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TUNA FISHERIES OF THE EXCLUSIVE ECONOMIC ZONE OF INDIA: Biology and Stock Assessment

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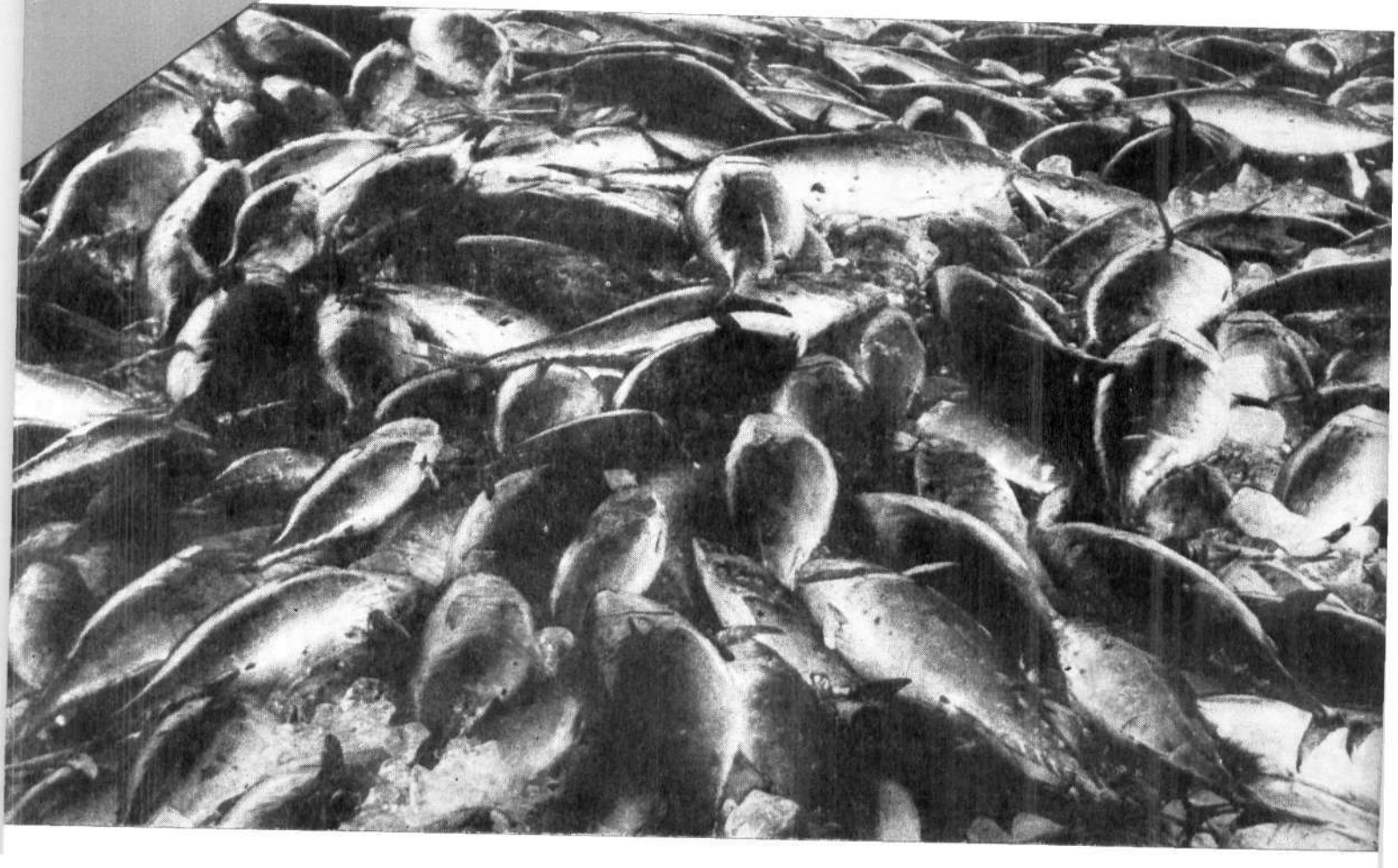

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FISHERY AND BIONOMICS OF TUNAS AT TUTICORIN

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In the fishery along Tuticorin Coast in the Gulf of Mannar, seven species of tuna and tuna-like fishes occur. They are the little tunny *Euthynnus affinis* (Cantor), Frigate mackerel *Auxis thazard* (Lacepede), bullet tuna *Auxis rochei* (Risso), oriental bonito, *Sarda orientalis* (Temminck and Schlegel), yellowfin tuna *Thunnus albacares* (Temminck and Schlegel), skipjack tuna *Katsuwonus pelamis* (Linnaeus) and long tail tuna *Thunnus tonggol* (Bleeker). In addition, among the billfishes, the sailfish *Istiophorus platypterus* (Shaw and Nodder) and the striped marlin *Tetrapterus audax* (Philippi) also occur in the fishery.

A comprehensive account on tunas of Indian waters has been given by Jones and Silas (1960) and Silas and Pillai (1982). Some aspects of the biology and fishery of these fishes are dealt with here based on the material collected during the years 1979-'82.

Fishing area

The tuna fishery at Tuticorin has earlier been documented by Silas (1967). Since then there has been shift in the pattern of fishery from a predominantly troll line fishery to gill net fishery (both 'paruvalai' and 'podivalai' of synthetic nylon). Troll line operations are conducted only when the use of gill nets are temporarily suspended and when the fishermen sail to deeper grounds. Fig. 1 shows the operational area of drift gill nets off Tuticorin.

Craft and gear and operational details

Fishing craft is still predominantly the 'Tuticorin type' boat which was described by Silas (1967) in detail.

Based on the data collected during the four years from 1979 to 1982, along the coast of Tuticorin from Vaipar, Tuticorin, Punnakayal, Kayalpatnam and Veerapandianpatnam landing centres, it may be stated that the peak season for tuna fishery is from June to September. Heavy landings were noticed only at Veerapandianpatnam. The stray catches of the juveniles of *E. affinis*, *A. thazard* and *S. orientalis* were mostly caught off Veerapandianpatnam by 'sardine drift gill nets' of mesh size 3.2 cm. The medium size (20 to 30 cm) fishes belong to the species *E. affinis*,

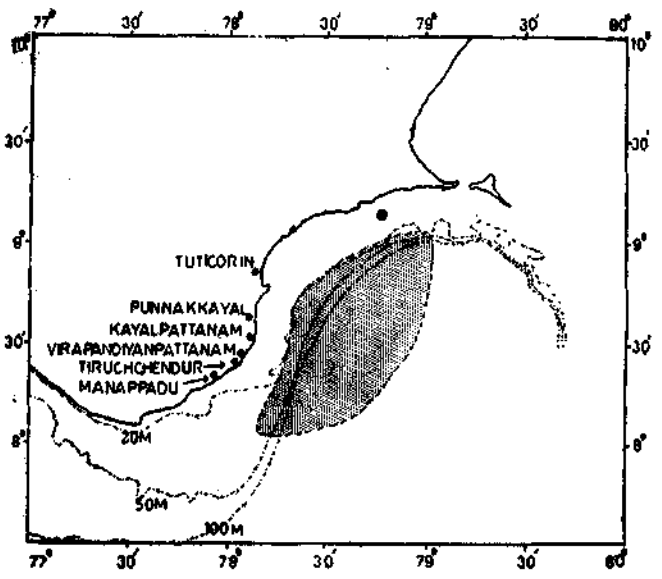

Fig. 1. Operational area of drift gillnetters off Tuticorin.

A. thazard, *S. orientalis* and *A. rochei* and larger sizes of *T. albacares*, *T. tonggol*, *E. affinis*, *S. orientalis*, *K. pelamis*, *A. thazard* and billfishes *I. platypterus* and *T. audax* were caught along with seerfishes and sharks by the drift gill nets called 'Podivalai' of the mesh size 7.0 to 11.5 cm and by 'Paruvalai' of mesh size 12.2-15.0 cm respectively. Occasionally dolphins were also caught by these drift gill nets. The length and

depth of a single piece of gill net is about 14-16 metres and 3-4 metres respectively. During operations usually 7-10 pieces are plied together.

E. affinis and *A. thazard* occur round the year. In addition to these three species *viz.*, *T. tonggol*, *T. albacares*, *K. pelamis* and *S. orientalis* occur only during the season (June-September). During the fishing seasons, fishermen from the northern parts of the Gulf of Mannar *viz.*, Vaipar, Vedalai, Mookayoor, Yervadi, Valinockam, Keelakkarai and adjacent villages use to migrate to Veerapandianpatnam with their boats and gears and camp there purely for tuna fishing. Totally 160 number of gill net operational units or even more during seasons were in use from Veerapandianpatnam alone. Of these nearly 90% of the gears were in operation daily depending upon favourable wind when the catches were also proportionately high. The fishing ground is within 30 to 50 metres depth off Veerapandianpatnam (Fig. 1). Totally 60% of the catch is constituted by tuna, followed by seerfishes (15%), sharks (12%) and other fishes such as *Caranx*, catfish, *Sphyraena*, etc.

The fishing ground off Veerapandianpatnam is less than 10 kilometres from the shore and the sailing time to reach the fishing ground is about 2 hrs. Each sail boat has a crew of 5 to 6. They leave the centre by about 1500-1600 hrs and operate the drift gill nets for about 8 hours or even more. Generally only one operation is done and occasionally it is increased by two. Next day morning, after 0600 hrs they start to return to the landing centre and reach the shore before 0800 hours.

Heavy landings of Scombroids, especially tunnies were observed only during the South-West Monsoon season, *i.e.* from June to September. Normally the catch is poor during the North-East Monsoon, due to the turbidity of the water and the difficulty in reaching the ground.

The scombroid fishes especially tunnies were mostly disposed by public auction in the landing centre of Veerapandianpatnam, as soon as they are landed. The fresh fishes were mostly sent to Kerala especially to Quilon, Kottayam and Trivandrum districts in fresh condition packed with ice by lorry and van. In case there is any shortage of ice, there is a steep fall in the price for tuna. When this occurs the fishes are sundried or even pit-cured . In earlier years sundried fish was mostly exported to Sri Lanka (Silas, 1967).

Effort, catch and CPUE

The effort expended in the drift gill net fishery during the year 1979 to 1982 ranged from 4002 to 9438 units, minimum during the year 1979 and the maximum efforts expended during the year 1981 respectively (Fig. 2). The tuna landing was high *i.e.*, 2,797 tonnes during the year 1980 and very low (135 t) during 1982. The latter at Veerapandianpatnam was due to the dispute between the fishermen operating mechanised and non-mechanised boats. The tuna landing was completely nil only in the month of October during the year 1979 and 1982.

During the year 1979, the maximum effort expended was of 896 units in the month of July and the catch of tuna and related fishes was of 186 tonnes. The minimum effort of 169 units have been expended in May 1979 and the catch was nearly 2 tonnes. The minimum catch of tuna (0.2 t) was recorded during February 1979. The tuna landing was high during June, July and August in 1979, being 72 t, 186 t and 98 t respectively. Their landing was very poor during the rest of the months in 1979 (Fig. 2).

The tuna landing was relatively high (2,797 t) during the year 1980, when compared to the corresponding years 1979, 1981 and 1982. During this year, effort was also high (2,219 units) in July and catch of tuna was recorded at 1,177 t. The minimum effort of 190 units was in February and the catch was 1 t only. Unlike that of 1979, the effort and catch were high in the months of July, August and September, during the year 1980, the catch being 1,177 t, 1,112 t and 450 t respectively (Fig. 2).

The effort were high (9,438 units) during the year 1981, when compared to that in 1979, 1980 and 1982, and the annual tuna catch was also estimated to be 1,239 t. Maximum units of 1,920 were operated during the month of July '81 and the catch also recorded to a maximum of 816 t in this month. The minimum effort was expended in October '81 and the catch recorded was 1.5 t. The minimum catch was recorded during the year 1981 in the month of September at 0.03 t. During this month, due to the dispute between the fishermen of mechanised and non-mechanised boats they suspended fishing activities.

When compared to the previous years, the annual tuna landing was poor (135 t) during the year 1982, and the effort expended was 7,654 units. The maximum effort and catch of tuna were recorded only in July '82 and the catch and effort were estimated at 116 t and 1,754 units respectively (Fig. 2.) The minimum tuna catch (0.2 t) and effort (316 units) was recorded in

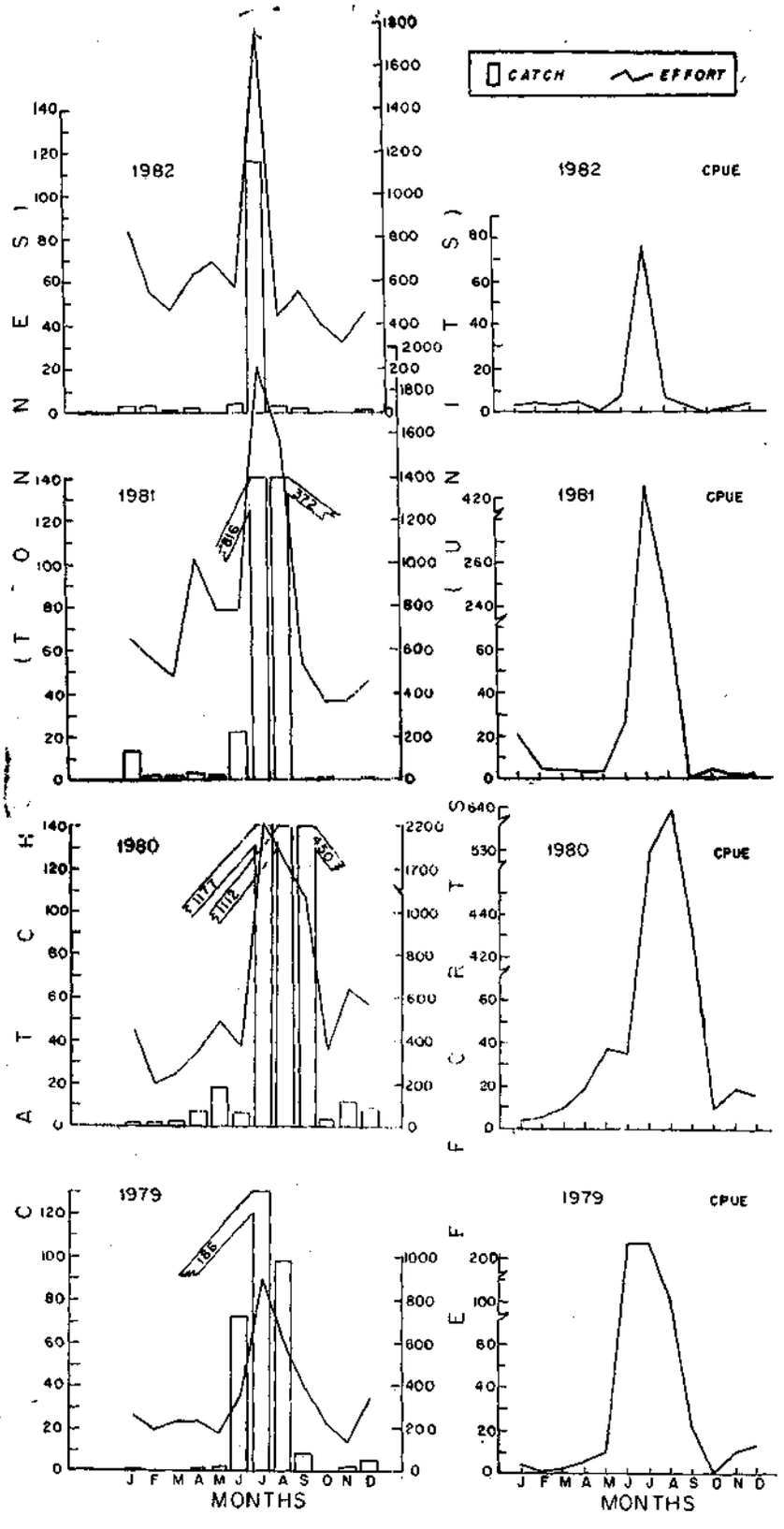

Fig. 2. Catch effort relationship and catch per unit effort of tunas at Tuticorin, 1979-'82.

November '82. But in October '82 the tuna landing was cmopletely nil even though 400 drift gill nets were operated. Totally the tuna landing was very poor during the year 1982, especially in the season June to September.

Species composition

The species composition showed that *E. affinis* formed 57.7%, 14.8%, 28.7% and 79% during the years 1979, 1980, 1981 and 1982 respectively (Fig. 3). *A. thazard* formed 27.8%, 82.6%, 61.3% and 11.1%

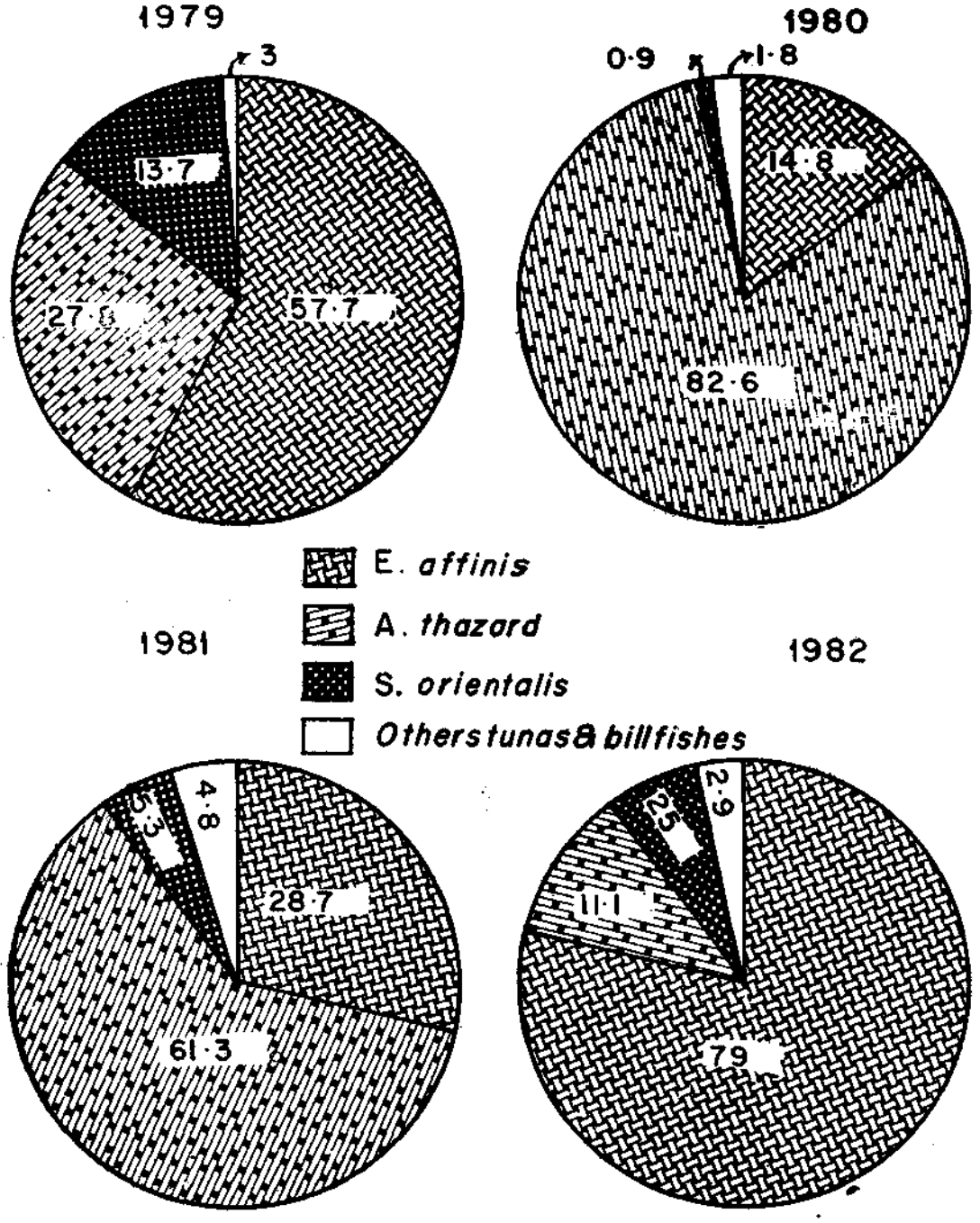

Fig. 3. Percentage composition of different species of tunas at Tuticorin, 1979-'82.

The annual catch per unit effort of tuna and related fishes by drift gill nets during 1979, 1980, 1981 and 1982 was 94, 324, 131 and 18 kg respectively. The minimum annual catch per unit effort was recorded as 18 kg during the year 1982 and the maximum of 324 kg during 1980 (Fig. 2).

during 1979, 1980, 1981 and 1982 respectively *S.orientalis* formed 13.7%, 0.9%, 5.3% and 7.0% during 1979, 1980, 1981 and 1982 respectively. The occurrence of *S. orientalis* is only seasonal, from June to September. *T. albacares* occurred as 0.3%, 0.2%, 2.4% and 1.4% during 1979, 1980, 1981 and 1982

respectively. In 1979 *T. albacares* occurred only in August and December ; but in 1980, during July, August, September, November and December ; in 1981, during June, July, August, October and December and in 1982, during February, July, August, November and December.

T. tonggol was completely absent during the year 1979. It was recorded as 0.08%, 0.02% and 0.06% during the years 1980, 1981 and 1982 respectively. In 1980, it occurred only in June, July and September, in 1981 in July and August ; and in 1982 February, June and December.

The occurrence of *K. pelamis* was also sporadic. During 1979, 1981 and 1982 the percentage composition was recorded only as 0.04. During 1979, it occurred only in June ; it was completely absent in 1980 ; in 1981, in July and August ; and in 1982, in December.

The species composition of *I. platypterus* was recorded as 0.4%, 1.5%, 2.3% and 1.4% during 1979, 1980, 1981 and 1982 respectively. In 1979, it occurred in June, August and September ; in 1980, from June to September ; in 1981, in July, August, October and December ; and in 1982, in February, April, July, August and September.

Length-weight relationship and sex ratio

Except for the information presented by Silas (1967), there is no published data on the length-weight relation ship of tuna species from the Tuticorin waters. The length-weight relationship of the different species of tunnies such as *E. affinis*, *A. thazard*. *S. orientalis*, *T. albacares*. *T. tonggol* and *K. pelamis* and the billfish I. *platypterus* and their sex ratio were studied.

Length-weight relationship of each fish can be expressed by the formula

$$W = aL^b$$

where W = weight, L = length and a and b are constants. The weight and length were related by using the logarithmic transformation of the formula :

$$\log W = \log a + b \log L$$

where, a and b are constants.

250 specimens of *E. affinis* (12.0 to 74.0 cm F.L. and weighing 0.012 to 5.25 kg) were analysed for length-weight relationship and out of that 165 fish sexed (81 males and 84 females) (Figs. 4 & 5).

The regression equation obtained were as follows :

E. affinis

Pooled .. $\log W = -12.1073 + 3.2944 \log L$
Male .. $\log W = -11.0248 + 3.0176 \log L$
Female .. $\log W = -11.5219 + 3.1819 \log L$

250 specimens of the frigate mackerel *A. thazard* ranging from 12.9 to 53.0 cm (FL) and weighing 0.02 to 3.25 kg were taken for the length-weight relationship study (Figs. 4 & 5). Of these, 118 fish sexed showed 52 males and 66 females.

A. thazard

Pooled .. $\log W = -12.8176 + 3.5139 \log L$
Male .. $\log W = -13.3054 + 3.6566 \log L$
Female .. $\log W = -13.6580 + 3.7733 \log L$

250 specimens of the oriental bonito *S. orientalis*, measuring from 14.0 to 59.6 cm (FL) and weighing 0.028 to 3.75 kg were analysed for length-weight relationship (Figs. 4 & 5). Sixty-nine fish sexed showed 29 males and 40 females.

S. orientalis

Pooled .. $\log W = -12.4968 + 3.4245 \log L$
Males .. $\log W = -7.5065 + 2.2028 \log L$
Female .. $\log W = -7.8291 + 2.3125 \log L$

A total of 44 specimens of northern bluefin tuna *T. tonggol* 45.0 to 73.0 cm (FL) and weighing 2.5 to 5.25 kg were examined for length-weight relationship (Figs. 4 & 6). Nineteen fish sexed showed 11 males and 8 females.

T. tonggol

Pooled .. $\log W = -4.9640 + 1.5440 \log L$
Male .. $\log W = -7.3655 + 2.0881 \log L$
Female .. $\log W = -7.9001 + 2.2319 \log L$

Only 7 specimens of the skipjack tuna *K. pelamis*, have been analyses for length-weight relationship, ranging from 46.6 to 58.0 cm (FL) and weighing 2.75 to 5.0 kg. Of these 3 were males and 4 females (Fig. 6).

K. pelamis

Pooled .. $\log W = -7.7149 + 2.2656 \log L$
Male .. $\log W = -8.0315 + 2.3017 \log L$
Female .. $\log W = -11.1618 + 3.1219 \log L$

Totally 240 specimens of sailfish *I. platypterus* of 66.6 to 267.5 cm (FL) and weighing 1.75 to 55 kg were analysed for the length-weight relationship. Seventeen fish sexed showed 4 males and 13 females (Figs. 4 & 6).

I. platypterus

Pooled .. $\log W = -9.7075 + 2.4947 \log L$
Male .. $\log W = -8.0835 + 2.1790 \log L$
Female .. $\log W = -11.0484 + 2.7787 \log L$

According to Silas (1967), the weight and length were related by using the equation. $\log W = a + b \log L$

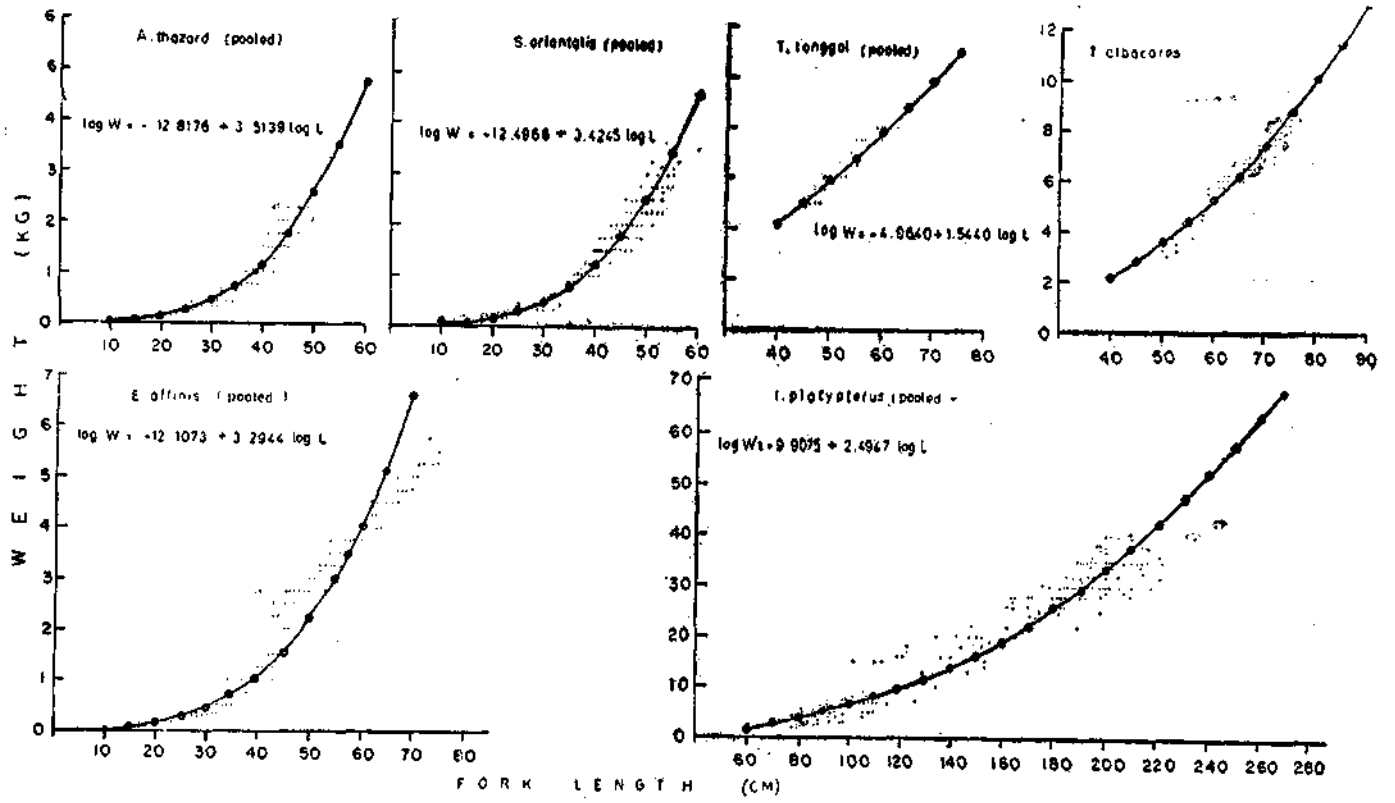

Fig. 4. Length-weight relationship of *A. thazard, S. orientalis, T. tonggol, T. albacares, E. affinis* and *I. platypterus* (pooled) at Tutcorin, 1979-'82.

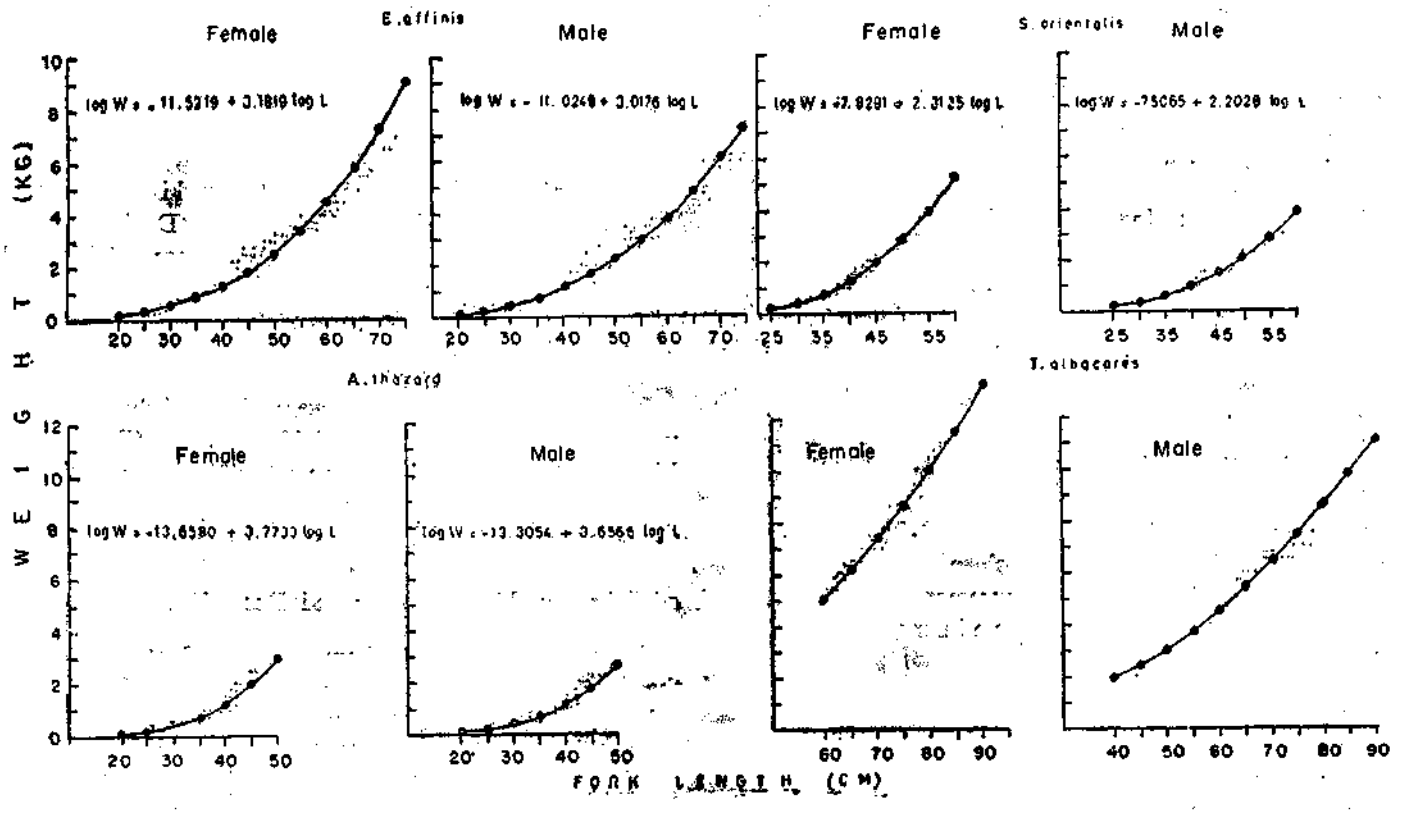

Fig. 5. Length-weight relationship of females and males of *E. affinis, S. orientalis, A. thazard* and *T. albacares* at Tuticorin.

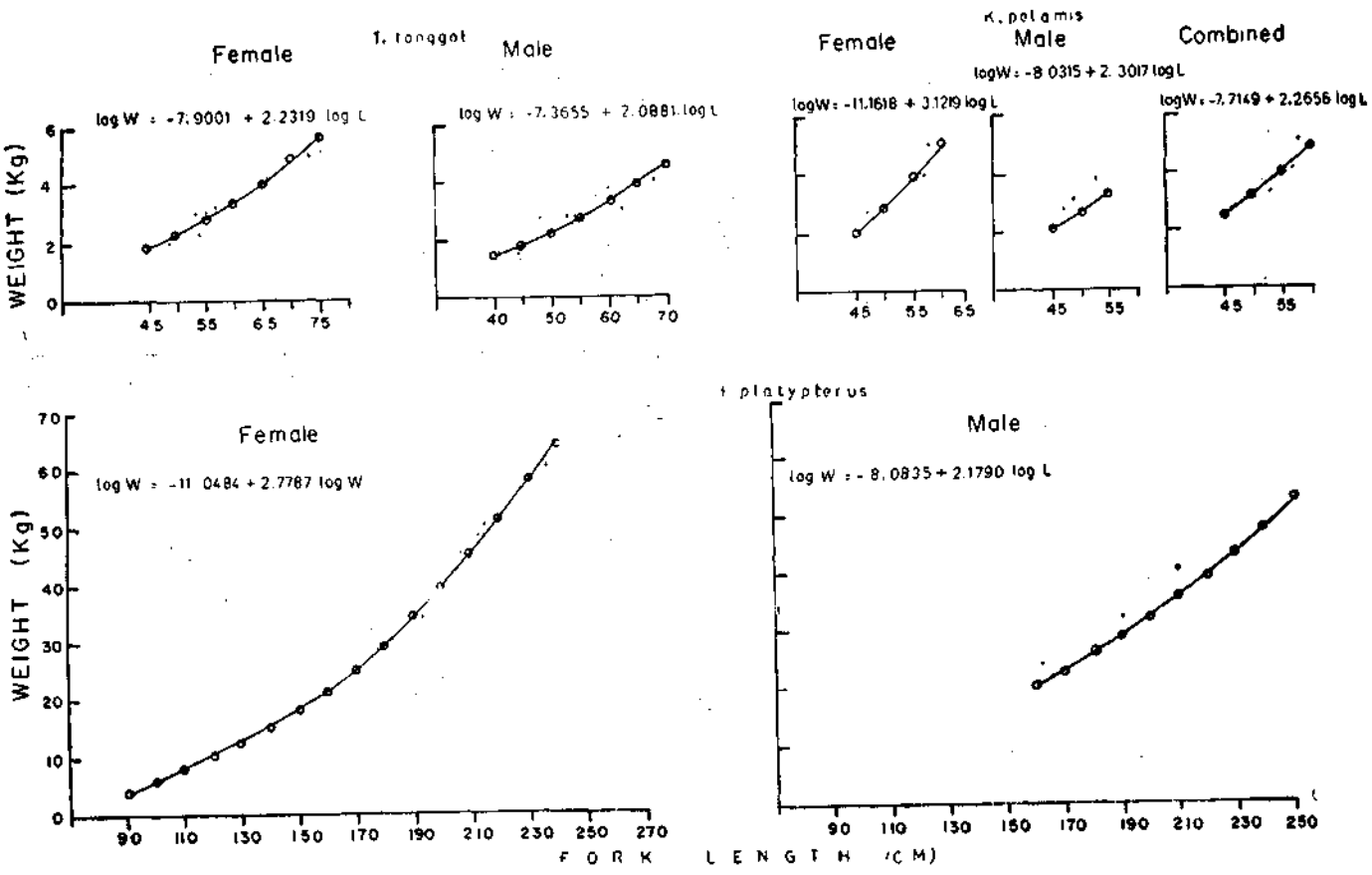

Fig. 6. Length-weight relationship of males and females of *T. tonggol, K. pelamis* and *I. platypterus* at Tuticorin.

is almost same and the fit was found to be good in the present study also. The regression equations obtained by him were as follows :

Yellowfin tuna : $\log W = -7.3781 + 3.0056 \log L$

Northern bluefin tuna : $\log W = -6.1708 + 2.5128 \log L$

Little tunny : $\log W = -7.5442 + 3.0287 \log L$

Size distribution

The size distribution of the tunnies in the Gulf of Mannar has been given by Silas (1967) for *T. tonggol T. albacares* and *E. affinis*. Six species of tuna and tuna-like species and the sailfish off Tuticorin were selected for taking length measurements. The length measurements were grouped at 2 cm intervals and length frequency curves were plotted.

Totally 12, 90, 155 and 5 specimens in the size range 66.5 to 267.5 cm (FL) of the sailfish, *I. platypterus* were examined for size distribution during 1979, 1980, 1981 and 1982 respectively.

The percentage frequency in the various size groups of the different species are worked out (Figs. 7-14).

For *E. affinis* major modes were observed in the range of 30 to 74 cm during the year 1979. During 1980 major modes were observed in the range of 14 to 68 cm. In 1981, the major modes were in the range from 30 to 68 cm. In 1982, major modes were observed in the range of 30 to 70 cm (Figs. 7 & 8).

In *A. thazard* major modes were observed during the year 1979 in the size range of 18 to 52 cm (Fig. 19). Major modes were in the range of 13 to 40 cm during 1980 (Fig. 64). During the year 1981 major modes were observed in the size range of 18 to 40 cm (Fig. 10). In 1982 no major mode was observed during the months of February, May, October and December.

S. orientalis occurred from June to September in the size range 40 to 54 cm. In 1980, it occurred during July to September and there were 11 modes in the size range of 14 to 44 cm. In 1981, also it occurred from July to September and 9 modes were observed in the range of 26 to 60 cm. During the year 1982, it was

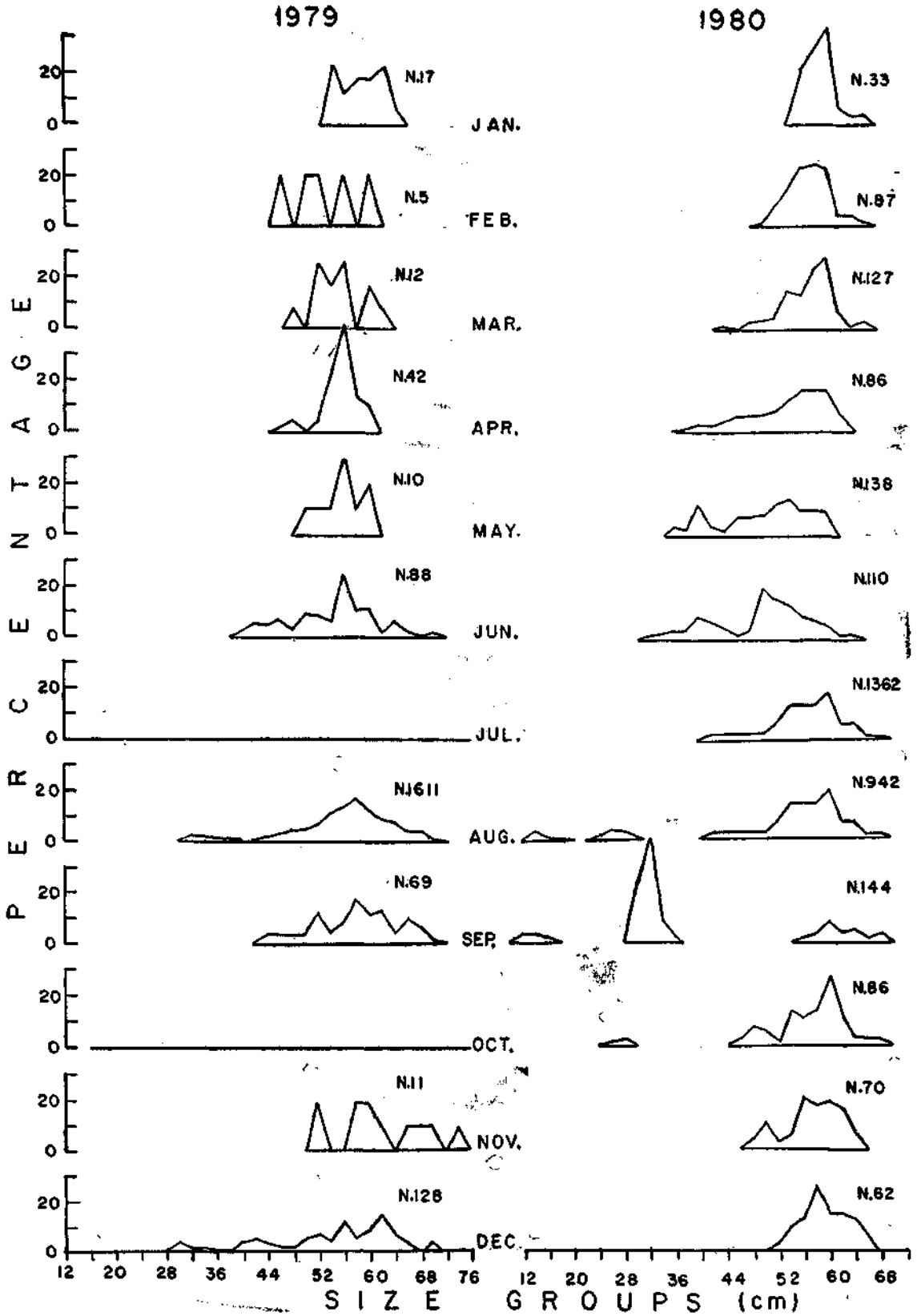

Fig. 7. Monthly length frequency distribution of *E. affinis* at Tuticorin, 1979-'80.

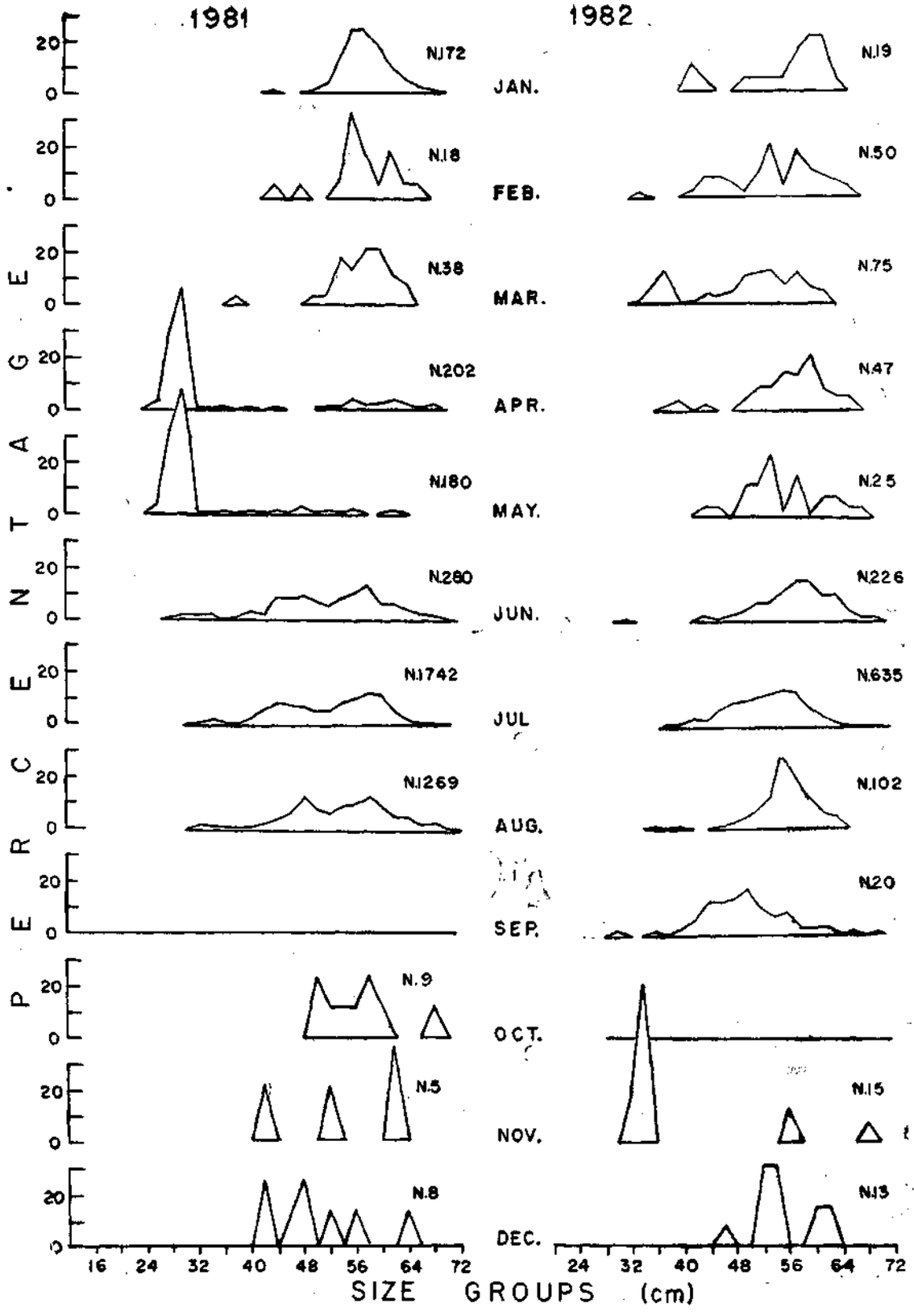

Fig. 8. Monthly length frequency distribution of *E. affinis* at Tuticorin, 1981-'82.

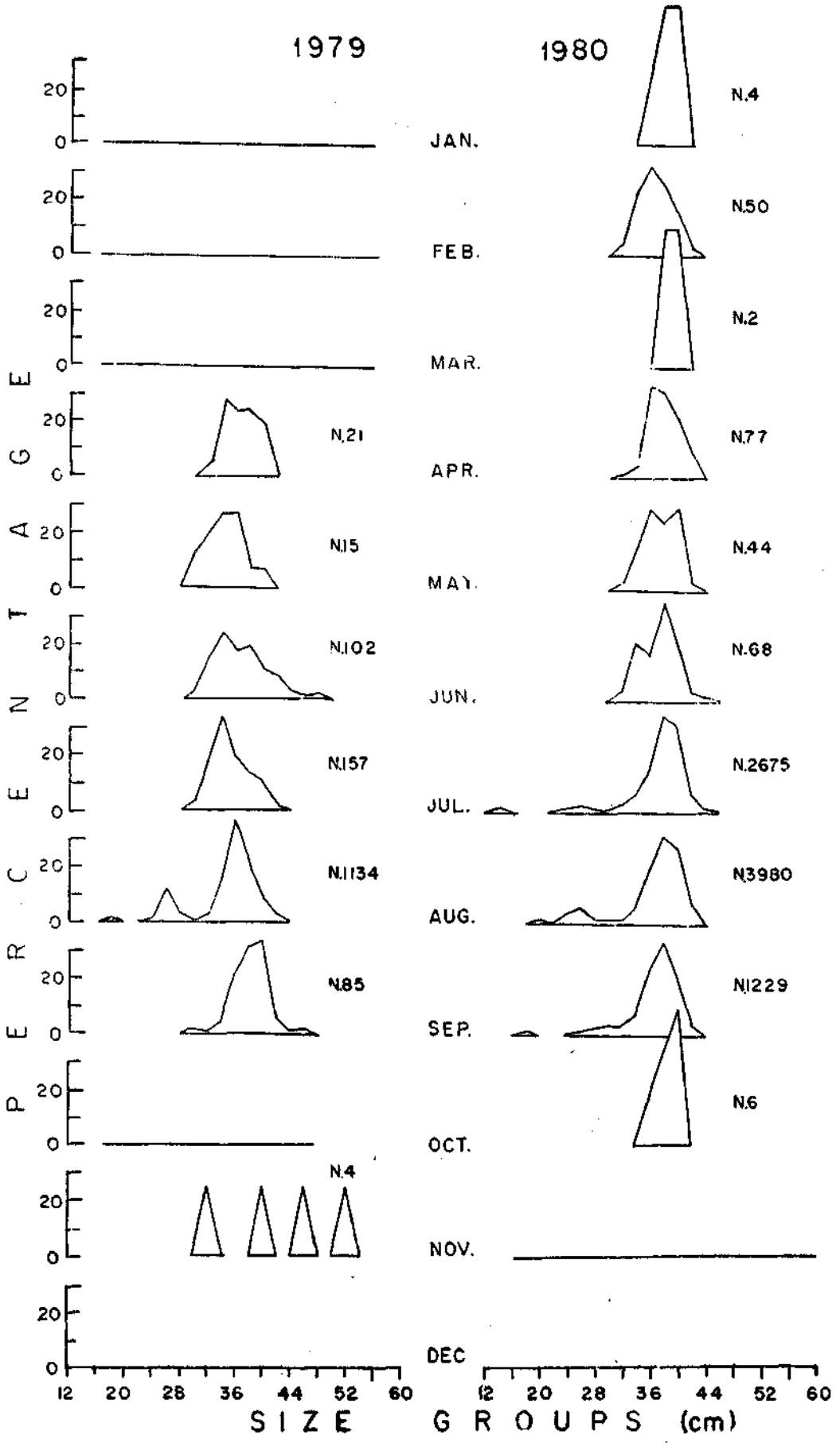

Fig. 9 Monthly length frequency distribution of *A. thazard* at Tuticorin, 1979-'80.

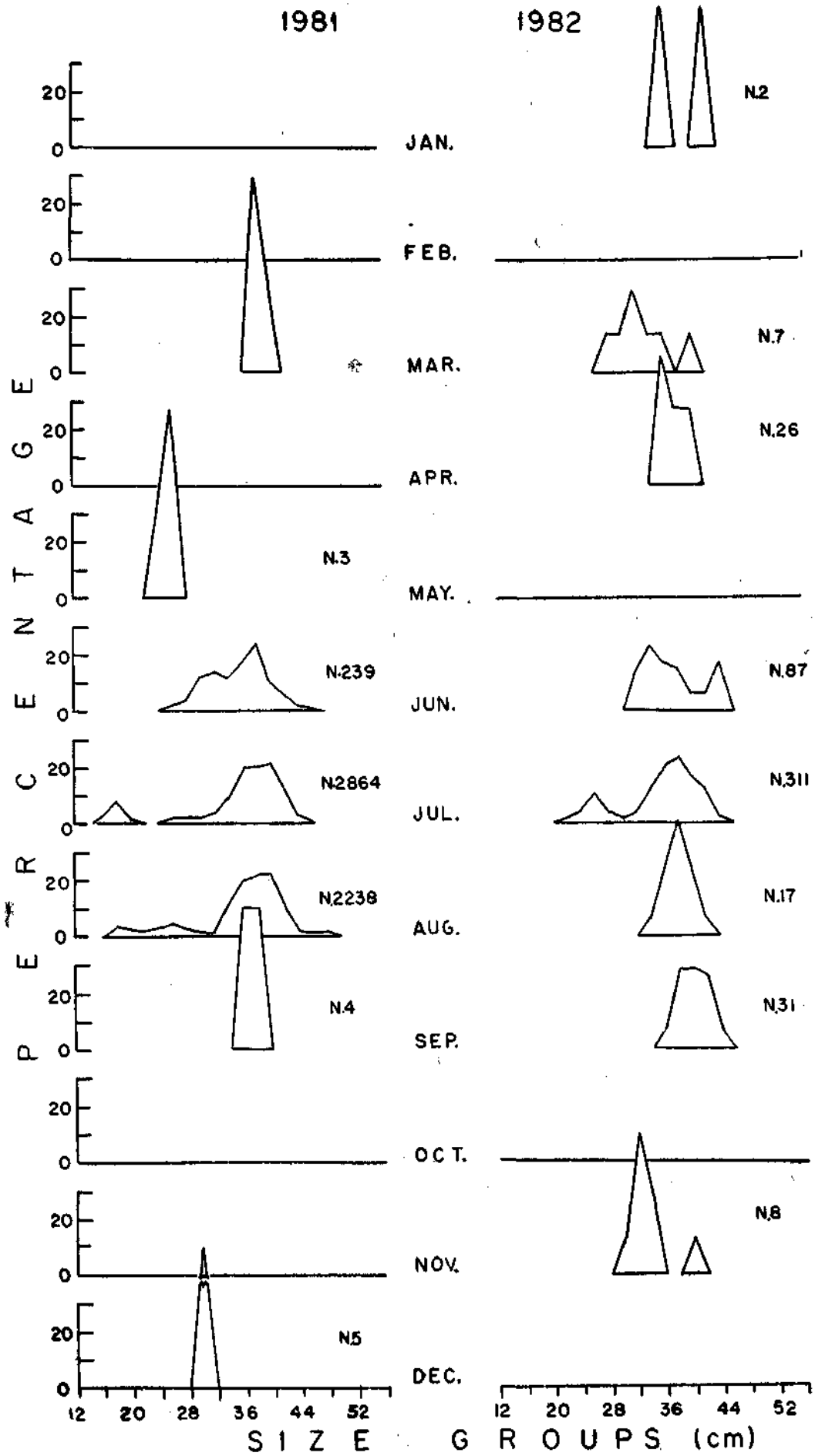

Fig. 10. Monthly length frequency distribution of *A. thazard* at Tuticorin, 1981-'82.

present only during July and only major modes were observed, in the size range 36 to 48 cm (Figs. 11 & 12).

T. albacares occurred in August and September in 1979, 8 modes were observed in the size range of 52 to 74 cm. 15 modes were observed during 1980 in the size range 62 to 88 cm. when the species occurred in the month of July, August, September, November December. A single mode was observed in the month of November (Figs. 13 & 14).

T. tonggol was completely absent in the catches during the year 1979. In June 1980, it occurred in June, July and September with 5 major modes in the range of 44 to 64 cm.

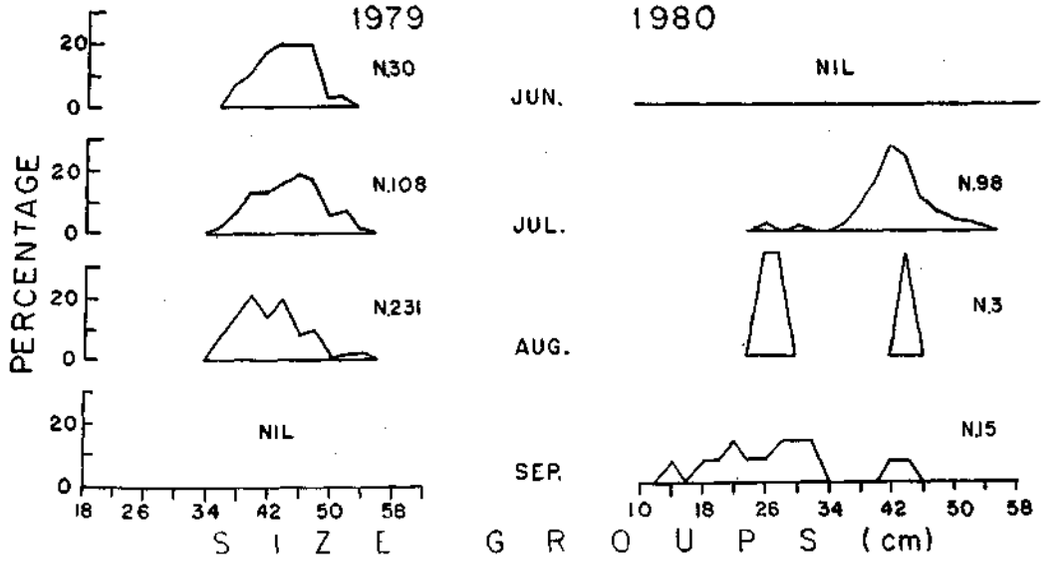

Fig. 11. Monthly length frequency distribution of *S. orientalis* at Tuticorin, 1979-'80.

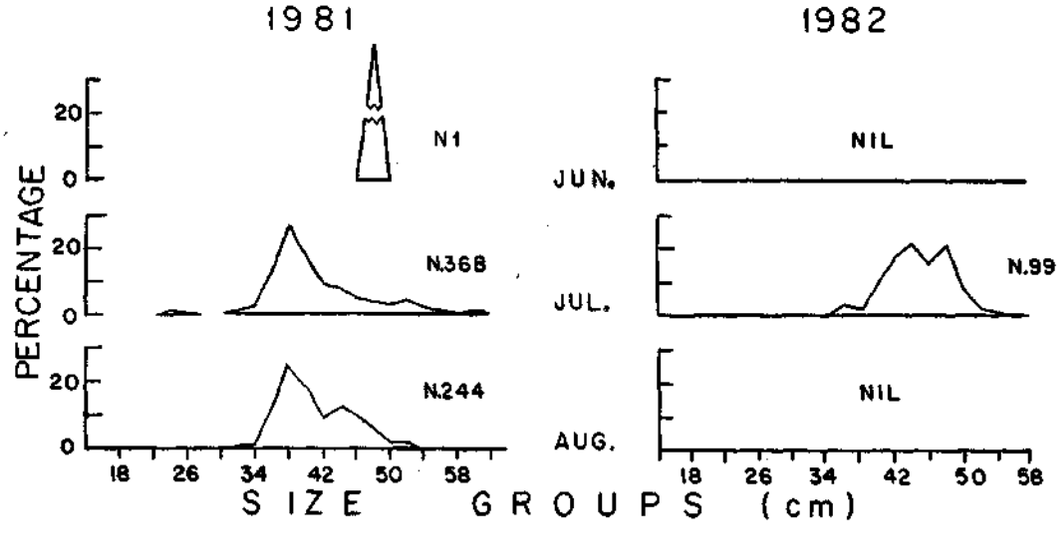

Fig. 12. Monthly length frequency distribution of *S. orientalis* at Tuticorin, 1981-'82.

and December. In 1981 *T. albacares* occurred during June, July, August, October and December. There was a single mode each in June and December. In 1982. it was present during of July, August, November and

In *K. pelamis* which is very rare in the Tuticorin waters only two modes were observed in the range of 56 to 60 cm during the year 1979. In 1981 and 1982 major modes were in August and December respectively.

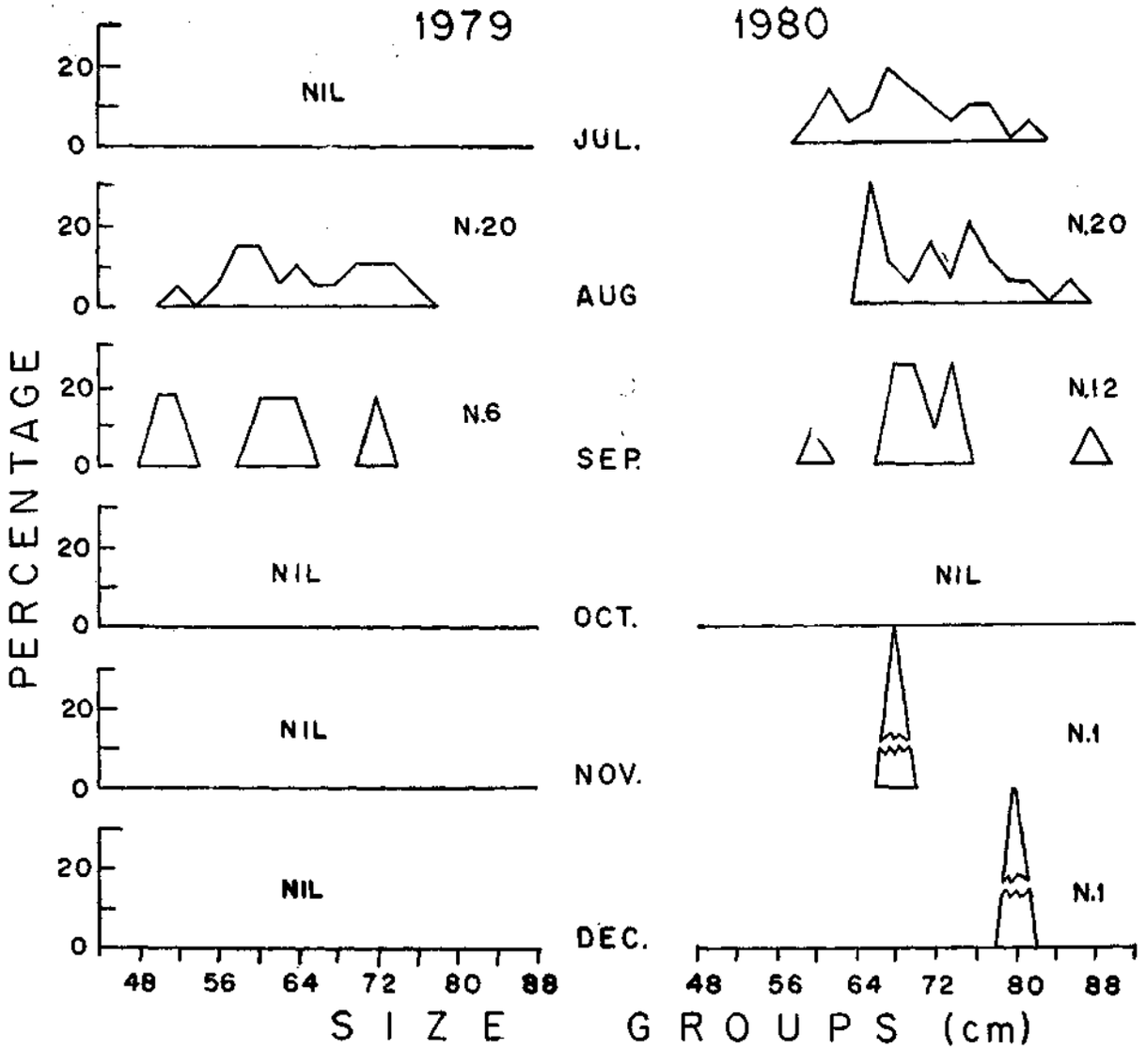

Fig. 13. Monthly length frequency distribution of *T. albacares* at Tuticorin, 1979-'80.

I. platypterus occurred in June, August and September in 1979 in the size range 100 to 250 cm. In 1980, they occurred in the size range of 90 to 220 cm from June to September. In 1981, their size ranged between 60 and 260 cm and they occurred in June, July, August, October and December. During 1982, they were present in February, July, August and September.

The occurrence of young specimens of tunas in the inshore waters off Tuticorin is seasonal and they were regularly present in the catches during July to September since 1976.

The stomach contents of the adults of *E. affinis, A. thazard, S. orientalis, T. albacares, T. tonggol* and *K. pelamis* and the sailfish *I. platypterus* in Tuticorin waters were analysed and the results are given below :

E. affinis

10 specimens in the size range 26.5 to 73.3 cm (FL) were examined during 1980 and 1981.

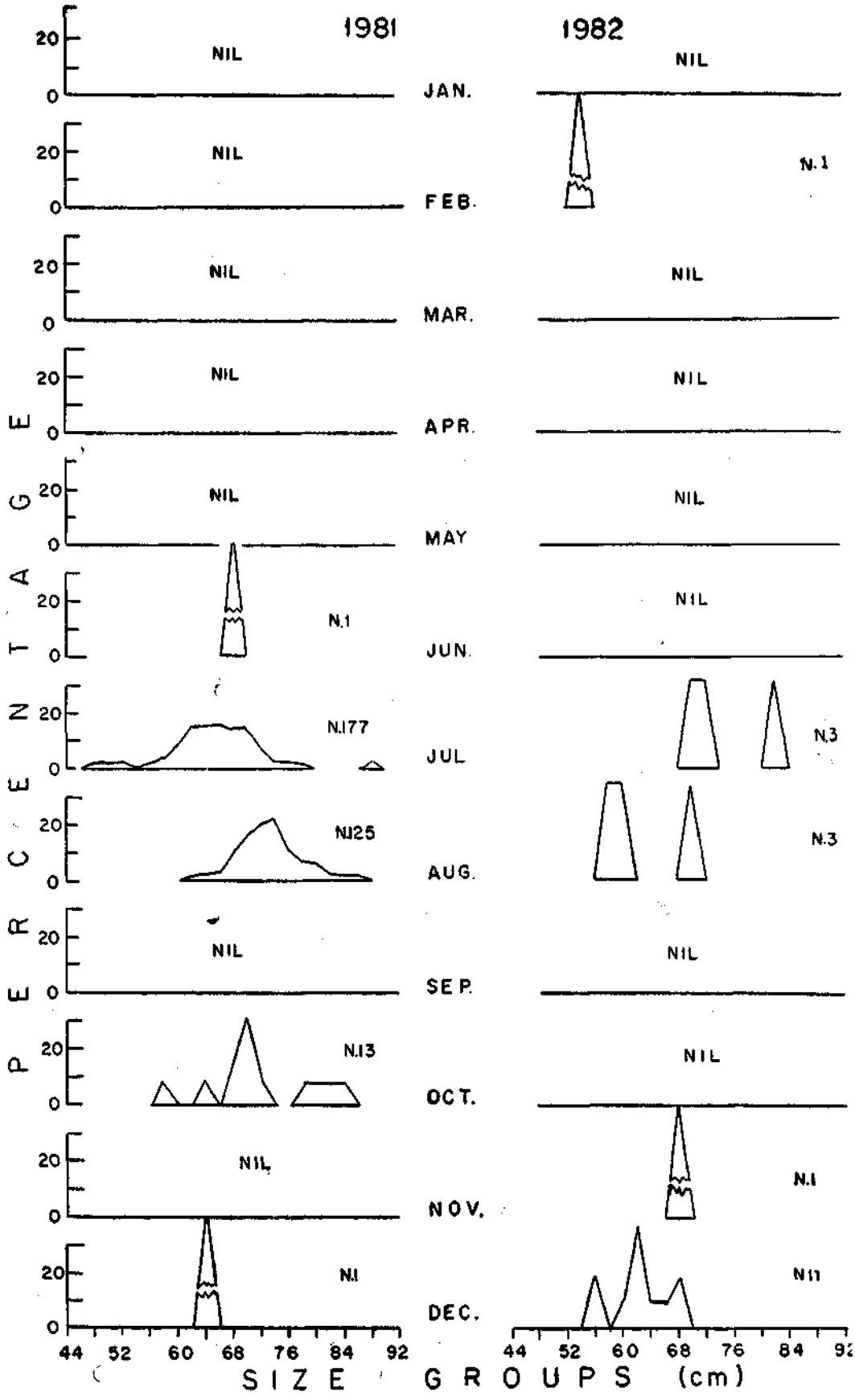

Fig. 14. Monthly length frequency distribution of *T. albacares* at Tuticorin, 1981-'82.

The visual gradings of the fullness of the stomach for the 10 specimens were as follows :

Grading		Percentage
Empty	..	40%
Trace	..	10%
1/4 + or —	..	10%
1/2 + or —	..	20%
3/4 + or —	..	—
Full (gorged)	..	20%

From Table 1 it appears that from the actual volume, *Sardinella* spp. constituted (88%) an important item among the food organisms of *E. affinis*.

TABLE 1. *List of food items of* E. affinis

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
Sardinella spp.	..	2	20	88.0	47.3	22
Unidentified fish	..	2	20	72.0	38.7	10
Skeletal remains of fish	..	2	20	26.0	14.0	..

A. thazard

28 specimens of *A. thazard* in the size range of 25.0 to 45.5 cm (FL) were examined during 1980 and 1981.

The visual grading of the fullness of the stomach for the 28 specimens was as follows :

Grading		Percentage
Empty	..	78.6
Trace	..	7.1
1/4 + or —	..	7.1
1/2 + or —	..	3.6
3/4 + or —	..	3.6
Full (gorged)	..	—

From Table 2 it will be seen that, when compared to the young the adult feeds on both fish as well as crustacean zooplankton and squids. A major food item of the adult *A. thazard* appears to be *Loligo* sp. (61.0% by volume).

TABLE 2. *List of food items of* A. thazard

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
Anchoviella commersonii	..	1	5.9	7.0	14.2	1
Fish remains	..	2	11.8	0.7	1.4	..
Squid—*Loligo* sp.	..	1	5.9	30.0	61.0	2
Fish larvae	..	1	5.9	4.0	8.1	46
Copepods	..	2	11.8	2.0	4.1	340
Decapod larvae	..	2	11.8	2.5	5.1	445
Amphipods	..	2	11.8	0.9	1.8	16
Megalopa larvae		1	5.9	1.1	2.2	9
Pteropods	..	1	5.9	Trace	..	1
Unidentified zooplankton	..	2	11.8	1.0	2.0	32

S. orientalis

Altogether 17 specimens of *S. orientalis* in the size range of 23.2 to 42.8 cm (FL) were examined during 1980-'82.

The visual grading of the fullness of the stomach for the 17 specimens was as follows :

Grading		Percentage
Empty	..	53.0
Trace	..	11.8
1/4 + or —	..	5.8
1/2 + or —	..	11.8
3/4 + or —	..	5.8
Full (gorged)	..	11.8

From Table 3 it will be seen that with regard to the preponderance *Sardinella* spp. constituted an important item followed by squids (*Loligo* sp.). But by volume, the young of *A. thazard* of 18.0 cm long (FL) was important.

Kumaran (1964) investigated the food habits of *S. orientalis* and pointed out that the most important single food item was *Anchoviella commersonii* and further he added that the food content of *S. orientalis* is similar to that of *E. affinis* and *A. thazard*, but in the present study it was observed that *S. orientalis* feeds mostly on *Sardinella* spp. 17.6% by prevalence and squids 11.8% by occurrence.

TABLE 3. *List of food items of* S. orientalis

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
Sardinella sp.	..	3	17.6	64.8	38.3	5
A. thazard (young one)	..	1	5.8	68.4	40.4	1
Squids (*Loligo* spp.)	..	2	11.8	35.6	21.1	6
Skeletal remains of fish	..	2	11.8	0.3	0.2	Trace

T. tonggol

12 specimens of *T. tonggol* in the size range of 44.5 to 73.0 cm (FL) were examined during 1980-'82.

The visual grading of the fullness of the stomach for the 12 specimens was as follows :

Grading		Percentage
Empty	..	58.3
Trace	..	16.7
1/4 + or —	..	16.7
1/2 + or —	..	—
3/4 + or —	..	8.3
Full (gorged)	.. ..	—

From the Table 4 it will be seen that both from the number of actual food organisms as well as the actual volume *Loligo* spp. constituted the most important item of food of *T. tonggol* (72.9%) followed by *Sardinella* spp. (13.2% by volume). The third item was *Sillago sihama* (10.7% by volume).

TABLE 4. *List of food items of* T. tonggol

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
Loligo sp.	..	1	8.3	68.0	72.9	5
Sardinella spp.	..	1	8.3	12.3	13.2	2
Sillago sihama	..	1	8.3	10.0	10.7	1
Skeletal remains of fish	..	1	8.3	3.0	3.2	Trace

T. albacares

4 specimens of *T. albacares* in the size range of 58.0 to 87.9 cm (FL) were examined in 1980. The visual grading of the fulness of the stomach for the 4 specimens was as follows :

Grading		Percentage
Empty	..	50
Trace	..	—
1/4 + or —	..	25
1/2 + or —	..	—
3/4 + or —	..	—
Full (gorged)	..	25

From Table 33 it will be seen that both from the number of occurrence as well as the actual volume, the juveniles of *A. thazard* constitute an important item of food of *T. albacares*.

TABLE 5. *List of food items of* T. albacares

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
A. thazard (young ones)	..	1	25	80.0	80.8	12
Unidentified fish	..	1	25	19.0	19.2	3

K. pelamis

4 specimens of *K. pelamis* in the size range of 48.5 to 58 cm (FL) were examined in 1979 and '82.

The visual grading of the fullness of the stomach for the 4 specimens was as follows :

Grading		Percentage
Empty	..	50
Trace	..	—
1/4 + or —	..	—
1/2 + or —	..	—
3/4 + or —	..	25
Full (gorged)	..	25

From Table 6 it is evident that both from the number of actual food organisms as well as the actual volume, *Sardinella* spp. followed by juveniles of *A. thazard* (36.4% by volume) constituted important items of food.

TABLE 6. *List of food items of* K. pelamis

Constituents		No. of occurrence	Percentage of prevalence	Actual volume ml.	Percentage by volume	Actual No. of food organisms
Sardinella spp.	..	1	25	85.0	63.7	14
A. thazard (juveniles)	..	1	25	48.7	36.4	2

I. *platypterus*

5 specimens of *I. platypterus* in the size range of 66.5 to 234.6 cm (FL) were examined during 1980 and '81.

The visual grading of the fullness of the stomach for the 5 specimens was as follows :

Grading		Percentage
Empty	..	40
Trace	..	—
1/4 + or —	..	—
1/2 + or —	..	20
3/4 + or —	..	20
Full (gorged)	..	20

From Table 7 it will be evident that both from the actual number of food organisms as well as the actual volume, *Sardinella* spp. constituted the important item of food (50.5% by volume) of *I. platypterus* followed by *Loligo* sp. (28.6% by volume) and *Kovala koval* (20.9% by volume).

TABLE 7. *List of food items of* I. platypterus

Constituents		No. of occurrence	Percentage of prevalence	Actual volume	Percentage by volume	Actual No. of food organisms
Sardinella spp.	..	1	20	60.0	50.5	4
Kovala koval	..	1	20	24.8	20.9	2
Loligo sp.	..	1	20	34.0	28.6	2

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