

COMPARATIVE EFFICIENCY OF LIVE-BAITS FOR SKIPJACK TUNA
KATSUWONUS PELAMIS FISHERY AT MINICOY

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ABSTRACT

Skipjack tuna *Katsuwonus pelamis* are caught commercially at Minicoy by pole and line fishing using live-bait fishes. Relationship between live bait fish catches and skipjack tuna fishery during 1981-82 season is described here for the first time from Indian waters. An attempt is made here to compare the relative effectiveness of the different species of the bait fishes. The factors which may affect effectiveness of different live baits and ultimately tuna fishery at Minicoy are being discussed.

INTRODUCTION

THE TUNA live-bait fishery at Minicoy has been described by Jones (1964) who also presented preliminary survey of the common tuna bait fishes of Minicoy. Thomas (1964) reported on the fluctuation of the occurrence of the major live-bait fishes for one season from Minicoy. But there is no published information on bait fish landings and about the efficiency of various species of the bait fishes at Minicoy. Baldwin (1975) has given the qualities of a good bait fish as follows :

Approximate size from 2.5 to 15.2 cms long, Silvery, Elongate, survive for extended periods in bait wells, can attract and hold tuna near the fishing vessel and available to the fishing vessels throughout the year.

But in island localities where sufficient quantities of bait fishes are not available, then most of the qualities become secondary to availability. All small fishes that are associated with coral reefs are used as bait, but they are sparsely scattered and it is difficult to collect them in large quantities.

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An attempt is made here to examine the relationship between bait catches and tuna catches, alongwith to study on the efficiency of major bait fishes during the 1981-82 season from November to April at Minicoy.

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METHODS

Data on species-wise quantity of bait fishes used by each boat and species-wise catches of tunas were recorded. Tuna catches of only those boats where the quantity of live bait used by them could be recorded, have been used for these studies. Bait fishes are caught in the morning of the tuna fishing day, but during peak tuna fishing days bait is caught during previous evening and are kept in bait storage. Data on quantity of the bait fish was recorded either by observing or by enquiring with the fishermen.

ABUNDANCE OF MAJOR BAIT FISHES

During 1981-82 season *Lepidozygus tapeinosoma* which is locally known as 'Bureki' was not available at all. Thomas (1964) stated that the unusual abundance of *L. tapeinosoma* was also a factor which contributed towards the betterment of the tuna catches during 1960-61 season. This species contributed 38.97% of the total bait fishes used in that season followed by *Archamia lineolatus* 16.28%, *Caesio caeruleus* 12.10%, *Dipterygnotus leucogrammicus* 11.71%, *Apogon* 7.41% and *Apogon sangiensis* 5.22%. But these investigations were based on the sample analysis and not on quantities of bait fish landings during 1960-61 season.

caeruleus 1.87%. A gradual increase in bait fish catches was observed from November to March which came down in April.

During all the months of the season *Spratelloides delicatulus* ranked highest in availability among all the bait fishes. *Archamia lineolatus* was available although in less quantities than *S. delicatulus* yet during all the months of the season. Whenever these two species were not available in sufficient quantities in the Minicoy lagoon, fishing boats collected *Spratelloides japonicus* and *Chromis caeruleus* of which the former was available in good quantity during January and February. *Caesio caeruleus* was available rarely even then it supported bait fishery. Stray speci-

TABLE 1. Percentage composition of tuna live-bait fishes at Minicoy during 1981-82 season

Month	<i>Spratelloides delicatulus</i>	<i>Archamia lineolatus</i>	<i>Spratelloides japonicus</i>	<i>Chromis caeruleus</i>	<i>Caesio caeruleus</i>	Total weight in kg.
November	68.55	26.61	1.61	3.23	—	124
December	50.59	31.91	1.30	16.20	—	308.65
January	75.97	8.98	10.50	1.38	3.17	362
February	45.34	30.06	20.30	0.20	3.90	795
March	87.30	5.98	6.23	—	0.49	803
April	53.69	42.12	1.48	1.23	1.48	406
Total weight in kg.	1,795.65	622	263	65.5	52.5	2,798.65
Percentage	64.16	22.23	9.40	2.34	1.87	

During the course of the present investigations only major bait fish caught and used were taken into consideration. Species available in very few numbers which did not make a significant percentage were not considered. As can be seen from the Table 1, *Spratelloides delicatulus* dominated among bait catches during 1981-82 season. This was followed by *Archamia lineolatus* 22.23%, *Spratelloides japonicus* 9.40%, *Chromis caeruleus* 2.34% and *Caesio*

mens of *Atherina* and *Apogon* spp. were also used as bait.

BAIT AND TUNA CATCHES

Twenty mechanised fishing boats operated for tuna fishery, but their number varied daily considerably as some of the boats had to cancel their trip due to various reasons. During good fishing season some boats operated twice or thrice daily.

Totally 885 boat trips were recorded from November 1981 to April 1982 for these studies. *Spratelloides delicatulus* was used as bait by 538 units (60.79%), *Archamia lineolatus* by 219 units (24.79%), *Spratelloides japonicus* by 79 units (8.93%), *Chromis caeruleus* by 30 units (3.39%) and *Caesio caeruleus* by only 19 units (2.19%). During the month of March maximum bait fish catches were estimated being 803 kg, followed in February 795 kg, April 406 kg, January 362 kg, December 308 kg and during November 124 kg (Fig. 1).

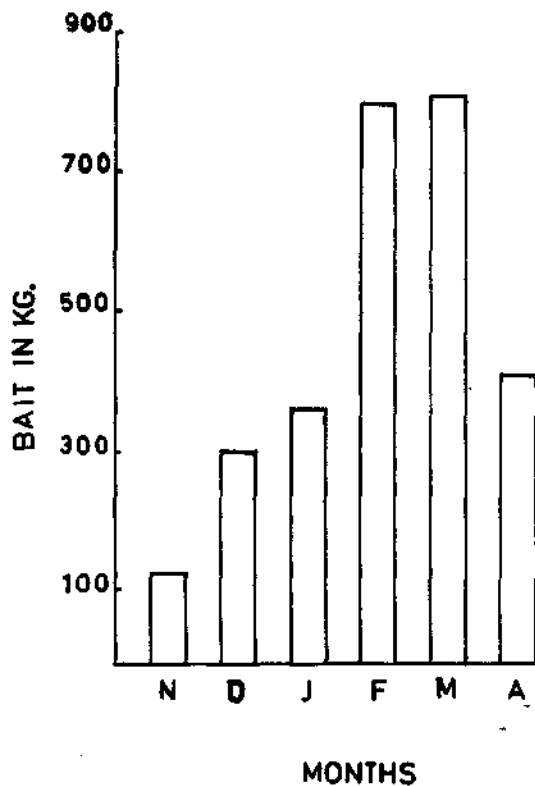


Fig. 1. Monthly bait fish catches in kg at Miniocoy during 1981-82 season.

During February 1982, maximum catches of tunas were recorded by these boats being 67,797.2 kg (34.61%), which were followed during March 41,846.5 kg (21.36%), during April 30,680 kg (15.66%), January 23,035.2 kg

(11.76%), November 16,811 kg (8.58%) and December 15,730 kg (8.02%) (Fig. 2).

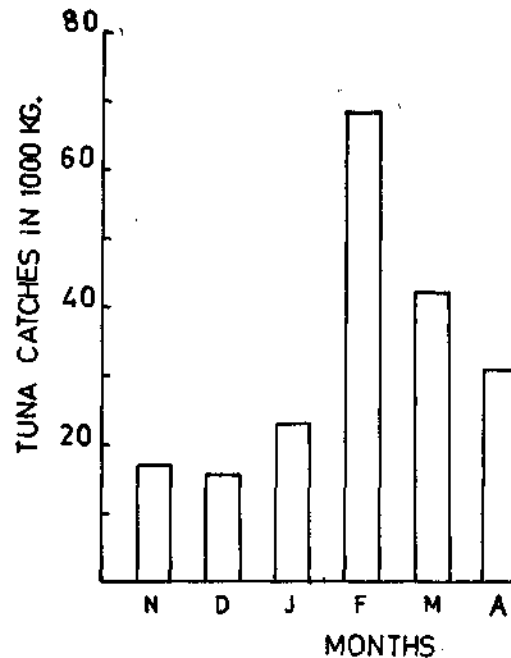


Fig. 2. Monthly total tuna landings in kg at Miniocoy during 1981-82 season.

From Fig. 3, it can be seen that there is gradual increase in monthly percentage of bait fish catches and tuna catches. During February and March maximum bait catches coincided with peak catches of tunas during these months.

Specieswise, skipjack dominated in tuna catches and accounted for 179,134.4 kg (91.44%) followed by yellowfin tuna 16,615 kg (8.48%) and other tunas 161 kg (0.08%) by 885 units.

Catch Per Unit Effort (CPUE)

A boat trip is considered here as a single unit since number of men involved in bait fishing and tuna fishing remained unchanged during the season. Catch per unit effort for

all the bait fishes together and tunas caught by 885 units (Boat trips) is given in the Fig. 4. As can be seen from the figure that there was gradual increase in the CPUE for bait fishes from

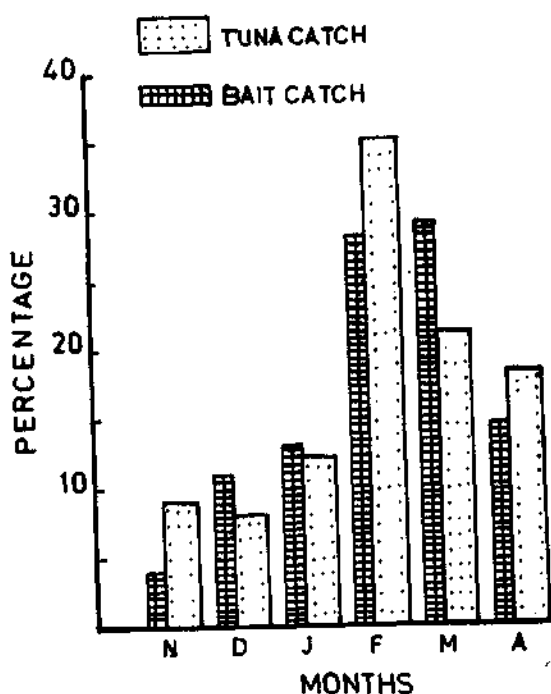


Fig. 3. Monthly percentage catch composition in kg of bait fishes and tuna catches at Minicoy during 1981-82 season.

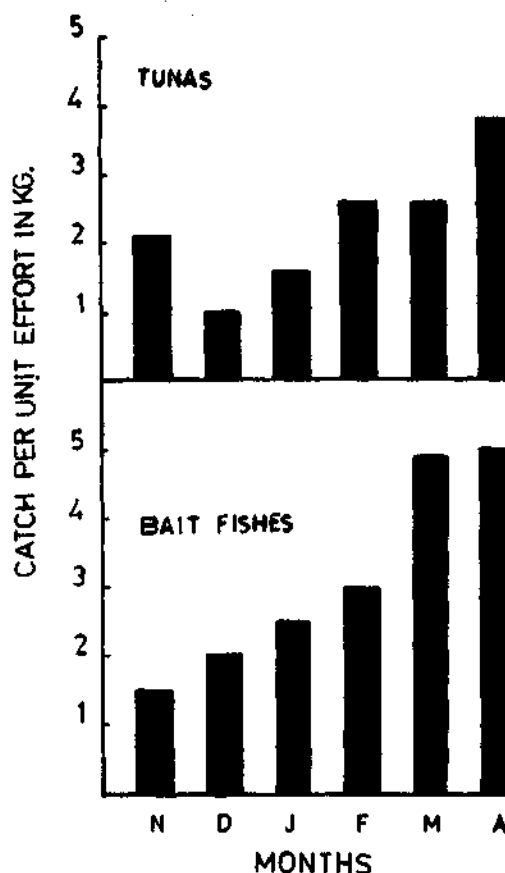


Fig. 4. Monthly catch per unit effort in kg for bait fishes and tunas at Minicoy during 1981-82 season.

November to April. But CPUE for tunas varied from month to month. For tunas it was 210.4 kg for November, 102.81 kg for December, 156.70 kg for January, 260.76 kg for February, 255.16 kg for March and 378.89 kg for April. For the season as a whole CPUE for bait fishes was 3.16 kg while for tunas it was 221.37 kg. Species-wise CPUE for tunas was 202.41 kg for *Katsuwonus pelamis*, 18.77 kg for *Thunnus albacares* and 0.18 kg for other tunas (Table 2). *Euthynnus affinis affinis* and *Auxis* were other tunas species caught with above-mentioned two main species.

EFFICIENCY OF DIFFERENT SPECIES OF BAIT FISHES DURING 1981-82 SEASON

As stated earlier, several different species associated with corals are used as bait fish for pole and line tuna fishery. However, there is no published information on the comparison of the relative effectiveness of the various species of bait fishes used at Minicoy. A bait fish can be more successful on one occasion in a particular area than at another. Here an attempt is made to study the efficiency of major bait fish species used at Minicoy during 1981-82 season.

TABLE 2. Species-wise live-bait and tuna catches in kg at Minicoy during 1981-82 season

Bait fish species	No. of boat trips	Quantity of bait	<i>Katsuwonus pelamis</i>	<i>Thunnus albacares</i>	Other tunas	Total tuna catch
<i>S. delicatulus</i>	538	1795.65	104,144.40	8,077	69.5	112,290.90
<i>A. lineolatus</i>	219	622	45,795	7,842	38.5	53,675.50
<i>S. japonicus</i>	79	263	24,662.5	423	49	25,134.50
<i>Ch. caeruleus</i>	30	65.5	1,749	273	—	2,022
<i>C. caeruleus</i>	19	52.5	2,785.5	—	4	2,787.50
Total	885	2,798.65	179,134.4	16,615	161	195,910.40
Percentage			91.44	8.48	0.18	
CPUE		3.16	202.41	18.77	0.18	221.37

Spratelloides delicatulus

This species locally known as 'Hondeli' was most abundant species of bait fish collected from Minicoy lagoon during 1981-82 season.

During November 1981, 50 units collected 85 kg of *S. delicatulus* by which 7,901 kg of tunas were caught. Tuna catch per kg of bait (CPUB) for the month was 39 kg. In December 90 units caught 156.15 kg of this bait and with their help tuna catch was 8,991 kg with CPUB of 58 kg. During January 113 units collected 275 kg of this bait by which 15,505.2 kg of tunas were caught with CPUB of 56 kg. Next month 99 units collected 360.5 kg of this bait and 27,047.2 kg of tunas were caught with their help with CPUB of 75 kg. During March 143 units caught 701 kg of this bait species which was maximum for the season as a whole. Tuna catch for this month was also maximum caught with the help of this bait being 36,184.5 kg with CPUB of 52 kg. In April only 43 units could catch 218 kg of this bait fish and tuna catch was 16,662 kg with CPUB of 76.4 kg.

During the season as a whole 538 units captured 1,795.65 kg of *Spratelloides delicatulus* and with their help 112,290.9 kg of tunas were caught with the average CPUB for the season being 62.53 kg.

Archamia lineolatus

This bait fish was caught all through the season. It was caught by 25 units during November. By 33 kg of this bait fish 7,890 kg of tunas were caught with CPUB of 239 kg. In December 37 units collected 98.5 kg of this bait and with their help 5,391.5 kg of tunas were caught with CPUB of 55 kg. During January this species was available only to 15 units who caught 32.5 kg of this bait and 2,742.5 kg of tunas with higher CPUB of 84.38 kg. During February bait fishing effort for this species was almost equal to *S. delicatulus* i.e., by 98 units but their quantity was less than the later being 239 kg. Maximum quantity of tunas were caught by this bait during this month being 21,505.5 kg with better CPUB of 90 kg. During next month for *A. lineolatus* 10 boats

collected 48 kg of this bait and caught 3,357 kg of tunas with CPUB of 70 kg. During April 34 units collected 171 kg of this bait and caught 12,769 kg of tunas with CPUB of 75 kg.

From November 1981 to April 1982 totally 219 units collected 622 kg of *A. lineolatus* which is about one-third of *S. delicatulus* caught during the season. Altogether 53,675.5 kg of tunas were caught during the season by using this bait with average CPUB of 86.3 kg.

Spratelloides japonicus

During November three units collected 2 kg of this bait and with their help 800 kg of tunas were caught with the highest CPUB of this species for the season 400 kg. Next month two units collected 4 kg of this bait and could catch 212 kg of tunas with CPUB of 53 kg. During January catch effort for this species increased and 13 units caught 38 kg of this bait and 3,985.5 kg of tunas with CPUB of 105 kg. Next month maximum effort was recorded for this species and 50 units collected 163 kg of this bait by which 17,092 kg of tunas were caught with CPUB of 105 kg. During March effort came down and only 10 units collected 50 kg of this bait by which tuna catch was 2,055 kg with minimum CPUB for the season for this species being 41 kg. During April only one boat could catch 6 kg of this bait by which 990 kg of tunas were caught with better CPUB of 165 kg.

Altogether 79 units collected 263 kg of *S. japonicus* during the season and by their help 25,134.5 kg of tunas were caught with average CPUB of 95.57 kg for the season.

Chromis caeruleus

During November 4 kg of this bait species was caught by two units and 220 kg of tunas were caught with their help with CPUB of 55 kg. Next month fishing effort for this species rose upto the highest during the season being 24 units and 50 kg of this bait was collec-

ted by them. Tuna catch for the month was 1,136 kg with lowest CPUB of 23 kg for this bait. During January, 2 units could collect only 5 kg of this species by which tuna catch was 328 kg with CPUB of 66 kg. Next month only one unit collected 1.5 kg of this bait by which tuna catch was 173 kg with maximum CPUB of 115 kg for this species for the season. This species was not available in March bait catches. During April only one unit collected 5 kg of this bait by which 165 kg of tunas were caught with CPUB of 33 kg.

Altogether 30 boat trips collected 65.5 kg of *Ch. caeruleus* for 1981-82 and with their help 2,022 kg of tunas were caught with average CPUB of 31 kg.

Caesio caeruleus

This bait fish was available only from January to April. During January, 4 units caught 11.5 kg of this bait and 474 kg of tunas with CPUB of 41 kg. Next month 12 units collected 31 kg of this species and 1,979.5 kg of tunas were caught with maximum CPUB of 64 kg for this species. During March only one boat collected 4 kg of this bait and 250 kg of tunas were caught with CPUB 62.5 kg. Next month two units collected 6 kg of this bait by which 84 kg of tunas were caught with the lowest CPUB of 14 kg for this species for this season.

Altogether 19 boat trips collected 52.5 kg of this bait fish and with their help 2,787.5 kg of tunas were caught with average CPUB of 53.10 kg.

RELATIVE EFFICIENCY OF MAJOR LIVE-BAIT FISHES DURING 1981-82 SEASON

Since *S. delicatulus* formed bulk of the live-bait fish catches with reasonably good average catch per unit of bait for the season being 62.53 kg and was available during all the months of the tuna fishing 1981-82 season, it has been taken as standard bait to work our

relative efficiency of other bait fishes. Average catch per unit of bait for other individual species were divided by the CPUB (average for the season) of *S. delicatulus* for this purpose. Relative efficiency of *A. lineolatus* was calculated as 1.38, *S. japonicus* 1.53, *Ch. caeruleus* 0.49 and for *C. caerulaureus* 0.85.

DISCUSSION

Uchida (1971) stated that one vessel which ranked lowest in catch from June to August 1967 in Hawaiian waters caught only 179.3 kg of skipjack per bucket of bait fish while the vessel which ranked highest caught 262 kg of skipjack per bucket of bait fish. In the Hawaiian pole and line fishery, the amount of bait per bucket used for nehu *Stolephorus purpureus* is 3.2 kg or 3.6 kg. Hida and Wetherall (1977) estimated amount of nehu per bucket

Tropical Central Pacific Ocean, Bryan (1978) reported catch ratio (kg bait chummed : kg tuna tagged), 1 : 17. He further stated if this ratio is multiplied by 3.47 as reported by Kearney (1978, while working on same vessel found that when fishing commercially tuna catch could be expected 3.47 times more than catch of a tagging operation), than ratio could be expected to have been 1 : 59.

CATCH PER UNIT OF BAIT

Catch per unit of bait in kg for different bait fish species from November 1981 to April 1982 season at Minicoy is given in Table 3. From the Table it can be seen that CPUB for different species varied from month to month. For *S. delicatulus* CPUB ranged from 39 kg to 76.4 kg with average for the season 62.53 kg. For *A. lineolatus* CPUB varied from 55 kg

TABLE 3. Catch per unit of bait for different species of bait fishes at Minicoy during 1981-82 season

Month	<i>S. delicatulus</i>	<i>A. lineolatus</i>	<i>S. japonicus</i>	<i>Ch. caeruleus</i>	<i>C. caerulaureus</i>	Average CPUB for the month
November	39	239	400	55	—	135.57
December	58	55	53	23	—	50.97
January	56	84.38	105	66	41	63.63
February	75	90	105	115	64	85.28
March	52	70	41	—	62.5	52.11
April	76.4	75	165	33	14	75.59
Average CPUB for the season	62.53	86.30	95.57	31	53.10	70.00

from 3.2 kg to 10.4 kg averaging 6.4 kg. The ratio of bait to tuna caught in the Hawaiian commercial pole and line fishery was estimated to be about 1 : 29 (Yoshida *et al.*, 1977) and this fishery was based on the anchovy *Stolephorus purpureus*, which is considered a superior live-bait fish by the Hawaiian fishermen. While examining the efficiency of mollies *Poecilia maxicana* as live-bait for skipjack fishery as fishing trials for tagging in the

to 239 kg with average CPUB for the season 86.3 kg. For *S. japonicus* it ranged from 41 kg to 400 kg with CPUB for the season 95.57 kg. For *Ch. caeruleus* it ranged from 23 kg to 115 kg with average CPUB 31 kg. For *C. caerulaureus* CPUB ranged from 14 kg to 64 kg with average for the season of 53.10 kg. Catch per unit of bait per kg for all above five bait species together for November was 135.57 kg which was highest for the season. Next

month lowest CPUB of 50.97 kg was observed. For other months it was 63.63 kg in January, 85.28 kg in February, 52.11 kg in March and 75.58 kg in April.

But there are some factors which can affect the tuna catch per unit of bait, such as size of tuna caught, number of men fishing, size and number of fish in one kg of bait and most important of all is the relative abundance of tunas in the area.

Number of men who were engaged in this tuna fishery remained almost unchanged and because of this reason the number was considered constant for all the boat trips under study.

Another factor which can affect CPUB is the number of fish in one kg of bait fish catch. Definitely the length of the bait fish will affect the number in a unit of bait. Length of blue sprat *S. delicatulus* ranged from 20 to 50 mm, *S. japonicus* from 40 to 70 mm, *A. lineolatus* from 20 to 40 mm, *Ch. caeruleus* 20 to 70 mm and *C. caeruleus* from 50 to 80 mm during this season.

If the relative abundance of tunas is higher around Minicoy, it can be expected that average monthly catch per unit of bait will be better.

Usually skipjack shoals are available in good numbers from January to April every year and tunas are caught in maximum quantity during this period for the season.

Average catch per unit of bait for the season as a whole for *S. japonicus* appeared to be highest being 95.57 kg in comparison to other bait fishes. It was followed by *A. lineolatus* 86.3 kg, *S. delicatulus* 62.53 kg, *C. caeruleus* 53.10 kg and *Ch. caeruleus* 31 kg. From these observations it appears that *S. japonicus* proved to be most efficient bait fish followed by *A. lineolatus* during the season. But former species contributed only 9.4% of the total bait catches and *A. lineolatus* accounted for 22.23%. *S. delicatulus* with CPUB of 62.53 kg too proved good in efficiency with the advantage that it contributed 64.16% of the total bait catches and was available to tuna fishing boats during all the months of the season. Although Jones (1964) reported that *Lepidozygus tapeinosoma* is the most important bait fish used at Minicoy Island which is very active and hardy fish and is very effective in chumming tunas, this species was not available during this season to prove its effectiveness in comparison to other bait fishes.

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