

A STUDY ON THE FLUCTUATIONS IN THE OCCURRENCE OF THE MAJOR TUNA LIVE-BAIT FISHES OF MINICOY*

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INTRODUCTION

MINICOY, the southernmost island of the Laccadive Archipelago, is the most important tuna fishing centre in the Indian Union. The fishing industry of the island with special reference to the tuna fishery has been comprehensively described by Jones and Kumaran (1959). The entire fishery is a pole and line one for the oceanic skipjack *Katsuwonus pelamis* (Linnaeus) mainly and the yellow-fin tuna *Neothunnus macropterus* (Temminck & Schlegel), using live-bait fishes. The tuna live-bait fishery of Minicoy has been dealt with in detail by Jones (1958). Appreciable fluctuations have been noticed in the catches in the island from year to year. Even though large shoals may be available for capture in the vicinity of the island, the availability of the right kind of bait fishes in sufficient quantities throughout the fishing season, may be a factor influencing the catches of a particular year. About forty species of fishes are used by the fishermen of Minicoy as tuna live-bait. Of these only ten species show regularity in their occurrence, the rest being specimens entering the nets during fishing. The present study reports on the relative abundance of the major species of live-bait fishes of Minicoy.

The major species of tuna live-bait fishes of Minicoy are *Lepidozygus tapeinosoma* Günther, *Archamia lineolatus* (Cuvier), *Caesio caeruleaureus* Lacépède, *C. tile* Valenciennes, *C. chrysozona* Cuvier, *Dipterygonotus leucogrammicus* (Bleeker), *Apogon sangiensis* Bleeker, *Chromis caeruleus* (Cuvier), *Spratelloides delicatulus* (Bennett) and *S. japonicus* (Houttuyn).

MATERIAL AND METHODS

The material for this study consists of samples obtained from the bait fish catches of Minicoy, during the period December 1960-April 1961. The bait fish sample was collected when the fishermen transferred them from the net into the bait wells. This is better than collecting them from the bait well as some species show the tendency to remain at the surface of the bait wells while others confine themselves to the bottom. The catches of one day consisted of more than one species on most days. Four persons have been going on rotation basis in different boats so that the samples would be more representative. The bait collection ground was more or less the same for all the boats engaged in tuna fishing. The sample was immediately preserved in 5% formalin and brought to the laboratory at the end of the fishing trip.

Twenty-six boats were engaged in tuna fishing in Minicoy during the season. Of these three or four boats did not go on each day, owing to various reasons. Thus the number of boats engaged in fishing on each day remained more or less constant. The number of bait wells in a boat may be three or four according to the size of the boat. But the average quantity of bait fish taken on a boat was two bait wells full. They returned without fishing if they could not obtain sufficient quantity of the bait, as it was not profitable. The fishermen of Minicoy do not keep any account

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of the bait caught by them or used on each fishing day. This study has been made on the assumption that the total number of boats engaged in fishing on each day and the total quantity of the bait fish taken by each boat remained more or less constant.

More than five samples per month have been analysed and the species in each sample sorted out. The number and the total weight of each species in a sample were determined. A sensitive pan balance was used in the determination of the weight. The total weight of each species in all the samples examined during a month was converted into percentages of the total quantity of bait fish examined for the month. So also with the number. The percentage composition of the samples of the different months thus became comparable. The percentages of the three major species according to the months of their occurrence are shown in Fig. 2.

The length frequency distribution of three major species, namely, *Lepidozygus tapeinosoma*, *Archamia lineolatus*, and *Caesio caeruleus* has been studied. The standard length of fifty specimens of each species from each sample was measured to the nearest millimeter. When fifty specimens were not available in a sample, all available specimens were measured. The frequency of each millimeter group during a month was converted into percentages of the total number of fish examined during the month.

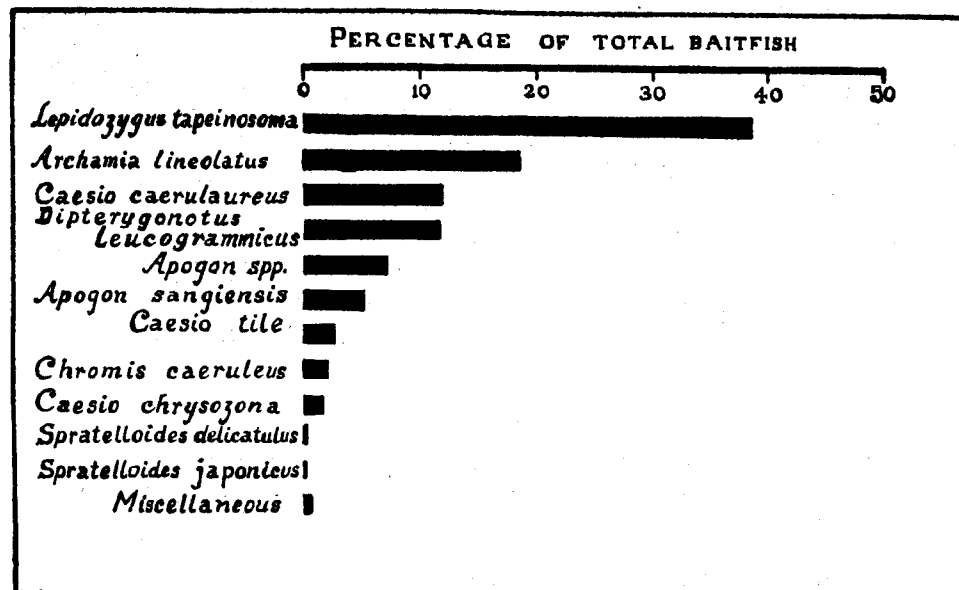


Fig. 1. The relative abundance of the bait fishes of Minicoy, during the season 1960-61 according to weight.

THE OCCURRENCE OF THE BAIT FISHES

The pattern of occurrence of the major tuna live-bait fishes of Minicoy during the season 1960-61, is given in Fig. 1 and Table 1. *Archamia lineolatus*, *Spratelloides delicatulus* and *S. japonicus* were the bait fishes used from the beginning of the season to the third week of December. On December 18th, *L. tapeinosoma* appeared for the first time in the season. Considering the bait fish catches for the month of December as a whole, *L. tapeinosoma* formed the majority by weight, followed by *Dipterygonotus leucogrammicus* and *A. lineolatus*. But according to number (Tab. 2), *Apogon spp.* came first, followed by *A. lineolatus* and *D. leucogrammicus*. Compared with *L. tapeinosoma*, the other species were smaller in size.

During January, *L. tapeinosoma* was the only dominant species forming above 80% of the bait catches both by weight and by number, the rest being contributed by *Caesio tile* and other species of *Caesio* (Fig. 2). *A. lineolatus* was absent in the catches during January. In February, *L. tapeinosoma* contributed 38% of the catches while *D. leucogrammicus* formed 31.8% by weight, the rest being formed by *C. caeruleus*, *A. lineolatus* and *Chromis caeruleus*. According to numbers *L. tapeinosoma* came first followed by *A. lineolatus* and *D. leucogrammicus*. During March *A. lineolatus* predominated in the catches both by weight and by numbers, followed by *Caesio caeruleus*. *L. tapeinosoma* almost disappeared during the month and appeared again only after the middle of April. Considering the bait catches during the month of April, *L. tapeinosoma* again formed the dominant species by weight, followed by *A. lineolatus* and *Apogon* spp. But according to numbers, *A. lineolatus* came first and *Apogon* spp. came second.

TABLE 1

The percentage composition by weight of tuna live-bait catches in Minicoy, during the season 1960-61

Species	Dec.	Jan.	Feb.	March	April	Average for Season
<i>Archamia lineolatus</i>	18.69	—	7.52	37.49	17.74	16.288
<i>Caesio caeruleus</i>	4.54	4.51	15.64	29.03	6.78	12.100
<i>Lepidozygus tapeinosoma</i>	30.90	84.09	38.02	00.40	41.46	38.974
<i>Caesio chrysozona</i>	2.23	00.07	00.58	06.15	00.85	01.976
<i>Apogon sangienseis</i>	—	—	02.06	15.94	8.12	5.224
<i>Apogon</i> spp.	16.99	—	00.89	4.22	14.97	7.414
<i>Caesio tile</i>	00.63	7.69	00.84	—	4.85	2.802
<i>Dipterygonotus leucogrammicus</i>	22.33	1.83	31.78	1.73	0.88	11.710
<i>Chromis caeruleus</i>	—	1.04	2.67	4.51	2.66	2.176
<i>Spratellodes delicatulus</i>	2.25	—	—	—	—	0.450
<i>S. japonicus</i>	0.56	—	—	—	—	0.112
Miscellaneous	0.88	0.77	—	0.53	1.69	0.774

Lepidozygus tapeinosoma Günther (Mahl name—Burechi)

L. tapeinosoma is a small Pomacentrid fish growing to a maximum size of 80 mm. It is most suited among the small fishes available in Minicoy, to be used as tuna live-bait. The bait fish have to be supplied to the tuna in the living condition and large numbers of them are required at a time. *L. tapeinosoma* occurs in shoals and so can be caught in large numbers at a time. The bait fish should remain alive and healthy even when kept in the bait wells of the tuna boat for a long time. Among all the species of bait fish used in Minicoy, this species has the maximum rate of survival in the bait wells. It is able to remain alive even if the water in the bait well is not changed very often. It is a very active fish. It has also the peculiar habit of moving towards the tuna boat when thrown in the water, to take shelter in the shadow of the boat. Thus it helps in chumming the tuna towards the boat.

The peak of occurrence of the species in January coincided with the maximum catches of tuna. During the season 1960-61 the tuna catches were exceptionally good. The unusual abun-

dance of *L. tapeinosoma* during the season was also a factor which contributed towards the betterment of the catches of tuna, according to the fishermen of Minicoy.

Length frequency distribution :

The length frequency distribution of *L. tapeinosoma* during the season is shown in Fig. 3. The majority of the fish belonged to the length-group 30-40 mm. when they appeared in December.

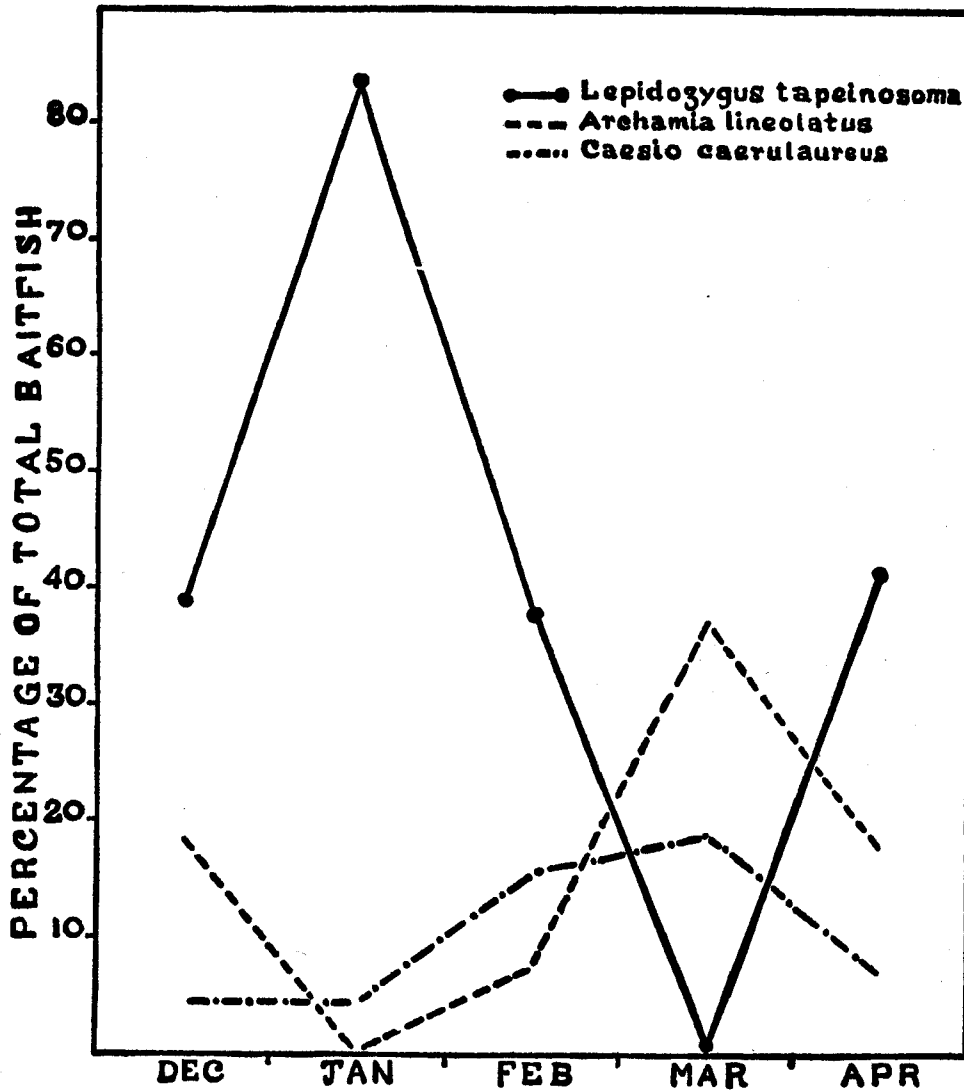


Fig. 2. Fluctuations in the occurrence of *Lepidozygus tapeinosoma*, *Arhamia lineolatus* and *Caesio caeruleus* in the tuna tuna live-bait catches in Minicoy, during the season 1960-61.

In January, the length-group 40-55 mm. predominated. The graphs for the months of February and April show that fish of smaller size again enter the fishery.

Maturity :

All the specimens used in the length frequency study were examined for their stage of maturity also. It was found that the majority of the specimens were immature, with the gonads either absent or just developing.

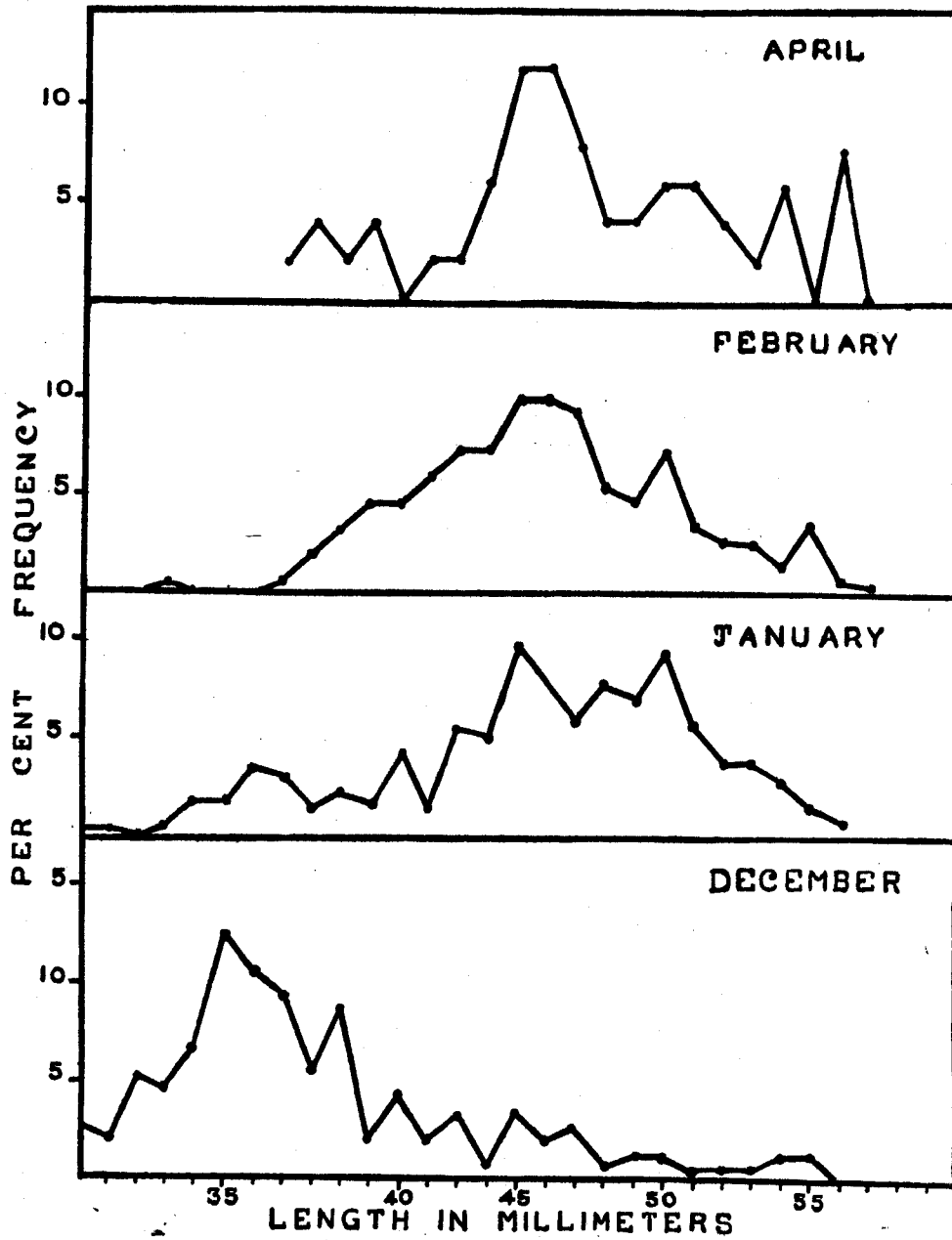


Fig. 3. Size composition of *Lepidozygus tapeinosoma* from the bait fish catches in Minicoy during the period December 1960-April 1961.

Archamia lineolatus (Cuvier) (Mahl name—Bodhi)

A. lineolatus is a small Apogonid fish occurring on corals in very large numbers. Though the species exceed all other bait fishes in number, it comes only second to *L. tapeinosoma* by weight, owing to the small size. The species was present in the bait catches from the beginning of the season, but became rare towards the end of December. The peak of occurrence of the species was in March.

TABLE 2
Showing the percentage composition by number of the tuna bait fish catches of Minicoy, during the season 1960-61

Species	Dec.	Jan.	Feb.	March	April	Average for season
<i>Archamia lineolatus</i>	27.83	—	27.57	54.48	34.17	28.81
<i>Caesio caeruleus</i>	6.95	11.29	13.99	13.60	11.15	11.39
<i>L. tapeinosoma</i>	10.71	80.82	32.24	00.33	09.21	26.66
<i>Caesio chrysozona</i>	01.15	00.27	02.06	03.92	01.08	01.69
<i>Apogon sangiensis</i>	—	—	04.12	15.86	07.72	05.54
<i>Apogon spp.</i>	34.22	—	02.61	03.92	30.79	14.31
<i>Caesio tile</i>	00.12	02.93	00.27	—	02.61	01.19
<i>Dipterygnotus leucogrammicus</i>	12.53	02.58	16.32	00.80	01.48	06.74
<i>Chromis caeruleus</i>	—	00.27	00.82	06.43	01.28	01.76
<i>Spratelloides delicatulus</i>	04.20	—	—	—	—	00.84
<i>Spratelloides japonicus</i>	00.16	—	—	—	—	00.03
Miscellaneous	02.13	00.84	—	00.66	00.51	01.02

Length frequency distribution :

The length frequency distribution of the species is shown in Fig. 4. The majority of the fishes belonged to the length-group 20-30 mm. in December, with the mode at 24 mm. The length-group 28-33 mm. predominated in February. During March and April fish ranging in size from 30-mm. to 40 mm. formed the majority.

Maturity :

The specimens measured for their length were examined for their stage of maturity also. As in *L. tapeinosoma*, the majority of the specimens were immature.

Caesio caeruleus Lacépède (Mahl name—Mugurang)

Caesiids are important among the bait fishes of Minicoy owing to their comparatively larger size. Though a large number of species of *Caesio* are represented in the bait fish catches in Minicoy, *C. caeruleus* is the prominent one. It is third in importance among the bait fishes of Minicoy, according to weight.

Length frequency distribution :

The length frequency of the species during the season is shown in Fig. 5. Fish of the length-group 17-40 mm. predominated in the catches during December, with the mode at 27 mm. During

January, the majority of the fish belonged to the length-group 32-37 mm., while in February, fish of the length-group 42-67 mm. formed the majority with the mode at 52 mm. In March there was the entry of smaller fish into the fishery. During April, fish ranging in size from 22 mm. to 32 mm. predominated in the catches. It indicates that there was the influx of smaller fish into the fishery during the month also, and that the spawning of the species is more than once in a year.

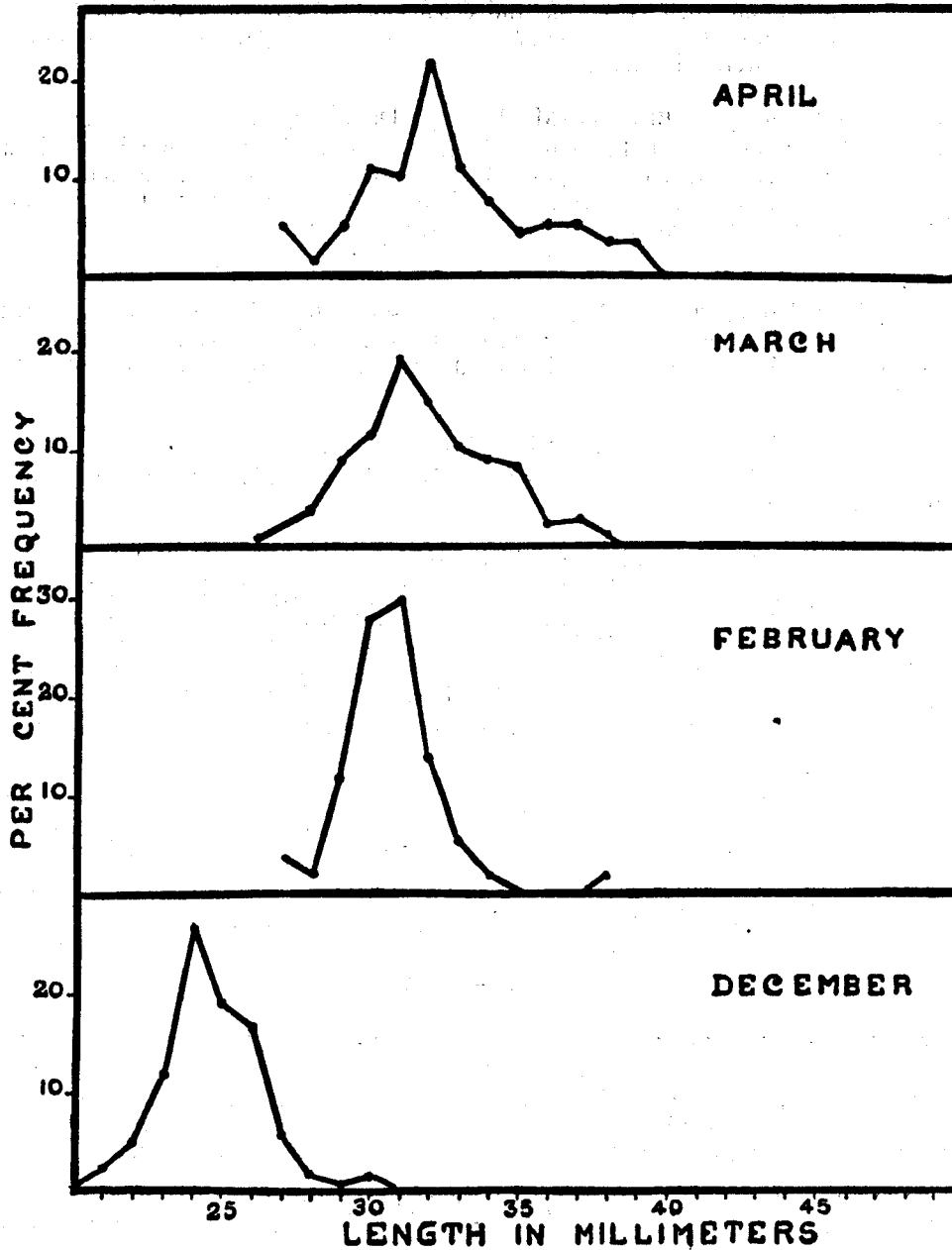


Fig. 4. Size composition of *Archamia lineolatus* from the bait fish catches of Minicoy during the period December 1960—April 1961.

Maturity :

C. caeruleus is reported to grow to a maximum size of 280 mm. But fish of size above 75 mm. have not been observed among the bait fish catches of Minicoy during the season. All specimens were immature.

Other caesioids :

Other species of *Caesio*, such as, *C. tile* and *C. chrysozona* were present in the bait catches in small numbers throughout the season. They also belonged more or less to the same size groups as of *C. caeruleus* and were all immature.

Dipterygonotus leucogrammicus (Bleeker) (Mahl name—Dandimugurang)

This fish belonging to the family Emmelichthyidae formed 11.7% of the total bait fish catches during the season, by weight and 6.7% according to numbers. The species was more abundant during December and March when it formed 31.7% and 22.3% respectively, of the bait catches. During the other months it was comparatively rare. All were juveniles.

Apogonids :

Apogonids formed about 20% by number of the total bait fish catches of the season. *A. sangiensis* Bleeker was the dominant species. *A. hyalosoma* Day and *A. frenatus* Valenciennes were also found in small numbers. All of them belonged more or less to the same size group as *Archamia lineolatus*.

Chromis caeruleus (Cuvier) (Mahl name—Nilamahi)

It is a small fish inhabiting corals. The species formed only 2.1% by weight of the total bait catches during the season.

Spratelloides delicatulus (Bennett) and *S. japonicus* (Houttuyn) (Mahl name—Rahi)

These two species were used as bait fish at the beginning of the season. Both are small fishes belonging to the family Dussumieriidae, entering the lagoon just before the monsoon and remaining till the end of the monsoon (Jones 1960a and 1960b). During the season they were available in fairly large quantities till the first week of December, after which they were absent from the catches, during the tuna fishing season. Samples have been obtained by experimental fishing in the lagoon during the night with the aid of light in the month of April.

Miscellaneous fishes :

The fishermen of Minicoy show no selection in the collection of bait fishes. Any fish that enters the net is used, provided it keeps alive in the bait well or storage basket. *Polynemus sexfilis*, juveniles of *Sphyræna obtusata*, *Allanetta forskåli*, *Trachinotus* spp., *Lutjanus* spp., *Pomacentrus* spp. and *Caranx* spp., also enter the nets and are used along with the other species of bait fishes. Altogether about thirty species of fishes come under this category.

GENERAL REMARKS

A study of the relative abundance of the tuna bait fishes of Minicoy indicates that *L. tapenosoma* is the most important species. *Archamia lineolatus* comes next in importance followed by *Caesio caeruleus*. Though species of *Caesio*, especially *C. tile* have been reported by the fishermen of Minicoy as the bait most effective in chumming the oceanic skipjack and the yellow-fin tuna, the present study shows that the occurrence of the species is not regular.

The examination of the pattern of occurrence of the bait fishes shows that most of the species appear in the bait collection grounds all on a sudden, remain for some time and disappear also abruptly. The factors influencing their movements are not known at present. Studies on their food and feeding habits and reproduction may throw some light on this aspect.

A report on the skipjack bait investigation of Saipan waters (Ikebe and Matsumoto 1938) shows that the main bait fishes used are the same as used in Minicoy. *Stolephorus delicatulus*

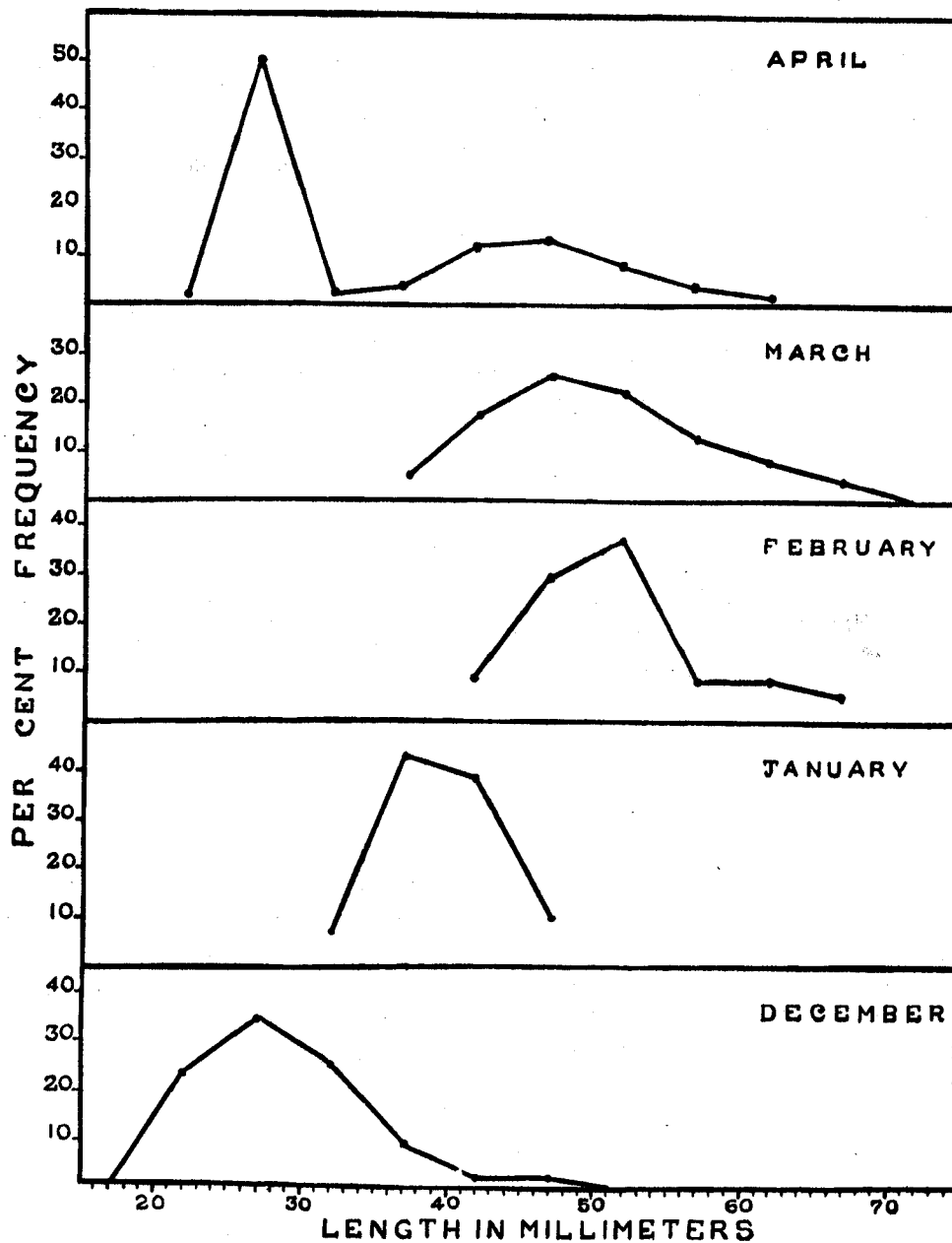


Fig. 5. Size composition of *Caesio caeruleus* from the bait fish catches of Minicoy during the period December 1960-April 1961.

(Bennett) is reported as the most important bait fish of Saipan. *Caesio chrysozona* and *Abudefduf sexfasciatus* are also used there. *Caesio chrysozona* appears in Saipan waters in very large shoals occasionally when they are impounded in hastily constructed enclosures.

A study of the natural food of *Katsuwonus pelamis* and *Neothunnus macropterus* from the catches in Minicoy, shows that all the species used as bait fishes are fed upon by them occasionally. These may be the specimens straying out of the lagoon.

The fishermen of Minicoy use traditional gear for the procurement of the bait fishes. Fishing with the aid of high power lights, as is practised successfully in many parts of the world, may bring in better results. According to the Japanese, juvenile fishes give better results when used as live-bait in the skipjack fishery. It is seen from the present study that the majority of the bait fishes used in Minicoy during the season were juveniles, which factor could have been of advantage to the fishery.

SUMMARY

A study on the relative abundance of the major tuna live-bait fishes of Minicoy has been made by the analysis of samples obtained from the bait fish catches during the tuna fishing season 1960-61. Eleven species of bait fishes were found to be regular in occurrence, though about forty species of fishes occur in the bait fish catches. The size composition of three major species during the season, has been studied. It was also found that most of the fishes used were juveniles, which could have been advantageous to the tuna fishery as juvenile fishes are reported to give better results when used as tuna live-bait.

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