.46 t (1987) with the average at 12.16 t. The landings were either poor or nil during certain months every year and this was reflected in the pooled total landings also (no landings for July and November, poor landings in June).

In the pooled landings the monthly percentage ranged from 0.2% (June) to 24.4% (January) with three modes in landings. The mode noted in January (postmonsoon) was the dominant (24.4%), followed by that of September (12.4%) (postmonsoon) and May (premonsoon) (Fig. 10 L).

The postmonsoon period accounted for the maximum (63.2%) landings followed by the premonsoon period. Comparing the seasonality trend noted in the landings of mechanised and non-mechanised Hooks and line fishery, it may be stated that though the trend was, for the most part similar, the landings during the postmonsoon by the mechanised sector were higher.

Lethrinds : The landing of this group, in this gear, was 4.16% (38.641 t for 1983 to 1987) (Table 5, Fig. 13 E, inset). The annual landings, in this case, varied from 0.2 t (1984) to 15.93 t (1986) with the average at 7.72 t. The landings, as seen from the pooled data, were confined to November - March and also to the monsoon.

The monthly landings in the pooled total were varying between 0.7% (August) and 38.3% (February) with two peaks, the dominant being of February (premonsoon), the other in July (monsoon) (Fig. 13 E).

The maximum landing by this gear was obtained during the postmonsoon (53.3%) and the minimum in the monsoon (7.4%).

The chief difference noted with Lethrinid landings by the gear as compared with those from the mechanised sector is that the landings were not protracted in this case.

Lutjanids : Lutjanids accounted for 23.013 t (2.16%) of the total perches by this gear occupying 5th position (Table 5, Fig. 12 F, inset). The annual landings showed a decreasing trend from 7.4 t (1983) to 2.2 t (1987) with the average at 4.9 t.

The landings were never spread throughout the year and in 1984 they were confined to two months. In the pooled monthly total for the entire period the paucity in landings could be noted only for two months (April and November).

In the pooled monthly landings for the entire period, it fluctuated from 0.1% (July) to 38.7% (February) with three modes in landings. The dominant mode was in February (38.7%, premonsoon peak) followed by September (8.2%, postmonsoon peak). The third one or monsoon peak (June, 4.0%) was quite inconspicuous (Fig. 12 F).

The postmonsoon period was the best for Lutjanids by this gear (46.0%) and the monsoon registered very poor landings (10.9%).

This group ranked third in the landings by non-mechanised sector. The landings were also more protracted by non-mechanised sector.

Theraponids : With a total landing of 4.329 t (0.47%) this group occupied 6th rank among the various groups by this gear (Table 5, Fig. 11 E, inset).

Theraponids were rather scarce in the monthly landings from 1983 to 1987 and were confined to 1 or 2 months per year. The annual landings were found to vary between 0.056 t (1983) and 1.9 t (1985) with the average at 0.86 t. The monthly landings fluctuated between 1.3% (November) and 49.4% (June) with two peaks, the dominant one in June (monsoon) followed by the other in October (postmonsoon, Fig. 11 E).

As compared with the present sector the monthly pattern of landing noted in the non-mechanised sector was more protracted.

Boat seine

This gear was in operation allthrough 1979 to 1987. The number of units engaged in the above period was 295,574 with a landing of 324.728 t. This works out to an average of 1.15 kg of perch per unit. The units operated annually were from 22,723 (1980) to 47,763 (1979) with an average of 32,841. Except during 1979, 1981, 1982 and 1985, the units operated annually was below the average. The monsoon period was the best period for this gear with 76.9% of the total number of units. An unusual increase in units noted in this period may be attributed to the migration of fishermen to Vizhinjam from nearby centres. Only 4.2% of the total number of units was operated in the premonsoon.

The landings by this gear for the period was estimated at 342.728 t (10.9% of the total by all gears) ranking third in the order of abundance (Table 3, Fig. 6 A). The annual landings varied from 11.3 t (1979) to 101.25 t (1985) with the average at 38.08 t and from 4.8% (1980, 1987) to 19.7% (1985) of the total (Fig. 8). The annual landings were higher than the average only in 1983, 1985 and 1986. In the pooled total for the various months it is noted that the monthly landings varied from 0.3% (February) to 27.8% (July) (Fig. 7 D), with two modes, the dominant one in July (monsoon) and the next in April (premonsoon peak). The monsoon accounted for the bulk (71.4%) followed by the premonsoon (15.8%).

Monthly CPU estimated was at its peak during January (11.02 kg, Fig. 7 D). After a sudden fall in February, it again went up by April (6.6 kg) and then from June to October it was at a lower level. In November it showed a slight increase (5.71 kg), but came down to 0.8 kg by December. It is interesting to note in this context that the peak period in landing registered lower CPU and vice versa.

Perches in Boat-seine

The total landings of 342.728 t by this gear was shared by 8 groups (Table 6, Fig. 6 E).

Siganids : This group formed the major item in the landings by this gear forming 64.62%

(221.468 t). The annual landings ranged from 3.19 t (1981) to 60.15 t (1985) with the average at 24.6 t. The annual landings were well above this average during 1983 to 1987 (Table 6, Fig. 12 K).

TABLE 6. *Perches landed in Boat-seine and their percentages*

Groups	Landings (t)	%
Siganids	221.468	64.62
Nemipterids	28.791	8.40
Ambassids	25.520	7.45
Serranids	19.344	5.65
Theraponids	14.000	4.08
Lutjanids	13.931	4.06
Lethrinids	10.904	3.18
Priacanthids	8.770	2.56

In the monthly landings, March to October was generally with good landings, though nil landings were somewhat regular for some years. In the pooled total for each month, however, nil landings were noted only in January and in other months the landings ranged from 0.06% (February) to 27.9% (August). Three peaks were seen with the dominant one in August (27.9%, monsoon). The other two peaks were in June (15.5%, monsoon) and April (Fig. 12 K).

The monsoon landed the maximum (65.8%) and the postmonsoon period, the minimum (13.9%).

Nemipterids : This group accounted for 28.791 t (8.40% of the catch by this gear) ranking second in the order of abundance (Table 6, Fig. 9 B). The landings were effected during February to October in 1980, but later they were confined to July only. For 5 years (1979, 1981 to 1983 and 1987), there were no landing of Nemipterids by this gear. The annual landings varied from 0.12 t (1984) to 14.2 t (1985) with the average at 7.19 t. The monsoon period accounted for 94.5% of the total by this gear.

Ambassids : This group accounted for 25.52 t forming 7.45 % of the total perch landed by this gear (Table 6, Fig. 13 I). There were no landings of Ambassids during 1980, 1985 and 1986 and for the rest of the period the landings were

irregular with average at 4.2 t. The landings recorded for 1983, 1984 and 1987 were below the average of 4.2 t.

In the pooled total for each month for the entire period, the landings were noted in all months and the monthly landings were from 0.7% (February) to 17.4% (July) (Fig. 13 I). The monsoon accounted for the maximum landings (38.3%) and the premonsoon for the minimum (23.8%).

Serranids : The landing of Serranids by Boat-seine for 1979 to 1987, was estimated at 19.344 t forming 5.65% of the total (Table 6, Fig. 10 H). Out of 9 years investigated this group could be encountered only twice in this gear : July, 1980 (124 kg) and August 1985 (19.2 t). This shows that the representation of this group in this gear is only accidental.

Theraponids : This group occupied 5th position with a total of 14.0 t (4.08%) (Table 6, Fig. 11 A). They landed almost throughout the year during 1979 and 1980, but later became rather scarce, the landings being, at the most, confined to a month or two per year. The annual landings of this group, by this gear, ranged from 0.13 t (1986) to 5.1 t (1979). In pooled monthly total for the entire period, the monthly landings fluctuated between 0.3% (Sept.) and 46.2% (July) (Fig. 11 A). Three peaks were seen : the monsoon peak in July was the dominant one (46.2%) followed by others in April (9.3%, premonsoon) and October (8.4%, postmonsoon). The monsoon accounted for 75.5% of the total, followed by the premonsoon period.

Lutjanids : The landing of this group for 1979 to 1987 by this gear was estimated at 13.931 t and by its 4.06 % contribution, ranked 6th in the order of abundance (Table 6, Fig. 12 B). The catches were nil during 1979, 1982, 1984, 1986 and 1987; and for the rest of the period varied from 0.4 t (1980) to 6.6 t (1985). The landings could be noted only for a month every year, but in the pooled catch data the landings were spread over 4 months from June to September. Two peaks (Fig. 12 B) in the pooled monthly landings could be noted, the dominant one was in August (47.6%).

Lethrinids : The landings of Lethrinids for the period were estimated at 10.904 t (3.18% of the total by this gear). Out of 9 years investigated, this group could be encountered only once (July, 1983) (Table 6, Fig. 13 B).

Priacanthids : With an aggregate of 8.770 t (2.56%) this group ranked 8th in the landings by this gear. There were no landings from 1979 to 1984 and in 1987. Of the two years when they were present, the landings were confined to July - September period only (Fig. 10 B, inset; Table 6).

Drift net (Mechanised sector)

Drift nets operated from mechanised crafts (*i.e.* catamaran and canoe) fitted with OBM are included under this category. Though this type of mechanisation got initiated at Vizhinjam by the end of 1982, the landings of perches by this sector upto 1983 were not at all encouraging. By 1984 the landings started showing distinct upward trend and from 10.7 t (1984) it had gone upto 86.8 t by 1987 (Fig. 6 A).

The total landings by this gear from 1983 to 1987 was estimated at 215.107 t (6.84%) ranking 4th among the various gears that landed perch at Vizhinjam (Table 3). The annual landings by this gear ranged from 2.7 t (1983) to 86.8 t (1987) with the average at 43.02 t. The contribution to the annual landings by this gear varied from 0.6% (1983) to 16.0% (1987) (Fig. 7).

The units operated during 1983 to 1987 was 65,830 against at total landings of 215.107 t and this worked out to an average of 3.26 kg per unit. The overall variation in the annual distribution of units was from 1332 (1983) to 24,208 (1987) with the average at 13166. 58.1% of the total units was employed during the postmonsoon months followed by 30.6% in the premonsoon (Fig. 7 C). The range in the pooled monthly total CPU for the entire period was from 0.3 kg (May) to 8.08 kg (January).

In the pooled catch data the monthly landings ranged from 0.3% (May) to 21.2% (January) with three modes in landings. Of these, two were noted during the postmonsoon (January and October) with 21.2% and 11.4%

respectively and the other in June (monsoon period, 2.7%).

Seasonwise, the postmonsoon period claimed the bulk (64.0%) of the total landings followed by the premonsoon period (30.8%).

Perches in Drift net (Mechanised sector)

The undermentioned 5 groups (Table 7, Fig. 6 F) constituted to total landings of 215.107 t of perches by this gear.

TABLE 7. *Perches landed in Drift net (Mechanised sector) and their percentages*

Groups	Landings (t)	%
Lethrinids	86.861	40.38
Priacanthids	75.372	35.04
Serranids	33.139	15.41
Lutjanids	19.563	9.09
Nemipterids	0.172	0.08

Lethrinids : This group formed the major item with 86.861 t (40.38%) of the total by this gear (Table 7, Fig. 13 A, inset). The annual landings, in this case, were found to vary between 0.19 t (1983) and 33.8 t (1987) with an average at 17.37 t.

Lethrinids were absent in the landings during May to August. Two peaks in the pooled monthly landings were noted and were in January (29.5%) and September (4.8%) (Fig 13 A). Postmonsoon period accounted for 62.9% and the premonsoon period for 37.1% of the total landings.

Priacanthids : The total landings of this group was 75.372 t (35.04 % of the total by this gear) (Table 7, Fig. 10 A). There was no landing in 1983 and in 1984 the landings were poor. The annual landings were fluctuating between 9.9 t (1984) and 25.5 t (1987), the average being 15.07 t. The landings of Priacanthids were not spread through the various months of the years and in the pooled total also the trend was the same. Usually these fishes were not obtained in April, May and August. Four peaks in the landings were seen in the pooled monthly total for the entire period (Fig. 10 A); they were in October (24.5%), March (16.8%), December

(15.0%) and June (2.3%). The postmonsoon period accounted for 74.8 % of the total landings and the monsoon for 4.0 % by this gear.

Serranids : This group was third in the order of abundance, with a total of 33.139 t (15.41%) (Table 7, Fig. 10 G). During 1983 and 1984 there were no landings but, for the rest of the period, the annual landings fluctuated from 2.4 t (1986) to 21.6 t (1987). In the pooled monthly total, there were no landings in July and for the rest the monthly landings ranged from 1.5 t (December) to 27.0 (February).

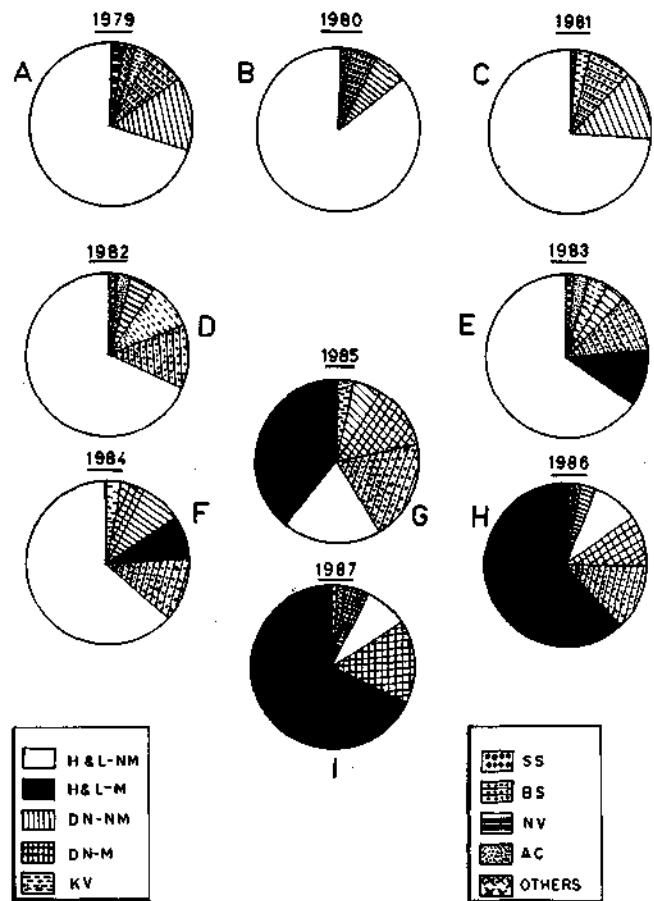


Fig. 8. Percentage contribution by different gears to the total annual landings of perch

Four peaks in the landings, two in the postmonsoon and one each during premonsoon and monsoon periods were noted (Fig. 10 G). Premonsoon peak (February) was the most dominant one (27%) followed by June (13.5%). The other two peaks were insignificant. The landings registered during the post- and

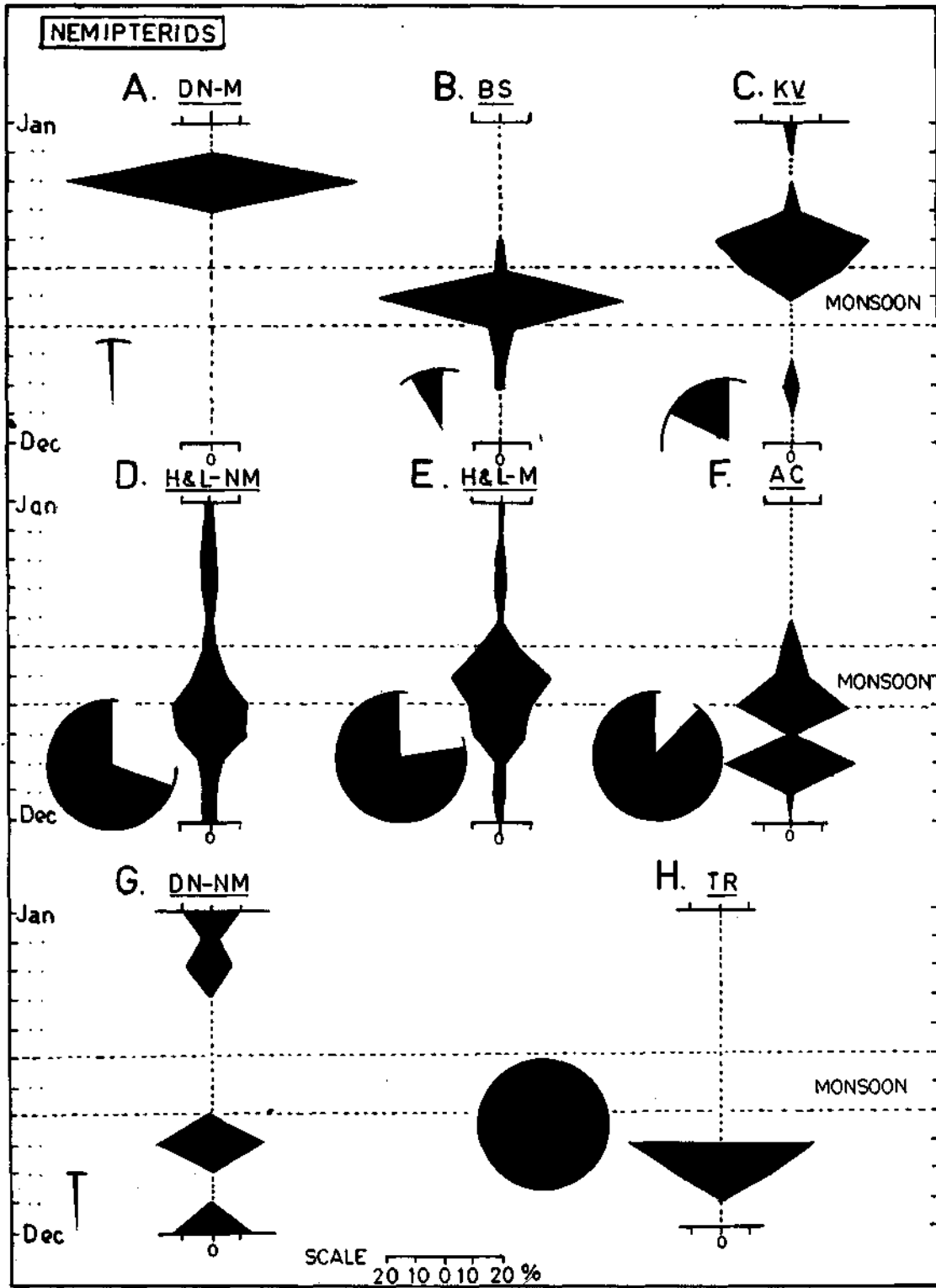


Fig. 9. Landings of Nemipterids by different gears. Monthly landings (%) from pooled (1979 - 1987) for each month are given. Monsoon period is indicated by interrupted lines.

A. Drift net (mech. sector), B. Boat seine, C. Konchu vala, D. Hooks and line (non-mech. sector), E. Hooks and line (mech. sector), F. Achil, G. Drift net (non-mech. sector) and H. Trawl (inset figure shows the percentage contribution of each gear by the respective gear).

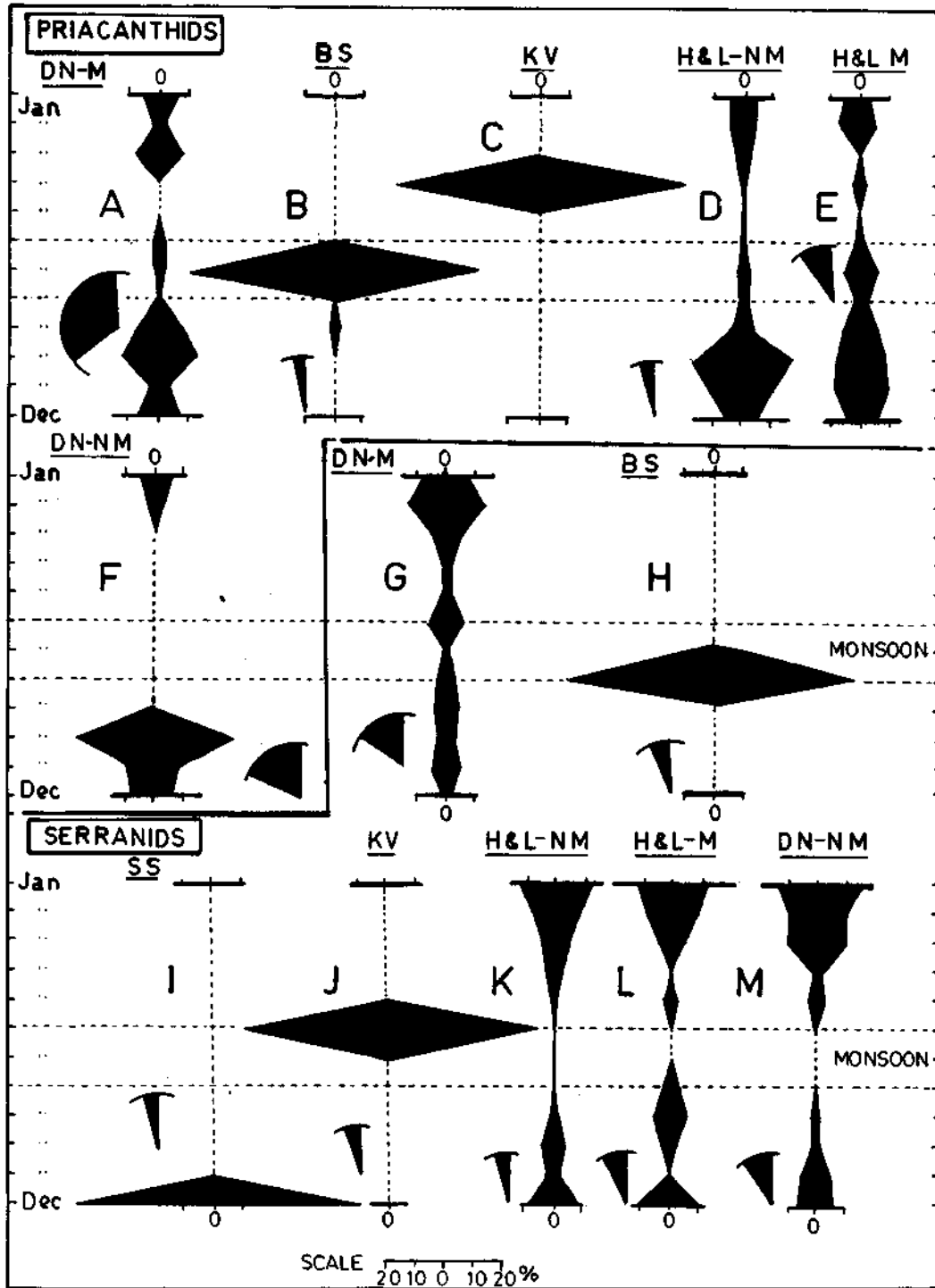


Fig. 10. Landings of Priacanthids and Serranids by different gears. Average monthly landings (%) for each month are given. Monsoon period is indicated by two interrupted lines.

A - F. Priacanthids : A. Drift net (mech. sector), B. Boat seine, C. Konchu vala, D. Hooks and line (non-mech. sector), E. Hooks and line (mech. sector), F. Drift net (non-mech. sector); G - M. Serranids : G. Drift net (mech. sector), H. Boat seine, I. Shore seine, J. Konchu vala, K. Hooks and line (non-mech. sector), L. Hooks and line (mech. sector) and M. Drift net (non-mech. sector) (inset figures shows the percentage contribution of each group by the respective gear).

premonsoon periods were more or less similar quantitatively (41.5% and 41.4% respectively).

Lutjanids : This group with 19.563 t, formed 9.09 % of the total perch landed by this gear (Table 7, Fig. 12 A). The variation noted in the annual landings of this group was from 0.052 t (1984) to 9.1 t (1985) with an average at 3.12 t. The landings were irregular in different months and in 1984 there was only a month's landing. However, in the pooled data the landings were noted from January to April and also from August to October and December, and the monthly landings fluctuated between 0.2% (March) to 27.6% (December) with 4 modes in landings (Fig. 12 A). Of these two were during the postmonsoon (December, dominant; October, 12.8%), one each in monsoon (August, 9.8%) and premonsoon (April, 2.7%). The maximum landing of this group was seen in the postmonsoon period (67.4%) followed by the premonsoon (22.8%).

Nemipterids : Out of 5 years fishing by this gear, Nemipterids occurred only in 1984 (Fig. 9 A) and that too, in small quantities (172 kg in March).

Drift net (Non-mechanised sector)

The contribution by this sector, for the period 1979 to 1987, was 5.59 % (Fig. 6 A) of the total amounting to 175.587 t, ranking 5th in the order of abundance (Table 3).

In the annual landings, the contribution by this gear ranged from 1.7% (1987) to 14.6% (1979) and the landings from 9.1 t (1987) to 20.0 t (1985) with the average at 19.5 t. Landings noted during the period 1982 to 1987 were below the average except in 1985. The annual landings showed a decreasing trend from 1985 onwards as more and more crafts were mechanised. This gear was not in operation during the monsoon period unlike their counterparts operated from mechanised crafts.

The total units operated during the entire period was 77,395 against a total landing of 175.587 t of perches and this worked out to a CPU of 2.26 kg per unit. The total units operated per year ranged from 1128 in 1987 to

17,573 in 1980, with an average at 8599 units. As noted in landings, there was a decline in the total units operated towards the fag end of the period.

In the pooled total landings for each month, the monthly landings fluctuated considerably, from 0.8% (May) to 30.5 (January) with two peaks in landing. Both these peaks were in the postmonsoon period, the dominant being that of January (30.5%) and the next in October (15%) (Fig. 7 E). CPU also registered a bimodal oscillation, the dominant one was in January (7.6 kg) and the next in October. Seasonwise it is seen that 71% of the total catch was landed in the postmonsoon months as against 61% of the total units engaged.

Perches in Drift net (Non-mechanised sector)

The total of 175.587 t of perches by this gear was shared by the following 7 groups (Table 8, Fig. 6 D).

Lethrinids : With a total of 67.059 t this group formed 38.19% of the total perches landed by this gear, ranking first (Table 8, Fig. 13 F). The annual landings varied from 1.6 t (1982) to 13.7 (1981) with an average at 7.45 t. During 1979 to 1981 and also in 1985 the annual landings were above the average (7.45 t).

The monthly landings by this gear, when examined yearwise, were quite irregular; in 1982 landings were only for two months (November and December) and in 1987 also a similar situation prevailed (January and February).

TABLE 8. *Perches landed in Drift net (Non-mechanised sector) and their percentages*

Groups	Landings (t)	%
Lethrinids	67.059	38.19
Lutjanids	48.244	27.48
Priacanthids	33.403	19.03
Serranids	16.967	9.66
Theraponids	8.014	4.57
Nemipterids	1.200	0.68
Ambassids	0.700	0.39

In the pooled total, it is noted that the landings were confined to November to May only, with one peak in January (41.6%). Landingwise the postmonsoon accounted for 66.8% of the total landings (Fig. 13 F).

Lutjanids : The landing of this group (1979 - 1987) was estimated at 48.244 t forming 27.48% of the total by this gear (Table 8, Fig. 12 I). This group occupied the second rank and in the annual landing this group varied from 0.608 t (1987) to 12.01 t (1979) with the average at 5.36 t. The annual landings had fallen short of the above average during 1982, 1984, 1986 and 1987.

In pooled total the monthly landings fluctuated considerably from 0.4% (September) to 30.5 % (January). The landings could be seen during January to April and also from September to December only. Two peaks could be noted and both of them were in the postmonsoon months, the dominant being that of January (30.5 %) followed by the one in October (14%).

The postmonsoon accounted for 62.1% of the total landings.

Priacanthids : This group ranked third with 33.403 t (19.03%) among the various groups landed by this gear. In some years (1979 and 1987) this group figured in the landings only for two months (Table 8, Fig. 10 F).

This group was caught by this gear only during the postmonsoon months, but in 1979, 1986 and 1987 the fishery got extended to the premonsoon month of February also. The fluctuation in the annual landings was from 0.15 t (1980) to 9.2 t (1984) with the average at 3.7 t. The landings were above this average during 1982, 1984, 1985 and 1987.

In the pooled total landings for each month, the landings could be noted in all months except March to September and the monthly landings were found to vary between 52.9% (October) and 3.9% (February) (Fig. 10 F). The peak landings of this group could be seen during the postmonsoon period (96.1%).

Serranids : The contribution to the total landings by this gear was 9.7% of the total

(16.967 t) ranking 4th in the order of abundance (Table 8, Fig. 10 M). The serranids could be observed allthrough the year in pooled data except during monsoon when the gear was not in operation. But such continuity could not be observed in the landings of any year when taken individually.

The annual landing ranged between 0.303 t (1983) and 5.1 t (1985) with the average at 1.88 t. The annual landings were above this average during the years 1980, 1981, 1985 and 1986.

In the pooled total landing for each month, the monthly landings were found to vary from 1.1% (October) to 28.0 (January) with two peaks in landings : the dominant was in January (28%) and the other in May (4.5%) (Fig. 10 M).

Seasonwise it is seen that the postmonsoon registered the maximum landings (52.4%) followed by the premonsoon period.

Theraponids : The total landing of this group, by this gear, was estimated at 8.014 t (4.57%) from 1979 to 1987. This group occupied 5th position among the different groups landed by this gear (Table 8, Fig. 11 H). there was no landings of Theraponids during 1979, 1986 and 1987, while in the other years their landings were irregular. The annual landings varied from 0.19 t (1984) to 3.7 t (1983) with an average at 0.89 t. The annual landings were above this average in 1980 and 1983.

In the pooled total for each month the monthly landings ranged between 1.7% (February) and 30.2% (September) with three peaks in landings (Fig. 11 H). Both the dominant and the next one in landings could be seen during the postmonsoon months of September and January contributing to 30.3% and 26.4% respectively of the total.

The postmonsoon period is the best season for this group by this gear as 93.7% of the total was registered during this period.

Nemipterids : The total quantity landed (1979-1987) was only 1.2 t (0.68%) by this gear (Table 8, Fig. 9 G). The landings were stray and registered for 1 to 2 months per year for 4 years

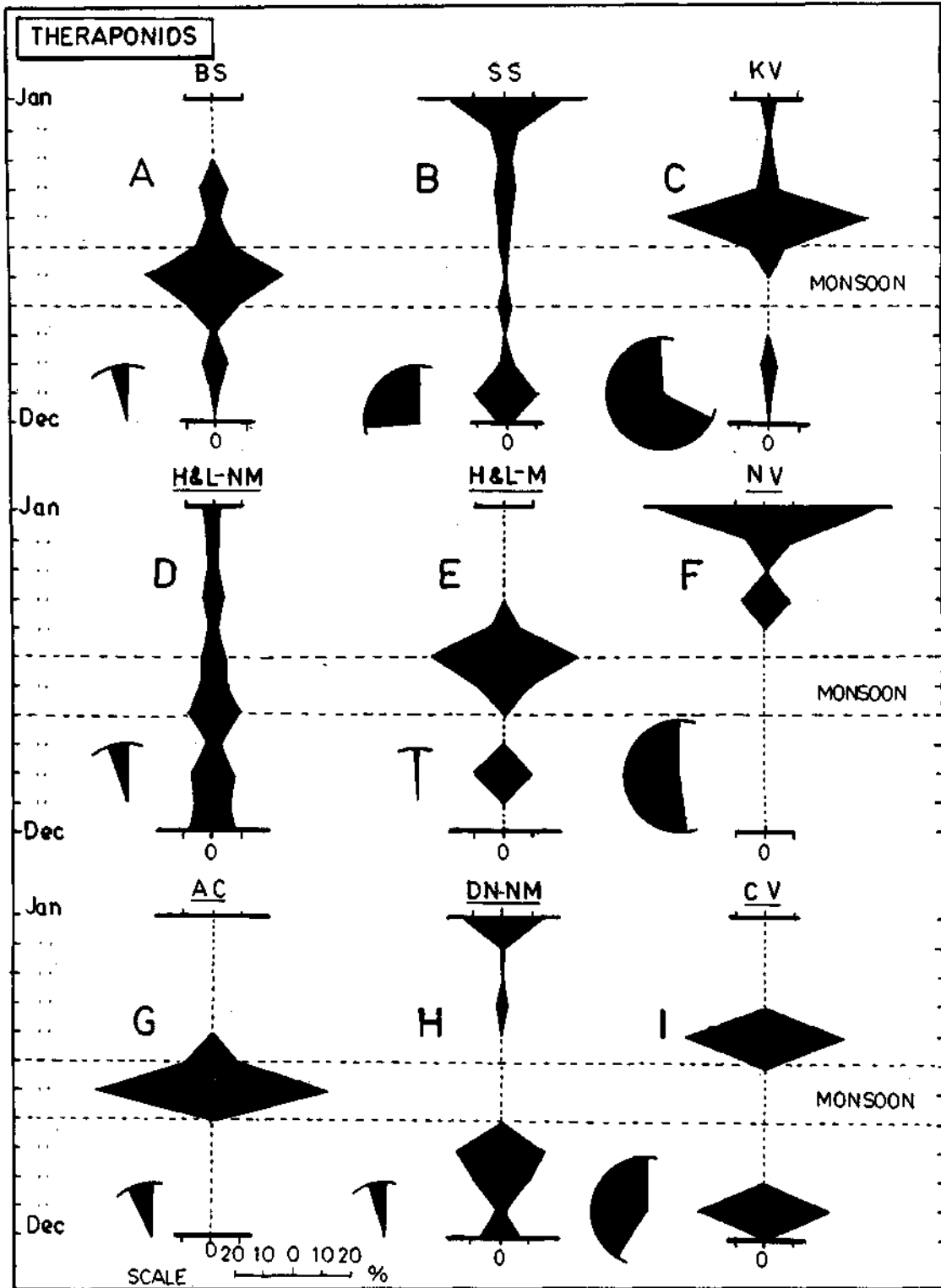


Fig. 11. Landings of Theraponids by different gears. Monthly landings (%) from pooled total for each month are given. Monsoon period is indicated by two interrupted lines : A. Boat seine, B. Shore seine, C. Konchu vala, D. Hooks and line (non-mech. sector), E. Hooks and line (mech. sector), F. Nandu vala, G. Achil, H. Drift net (non-mech. sector) and I. Chala vala (inset figure shows the percentage contribution of each group by the respective gear).

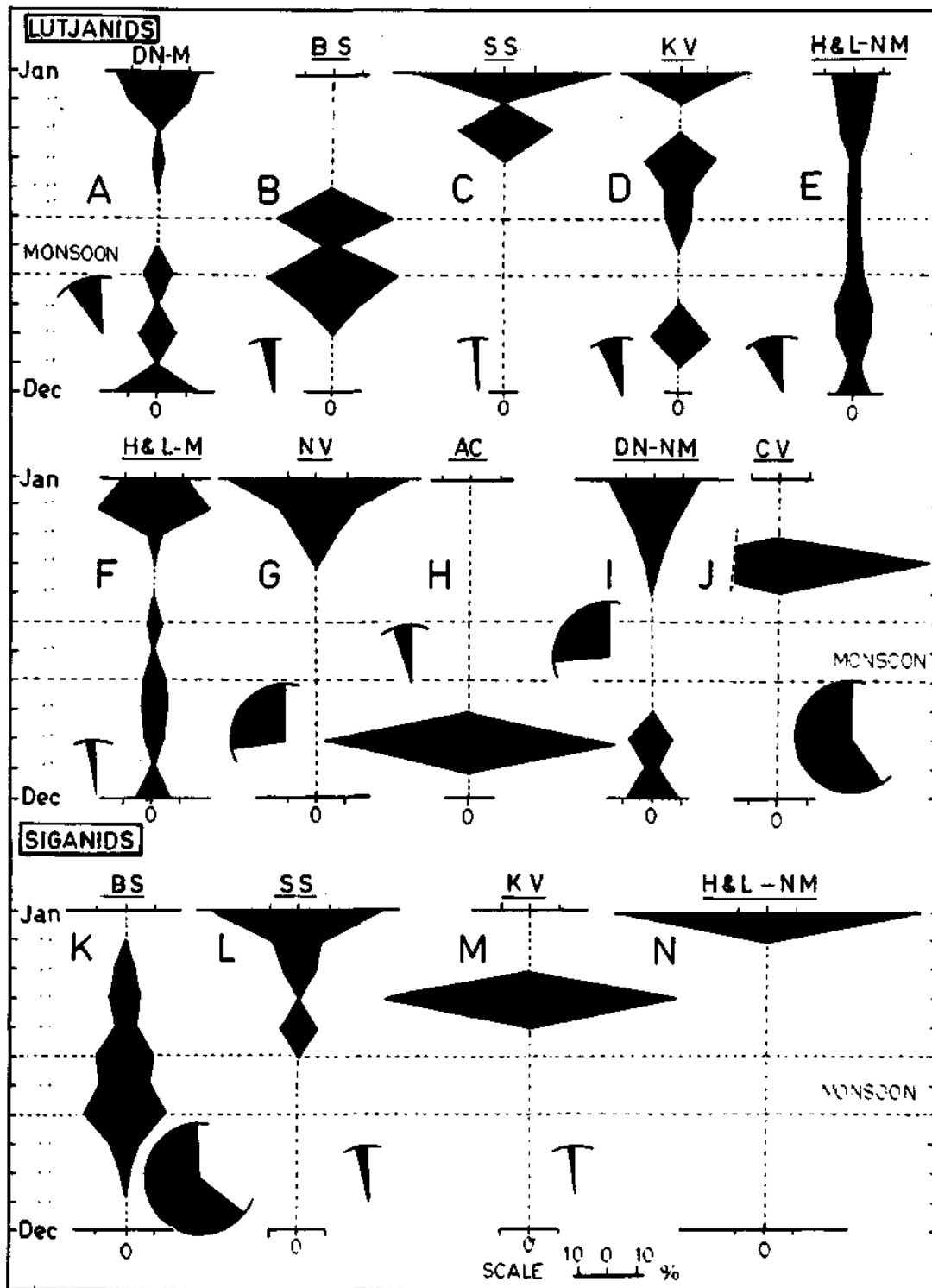


Fig. 12. Landings of Lutjanids and Siganids by different gears. Monthly landings (%) from pooled total for each month are given. Monsoon period is indicated by two interrupted lines. A - J. Lutjanids and K - N. Siganids. A. Drift net (mech. sector), B. Boat seine, C. Shore seine, D. Konchu vala, E. Hooks and line (non-mech. sector), F. Hooks and line (mech. sector), G. Nandu vala, H. Achil, I. Drift net (non-mech. sector), J. Chala vala, K. Boat seine, L. Shore seine, M. Konchu vala and N. Hooks and line (non-mech. sector) (inset figure shows the percentage contribution of each group by the respective gear).

(1980, 1982, 1984 and 1985) and for the rest of the period this group was not at all present in the landings.

In the pooled total for each month the landings could be noted only against 5 months *viz.* January to March, September and December. Three peaks in the landings could be observed, of which the one in September formed the dominant (36.2%) followed by December (20.9%) (Fig. 9 G). The postmonsoon accounted for 77.8% of the total Nemipterid landings by this gear.

Ambassids : This group accounted for 0.7 t (0.39%) and the entire landing was registered in April, 1982 (Fig. 13 J).

Konchu vala

This gear was in operation for the entire period (1979 to 1987), but the periodicity of operation was restricted to March to June and from October to January. The contribution by this gear to the perch landings accounted for 82.514 t (2.63%) (Fig. 6 A, Table 3). In the annual landings, the percentage contribution by this gear ranged from 0.6 (1987) to 9.3 (1982) and the landings from 3.0 t (1987) to 26.18 t (1982) with an average at 9.16 t (Fig. 8).

The total units operated during the period was 53,317 and the annual variation in the number of units operated was from 1163 (1985) to 13,020 (1979) with the average at 5924. The average production per unit for the period was 1.54 kg. In the pooled total for each month, the monthly landings fluctuated between 0.3% (Sept.) and 56.7% (May) with three peaks in landings. The peak in May (premonsoon period) was the dominant one (56.7%) followed by that of January (6.1%) and of October (6%) (Fig. 7 F).

The CPU, in the pooled total for each month, was found to vary from 4.24 kg (January) to 0.42 kg (December). Three peaks in the distribution of CPU could be noted in the above pooled data. When the landing was the maximum in May, the CPU was only 1.62 kg, and in October, when the last peak occurred, the CPU was higher (3.35 kg) (Fig. 7 F).

The maximum units were employed during the postmonsoon period (64.6% of the total) and in this period 67 % of the total landings was recorded.

Perches in Konchu vala

The total landing of 82.514 t of perches was shared by the following 7 groups (Table 9, Fig. 6 G).

TABLE 9. *Perches landed in Konchu vala and their percentages*

Groups	Landings (t)	%
Theraponids	55.695	67.49
Nemipterids	14.438	17.49
Lutjanids	5.706	6.92
Serranids	3.660	4.44
Lethrinids	1.653	2.01
Siganids	1.282	1.56
Priacanthids	0.080	0.09

Theraponids : Theraponids ranked first with 55.695 t (67.49%) (Table 9, Fig. 11 C). The annual landings ranged from 1.07 t (1987) to 24.89 t (1982) with the average at 6.18 t. The annual landings were well above this average only in 1982 and 1983, but after this period, the landings showed a decreasing trend. No landings in February, July, August and November for all the years. The period from March to June had better landings while September to January witnessed poor landings.

In the pooled total for each month, the monthly landings ranged from 0.6% (December) to 67.4 (May) with three peaks (Fig. 11 C). The dominant peak was seen in May (premonsoon period, 67.4%) followed by October (postmonsoon period, 5.6%) and January (2.8%). 75.8% landing was registered during the premonsoon period while the landing in the postmonsoon period was only 9.6%

Nemipterids : This group ranked second in the total landings by this gear with 14.438 t (17.49%) (Table 9, Fig. 9 C). There were no landings by this gear in 1981 and 1986, and for the other years the landings were either poor or irregular. In the pooled total, the landings

were confined to March to June. In 1983 there were some stray landings in October.

The annual landings ranged between 0.5 t (1984) and 5.6 t (1985) with the average at 1.6 t. In general, the annual landings dwindled considerably after 1984. In the pooled monthly total for each month, the landings ranged between 0.7% (March) and 53.0% (May). The mode noted in October 1983 was due to an unusual landing, but in other years no such landing was observed (Fig. 9 C). The premonsoon period accounted for 60.2% of the total landings followed by the monsoon period (34.0%).

Lutjanids : This group figured in landings of 1980, 1983, 1984 and 1985; and that too for one or two months only.

The total landings by this gear accounted for 5.706 t (6.92%) (Table 9, Fig. 12 D), ranking third among seven groups. The annual landings varied from 0.056 t (1984) to 3.6 t (1985).

In the pooled total for each month the landings were seen only during January, April to June and October. Three peaks in the landings were noted, the dominant one in January (39.7%) followed by April and October (24.0% and 19.0% respectively) (Fig. 12 D).

The maximum landing was recorded during the postmonsoon period (58.7%) followed by the premonsoon period.

Serranids : This groups with 3.660 t (or 4.44%), ranked 4th in abundance (Table 9, Fig. 10 J). This group could be fished only during June in 1980 and 1982 by this gear.

Lethrinids : The total landings of Lethrinids, by this gear, was estimated at 1.653 t ranking 5th in the order of abundance (Table 9, Fig. 13 C). This group was generally scarce in the landings and was available only for 1 to 2 months per year for three years (1979, 1980 and 1985). In the pooled total for each month the landings were spread over January, and April to June period (Fig. 13 C), January accounting for 68.8% of the total landings.

Siganids : This group was encountered in the landings by this gear only once (April, 1983)

with a total of 1.282 t (1.56% of the total by this gear) (Table 9, Fig. 12 M).

Priacanthids : A small quantity (80 kg) was landed by this gear in April, 1979 (Table 9, Fig. 10 C).

Achil

This gear which is a modified version of Hooks and line, is a hand line with closely set smaller hooks at the end of the line. Out of 9 years studied, this gear was employed only in 1982 and 1983. The total landings, by this gear, were estimated at 19.822 t forming 0.63% of the total perch landings by all gears (Fig. 6 A, under 'others' and Table 3). The contribution by this gear to the annual landings in 1982 was 2.3% of the total, while in 1983 it was 3% (Fig. 8).

The season of operation of this gear also fluctuated considerably: it was operated during June to August in 1982 and from May to November in 1983. The monsoon was the best period in the landings (49.9% of the total) followed by the postmonsoon period (49.4%) (Fig. 7 H).

The total units employed was 12,146. In the pooled total for each month, the monthly CPU varied from 0.09 kg (June) to 10.5 kg (October). Three peaks in the distribution of CPU could be noted in the pooled monthly total, the dominant being that of October (10.5 kg), followed by August (3.09 kg) and May (1.4 kg). Peaks in CPU coincided with the peaks in landings (Fig. 7 H).

The maximum number of units was operated during the monsoon period (81%), but the catch accounted was only 49.9% of the total. The postmonsoon period, on the contrary, engaged only 18.3% of the total number against a landing of 49.4% of the total.

Perches by Achil

The total landings of 19.822 t by this gear, was consisted of 3 groups (Table 10, Fig. 6 H).

Nemipterids : This group dominated with 17.434 t (87.95%) (Table 10, Fig. 9 F). There were landings only in August (1982), but were

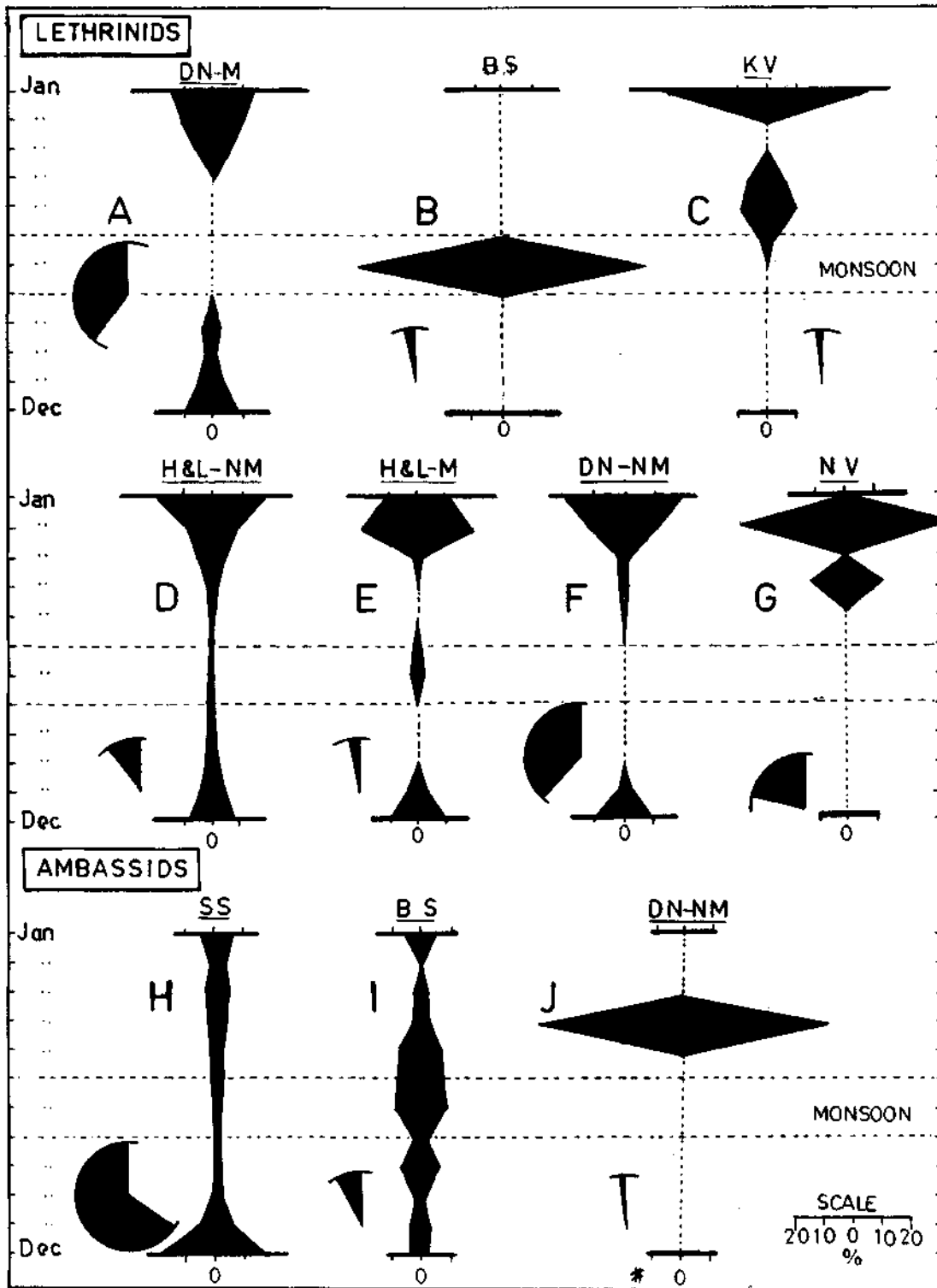


Fig. 13. Landings of Lethrinids and Ambassids by different gears. Monthly landings (%) from pooled total for each month are given. Monsoon period is indicated by two interrupted lines. A - G. Lethrinids : A. Drift net (mech. sector), B. Boat seine, C. Konchu vala, D. Hooks and line (non-mech. sector), E. Hooks and line (mech. sector), F. Drift net (non-mech. sector), G. Nandu vala; H - J. Ambassids : H. Shore seine, I. Boat seine and J. Drift net (non-mech. sector) (inset figure shows the percentage contribution of each group by the respective gear).

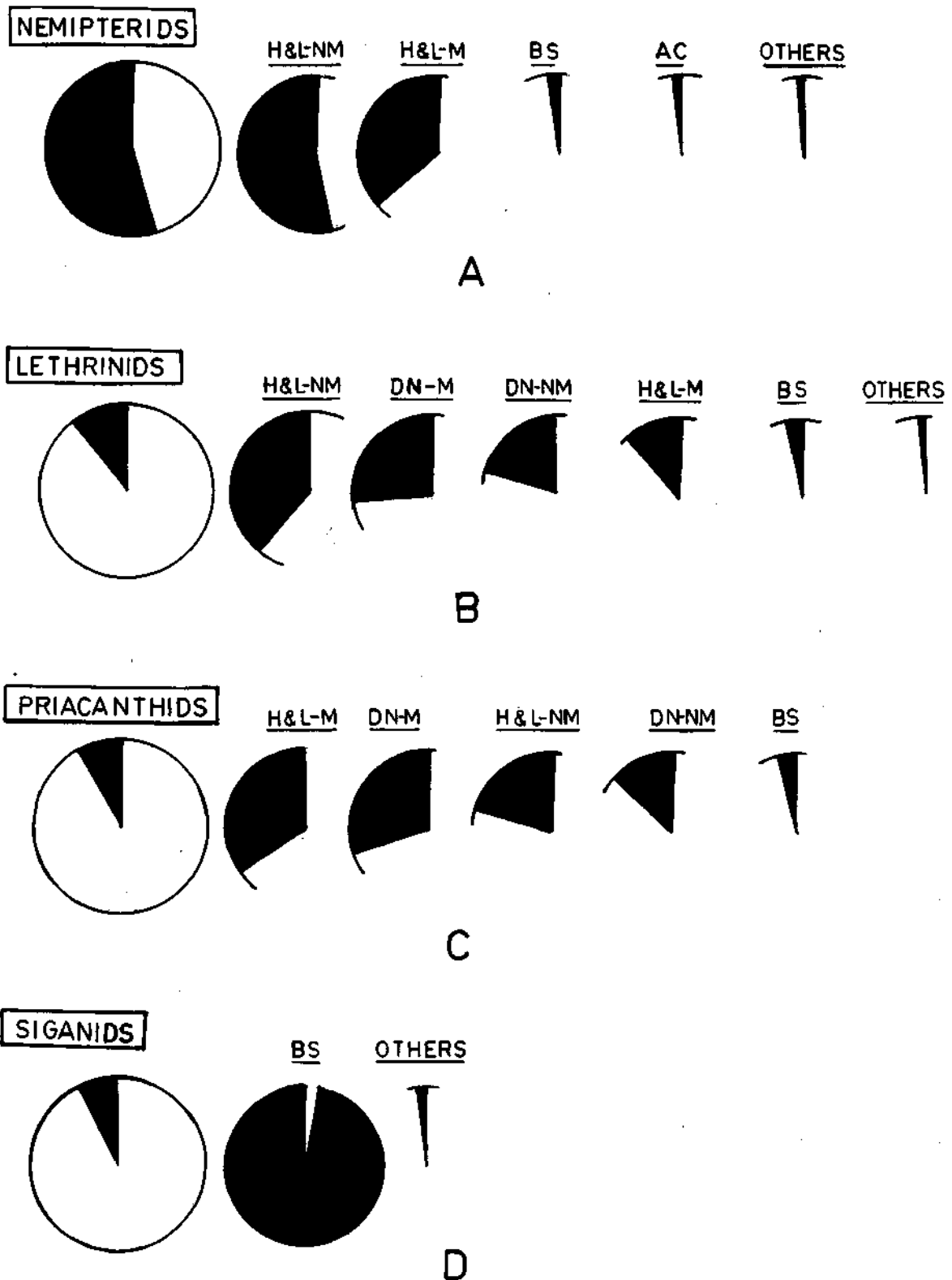


Fig. 14. The percentage share of each group in the total landings of perches at Vizhinjam for 1979 - 1987 and their gearwise contribution.

spread from May to November in 1983. The annual landings noted during 1982 and 1983 were 5.0 t and 12.36 t respectively.

TABLE 10. *Perches landed by Achil and their percentages*

Groups	Landings (t)	%
Nemipterids	17.424	87.95
Theraponids	1.427	7.19
Lutjanids	0.961	4.86

In the pooled total for each month, landings ranged from 0.8% (May) to 4.62% (October) with two peaks (Fig. 9 F). The dominant peak was in October (46.2%) and the other in August (36.8%).

The postmonsoon period may be taken as the best period for this group (50.6%) followed by the monsoon period (48.6%).

Lutjanids : This group was available in the landings by this gear in October, 1983 and the quantity was only 0.961 t (4.86%) (Table 10, Fig. 12 H).

Shore-seine

The landing by this gear was somewhat regular during 1979 to 1981, but later became irregular and sparse; there were landings for three months in 1983, for one month in 1986 and were totally absent in 1984, 1985 and 1987.

The total landings by this gear for the period 1979 to 1987 were at 9.972 t forming 0.32% of the total perch landed by different gears for the period (Table 3, Fig. 6 A, under 'others') ranking 8th in the order of abundance. The contribution by this gear to the annual landings fluctuated between 0.01% (1986) and 2.3% (1979) and the landings from 0.028 t (1986) to 3.967 t (1979) with the average at 1.1 t (Fig. 8).

Only one peak in landings could be noted both in the monthly landings for the individual years and also in the pooled total for each month. This peak invariably occurred during the postmonsoon month (December, 27.9% of the total landings) (Fig. 7 I).

The postmonsoon period accounted for the bulk in landings (67.9%) followed by the premonsoon (23.6%).

The total units operated during 1979 to 1987 was 5619 and the annual variation in number was from 39 (1986) to 2614 (1979) with the average at 624. In the pooled total for each month the CPU fluctuated between 0.8 kg (August) and 6.96 kg (July). Two peaks in CPU was noted in the pooled monthly total, the dominant one in July (6.96 kg) and the next in December (3.0 kg) (Fig. 7 I).

Perches in Shore-seine

The total landings of 9.972 t were shared by the following 5 groups (Table 11, Fig. 6 J).

TABLE 11. *Perches landed in shore-seine and their percentages*

Groups	Landings (t)	%
Ambassids	6.637	66.5
Theraponids	2.652	26.6
Serranids	0.386	3.9
Siganids	0.246	2.5
Lutjanids	0.051	0.5

Ambassids : This group constituted the bulk (66.5%) with 6.637 t in the landings by this gear (Table 11, Fig. 13 H). The landings, though irregular, could be noted only during 1979 to 1983. The quantity landed during the above period fluctuated between 0.294 t (1983) and 2.9 t (1979). In the pooled total for each month the monthly landings varied from 1.7% (September) to 37.1% (December) with a single mode in December (Fig. 13 H). The best season for this group, by this gear, was the postmonsoon (66.1%) followed by the premonsoon (25.2%).

Theraponids : This group ranked second among the five groups with 2.652 t (26.6%) of the total landings by this gear (Table 11, Fig. 11 B). Here also, as seen in the above group, there were no landings after 1983, with the exception in 1986, when a meagre quantity of 28 kg was landed. The annual landings ranged from 0.028 t (1986) to 1.0 t (1979).

In the pooled total for each month, the monthly landings ranged from 0.3% (September) to 38.2% (January) with 4 peaks in landings. The dominant peak was noted in January (38.2%) followed by the next in November (22.5%). The other two peaks were insignificant (Fig. 11 B). The postmonsoon period, with two peaks (in January and November), accounted for the maximum landings (69.2% of the total) followed by the premonsoon (22.9%).

Serranids : This group accounted for 0.386 t (3.9%) of the total landings by this gear (Table 11, Fig. 10 I). Out of 9 years studied, this group occurred only once, *i.e.* in December 1981.

Siganids : The total quantity landed was only 0.246 t (2.5% of the total by this gear). Landings were noted only in 1980, 1981 and 1983. In the pooled total for each month the landings could be seen only during January to June, with two peaks in landings (Fig. 12 L). These peaks were noted in January and May (57.3% and 12.2% respectively).

Lutjanids : During January 1979 and March 1980, this group formed a small fraction in the landings by this gear (5 kg and 0.5 kg respectively) (Table 11, Fig. 12 C).

Nandu vala

Nandu vala, a bottom set gill net, was under operation during 1979 and landed 2.574 t (Table 3, Fig. 6 A, under 'others'). This gear was employed during January to April and the CPU, during this period, fluctuated between 0.45 kg (March) and 16.9 kg (January) (Fig. 7 G).

The number of units operated during 1979 was 1324 with a landing of 2.574 t and this works out to an average of 1.94 kg per unit. 95.8% of units was operated during the premonsoon period.

Perches landed by Nandu vala

The total of 2.574 t was shared by 3 groups of perches (Table 12, Fig. 6 K).

Theraponids : With 1.346 t, this group was the most dominant one in the total landings by this

gear (Table 12, Fig. 11 F). The maximum landing of this group occurred in January when 69.3% of the total occurred. The catches then came down to a 16.2% level by April.

TABLE 12. *Perches landed by Nandu vala and their percentages*

Groups	Landings (t)	%
Theraponids	1.346	52.3
Lutjanids	0.686	26.7
Lethrinids	0.542	21.0

Lutjanids : This group was available only during January to April and the total was only 0.686 t (26.7% of the total by this gear). Here also the landings registered a decreasing trend during January to April period (Table 12, Fig. 12 G).

Lethrinids : This group was recorded during February (peak) and April (0.542 t) (Table 12, Fig. 13 G).

Trawl

This gear was in operation only during September and October 1982 and the total landings were 1.303 t (Fig. 6L).

Perches landed by Trawl

The only group represented was Nemipterids and 64.3% of the total was landed during September and the rest in October (Fig. 9 H).

Chala vala

Between 1979 and 1987, this gear was under operation only in 1982, 1986 and 1987 with a total of 0.507 t ranking 11th in abundance (Table 3, Fig. 6 A under 'others').

The contribution by this gear in the total annual landings varied from 0.04% (1982) to 0.1% (1986) and the landings from 94 kg (1987) to 300 kg (1986). The premonsoon period accounted for 81.4% of the total landings. The total units employed was 1785 and landed 0.507 t and this works out to an average of 0.28 kg per unit.

Perches landed in Chala vala

Only Lutjanids and Theraponids shared the total landings (Table 13, Fig. 6 D).

Lutjanids : This group was encountered only once in April 1986 with 59.2% of the total (Table 13, Fig. 12 J).

TABLE 13. Perches landed by Chala vala and their percentages

Groups	Landings (t)	%
Lutjanids	0.300	59.2
Theraponids	0.207	40.8

Theraponids : This group was seen in the landings during May and November of 1982 and 1987 respectively. The total was only 0.207 t (Table 13, Fig. 11 I).

to considerable variation both in time and space. The occurrence of perches in different gears during 1979 - '87, is given in Table 14. Some gears were highly seasonal in their operation.

A perusal of Table 14 indicates that Boat-seine is the only gear that lands all the 8 groups of perches dealt with here. Three gears viz. Hooks and line (non-mechanised sector), Drift net (nonmechanised sector) and Konchu vala landed 7 groups each; Hooks and line (mechanised sector) landed 6 groups each; Achil and Nandu vala landed 3 groups each; Chala vala landed 2 groups and finally trawl landed only one group.

No group had figured in the landing of all the 11 gears; the maximum noted was 10 gears in the case of Lutjanids. Theraponids figured in the landings by 9 gears; Nemipterids by 8 gears;

TABLE 14. Group - Gear relationship of perches at Vizhinjam during 1979 - 1987

Gears	1	2	3	4	5	6	7	8	Number of groups in each gear
Boat seine	X	X	X	X	X	X	X	X	8
Hooks & line (NM)	X	X	X	X	X	-	X	X	7
Shore seine	-	-	X	X	X	X	X	-	5
Drift net (NM)	X	X	X	X	X	X	-	X	7
Konchu vala	X	X	X	X	X	-	X	X	7
Achil	X	-	X	X	-	-	-	-	3
Chala vala	-	-	X	X	-	-	-	-	2
Trawl	X	-	-	-	-	-	-	-	1
Hooks & line (M)	X	X	X	X	X	-	-	X	6
Nandu vala	-	X	X	X	-	-	-	-	3
Drift net (M)	X	X	-	X	X	-	-	X	5
Gears that landed each group	8	7	9	10	7	3	4	6	

NM = Non-mechanised, M = Mechanised

1. Nemipterids, 2. Lethrinids, 3. Theraponids, 4. Lutjanids, 5. Serranids, 6. Ambassids, 7. Siganids and 8. Priacanthids.

GEAR - GROUP INTERACTION IN THE LANDING OF PERCH AT VIZHINJAM

At present 11 types of gears contribute to the perch landings at Vizhinjam, of which none is employed specifically for perches. Some groups of perches were found dominating in certain gears, but this situation was also subject

Lethrinids and Serranids by 7 gears; Priacanthids by 6 gears; Siganids by 4 gears and finally Ambassids in the landings by 3 gears.

Different groups of perches were caught by different gears in different quantities and hence, how the different gears and groups of perches interacted in landings is dealt here.

The details are discussed for each group in the following lines:

- Sub Section. 1. How the total landing of each group was apportioned as the catches of different gears and
- Sub Section. 2. How much of each gear's catches was contributed to by the particular group discussed in the section.

Nemipterids

1. Among the 8 groups of perches landed at Vizhinjam during the above period, this group formed 55% of the total (1729.956 t) (Fig. 14 A). 8 gears were instrumental in the landing of this group. Hooks and line (non-mechanised sector) accounted for 948.917 t (54.8%) followed by Hooks and line operated from mechanised crafts (717.701 t or 41.5%). It may, hence, be stated that the Hooks and line accounted for about 86.3 % of the total Nemipterid. The rest of the landings, *i.e.* 3.7% (63.3 t) was contributed by 6 different gears in the following order : Boat seine 1.7%, Achil 1%. The contribution by the 4 other gears were negligible (1 %) (Fig. 14 A, under each gear).

2. The share of Nemipterids in the landings of the respective gear is given here. This group constituted the entire landings (100%) only in the case of Trawl net operated during 1982, for two months. In the case of other gears their share is as follows : Hooks and line (non-mechanised sector) 69.4%; Hooks and line (mechanised sector) 77.3%; Achil 87.9%; Konchu vala 17.5% and Boat-seine 8.4%. The share of other gears were negligible (Fig. 9 A-H, under various gears).

Lethrinids

1. The contribution by this group to the total perch landings, as compared to that of the previous group, was less, only 10.6% of the total with 332.464 t. 7 gears contributed their share in the above landings. The percentage contribution by Hooks and line (non-mechanised sector) was the maximum (38.1% or 126.8 t) followed by Drift net (mechanised sector 26.1% or 86.8 t). Drift net operated from non-mechanised crafts accounted for 20.2% or 67.0 t. Hooks and line (mechanised sector) accounted for 11.6% ;

Boat-seine 3.3% or 10.9 t; Konchu vala 0.5% or 1.6 t. The contributions from other gears were negligible (Fig. 14 B, under each gear).

2. The composition of Lethrinids in the total landings of each gear indicated that Drift net (mechanised sector) accounted for 40.4%; Drift net (non-mechanised sector) 9.3%; Hooks and line (mechanised sector) 4.2% and Boat-seine 3.2% of the total by this group (Fig. 13 A-G, under various gears).

Priacanthids

1. This group accounted for 8.2% or 265.305 t of the total perch landings for 1979-1987. The percentage contribution was more in the mechanised sector of both Drift net and Hooks and line (29.4% and 33.7 % respectively). Hooks and line operated from non-mechanised craft accounted for the maximum among the non-mechanised gears with a total of 136.57 t. or 20.4% of the total landings. Drift net (non-mechanised sector) accounted for 13% followed by Boat-seine (3.4%). The contribution by Konchu vala was negligible (Fig. 14 C, under each gear).

2. This group accounted for 35% in the total landings by Drift net (mechanised sector); 19% by Drift net (non-mechanised sector); 9.3% by Hooks and line (mechanised sector); 3.8% by Hooks and line (non-mechanised sector) and 2.6% by Boat seine. Landings of Priacanthids by Konchu vala were negligible (Fig. 10 A-F, under various gears).

Siganids

1. This group formed 7.1% of the total perch landings with 223.894 t and the number of gears that contributed to this total was four. Of these 4 gears, the Boat seine accounted for 98.9% (221.4 t) of the total Siganid landings. The other gears such as Konchu vala, Hooks and line (non-mechanised sector) and Shore seine accounted for 0.6%, 0.4% and 0.1% respectively (Fig. 14 D, under each gear).

2. Among perches landed by the Boat seine the foremost position was occupied by Siganids with 64.4% of the total. This group constituted only 2.5% in the total by Shore seine, 1.6% in the total by Konchu vala; landings by Hooks and

line (non-mechanised sector) were negligible (Fig. 12 K-N, under various gears).

Lutjanids

1. This is the only group landed by 10 different gears. The total landing for the period 1979 to 1987 was estimated at 216.624 t or 6.9% of the total perch landings at Vizhinjam for the above period. Hooks and line (non-mechanised sector) accounted for the maximum landings (107.169 t or 49.5%) followed by that of Drift net (non-mechanised sector) (48.244 t or 22.3%). Contributions by Hooks and line and Drift net (both from mechanised sector) were quite negligible (9.2% and 9% respectively) (Fig. 15 A, under each gear).

2. From the share of Lutjanids in the total landing by different gears, could be noted that 59.2% of Chala vala, 27.4% of the total by Drift net (non-mechanised sector) 26.7% by Nandu vala, 9.1% by Drift net (mechanised sector) and 7.8% by Hooks and line (non-mechanised sector). The Lutjanid landing in other gears were negligible (Fig. 12 A-J, under various gears).

Serranids

1. Seven gears landed a total of 189.931 t of Serranids. Hooks and line operated from both mechanised and non-mechanised crafts claimed the major share in the above total (61.3%). Drift net (mechanised sector) accounted for 17.4%, while Hooks and line (non-mechanised sector) for only 8.9%. The serranid landings by Boat seine formed 10.2%, by Konchu vala 1.9% and by Shore seine 0.2% (Fig. 15 B, under each gear).

2. In no gear this group formed the bulk. 15.4% of the total landings by Drift net (mechanised sector) was Serranids and 9.7% of the total by Drift net (non-mechanised sector) was accounted by this group. The percentage occurrence of Serranids in different gears were as follows: 6.6% by Hooks and line (mechanised sector), 4.1% by Hooks and line (non-mechanised sector), 4.4% by Konchu vala, 3.9% by Shore seine and 5.6% by Boat-seine (Fig. 10 G-M, under different gears).

Theraponids

1. This group accounted for 161.666 t (5.1%) in the total perch landings for the period 1979 to

1987 (Fig. 15 C) and was fished by 9 gears at Vizhinjam.

A major share of the total landings (45.8% or 73.99 t) came from Hooks and line operated from non-mechanised crafts. Konchu vala landed 55.695 t (34.5%) and the rest of the landing was shared by gears such as Boat seine (14.0 t or 8.6%, Drift net (non-mechanised) 4.9% or 8.014 t), Hooks and line (mechanised, 2.7%, 4.329 t) and Shore seine (1.6% or 2.652 t). The contribution by other gears *viz.* Nandu vala, Achil and Chala vala together formed only 1.8% of the total (Fig. 15 C, under each gear).

2. In some gears the Theraponids formed a major part, while in others only a minor item. In the landings by Konchu vala this group accounted for 67.4% of its total, while in Chala vala only 40.8% or 207 kg. In Shore seine landings 26.6% (2.652 t) was composed of this group and in Nandu vala, 52.3% (1.346 t). The percentage of Theraponids in the landing by other gears were as follows : Boat seine 4.1%, Hooks and line non-mechanised sector 5.4%, Driftnet non-mechanised sector 4.6%, Achil 7.2% and Hooks and line, mechanised sector 0.5% (Fig. 11 A-I, under various gears).

It is seen from the landings that this fish is very common in the inshore waters within the reach of traditional crafts. The mechanised units which were operating in distant and deeper grounds could, however, make no impact in enhancing the production.

Ambassids

1. This group ranked 8th among the different groups with a total of 32.857 t constituting 1% of the total perch landings. Ambassids were landed by 3 gears of which Boat seine accounted for the bulk (77.7% or 25.52 t) followed by Shore seine (20.2% or 6.637 t) and Drift net non-mechanised sector 2.2% (or 0.7 t) (Fig. 15 D, under each gear).

2. Among the 3 gears given above the percentage composition of Ambassids was the highest in Shore seine (66.5%). Boat-seine accounted for only 7.4% of the total by this gear, though the quantity landed was 25.520 t. Drift net (non-mechanised sector) contributed to 0.4% of its total landings (Fig. 13 H-J, under various gears).

IMPACT OF MECHANISATION ON THE PERCH FISHERY

When this work was initiated at Vizhinjam in 1979, the fishermen of the area were operating 9 different types of gears. The craft in vogue were of traditional type *i.e.* catamaran and canoe. Even though they were well aware of the advantages of mechanisation, they were avoiding it on the ground that besides being capital intensive, this might invite big businessmen into the field.

The first attempt to fit a few (approximately 5) traditional crafts with 'Yamaha' outboard motors (Kerosene, Model 8 BE, 7 HP) in September 1982 became an eye opener to many of the fishermen who were always lamenting on the illeffects of mechanisation. The fishermen could reach, at a low cost, distant grounds at 60 to 80 m depth and 20 to 25 km away from the shore, beyond the limits of traditional fishermen (The traditional grounds are within 10 km from the shore, at depths varying between 40 and 50 m). This enabled them to spend more time in fishing. Since these beds were not exploited in the past, the catch per trip was much higher. The mechanisation of traditional crafts thus became acceptable to the fishermen at Vizhinjam and they now consider it a better combination in their search for an 'ideal unit'.

The past experience with mechanisation is that it will, sooner or later, lead to a law and order situation. But as far as the present centre is concerned the transformation from traditional crafts to 'mechanised' ones did not create any problem since the beneficiaries were traditional fishermen themselves.

Initiated with a meagre number of 5 in 1982, the number of OBM fitted traditional crafts has swelled up to 60 within 18 months. The present (1988) estimate is that their number is somewhere between 400 and 500. It is expected that the number may still go up when the Harbour and servicing facilities improve in future.

Details pertaining to improvement in general landing, the major groups where an enhancement in landing was effected due to mechanisation, socio-economic problems akin to

mechanisation, etc. have been dealt with by Gopakumar *et al.* (1986).

The total landing effected at Vizhinjam by the mechanised sector (1979 to 1987) through three gears *viz.* Hooks and line, Drift net and Trawl, was 1144.28 t. This is only 36.39% of the total perch landings for the said period. Hence, it is evident that the non-mechanised sector still controls the bulk in landings.

Since mechanisation effected by fitting OBM on to traditional crafts only comes under the purview of the present study, a small quantity (1.3 t) landed by Trawl net in 1982 is left out while assessing the impact of mechanisation. Hence, the total by the other two gears was reestimated as 1142.98 t or 36.35% of the total. Of this total 927.873 t or 81.19% came from the Drift net landings (Fig. 16 A - D).

No doubt, mechanisation has improved the landings considerably in some groups of perches, while in others a decreasing trend was evident. The impact of mechanisation on the landing and the shift in composition of perch at Vizhinjam are discussed below.

IMPACT OF MECHANISATION ON HOOKS AND LINE FISHERY

Changes in annual percentage composition : Among the various gears employed at Vizhinjam, the most important one that contributed to the bulk in perch landings was the Hooks and line. The contribution by this gear to the total perch landings fluctuated considerably from year to year from 69.4% (1982) to 85.9% (1980) during 1979 to 1982. Since mechanisation got initiated in 1982, this is here reconsidered as relating to two phases *viz.* the pre-mechanisation (1979-'82) and post-mechanisation (1987-1989) periods.

This shows that during the post-mechanisation period, there was a decreasing trend in landings by the non-mechanised sector as the percentage narrowed down from a higher percentage (65.7%) in 1983 to 8.7 in 1987. On the contrary, the contribution to total landings registered a steady increase from 11.8% (1983) to 68.2% (1987) by the Hooks and line operated from mechanised crafts (Fig. 15 A - 1).

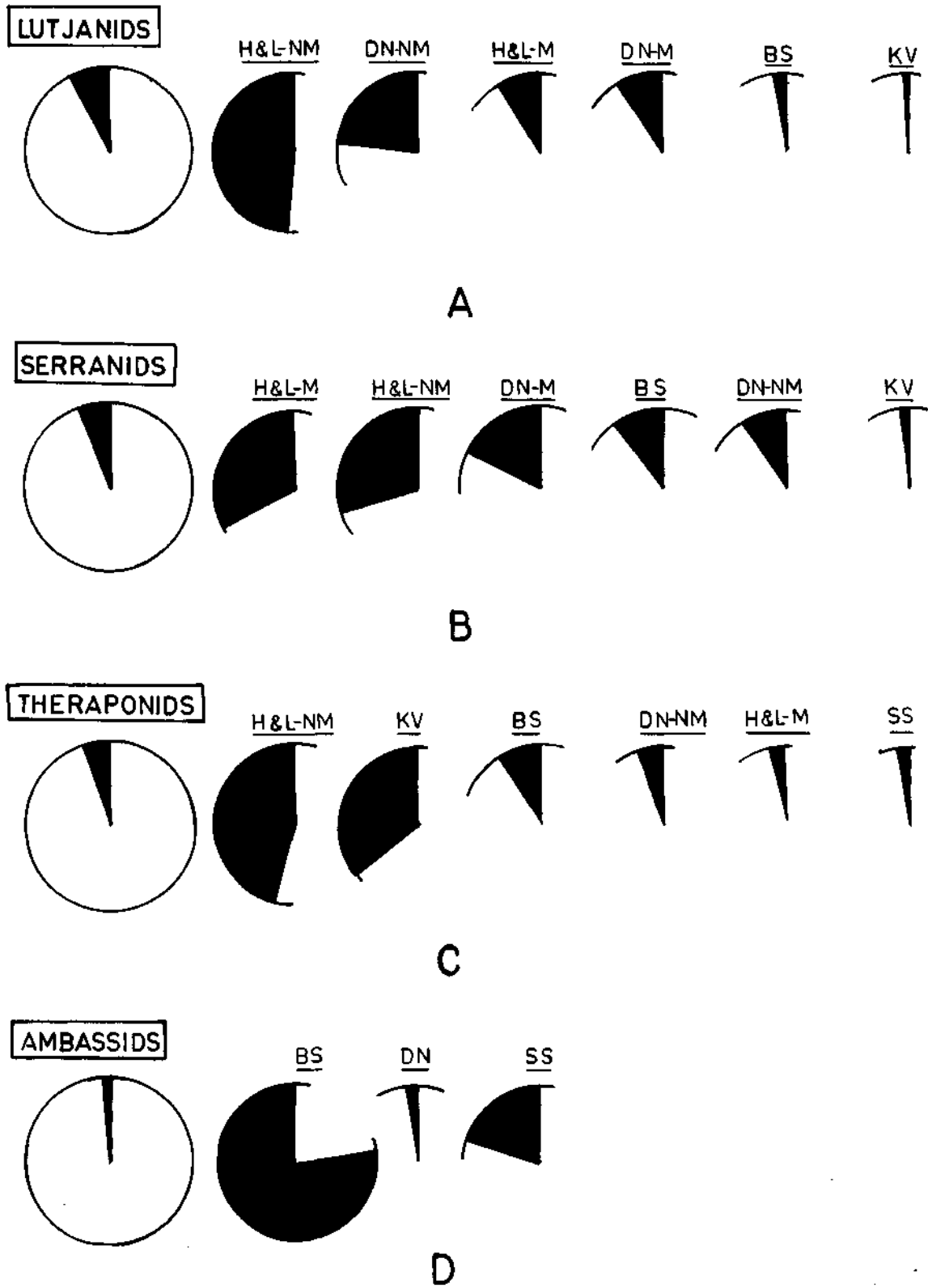


Fig. 15. The percentage of each group in the total landings of perch at Vizhinjam for 1979 - 1987 and their gearwise contribution.

PERCH FISHERY AT VIZHINJAM

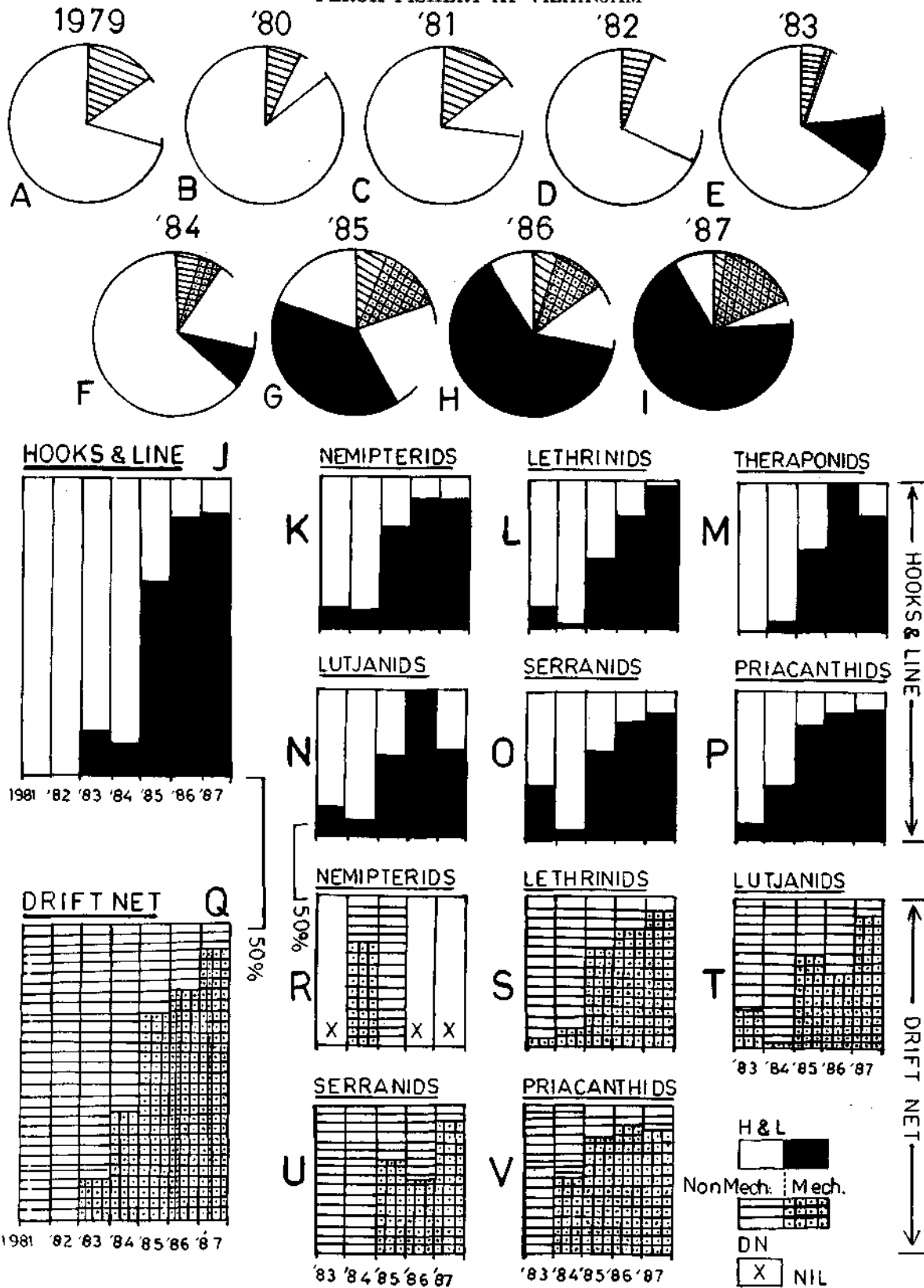


Fig. 16. A - I. Fluctuation in the landings (%) by mechanised and non-mechanised sectors of Hooks and line and Drift net, J. Total landings by both mechanised and non-mechanised sectors of Hooks and line are compared, K - P. Landings of different groups of perches by both sectors of Hooks and line and Q - V. by Drift net.

Quantitative fluctuations : The total quantity of perch landed by non-mechanised sector was 1365.71 t (1979 - 1987) and by mechanised sector was 927.873 t (1983 - 1987) (Table 3). Of the total 1365.71 t landed by the non-mechanised sector, the pre-mechanisation period (1979 to 1982) accounted for 722.33 t and the post-mechanisation period for 643.38 t. The annual average landings for the respective period were calculated at 180.583 t and 128.677 t. Likewise, the average for the mechanised sector was calculated at 185.574 t (Table 15). This clearly indicates that mechanisation has helped considerably in improving the landings.

Nemipterids ranked first in the landings by both sectors. Lethrinids and Lutjanids, which occupied the second and third position respectively in the non-mechanised sector, had very poor representation in the landings by the mechanised sector where they occupied only the 4th and 5th position. The group which was 4th in rank in the non-mechanised sector *viz.* Theraponids was very rare in the landings by the mechanised sector. Serranids and Priacanthids, which occupied the 5th and 6th rank respectively in the non-mechanised sector, ranked 3rd and 2nd respectively in the mechanised sector. The only group which could be seen exclusively in the landings by the non-mechanised sector was

TABLE 15. Trend in the landings (t) by Hooks and line operated from both mechanised and non-mechanised sectors at Vizhinjam during 1979 to 1987

Groups	Average landing by non-mech. sector		Average landing by mech. sector	Increase (+) or decrease (-)
	Average for 1979 - '82	Average for 1983 - '87	Average for 1983 to 1987	
Nemipterids	126.474	88.604	143.540	+
Lethrinids	17.398	11.441	7.728	-
Priacanthids	4.446	6.909	12.270	+
Siganids	Nil	0.179	Nil	-
Lutjanids	15.096	9.356	4.002	-
Serranids	5.475	6.739	12.167	+
Theraponids	11.691	5.446	0.865	-
All groups combined	180.583	128.677	185.574	

The percentage contribution of each sector in the total landings was then calculated on an annual basis. Though in the initial years (1983 and 1984) the percentage composition by non-mechanised sector was higher (84.7% and 88.2% respectively). Subsequently the contribution by non-mechanised sector started decreasing : 34.0% (1985), 12.4% (1986) and 11.4% (1987). The loss in landing by this sector was made good by the mechanised sector (Fig. 15 J).

Qualitative fluctuations : Out of 8 groups of perches considered here, 7 were landed by Hooks and line operated by non-mechanised sector and 6 by the mechanised sector. Ambassids were absent to both sectors while Siganiids were absent in the mechanised sector.

Siganids. Here also, as noted in the case of Theraponids, a preference towards the shallower traditional grounds was evident.

Nemipterids

Landings during the pre- and post-mechanisation periods : The total landings of Nemipterids by Hooks and line (both sectors) for the period 1979 to 1987 was 1666.618 t, of which the contribution by non-mechanised sector was 948.917 t and by mechanised sector 717.701 t. Of the 948.917 t landed by the former sector the landings for the pre-mechanisation period were 505.897 t and for the post-mechanisation period, 443.020 t; the average annual production being 126.474 t and 88.604 t respectively (Table 15). The total landings by the mechanised sector for the post-mechanisation period were estimated at

717.701 t with the average at 143.540 t (Table 15)

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

It is seen that the landings from the mechanised sector increased as years advanced at the expense of the other sector and this trend was noted in the distribution of units also.

It is evident (Fig. 16 K) that in the initial years of mechanisation (1983 and 1984) the landings of this group by non-mechanised sector dominated (85.6% and 87.4% respectively), but later this trend got reversed and the mechanised sector started catching the bulk (66.4% in 1985; 89.4% in 1986 and 89.0% in 1987).

Regarding the seasonality in landings it could be noted that though the monsoon period formed the best period in both cases, more landings were registered (69.8%) by the mechanised sector.

Lethrinids

Landing during the pre- and post-mechanisation periods : The total landings of Lethrinids, by both sectors, were estimated at 165.445 t. Of this, 126.804 t may be accounted by the non-mechanised sector (76.18%) and 38.641 t by the mechanised sector. The former landings were the aggregate for 9 years (1979 to 1987) while the latter were for 5 years (1983 to 1987). The landings by Hooks and line (non-mechanised sector) for the entire period, when calculated on a pre- and post-mechanisation basis, it is found that the annual average for the former period was 17.398 t and for the latter period, 11.441 t (Table 15). It is evident that, as compared to the pre-mechanisation period, there was a cut in the average landing during the post-mechanisation period and this can be due to the conversion of non-mechanised crafts into mechanised crafts.

The average landing by mechanised crafts (1983 to 1987) was only 7.728 t. This shows that mechanisation could produce no effect on the landing of this group probably due to the poor distribution of these fishes in the offshore grounds.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

For the first three years of mechanisation (1983 to 1985) the landings from the non-mechanised sector accounted for the bulk, i.e. 85.0%, 99.2% and 51.7% respectively. But later, i.e. from 1986 onwards, the mechanised sector started scoring the bulk in landings, i.e. 75.3% in 1986 and 98.2% in 1987 (Fig. 16 L).

The major difference noted with regard to the pattern of landing is that in the non-mechanised sector the landings could be recorded allthrough the year while in the other sector it was rather interrupted. In both cases the postmonsoon period accounted the maximum landings.

Priacanthids

Landings during the pre- and post-mechanisation periods : The total landings (1979 to 1987) were estimated at 138.68 t; of which 52.33 t were contributed by the non-mechanised sector and 86.35 t by the mechanised sector. The average annual landing by this gear for the pre-mechanisation (1979 to 1982) was estimated at 4.446 t and for the post-mechanisation period (1983 to 1987) at 6.909 t (Table 15). This shows that though many of the traditional crafts were converted into mechanised units the landings by the non-mechanised sector still registered an upward trend.

The landings of Priacanthids by the mechanised sector registered an average annual landing of 17.27 t during the period 1983 to 1987 (post-mechanisation period). This shows that the mechanised sector was quite efficient in landing more priacanthids since the total landings (86.35 t) were only for a period of 5 years as against a total of 52.33 t for 9 years by the non-mechanised sector.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

As seen in other cases, here also the landings for the first two years of mechanisation (1983 and 1984) were dominated by those from the non-mechanised sector. The percentages, by this sector, in the total landings were found to

be 90 in 1983 and 62.3 in 1984 (Fig. 16 P). But from 1985 onwards a reversal in the order of abundance could be noted; the percentages of mechanised sector were 75.8 in 1985, 84.2 in 1986 and 86.7 in 1987.

Comparing the two sectors it is found that while the monsoon landing was slightly better in the mechanised sector with a minor peak in July, the postmonsoon accounted for the bulk in landings in both sectors alike.

Siganids

Though this group ranked 4th in total landings (1979 to 1987), the contribution to the Hook and line fishery (of both sectors) was rather negligible. The total landings estimated were only 0.898 t and the entire landing came from the non-mechanised sector. Hooks and line operated from mechanised crafts in distant grounds did not make any improvement in the landing of this group.

Lutjanids

Landings during the pre- and post-mechanisation periods : The landings from nonmechanised sector accounted for the bulk (107.169 t), while that from the mechanised sector was only 20.013 t. Out of 107.169 t from the non-mechanised sector, 60.387 t could be accounted for the premechanisation period (1979 to 1982) with the average at 15.096 t and the rest *i.e.* 46.782 t for the post-mechanisation period (1983 to 1987) with the average at 9.356 t (Table 15). This clearly indicates that the landings by the non-mechanised sector dwindled considerably during the post-mechanisation period (1983 to 1987).

The landings registered during 1983 to 1987 period by the mechanised sector were very poor (20.013 t with the average at 4.002 t). This shows that mechanisation has failed to not only help much in enhancing the production, but there was fall in total landings in this group.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Here also the effect of mechanisation was evident only from 1985 onwards. During 1983

and 1984 the landings were dominated by those from the non-mechanised sector (Fig. 16 N). But by 1985 a clear change in the pattern of dominance was discernible; the percentage went upto 57.7 in 1985, 100 in 1986 and 61.7 in 1987. In the pooled monthly total for various years, it is noted that the landings were rather protracted upto 1985, but when mechanised sector started gaining momentum this pattern changed altogether and the landings became sparse. This situation prevailed in both sectors alike.

Serranids

Landings during the pre- and post-mechanisation periods : The total landings (1979 - 1987) by Hooks and line (both sectors) were estimated at 116.435 t. Out of this the share by non-mechanised sector was 55.596 t and by the other sector 60.839 t. In the case of non-mechanised sector the total for the period 1979 to 1982 was 21.9 t and for the post-mechanisation period (1983 to 1987) 33.696 t with a corresponding annual average of 5.475 t and 6.739 t (Table 15). This shows that during the post-mechanisation period there was marginal increase in the landings of this group.

Assessing the performance of Hooks and line operated from the mechanised craft it may be stated that the total landings for the period 1983 to 1987 were 60.839 t with the average at 12.167 t. This is an indication that the introduction of mechanised units has considerably improved the Serranid landings.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Here also the landings registered during 1983 and 1984 were dominated by those from the non-mechanised sector (63.6% and 92.7% respectively). From 1985 onwards the trend got reversed and the landings dominated by those from the mechanised sector; 59.6% in 1985, 81% in 1986 and 84.78% in 1987 (Fig. 16 O).

The landings registered during June-July were very poor in both sectors, but by August the landings improved. The postmonsoon fishery was very good in both sectors alike.

Theraponids

Landings during the pre- and post-mechanisation periods : By both the sectors for the period 1979 to 1987, landings were estimated at 78.325 t. Of this total, 73.996 t were landed by the non-mechanised sector and 4.329 t by the mechanised sector; or in other words, 94.47% was landed by the former sector. The share of the pre-mechanisation period in the total for the non-mechanised sector was 46.765 t and for the post-mechanisation period, 27.231 t with the averages respectively at 11.691 t and 5.446 t (Table 15). This shows that landings of Theraponids decreased considerably during the postmechanisation period in the non-mechanised sector.

The total landings for the period 1983 to 1987 by the mechanised sector were only 4.239 t with the average at 0.865 t. So mechanisation made only a decline in the landings of this group in the mechanised sector.

Annual trend in the landings by the mechanised and non-mechanised sectors - a comparison

Here also the first two years (1983 and 1984) did not make any notable change in the production by the mechanised sector and the contributions by the other sector (non-mechanised) were high (99.7% and 92.4% respectively). From 1985 onwards a clear cut dominance in the landings by the mechanised sector could be noted. The contributions for the subsequent years were : 57.5% in 1985; 100% in 1986 and 78.3% in 1987 (Fig. 16 M).

Theraponids were available in the landings throughout the year in the non-mechanised sector, but their occurrence in the other sector was highly seasonal; May to July and also in October and November (pooled landings). While assessing the landings annually it could be seen that the landings by the non-mechanised sector became quite irregular from 1985 onwards when the mechanised sector gained dominance over the landings. There were no landings in 1986 and the landings in 1987 were confined to one month only.

The general pattern of landings noted in both the sectors was interesting. The peaks in monthly landings (pooled data) alternated with each other, *i.e.* the peak landings in the mechanised sector were noted in January and October while the same in the other sector in April, August and December. Monsoon period accounted for the bulk in landings (67.1%) in the case of mechanised sector while the postmonsoon period (53.4%) in the other.

Remarks

In short, it may be stated that in the case of 3 groups (Nemipterids, Priacanthids and Serranids) the average landings were more in the mechanised sector, while in the others these were less (Table 15). While comparing the average landings for both pre- and post-mechanisation periods it is noted that the average was higher in the latter period (1983 to 1987) in the case of groups such as Priacanthids, Siganids and Serranids. The landings of Lethrinids, Lutjanids and Theraponids did not show any improvement. The decrease in landing noted in the non-mechanised sector during 1983 to 1987 may be attributed to the conversion of non-mechanised crafts to mechanised units.

IMPACT OF MECHANISATION ON THE EFFORT EXPENDED

The units operated in the non-mechanised sector during 1979 to 1987 was 378262. There were only non-mechanised units upto 1982 and for the rest of the period (1983 to 1987) both mechanised and nonmechanised units were in operation. Since many of the traditional crafts got fitted with OBM, there was drastic cut in the number of non-mechanised units from 1983 onwards.

Out of 378,262 units operated during 1979 to 1987, 246,481 units were operated during 1979 to 1982 (pre-mechanisation period), while 131,781 units during 1983 to 1987 (or post-mechanisation period). In other words, 65.2% of units was operated during 1979 to 1982 and 34.8% during 1983 to 1987.

In the non-mechanised sector the variation in the number of units operated annually in the

pre-mechanisation period was from 51,115 (1979) to 70,854 units (1980), with the average at 61,620 units. And for the post-mechanisation period the same was from 5,184 (1983) to 71,782 units (1984), with the average at 26,356 units. The cut noted in the average as well as in the annual number of units may be attributed to the conversion of non-mechanised units into mechanised units.

As given earlier, the total perch landings for the period 1979 to 1982, by the non-mechanised sector (Hooks and line) were 722.33 t and for 1983 to 1987 were 643.38 t against a total effort of 246,481 units and 131,781 units respectively. These work out to an

The total units operated from 1983 to 1987 by the mechanised sector was 122,094 with the average at 24,418 units. The total landings, by this sector, was 927.873 t (Table 3) and this works out to an average CPU of 7.6 kg for the period. This indicates that the CPU in mechanised sector was higher as compared to the other sector.

While examining the pooled monthly CPU for the entire period it could be noted that in the non-mechanised sector CPU showed two ranges in its distribution. It was at a higher range during July-September period and at a lower range during December - January period. In the former period the fluctuation noted was

TABLE 16. *Trend in the landings (t) by Drift net operated from both mechanised and non-mechanised crafts at Vizhinjam during 1979 - 1987*

Groups	Average landing by non-mech. sector		Average landing by mech. sector	Increase (+) or decrease (-)
	Average for 1979 to '82	Average for 1983 to '87	Average for 1983 to '87	
Nemipterids	0.233	0.053	0.034	-
Lethrinids	9.703	5.649	17.372	+
Priacanthids	2.363	4.790	15.074	+
Lutjanids	7.112	3.959	3.912	-
Serranids	1.459	2.226	6.627	+
Theraponids	0.856	0.918	Nil	-
Ambassids	0.175	Nil	Nil	-
All groups combined	21.902	17.595	43.021	+

average CPU of 2.9 kg for the pre-mechanisation period and 4.9 kg for the post-mechanisation period. This indicates that though the effort and landing dwindled as a result of mechanisation, the CPU showed an increase as against that noted in the pre-mechanisation period.

With reference to the mechanised sector there was slight hike (50.2 %) in the total units operated in 1983 as against that in the non-mechanised sector, but during 1984 and 1985 the number of units operated was far less (12.1 % and 48.1 % respectively) than that in the other sector. From 1986 onwards the non-mechanised sector's landing started decreasing as the mechanised sector's percentages increased : 74.6% in 1986 and 82.4 % in 1987.

from 5 to 7.32 kg while in the latter, it was from 3 to 4.18 kg. In the mechanised sector the higher range could be noted during June to September when the fluctuation noted was between 10 and 23 kg. The lower range, in this case, was noted from December to February when the variation was from 4 to 7 kg.

Maximum effort was expended during the postmonsoon period and this was rather similar for both sectors.

IMPACT OF MECHANISATION ON DRIFT NET FISHERY

Changes in the annual percentage composition

Drift net was in operation throughout the 9 years covered under the present study. During

the pre-mechanisation period (1979 - 1982) the contribution to total landings by this gear fluctuated between 5.6% (1982) and 14.6% (1979). In the post-mechanisation period (1983 - 1987) the contribution to the annual landings by non-mechanised sector fluctuated between 1.7% (1987) and 7.6% (1984) while that of mechanised sector was from 0.6% (1983) to 16.0% (1987).

Fluctuations in landing

With the total of 175.587 t the Drift net operated from non-mechanised sector ranked 5th among the various gears that landed perch during 1979 to 1987 (Table 3). Of this total, 87.608 t were landed during the pre-mechanisation period (1979 - 1982) and the rest *i.e.* 87.979 t during the post-mechanisation period (1983 to 1987). Percentage-wise, the former came to 49.9% and the latter 50.1% which indicated that there was not much variation in the landings of the pre- and post-mechanisation periods. The average landing for the respective period was calculated at 21.902 t and 17.595 t (Table 16).

Drift net operated from the mechanised crafts accounted for 215.107 t (Table 3) for 1983 to 1987 with the average at 43.021 t (Table 16). This shows that mechanisation helped much in improving the landings.

The percentage contribution by Drift net to the total annual landing revealed that, as in Hooks and line, here also the effect of mechanisation was not much spectacular in the initial stages (*i.e.* 1983 and 1984). For these two years the contribution by the non-mechanised sector was comparatively at a higher level, say 86.2% and 63.7% respectively. By 1985 the trend reversed and percentage contribution from mechanised sector gained dominance; 69.7 % in 1985, 77.9% in 1986 and 90.5% in 1987 (Fig. 16 Q).

Fluctuations in groups

Groups of perches represented were only 5 in the mechanised sector as against 7 noted in the non-mechanised sector.

Regarding the abundance of various groups in the landings by these two sectors, it could be noted that Lethrinids ranked first in both sectors. Lutjanids occupied 4th rank in the

mechanised sector, but the 2nd position in the non-mechanised sector. Priacanthids occupied the third position in the non-mechanised sector, but 2nd in the other. Serranids occupied the 3rd position in the landings by the mechanised sector, but its position was 4th in the non-mechanised sector. Nemipterids formed the least in the order of abundance in the mechanised sector with negligible composition (0.08%) as in the non-mechanised sector (6th rank, 0.39% of the total).

Nemipterids

Landings during the pre- and post-mechanisation periods : The total landings from both sectors were only 1.372 t, of which 1.2 t came from non-mechanised sector and the rest (0.172 t) from mechanised sector. Of this 1.2 t, 0.933 t was from the pre-mechanisation and 0.267 t from the post-mechanisation periods. The respective average for the above periods were at 0.233 t and 0.053 t (Table 16).

The total landings by the mechanised sector (1983 to 1987) came to 0.172 t with the average at 0.034 t. This shows that mechanisation had no beneficial effect on the landings of this group.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Landings on Nemipterids were confined to 1984 and 1985 in the non-mechanised sector; only for 1984 in the other sector. In 1984, the mechanised sector accounted for 70.2% of the total. In 1985, there were landings only from the non-mechanised sector (Fig. 16 R).

Lethrinids

Landings during the pre- and post-mechanisation periods : This group ranked first in the landings by both sectors alike. The total landings of Lethrinids were estimated at 153.92 t. The contribution from mechanised sector (86.861 t or 56.4%) was for a period of 5 years while that by non-mechanised sector (67.059 t or 43.6 %) accounted for a period of 9 years.

Out of 67.059 t landed during the non-mechanised sector, 38.813 t were landed during the pre-mechanisation period and 28.246 t in the

post-mechanisation period with the respective average at 9.703 t and 5.649 t (Table 16).

As mentioned earlier, the total landings by mechanised sector came to 86.861 t (1983 to 1987), the average being 17.372 t. This shows that mechanisation has helped much in enhancing the production of this group.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Here also the effect of mechanisation was quite negligible upto 1984 (6.6% in 1983 and 12.1% in 1984) in the landings by the mechanised sector. From 1985 onwards, landing by the mechanised sector showed an upward trend : 67.6% in 1985; 80.2% in 1986 and 92.0% in 1987 (Fig. 13 S).

In both sectors there were no landings during May to September and for the rest of the year (in pooled data) the landings were almost of the same pattern, the only difference being that the mechanised sector registered comparatively better landings during September and October.

Priacanthids

Landings during the pre- and post-mechanisation periods : The total landings (1979 - 1987) by this gear were estimated at 108.775 t, of which 33.403 t were by the non-mechanised sector and 75.372 t by the mechanised sector. This landing showed that 69.3% of the total was landed by the mechanised sector.

Of the total of 33.403 t landed for 9 years by the non-mechanised sector, the pre-mechanisation period accounted for 9.452 t and the post-mechanisation period, for 23.951 t. This is an indication that though the mechanised sector attracted more crafts into its fold, the landings by the non-mechanised sector were still on the increase. The landings of non-mechanised sector for the pre- and post-mechanisation periods indicate an average of 2.363 t for the former and 4.79 t for the latter periods (Table 16). The average for the mechanised sector, similarly, was estimated at 15.074 t. This indicates that irrespective of the sector there was an increase in the landings of Priacanthids during 1983 to 1987.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

In 1983 there were no landings by the mechanised sector and in 1984, this sector contributed 51.6% of the total. Thereafter the contribution by this sector was steadily on the increase; 80.5% in 1985; 88.1% in 1986 and 86.8% in 1987 (Fig. 16 V).

Drift net was not operated by the non-mechanised sector during monsoon period, but this was not the case with the mechanised sector. There were appreciably good landings of this group during June - July by the mechanised sector. The postmonsoon period registered the maximum landings in both sectors alike.

Serranids

Landings during the pre- and post-mechanisation periods : The total landings (1979 - 1987) of Serranids by this gear, amounted to 50.106 t, of which 33.139 t or 66.1% were contributed by the mechanised sector and 16.976 t or 33.9% by the non-mechanised sector. Of the above total of 16.976 t, 5.837 t were landed during 1979 to 1982 and 11.130 t during 1983 to 1987; the average being 1.459 t and 2.226 t respectively (Table 16). This shows that though many of the conventional crafts were converted into mechanised units, the landings in the post-mechanisation period were on the increase. In the case of mechanised sector, the average landing for the post-mechanisation period was 6.627 t clearly indicating that mechanisation had helped in improving the landings.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

During the first two years of mechanisation (1983 and 1984) there were no landings by the mechanised sector. From 1985 onwards the trend changed and the landings by mechanised sector started dominating except during 1986, when the contribution had decreased to 49.8% level. For the other two years the contribution by the mechanised sector were 63.8% (1985) and 92.5% (1987) (Fig. 16 U).

In the mechanised sector there were landings in all months except in July, while in the other sector, there were landings allthrough

the monsoon months. The postmonsoon period registered the maximum landings followed by the premonsoon; the difference in the percentage being very insignificant.

Theraponids

Landings during the pre- and post-mechanisation periods : The total quantity landed by this gear was 8.014 t and there were no landings by the mechanised sector. The average landings for the pre- and post-mechanisation periods were at 0.856 t and 0.918 t respectively. This clearly indicate that the landings of the group were retained at almost the same level though many of the traditional crafts got converted into mechanised ones (Table 16).

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Out of 9 years investigated the presence of this group in this gear was noted only from 1980 to 1985. In the pooled monthly landings, however, the landings could be noted during September to February and also in April. The postmonsoon period accounted for the bulk in landings (93.7%).

Lutjanids

Landings during the pre- and post-mechanisation periods : The total landings (1979 - 1987) by this gear, were estimated at 67.807 t. The non-mechanised sector accounted for the bulk (48.244 t or 71.1 %) in landings. The average landing by this sector for the pre-mechanisation period was 7.112 t and for the post-mechanisation period, 3.95 t (Table 16). The sharp decline in the average landing for the latter period may indicate two possibilities : (1) that mechanisation has affected the landing in the other sector and (2) Lutjanids have sparse distribution in distant areas. The findings from Hooks and line landings (of mechanised sector) also suggest a similar possibility.

Annual trend in the landings by mechanised and non-mechanised sectors - a comparison

Here also, as seen in other groups, the effect of mechanisation was slowly felt in its initial phase. The contributions from non-

mechanised sector were 75.5% and 98.5% respectively of the total landings in 1983 and 1984. In 1986, there was slight fall in the percentage contribution by the mechanised sector (48.9%; Fig. 16 T). For the other years the percentages were 62.1 (1985) and 90.5 (1987).

In both sectors there were no landings during May - July period. The landings for the rest of the months, were regular in the initial years, but later became sparse in the mechanised sector. The postmonsoon period registered the maximum landings in both sectors alike.

Ambassids

Landing during the pre- and post-mechanisation periods : Ambassids were caught only once by the non-mechanised sector (1982) and the mechanised sector totally failed to land this group.

Remarks

In conclusion, the landing trend noted in both sectors of the Drift net showed that more groups of perches were represented in the traditional grounds that are frequented by the traditional fishermen. No doubt, the mechanisation has increased the landings in some groups, but it had affected the landings of some other groups for two reasons : (1) More and more fishermen were adopting mechanisation and it made a notable cut in the number of units which were previously exploiting the stocks in the conventional grounds and (2) only some groups of perches enjoy an extensive distribution and hence, the landings in such groups only could be augmented by increasing the area of operation through mechanisation.

It may be seen from Table 16 that 3 groups *viz.* Ambassids, Siganids and Theraponids, failed to figure in the landings by the mechanised sector of Drift net and 2 groups *viz.* Ambassids and Siganids, in the landings by the same sector of Hooks and line (Table 15). While evaluating the abundance of the above groups in different gears, it is noted that Theraponids constituted 67.4% of the total landings by Konchu vala which is a gill net; 40.8 % by Chala vala which

is a gill net; 52.3% in Nandu vala which is a bottom set gill net; Hooks and line (non-mechanised sector); Shore seine, etc. Siganids, similarly, are caught by 4 different types of gears such as Boat seine, Shore seine, Konchu vala, etc. This shows that this group dominates in the near shore areas. A similar behaviour may be noted in the case of Ambassids also.

The other groups represented may be divided into 2 categories based on their landing in the mechanised sector : (1) Those which showed an increase in their average landings during the period of mechanisation and (2) those which showed a decrease in their average landings during the period of mechanisation (Table 16).

The various groups represented in the landings by Drift net may be arranged as follows :

a. Those with increased production : Lethrinids, Priacanthids, Serranids and landings as whole.

b. Those with decreased production : Nemipterids, Lutjanids, Theraponids and Ambassids.

The various groups represented in the landings by Hooks and line may be arranged as follows.

a. Those with increased production : Nemipterids, Priacanthids, Serranids and landings as a whole.

b. Those with decreased production : Lethrinids, Siganids, Lutjanids and Theraponids.

It may, hence, be concluded that mechanisation has helped much in improving the landings of Nemipterids, Priacanthids, Serranids and Lethrinids.

IMPACT OF MECHANISATION ON THE EFFORT EXPENDED

The total number of units (both sectors) operated at Vizhinjam during 1979 to 1987 was 143,225, of which 77,395 units belonged to the nonmechanised sector and 65,830 units to the

mechanised sector. In other words, 54.03% of the total was claimed by the non-mechanised sector.

Of the total 77,359 units employed by the non-mechanised sector, 42,296 were operated during the pre-mechanisation period and 30,099 during the post-mechanisation period, the average being 11,824 and 6,019 units respectively. Percentage-wise, the former is 61.1 and the latter 38.9. This clearly indicates that there was a cut in the number of non-mechanised units operated during the post-mechanisation period.

Since both mechanised and non-mechanised units were operated during the post-mechanisation period (1983 to 1987) and many of the traditional crafts had been fitted with OBM, there was a cut in the number of units of the latter sector subsequently. Hence, the number of units operated by both sectors were 95,929. The percentage for the mechanised sector was found to be more (68.6%) and this indicates that the mechanised units increased numerically in the post-mechanisation period.

The above paragraphs give only a general idea on the trend of mechanisation at Vizhinjam after 1982, but it throws no light on the annual variation in landings. Hence, the percentage fluctuations in the landing by both sectors were calculated year-wise. Though mechanisation was initiated in 1982, its effects were seldom felt in the landings both in 1983 and 1984. Of a total of 9,297 units operated in 1983, 85.7% belonged to the non-mechanised sector. A similar condition prevailed in 1984 also as the percentage composition of the non-mechanised sector was 70.4. From 1985 onwards the situation reversed and landing in the mechanised sector increased to 70.5% in 1985, 77.8% in 1986 and 95.5% in 1987.

The total landings registered by the non-mechanised sector (Drift net) during 1979 to 1987 were 175,587 t (Table 3) of which 87,608 t were landed during pre-mechanisation and 87,979 t during the post-mechanisation periods. This indicates that the hike in landings registered during the latter period was rather negligible. The number of units operated during the pre-mechanisation period was 47,296, while

TABLE 17. Summary of monthwise peak landing of each group and the gears used during the present study at Vizhinjam

Groups	Months of peak landing	Gears used and sector	Remarks
Nemipterids	March	Drift net (MS)	Certain gears were seasonal. Boat seine, Achil, Konchu vala and Drift net (MS) registered low landings.
	May	Konchu vala	
	July	Boat seine, Hooks & line (MS)	
	August	Hooks & line (NMS)	
	September	Drift net (NMS),	
	October	Achil	
Lethrinids	January	Konchu vala, Hooks & line (NMS) Drift net (NMS and MS)	Konchu vala, Nandu vala and Boat seine registered low landings. Other gears were seasonal.
	February	Hooks & line (MS), Nandu vala	
	July	Boat seine	
Priacanthids	April	Konchu vala	Boat seine and Konchu vala registered low landings.
	July	Boat seine	
	October	Hooks & line (NMS), Drift net (NM & MS)	
	November	Hooks & line (MS)	
Lutjanids	January	Shore seine, Hooks & line (NMS); Drift net (NMS & MS); Konchu vala; Nandu vala	Achil, Nandu vala, Chala vala and Shore seine recorded low landings. Certain gears were seasonal.
	February	Hooks & line (MS)	
	April	Chala vala	
	August	Boat seine	
	October	Achil	
Serranids	January	Hooks & line (NMS & MS), Drift net (MS)	Konchu vala, Shore seine and Boat seine registered low landings. Some gears were seasonal.
	February	Drift net (MS)	
	June	Konchu vala	
	August	Boat seine	
	December	Shore seine	
Siganids	January	Shore seine and Hooks & line (NMS)	Except Boat seine all the other gears recorded poor catches during the peak period.
	April	Konchu vala	
	August	Boat seine	
Theraporids	January	Shore seine and Nandu vala	Nandu vala, Achil and Chala vala registered low landings. Some gears were seasonal.
	May	Konchu vala and Chala vala	
	June	Hooks & line (MS)	
	July	Boat seine and Achil	
	August	Hooks & line (NMS)	
	September	Drift net (NMS)	
Ambassids	April	Drift net (NMS)	Drift net (NMS) and Boat seine recorded low landings.
	July	Boat seine	
	December	Shore seine	

MS = Mechanised Sector; NMS = Non-mechanised Sector.

that for the post-mechanisation period 30,097. From this the average CPU for the respective period may be calculated at 1.8 kg and 2.9 kg. This shows that inspite of a reduction in the number of units in the non-mechanised sector, there was an increase in CPU during the post-mechanisation period.

The total landings by the mechanised sector, for 1983 to 1987 were 215.107 t (Table 3) and this was landed against a total effort of 65,830 units with an average CPU of 3.26 kg indicating better production by this sector.

In the pooled monthly total of CPU for the entire period, it is seen that the monthly CPU for the non-mechanised sector fluctuated between 0.23 kg (May) and 7.6 kg (January). The CPU was at a higher range from December to February (with peak in January). 61% of the total units was operated during the postmonsoon period and 31% in the premonsoon period. There were no landings during the monsoon period by this sector unlike their mechanised counterparts.

In the mechanised sector the monthly fluctuation in CPU was from 0.3 kg (May) to 8.08 kg (January). The CPU was at a higher range from November to March with a peak in January. While comparing the CPU noted in both sectors it may be stated that in the mechanised sector the period with higher CPU was more protracted (5 months) while in the other, it was only for 3 months. The monsoon operation was characteristic only of the mechanised sector.

CONCLUSIONS AND RECOMMENDATIONS

1. The southwest coast of India with characteristic rocky outcrops and offshore 'Kalava' grounds situated at a depth range of 75 to 100 m provides congenial conditions for many a perch to dwell in. Vizhinjam, a fishing centre situated right on this coast, hence, is an important centre for any study pertaining to this group of fishes.

2. The percentage of perch in total fish landings at Vizhinjam varied from 3.78 (1979)

to 8.37 (1980) during the period of the present study (1979 to 1987). The total landings, at this centre for the above period fluctuated between 169.9 t (1979) and 542.2 t (1987) registering an upward trend.

3. Under the present conditions it was possible only to evaluate the landings of perch on a family-basis. Attempts to study the biology of a few common species failed on account of the nonavailability of statistically sound sampling throughout the year. It is hoped that in future, when mechanised vessels bring in more landings from the offshore areas, the condition might improve to make biological investigations more meaningful. More studies on the qualitative and quantitative aspects of landings will have to be made.

4. The period 1983 to 1987 represents a new phase in the fisheries of the area since many of the traditional crafts (catamaran and canoe) got fitted with OBM, which resulted in notable enhancement in the catch per trip of such mechanised units. The advantages of such mechanisation, the quantitative and qualitative changes that took place in landings, the effect of mechanisation on the number of non-mechanised units, etc. could be studied carefully for a period of 5 years (1983 to 1987). Hence, the present study may serve as a basic work for the said period and major changes, if any, that might take place in future will have to be evaluated by comparing with the results presently reported.

5. The fishermen themselves adopted mechanisation and as there was no compulsion or coercion from any outside agency in doing so and as the beneficiaries were the fishermen themselves, no law and order situation emanated in this process. From a meagre number of 5, in September 1982, the number of such units has gone up to nearly 500 in 1988.

6. It is sure that completion of the Fishing Harbour at Vizhinjam will give more thrust to the mechanised sector at the expense of the non-mechanised, which now claims the bulk in landings (63.65%). At this stage, an influx of big business houses to Vizhinjam will become inevitable and their profit-oriented operations

might relegate the artisanal sector to an insignificant entity. Many of the distant fishing grounds that are profitably fished at present by OBM fitted traditional crafts will no longer be their monopoly. Hence, these OBM fitted crafts, in turn, may try to encroach upon the inshore realms for better returns. This might ignite any law and order situation unless proper precautionary measures are adopted in the beginning itself.

7. The distant grounds now covered by such OBM fitted traditional crafts are quite productive due to their virgin nature. But in future, when fishing pressure increases in an unbridled manner there is every likelihood that these grounds also may become less productive. Hence, it is quite essential to limit the operation of such units in these offshore realms. The needed fishing restrictions, then, will have to be arrived at based on more precise knowledge about the resource availability in these grounds. Hence, more investigations will have to be undertaken to recommend measures for their rational exploitation.

8. More studies on the breeding, fecundity and recruitment patterns will have to be initiated atleast in a few of the more common species of perches. Such studies will have to be intensified as it might throw some light on the recruitment patterns in perches.

9. Mechanisation of traditional crafts has so far resulted in increasing the landings in 4 groups only *viz.* Nemipterids, Priacanthids, Serranids and Lethrinids, while in the case of the other 4 a decreasing trend was discernible. The reason is that the fishing pressure decreased considerably in the inshore areas as more and more traditional crafts have resorted to mechanisation. The 4 groups, in which a decreasing trend in production was evident, were those which were being caught in plenty

in gears that were operated in the nearshore areas.

10. As seen from the present account, different groups of perches are fished throughout the year by different gears. The period of their peak landings also vary from month to month as well as from gear to gear. Hence, to increase their production it would be worthwhile attempting (i) any alternate gear to fish any group in such months (periods) when it does not form a peak in any gear and (ii) to intensify the operation of the gear in the month in which any particular group forms a peak (Table 17).

Though with the completion of the Fishing Harbour and the availability of other attendant facilities for large trawlers and gill netters, the nature of the fisheries at Vizhinjam is likely to change, till such a situation arises, for some years to come, the transitional phase of indigenous crafts getting fitted with OBM and small mechanised vessels competing with country crafts in the same coastal grounds is likely to continue and some effort to regularise the fishing operation by different gears would be necessary. It is hoped that the information on catch and effort with reference to fish landed, the gears used and effort expended, given above would be helpful in arriving at some of these decisions for a rational exploitation.

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