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PRESENT STATUS OF TUNA FISHERIES OF LAKSHADWEEP

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INTRODUCTION

Lakshadweep, the smallest among all the States and Union Territories of India consists of 36 Islands covering a land area of 32 sq. kms, a lagoon area of 4200 sq.kms, 20000 sq.kms. of territorial waters and 40000 sq. kms of Exclusive Economic Zone which are potentially rich in marine fishery resources. Tuna fishing has emerged as an organized and viable industry in many Islands. Out of the total, 6809 tonnes of fish landed in Lakshadweep in 1988, 86% is accounted by tunas contributing about 21% to the total all India tuna landings.

The tuna catch of the mainland coast of India is chiefly contributed by incidental catches where as in Lakshadweep the effort is specifically directed on tunas. Pole and line and troll line are the principal gears employed for capture. Hand lines and drift gillnets are also rarely used. Agatti, Bitra, Suheli and Minicoy are the major pole and line fishing centres which together contribute 75% of the total tuna catch.

BACKGROUND INFORMATION

Tuna pole and line fishing employing non-mechanised country crafts (Masodis) was in practise in Minicoy from time immemorial. But tuna remained uexploited by any of the other Islands prior to 1960 due to lack of knowhow on the part of local fishermen. Tuna pole and line fishing employing mechanised crafts was introduced in Lakshadweep in 1962. The Lakshadweep administration encourage the expansion of tuna fishery by introducing demonstration fishing vessels, and by providing boats, training and necessary infrastructural facilities. From a meagre annual fish catch of 500 tonnes in 1960 the production has leaped to 7300 tonnes by 1987 (Table 1). Out of the total population of 42,000, about 4000 persons find employment in fisheries sector directly and indirectly. The income contributed by the fisheries sector is Rs. 3.4 crores annually which works out to a percapita income of Rs. 810.

MATERIALS AND METHODS

The data used for the preparation of this paper are the boat-wise daily fish catch from pole and line and troll line fishing boats operated for the last 15 years from 1974 to 1988 at different Islands collected by staff of Fisheries Department. The method of collection of data was enumeration and this is followed in all the Islands of Lakshadweep. Normally a day's fish catch in a boat is composed of one or two size groups. Therefore total weight can be taken easily by multiplying the weight of one fish with number of fish in each size group. The data on fishing effort were collected from Agatti, Minicoy, Bitra and Andrott. Samples of tuna were collected from boats every day for taking length measurements. In this study the fishing effort is considered in terms of boat days. All the boats leave for fishing early in the morning and return by afternoon the same day.

FISHING GROUNDS AND AREAS

The oceanic waters surrounding the islands are potentially rich in living resources such as tunas, shark and billfishes. The areas around some of the Islands and submerged reefs are potentially rich in fishery resources, the important of which are given below:

Area	Location	Inhabited or not
Agatti	10°51'N - 72°11'E	Inhabited
Bangaram	10°56'N - 72°17'E	uninhabited
Thinnakara	10°56' - 72°18'E	"
Parali	10°57'N - 72°20'E	"
Perumal par	11°10'N - 72°20'E	"
Pitti	10°47'N - 72'32'E	"
Suheli	10°08'N - 72°18'E	"
Bitra	11°36'N - 72°10'E	Inhabited
Cheriya Paniyam	11°56'N - 71°54'E	Submerged reef
Valiya Paniyam	12°22'N - 71°52'E	Uninhabited
Kadamat	11°13'N - 72°47'E	Inhabited
Androth	10°49'N - 73°40'E	"
Kalpeni	10°05'N - 73°39'E	"
Eli Kalpeni	11°18'N - 74°00'E	Uninhabited
Minicoy	08°17'N - 73°04'E	Inhabited

CRAFTS AND GEARS

Mechanised boats of two sizes, ie. 7.93 metres and 9.14 meters OAL installed with 16-30 BHP diesel engines are being used for tuna fishing. The former having a beam of 2.18 M and installed with 16-19 BHP inboard diesel engines are more popular for pole and line fishing due to their shallow draught that suits the shallow nature of the reef. In the forward cockpit of the boat is kept a wooden live bait tank of dimension 1.6 x 0.6 x 0.8 metres. Details of crafts, gear employed in tuna fishery and operational aspects have been dealt with earlier (Madan Mohan et al., 1986; Ben Yami, 1980) (Table 2).

The pole and line tuna fishing depend completely on a constant supply of live bait and their survival until needed for the fishing operation. The lagoons provide good habitat for the growth of live bait which fall under two categories viz., migratory and resident forms. While the former enter the lagoon temporarily from outside the reef at different periods, the latter use the lagoon as their permanent habitat. The common species caught for the fishing are the following:

Spratelloides delicatulus
S. gracilis
Caesio chrysozona
Caesio pisang
Apogon sangiensis
Chromis caeruleus
Chromis ternatensis
Gymnocaesio argenteus
Lepidozygus tapeinosoma
Archamia fucata
Rhabdamia gracilis
Dussumieria hasselti
Pranesus pinguis

In Minicoy, pole and line fishermen utilize different species of live baits depending upon their availability. But in all other islands the fishermen depend on single species viz., Spratelloides delicatulus locally called "HONDELI" which make their appearance in big shoals on the shallow sandy areas inside the lagoon. The reason for the dependence on this single species is that it is found in abundance

inside the lagoon throughout the fishing season and the efforts required for its capture is less compared to the capture of other species which are associated with coral boulders. The dependence on a single species in these islands does not mean that the species caught in Minicoy are not available there. Similarly sprats are available in Minicoy also. This indicates that utilisation of all the suitable species in each island could increase the tuna bait catch many fold.

Details of live-bait fishing by different types of nets have been published earlier (Pillai et al., 1986; Madan Mohan et al., 1986). In Minicoy, the live bait reservoir is traditionally made of local twigs. But in other island the same is made of GI sheet nailed to two semicircular wooden planks. The GI sheet and planks are perforated for water circulation and the reservoir is anchored inside the lagoon. Locally the reservoir is called "Chalapetti" (Laberi) in Minicoy which has a life of 1-3 years depending on the quality of sheets and maintenance. The size of the reservoir is usually 1.8 x 1 x 1 m and two wooden poles are tied longitudinally to the reservoir to help float the tank when it is towed to the vessel or anchored in the lagoon. From the reservoir the live bait is transferred to the bait tank in the boat by a square piece of cloth.

The details of pole and line and troll line fishing operations have been dealt with earlier (Madan Mohan, Livingston and Kunhikoya, 1986).

PROCESSING AND MARKETING

Tuna meat is processed in different methods, of which freezing, canning and drying are the most popular. In Lakshadweep the bulk of the surplus catch of tuna after local consumption is processed into a traditional product called 'MAS'. This product is very ideal for island conditions since the processing can be carried out with fuel available in plenty in the islands. This product resembles the traditional Japanese product 'KATSUWOBUSHI'.

Filleting is the first step in the preparation of Mas. The fish after washing is cut longitudinally along the back bone to form two pieces which again are cut longitudinally to form 4 pieces. The fillets are cooked in sea water with a little salt in aluminium vessels. The cooking is done for 2-3 hours and then the fish is left over night in the vessel to be smoked next morning. Smoking

is done spreading the cooked fillets on iron grills placed over pits where coconut husks are burned. Smoking is continued till fish gets smoke colour. Besides being preservative, smoking gives particular taste and firmness to the flesh. After the smoking is over the fish fillets are spread on cudjan leaves on the sea shore under sun until they are dried hard like wood which takes about a week. The conversion from fresh whole fish to Mas is about 18% in weight.

The annual production of Mas in Lakshadweep is around 700 tonnes. Mas is packed in gunny bags and transported to mainland by ships and sold to dealers in Calicut, Mangalore or Tuticorin. The current price of mas ranges from Rs.30-45 per kg depending on catch and season. The production statistics of Mas in Lakshadweep for the period 1984-88 is given in Table 3.

A small portion of the tuna caught is canned in the canning factory set up in Minicoy in 1969 under government sector. The thoroughly cleaned fish is cooked in steam. The cooked fishes are cooled. Then the skin, bones and blackmeat are removed leaving only clean white meat which forms about 40% of the total body meat. The white meat is then cut into size and packed in cans along with refined oil and salt. Tuna is packed in brine too. The filled cans are vacuum sealed, washed and sterilized.

The tuna canning factory at Minicoy has a installed capacity of 1500 cans per 8 hours. An ice plant of 5 tonnes and a cold storage of 20 tonnes capacity are attached to it. The product from this factory are regarded in high esteem both in home and foreign markets. The present average production is around 1,12,000 cans during a season. The production trend for the last 6 years is given in Table 4. The factory has opened avenues of employment to 50 persons directly, the only factory in India where tuna is processed exclusively.

FISHING EFFORT, CATCH AND CATCH PER UNIT EFFORT

In 1974 the tuna catch was 1385 tonnes, which increased to 5855 tonnes in 1988 recording a rate of increase of 323%. This marked increase in the catch was mainly due to the increase in effort resulted by the introduction of more number of boats for fishing. Wide fluctuation in the tuna landings is noticed from 1974 to 1980. But the production from 1981 to 1988 indicate almost a steady

increasing trend. There has been appreciable increase in the total fish landings as well. The tuna catch has increased more rapidly, the average rate of growth being 22% per annum during the period 1982-87, while the corresponding growth of total fish landings during the same period was 17%. The contribution of tuna in the total landings has increased from 62% in 1974 to around 86% in 1988. 6528 tonnes recorded in 1987 was the maximum tuna production during the 15 year period.

Agatti, Minicoy, Bitra and Suheli are the four major tuna landing centres in Lakshadweep. Out of these, Agatti is the most important one contributing 46% of the total tuna caught in Lakshadweep. The share of Minicoy is 20%, Bitra 9% and the balance 25% is contributed by other Islands together. A comparative account of fishing effort, catch per unit effort, in respect of Agatti, Minicoy and Bitra for 5 years is presented in Figs. 1 and 2. Highest CPUE is at Agatti (458 kg) followed by Bitra (341 kg) and Minicoy (236 kg).

Catch, effort and CPUE at three pole and line centres and one troll line fishing centre by month wise and species wise for the year 1988 indicate that Agatti, Minicoy and Bitra are the pole and line fishing centres and Androth Island was the troll line centre. The average total CPUE for 9 months period in Bitra (566 kg) was found higher than that of Agatti (539 kg) and Minicoy (375 Kg). Comparatively higher CPUE were obtained in November, December, January, February and March in all the three centres. However, in Agatti, during October also a higher CPUE was realised, the peak months being October, December, January and February. The peak fishing months for Minicoy were December, January and February and the same for Bitra were November, December, February and March. The months in which high effort were recorded were same for Minicoy and Agatti ie. November, December, January and February. With regard to Bitra high effort were recorded only in January and February. Among the three centres, the highest CPUE was 1399 kg recorded in November at Bitra. The corresponding figures for Agatti and Minicoy were 724 kg in October and 699kgs. in February respectively. The lowest CPUE was 23 kgs for Agatti in September and 41 kg for Minicoy in the same month. The lowest CPUE for Bitra was in October (8 kg).

There has been pronounced differece in the annual average total CPUE between pole and line fisheries at Agatti and Minicoy (539 kg. and 375 kg.) and troll fisheries in Androth (68 kg). The peak months in Androth were December, June, July and August with highest value of 84 Kg in June. The lowest CPUE was 20 kg recorded in April. While troll fishing is conducted during all the months in a year without much fluctuations in effort the pole and line fishery is restricted to the season commencing from September to May with peak period from December to March (Table-5).

TUNA LANDING - GEAR WISE AND SPECIES COMPOSITION

Pole and line and troll lines are the gears employed for exploitation of tuna in Lakshadweep. Number of pole and line boats and troll line boats operated from different islands are given in Table 2 and 247 mechanised boats and about 177 of country crafts fitted with OBM are currently engaged in catching tuna. Based on the average for the 5 year period, the annual production from these two gears were 3903 tonnes and 1152 accounting 77% and 23% respectively.

Skipjack was the principle species caught by pole and line which accounted to 81% in the total tuna landing in Agatti. Yellowfin was the second most important species contributing about 10%. Little tunny contributed 7% and the balance 2% was composed of Auxis sp. Dog-toothed tuna has been reported from some of the islands but quantity was negligible. Skipjack remains the main species caught in the troll catches of Androth (60%). But percentage composition of yellowfin (15%) and little tunny (18%) were comparatively higher than that of pole and line.

The maximum and common size range of tunas landed in Lakshadweep are given in Table 6.

ECONOMICS OF OPERATION

The pole and line fishing operation now being conduted in the small scale sector in Lakshadweep is proved to be highly economial. The approximate present cost of a pole and line fishing boat of length 7.9 M is Rs.1.25 lakhs which need only engines of lower HP ranging from 14 to 19. The total investment required for fishing gear and accessories is only about Rs.18000/-.

The average catch per boat works out to 42 tonnes in a year for a 6 months fishing period. At a reasonable rate of Rs. 5/- per kg of tuna the value of catch per boat comes to Rs. 2.1 lakhs a year. At the prevailing share of 50% to the fishermen (9 to 10 fishermen in a boat) the income for the fishermen is Rs. 1.05 lakhs. After deducting the running and maintenance expenditure the net earning for the boat owner is around Rs.75000/- in a year. There had been record catches of upto 105 tonnes of tuna in a season per boat at Agatti.

The existing small scale tuna fishery in the Islands can further be developed by increasing the number of boats. But the shortage of manpower stands as a major hurdle in this regard. The solution to the problem is diversion of the available man power to the productive sector of fishing from the present unproductive sectors. Reorientation of the existing educational system which will enable diversion of students not good at their studies at a lower stage towards fishing should be thought of.

The potential of tuna in Lakshadweep waters is 50,000 tonnes (Silas et al. 1986). Against this the present prodution of 6000 tonnes of tuna cover only a fraction of the exploitable resource. The bulk of the resource is beyond the operational range of the present small boats and is left untapped. This unexploited valuable resource that has a ready export market is either getting perished or migrated to the seas of other countries. This should be exploited by commercial operation employing large purse seiners long liners and pole and line vessels.

The two oceanic species that are exploited by small scale fisheries of Lakshadweep are skipjack and young yellowfin which enter the surface fishery in the coastal waters. But the deep swimming bigger ones of these two species generally contribute to the tuna longline fishery which is not exploited at present.

The exploratory fishing vessels of FSI which conducted tuna longline operation around Lakshadweep have located rich ground of deep water tunas. The tuna catch was composed of yellowfin 97.9%, bigeye 0.4% and skipjack 1.7%. The hooking rate recorded was 18.5% which was quite encouraging. The above results indicate that there is great scope for commercial tuna longline operation around Lakshadweep water.

The future course of fisheries development in Lakshadweep would be in favour of capitalising the fishing industry employing large purseseiners, pole and line vessels and longliners. In order to handle these capital oriented programmes, a Lakshadweep Development Corporation has already been set up with the intention to take up not only harvesting but the entire range of activities such as processing packaging and marketing of tunas.

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TABLE 1. Islandwise tuna landings (in tonnes) for the last fifteen years from 1974-88

Islands	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	Aver-age
AGATTI	518	718	542	392	899	1314	490	820	550	731	2000	2014	1937	3141	2295	1224
AMINI	32	79	44	67	64	72	46	81	77	53	110	123	91	103	80	75
ANDROTT	60	69	33	72	173	303	179	196	243	283	210	183	334	198	237	185
BITRA	116	79	103	49	93	118	104	126	345	166	140	185	526	465	451	204
CHETLAT	77	238	39	14	37	116	32	38	148	96	129	329	151	144	181	118
KADMAT	32	61	37	40	49	101	43	37	38	36	58	113	39	37	47	51
KALPENI	144	45	54	30	20	62	27	41	63	59	48	133	134	58	58	65
KAVARATTI	45	76	70	62	211	207	150	395	150	164	111	118	273	303	259	173
KILTAN	28	32	39	19	19	86	55	23	102	55	93	173	103	256	187	85
MINICOY	333	542	330	420	310	415	644	485	428	273	615	289	946	1192	1250	565
SUHELI									822	1121	799	116	274	632	809	653
TOTAL	1385	1939	1291	1165	175	2794	1770	2242	2966	3037	4313	3776	4808	6529	5854	3050

TABLE 2. Details of fishing crafts in operation, island wise and gear wise for the year 1988.

Island	Mechanised Boat (25' and 30') (Pole and line)	Mehanised Boat (25' and 30') (Troll Line)	Mechanised Boat (25' and 30') Longline	Country craft fitted with OBM	Total (25' - 30')
AGATTI	65		4	20	69
AMINI	7	7	2	15	16
ANDROTT		20		25	20
BITRA	13		1	8	14
CHETLAT	7	4	1	20	12
KADMAT	4		3	4	7
KALPENI		4		15	4
KAVARATTI	31	19		20	50
KILTAN		14	5	15	19
MINICOY	36			20	36
TOTAL	163	68	16	162	247

TABLE 3. 'Mas' Production in Lakshadweep during the year 1984-88.

Year	Mas Production (in tonnes)	Value (Rs. in lakhs)
1984	576.670	136.75
1985	490.684	130.48
1986	576.494	164.10
1987	720.200	239.40
1988	690.400	234.79
Average	610.890	216.72

TABLE 4. The production and sales of the Minicoy Canning Factory for the last six years 1981-87

Year	Sales	Production
1981-82	26,963 cans	51,976 Cans
1982-83	36,432 "	76,050 "
1983-84	42,848 "	75,752 "
1984-85	62,684 "	1,22,012 "
1985-86	64,322 "	1,09,985 "
1986-87	126,796 "	1,04,000 "

TABLE 6. Maximum and common size range of tunas landed in Lakshadweep.

SPECIES		LENGTH (cms)	
Common name	Scientific name	Maximum	Common size range
Skipjack	Katsuwonus pelamis	85	20-64
Yellow fin	Thunnus albacares	150	25-75
Little Tunny	Euthynnus affinis	50	20-40
Frigate mackerel	Auxis thazard	40	25-35

TABLE 5. Fishing effort, Catch (kg) and CPUE (kg) of small scale troll line fishing operation at Andrott for 1988.

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
No. of vessels	16	13	15	11	13	12	11	11	12	14	19	20	
No. of trips	347	289	355	258	253	228	236	223	277	294	389	360	3489
No. of effective fishing days	347	289	355	258	253	228	236	223	277	294	389	360	3489
Tuna total catch	23860	18600	14130	5110	11265	19130	17720	15140	21240	19220	32910	38675	237000
Skipjack 60%	14316	11160	8478	3066	6759	11478	10632	9084	12744	11532	19746	23205	142200
Yellowfin 15%	3579	2790	2119	766	1690	2869	2658	2271	3186	2883	4936	5801	35548
Little Tunny 18%	4295	3348	2543	920	2028	3443	3190	2725	3823	3460	5924	6961	42660
Frigat Tuna 7%	1670	1302	990	358	788	1340	1240	1060	1487	1345	2304	2707	16591
CPUE	69	64	42	20	45	84	75	68	77	65	84	107	68

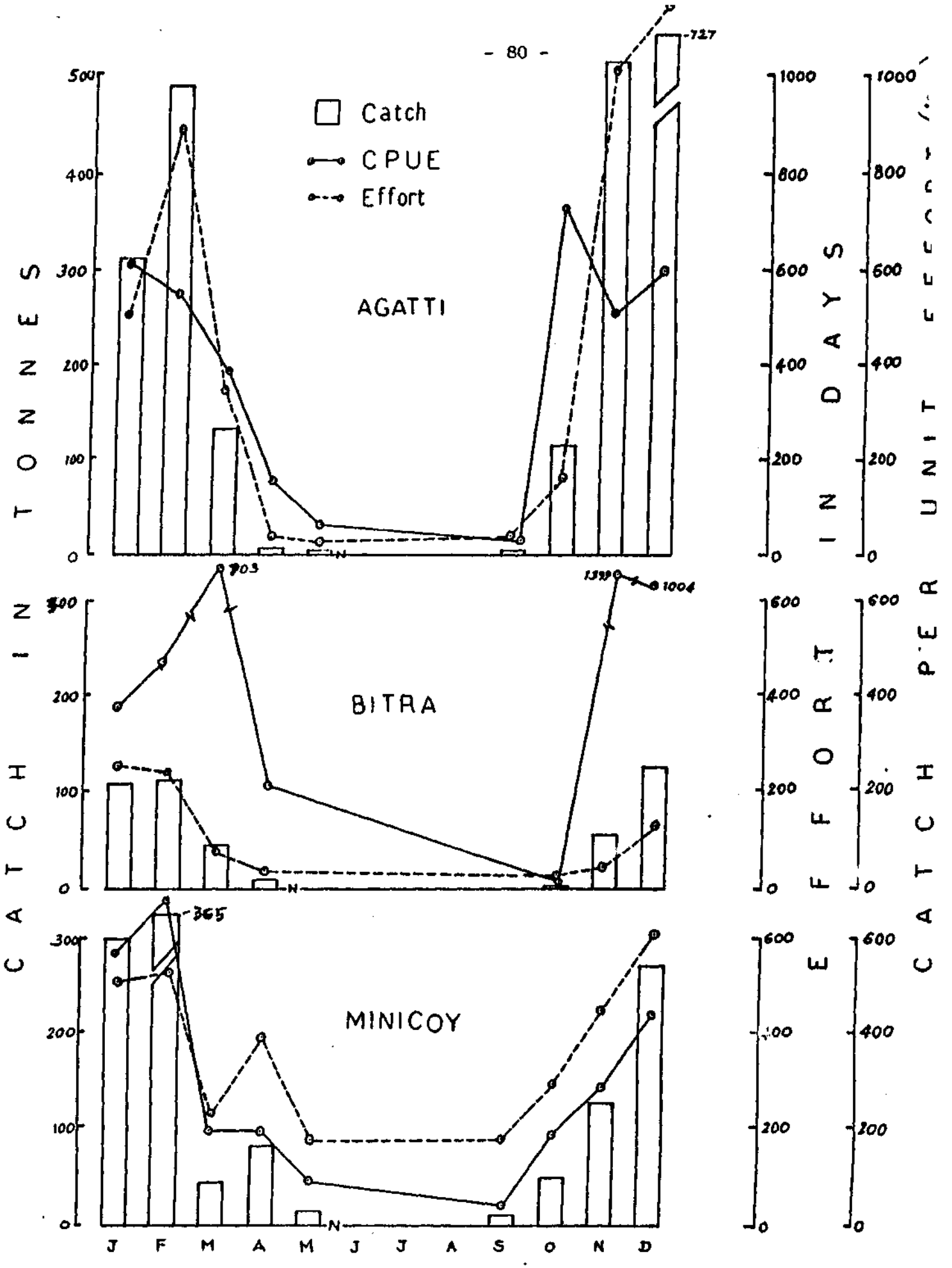

Fig. 1. MONTHLY CATCH EFFORT RELATIONSHIP OF TUNAS AT AGATTI, BITRA AND MINICOY 1988

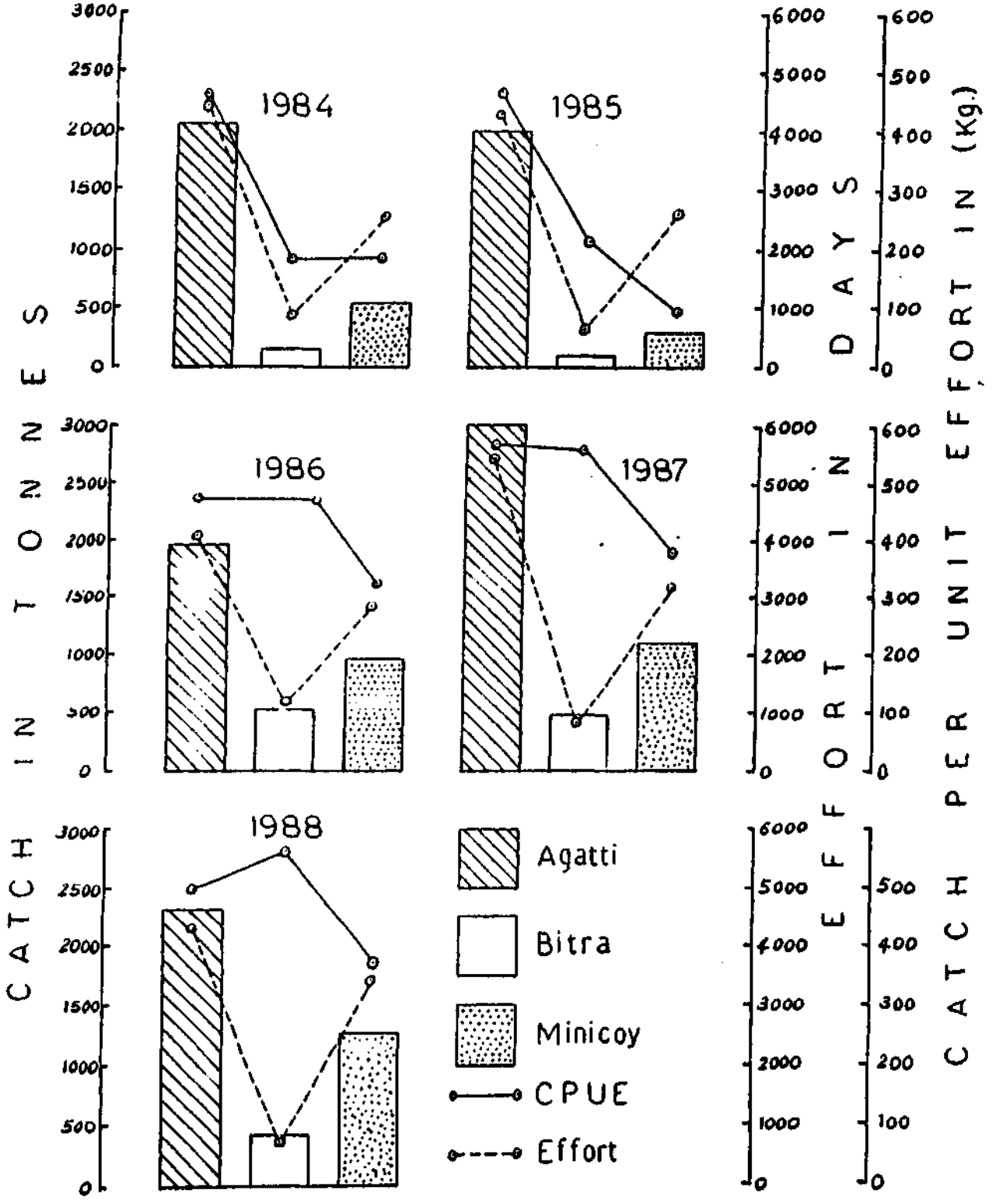

Fig 2. CATCH EFFORT RELATIONSHIP FOR 5 YEARS 1984-88 FOR TUNAS AT AGATTI, BITRA AND MINICOY