ARTISANAL FISHERY OF TUNA AROUND FISH AGGREGATING DEVICES (FADs) IN COMOROS ISLANDS. Prelimary Estimate of FAD Efficiency

BY

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SUMMARY

Settlement of Fish Aggregating Devices (FADs) around Anjouan Island (Comoros) was undertaken by the Regional Tuna Project of the Indian Ocean Commission. A statistical coverage of the important artisanal canoe fishery was simultaneously set up to assess the FAD efficiency on the CPUE of the yellowfin and skipjack tuna.

The detailed data obtained for the last 6 months of 1989 are analysed.

It appears that FADs significantly (+86%) enhanced the CPUE of both species for handline fishing gear, and only the CPUE of yellowfin tuna for troll lines (+29%). These heterogeneous results are discussed as well as the total FAD efficiency, as measured by the CPUE, on all pelagic species exploited around FADs and in the open sea.

Due to the social importance of the artisanal fishery operating with numerous non-motorized canoes and handlines the continuation of FAD settlement, with a careful monitoring of its economic and social aspect seems desirable.

1. INTRODUCTION

The use of FADs to aggregate and exploit fish was initiated in Comoros Islands by artisanal fishermen more than 30 years ago. The first FADs used were moored in shallow waters (60–100m depth), and their use limited to some fishermen of the Anjouan Islands. Due to the huge increase of the population (418,000;FAO 1988), the scarce resources* of benthic species and the absence of continental shelf and lagoon, any attempt to increase the catch of pelagic fish such as tunas, dolphin or sharks was considered by the local authorities to be of primary importance.

The first tentative settlement of FADs specially targetted at large pelagic fish was carried by the SWIOP FAO Project (Regional Project for the Development and Management of Fisheries in the South West Indian Ocean). Two FADs were moored within 600m and 12000m depth off the main island in 1984, but were lost after only ten days.

New settlement of FADs around Comoros Islands was simultaneously undertaken in 1987 by two different projects. The first project based in Moroni and financed by the FED (European Economic Community Development Funds), is a national project which aims mainly at helping the local artisanal fisheries by constructing and selling plastic canoes specially designed and constructed in a local factory

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* The mean annual total catch of fish for the 1982–84 period was estimated at 5,250MT (FAO, 1988).

operated by the project; as an additional activity this project also setted 4 FADs around the "Grande Comore" Islands. The second project is a regional project of the Indian Ocean Commission (IOC), funded mostly by EEC and directed by the "Association Thoniere" (based in Madagascar); this project is specially targetted at the development of tuna fisheries in the member countries; Comoros Island, Mauritius, Madagascar, La Reunion (France) and Seychelles (Observer).

The activities of the Regional Tuna Project are locally handled by different national institutions. In Comoros Islands, the National School for Fisheries of Anjouan is in charge of these activities and one of its major activities was to settle FADs all round Anjouan Island since 1988 (Fig. 1).

Based on a recently operational statistical survey, the efficiency of FADs in the artisanal fishery will be analyzed in this paper in terms of catch and CPUE trends over the last two quarters of 1989.

2. METHODS

2.1 Data

Since July 1989, catch and effort data are collected on a daily basis, twice a day (morning and afternoon), by technicians at 17 artisanal fishery landing points. A distinction is made between the catch and effort in the vicinity of FADs (within 1 mile of the FADs tuna can be considered as associated with the FAD, Depoutot, 1987), and in the open sea area.

For the effort data a distinction was made between two types of craft (canoes):

– motorized canoes using trolling lines and artificial lures;

–non-motorized canoes using handlines and natural bait.

The effort unit is the fishing trip. One trip generally represents a half day of fishing at sea (about 5 hours).

For processing and analysis, all data are combined on a 2 week basis by type of craft (i.e. fishing gear), by type of exploited area (DCP vicinity v.s. open sea area) and by species.

The non-parametric Wilcoxon test (Snedecor and Cochran, 1957) was applied on paired series of CPUE (CPUE in FADs area v.s. CPUE in open-sea) to test the significance of the observed difference.

2.2 Coverage Rate

A recent census of the artisanal fishery was undertaken in November 1989, by MM. PARKER (FAO) and OIRDI (Comorian Ministry of Fisheries).

An estimation of the total number of canoes in operation in Anjouan Island showed that it included 890 canoes without motors and 120 with motors (OIRDI, Com. pers.). The coverage rate of each craft is 89% (motorized canoes) and 58% for the others. If the canoes based in the main Island are added to those based in Anjouan Islands (2855 canoes without motors + 253 with motors, OIRDI, Com. pers.), the coverage rate for motorized and non-motorized canoes is respectively 13.8% and 28.2%.

3. RESULTS

All the results concerning catch effort and CPUE data for the fortnights 13 to 24 are summarized in Table 1 for non-motorized canoes and in Table 2 for motorized canoes.

Effort (Fig. 2A and 2B)

The effort (number of trips) is always at a significant level for both kinds of craft and fishing area. Low effort values are observed from July to the end of September (fortnights 14 and 18) for non-motorized canoes (Fig. 2A). This corresponds with bad weather conditions to which small non-motorized canoes are sensitive.

Catch

– Un-motorized canoes

The yellowfin tuna catches made by non-motorized canoes (Fig. 3A) seem to fluctuate with a slight decreasing tendency through the different fortnights. The decreasing tendency appears to be much more marked for skipjack catches (Fig. 3B).

From Table 1, it appears that yellowfin catches are more important than those of skipjack. This reflects the fact that yellowfin is the target species for non-motorized canoes using the handlining method.

– Motorized canoes

The catches of yellowfin (Fig. 4A) and skipjack (Fgi. 4B) fluctuate with a slight increasing tendency from July to December; peak catches occur in the October-November months for both fishing areas (i.e. FAD and open-sea).

The catches of yellowfin (Table 2) are lower than those of skipjack, in both fishing areas. This can be explained by the greater catchability of skipjack by trolling.

Catch Per Unit of Effort

The different series of CPUE (Figs. 5A, 5B, 6A, 6B) observed for the 2 gears and 2 species fluctuate without any common trend. It thus appears impossible to standardize the CPUE between the two fishing gears.

– Non-motorized canoes (Table 1, Fig. 5)

The yellowfin CPUE for both fishing areas shows a decreasing trend from July to December for both fishing areas (Fig. 5A). The CPUE of yellowfin corresponding to effort applied in the vicinity of FADs is always higher than that observed in the open-sea area. These differences appear highly significant at the P= 0,009 level of the Wilcoxon test. This indicates that FADs have a positive effect on the catchability of yellowfin. This effect can be summarized by an increase of 86% in the mean CPUE observed in the FAD area (Table 1).

For skipjack (Fig. 5B), the same efficiency of FADs can be observed. The difference between the FAD CPUE and open-sea CPUE values is highly significant as indicated by the Wilcoxon test. An increase of 86% of the mean CPUE is observed for the FAD area (Table 1).

For both species the fluctuation of the CPUE is much more important in the FAD area than in the open sea ones. The variability of environmental factors, e.g. availability of food, could be more extensive and have more direct effects on the behaviour of fish in a restricted area of the sea such as a FAD area. The effect of such local variabilities is probably smoothed for canoes exploiting a wider area such as the open-sea.

– **Motorized canoes (Table 2, Fig. 6)**

The CPUE of yellowfin tunas observed in the FADs area (Fig. 6A) is always higher (with exception of 17th fortnight) than those observed in the open-sea area. These differences are highly significant at the P= 0,009 level of the Wilcoxon test. The average CPUE (Table 2) in the FAD area is 29% higher than the average CPUE observed in the open sea area.

In contrast, the Wilcoxon test applied to the CPUE of skipjack observed in fishing around FAD and the open sea (Fig. 6B), indicates that there is no significant difference between the two series of data. Thus FADs appear to have no effect on the fishing efficency of motorized canoes as far as skipjack catches are concerned.

– **Other Species**

If catches of species other than tunas are considered (e.g. dolphins, barracudas), the CPUE observed in both areas (FAD and open sea) by the two types of fishing gear (Fig. 7A and 7B), show no difference between the FAD and the open-sea area.

4. DISCUSSION

The Comorian tuna fishery appears much more important than indicated in past statistics (500t of yellowfin and skipjacks, FAO, 1988); the present data extrapolated to the total number of canoes from the recent census (cf. $2.2), and making the assumption that the yellowfin and skipjack catches are the same for the January-June and July-December, lead to an estimation of yellowfin + skipjack catches ranging from 4000t to 5000t.

From the present observations FADs appear to have a significant effect on the CPUE of yellowfin for both type of craft (i.e. fishing gear) in use in Comoros Islands. For skipjack the enhancement of CPUE by FADs is observed only for non-motorized canoes. For other pelagic species, FADs do not seem to have any effect for both types of craft and fishing gear.

The total effect of FADs on CPUE of all species combined (tunas + mixed species) appears to be highly significant (P= 0,009) for non-motorized canoes (Fig. 8A) and without any significance for motorized canoes (Fig. 8B). It would therefore appear difficult with the present data, limited only to the fishing statistics, to assess the real value of FAD settlement; many other economic factors (e.g. cost of the FADs, cost of the fishing eqipment,including motors and petrol consumption, market price of the fish...) should be taken into account.

Nevertheless, several positive aspects of FAD settlement in Comoros Islands can now be outlined:

– the local need for fresh fish is important and FAD exploitation enhances the production in some ways;

– even if FAD efficiency (measured by the CPUE enhancement) for some species and fishing craft is not proved, the presence of FADs probably reduce the searching time and thus the petrol consumption;

– FADs seem to be very efficient in increasing the tuna catches of non-motorized canoes; the number of these canoes (n= 3745) compared to those which are motorized (373) give a prime social importance to the output of the non-motorized canoe fleet.

Taking into account the fact that FAD efficiency (as measured by CPUE increase) is highly dependent on the average density of fish in the whole area (Depoutot, 1987) but also on their precise location (Wicklam and Russel, 1974; Preston, 1982; Anon., 1982) and density (Samples and Sproud, 1985; Hilborn and Medley, 1989), the settlement of new FADs should be precisely monitored.

Given the present conditions it appears quite desirable to continue the maintenance of the existing FADs. The settlement of new FADs should be encouraged by a simultaneous precise survey of their effects on the local market and on the fishery itself.

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Table 1: NON-MOTORIZED CANOES
Summary of catch (kg), effort (no. of trips) and CPUE (kg/trip)
of yellowfin and skipjack tunas for the fortnight 13 to 24
(i.e. July to December 1989)

FORT-NIGHT NUM.	FAD					OPEN SEA				
	EF-FORT	CATCH (KG) YF	SJ	CPUE YF	SJ	EF-FORT	CATCH (KG) YF	SJ	CPUE YF	SJ
13	1360	3616	2357	2.7	1.7	2203	4138	2159	1.9	1.1
14	740	2895	1948	3.9	2.6	1411	3112	1703	2.4	1.2
15	723	2560	1873	3.5	2.6	1524	1892	1124	1.2	0.9
16	717	2240	1367	3.1	1.9	1493	1720	1140	1.2	0.8
17	601	908	524	1.5	0.9	1378	1874	777	1.4	0.6
18	384	1227	464	3.2	1.2	1502	2517	984	1.7	0.7
19	566	1016	389	1.8	0.7	2022	2850	1175	1.4	0.6
20	782	1637	639	2.1	0.8	2415	3123	1083	1.3	0.4
21	673	1870	547	2.8	0.8	2185	2364	802	1.0	0.3
22	507	1391	400	2.7	0.8	2063	2090	1155	1.0	0.6
23	913	1738	660	1.9	0.7	2495	3055	833	1.2	0.3
24	499	1038	385	2.7	0.8	1679	1586	692	0.9	0.4
TOTAL	8465	22136	11553			22730	30621	14227		
MEAN				2.6	1.3				1.4	0.7

Table 2: MOTORIZED CANOES
Summary of catch (kg), effort (no. of trips) and CPUE (kg/trip)
of yellowfin and skipjack tunas for the fortnight 13 to 24
(i.e. July to December 1989)

FORT-NIGHT NUM.	FAD					OPEN SEA				
	EF-FORT	CATCH (KG) YF	SJ	CPUE YF	SJ	EF-FORT	CATCH (KG) YF	SJ	CPUE YF	SJ
13	621	7865	8261	12.7	13.3	641	6115	7481	10.1	11.1
14	608	5646	7280	9.3	12.0	414	3573	3186	8.6	7.7
15	463	3719	3852	8.0	8.3	607	3443	3965	5.7	6.5
16	518	5021	7039	9.7	13.6	755	5083	9843	6.7	13.0
17	491	3579	6177	7.3	12.6	657	4809	8337	7.3	12.7
18	721	8185	9235	11.4	12.8	747	6641	10462	8.9	14.0
19	753	8673	12430	11.5	16.5	1008	8812	22023	8.7	21.9
20	862	10845	17589	12.6	20.4	1188	10556	29959	8.9	25.2
21	956	9363	17291	9.8	18.1	1329	9538	43472	7.2	32.7
22	749	5592	19731	7.5	26.3	1281	7418	35984	5.8	28.1
23	771	8587	15144	11.1	19.6	1229	10124	33908	8.2	27.6
24	525	5787	12432	11.0	23.7	1065	8738	39859	8.2	37.4
TOTAL	8038	82862	136461			10921	85150	248479		
MEAN				10.2	16.4				7.9	19.9

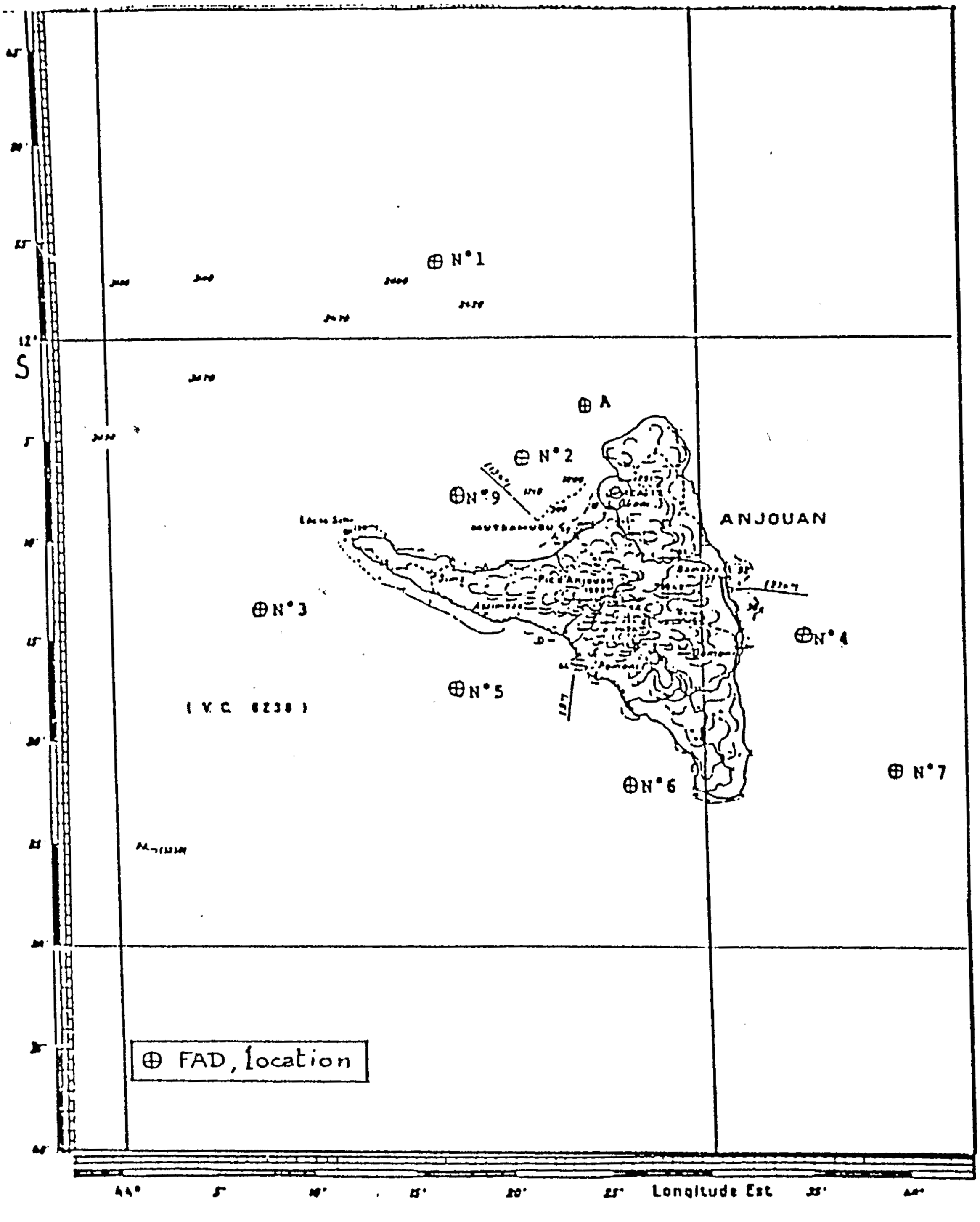


Figure 1: Location of Fish Aggregating Devices anchored off Anjouan Island (Comoros). FADs n° A n° 1 to 8 were settled before July 1989, date of beginning of the present study; FAD n° 9 was settled on the 10th October, 1989,

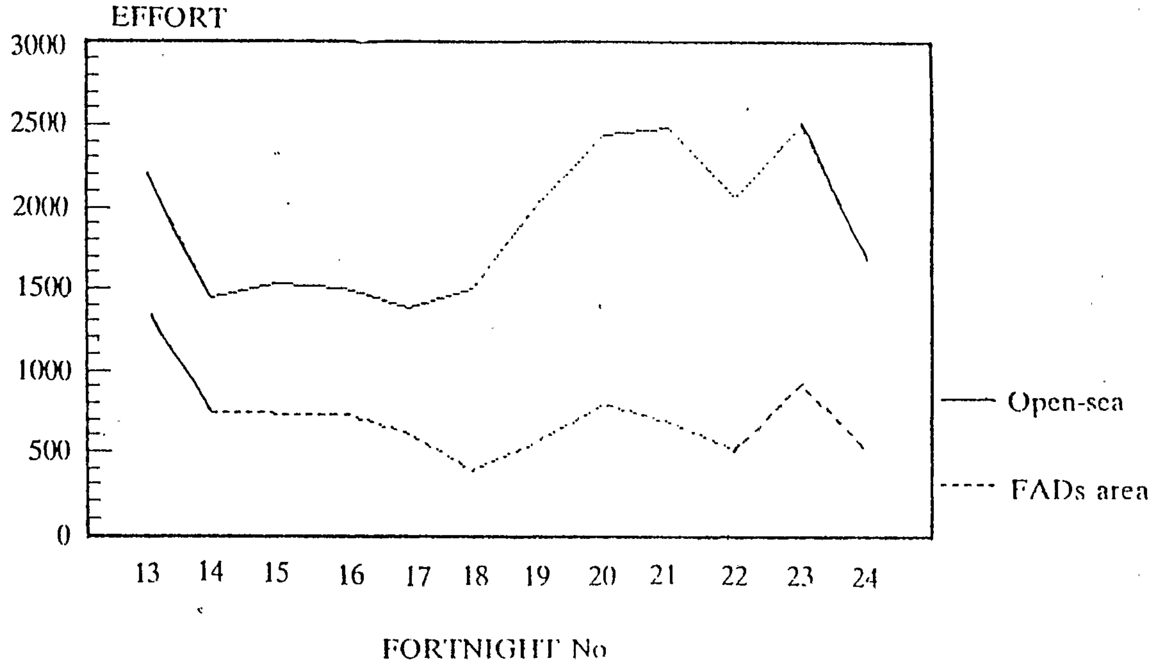


Fig. 2A

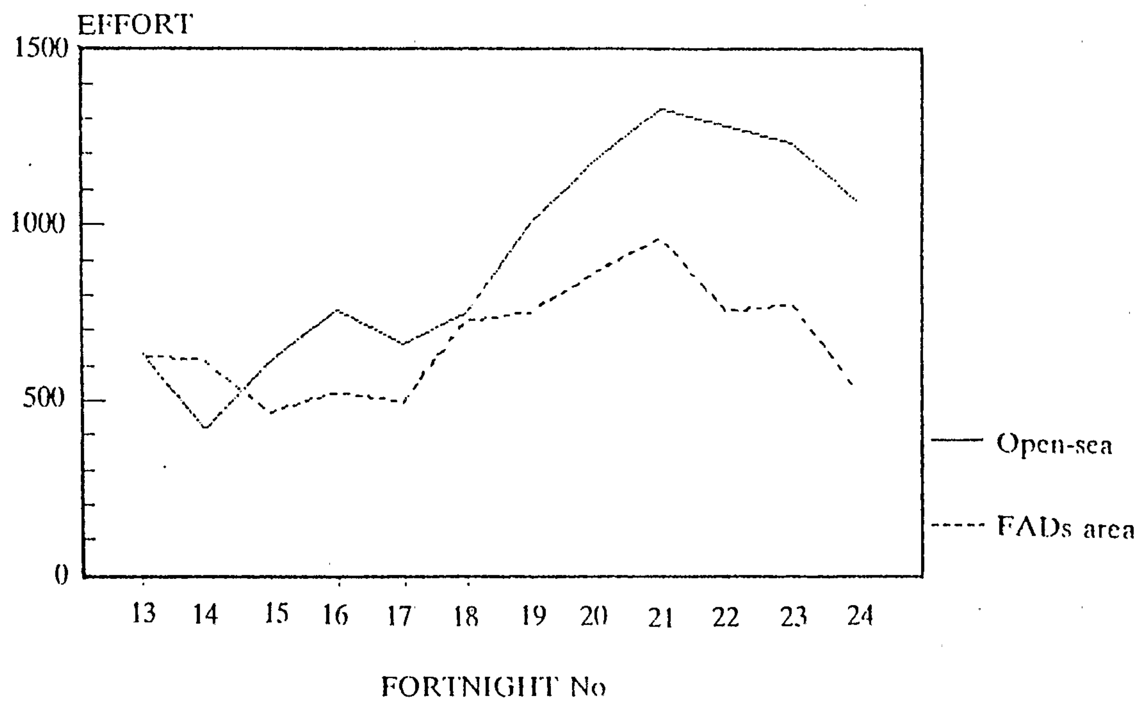
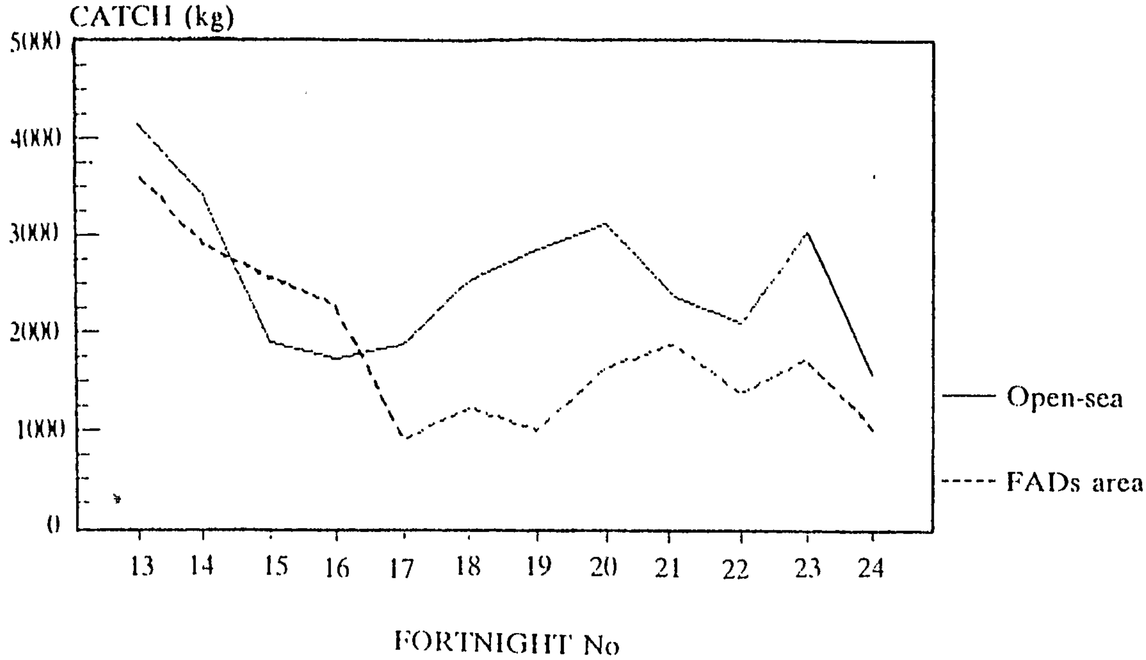


Fig. 2B

Figure 2. Effort (number of trips) of non-motorized (fig. 2A) and motorized (fig. 2B) canoes applie around the FADs and in the open-sea area.



--- Fig. 3A ---

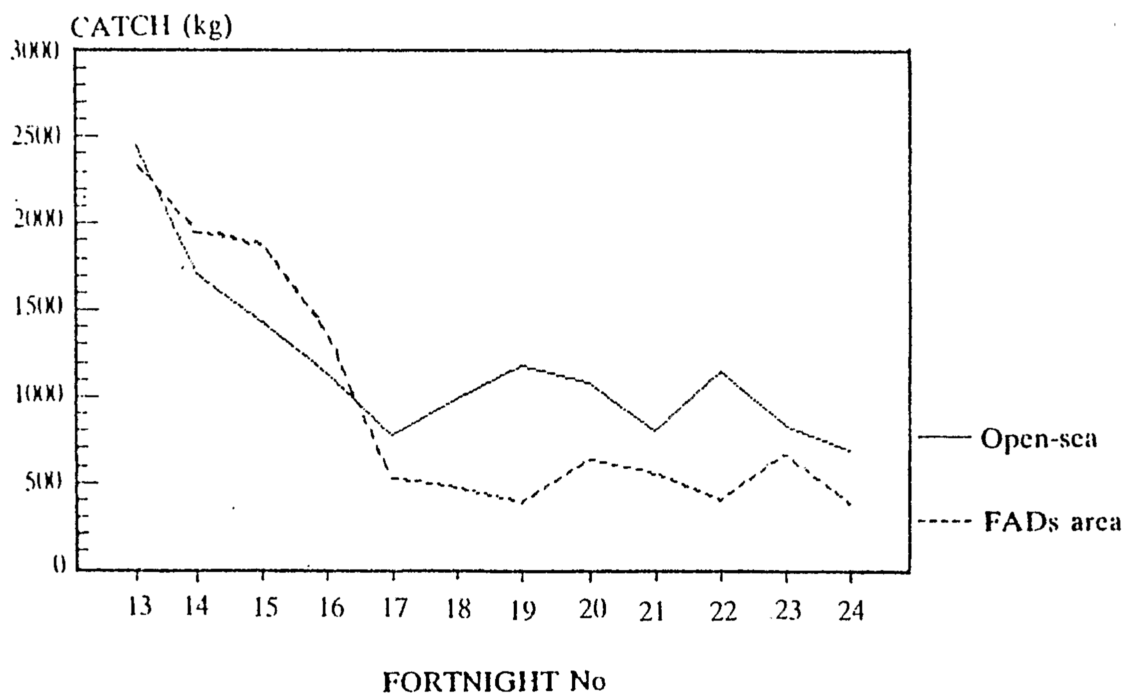
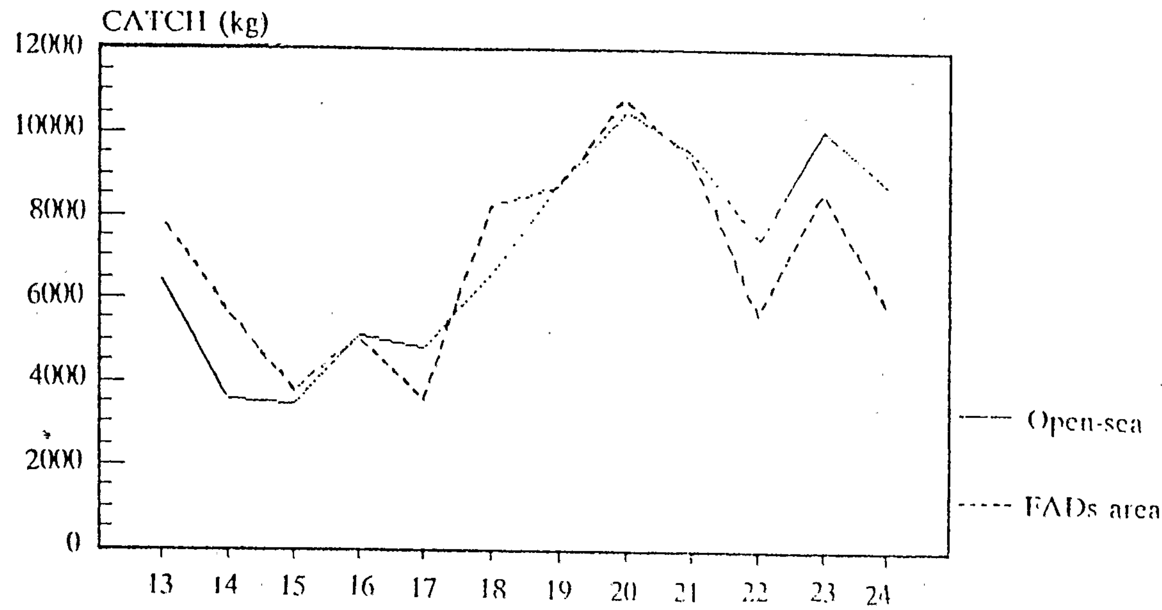


Fig. 3B

Figure 3. Non-motorized canoes catches of yellowfin (fig. 3A) and skipjacks tuna (fig. 3B) by fishing area and fortnight.



--- Fig. 4A ---

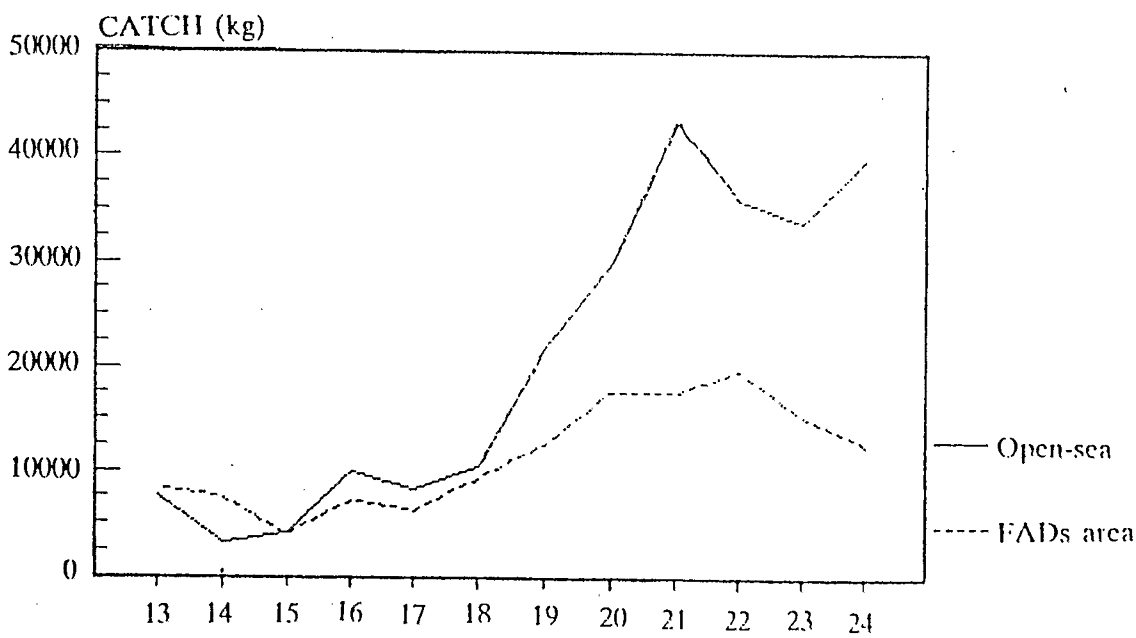
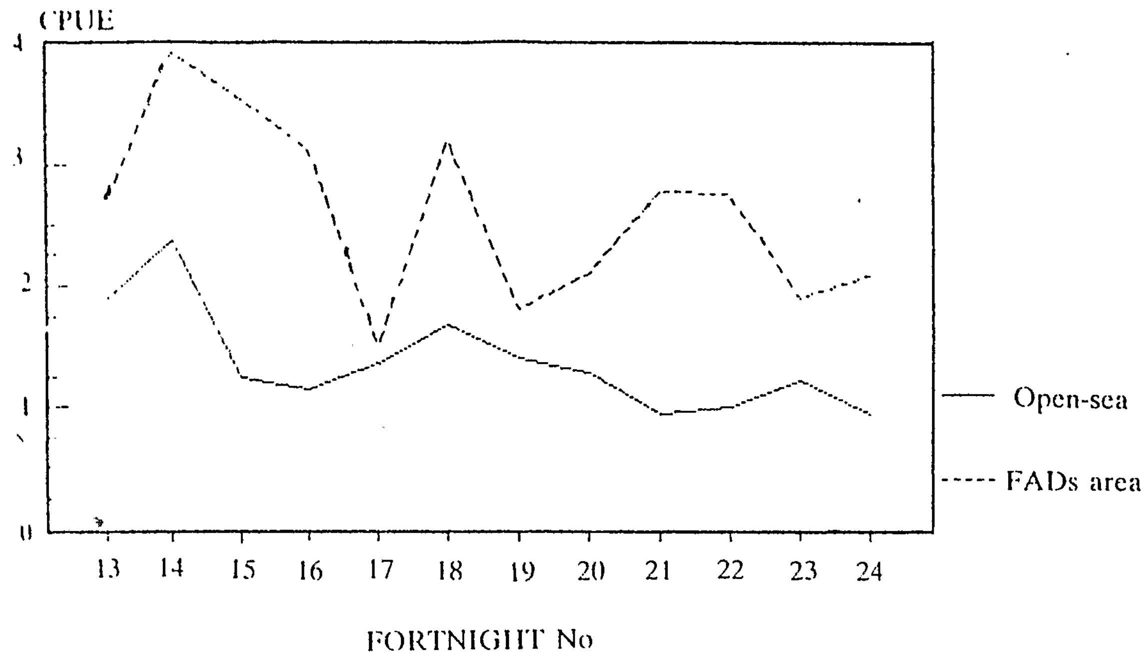


Fig. 4B

Figure 4. Motorized canoes catches (kg) of yellowfin (fig. 4A) and skipjack tuna (fig. 4B) by fishing area and fortnight.



--- Fig. 5A ---

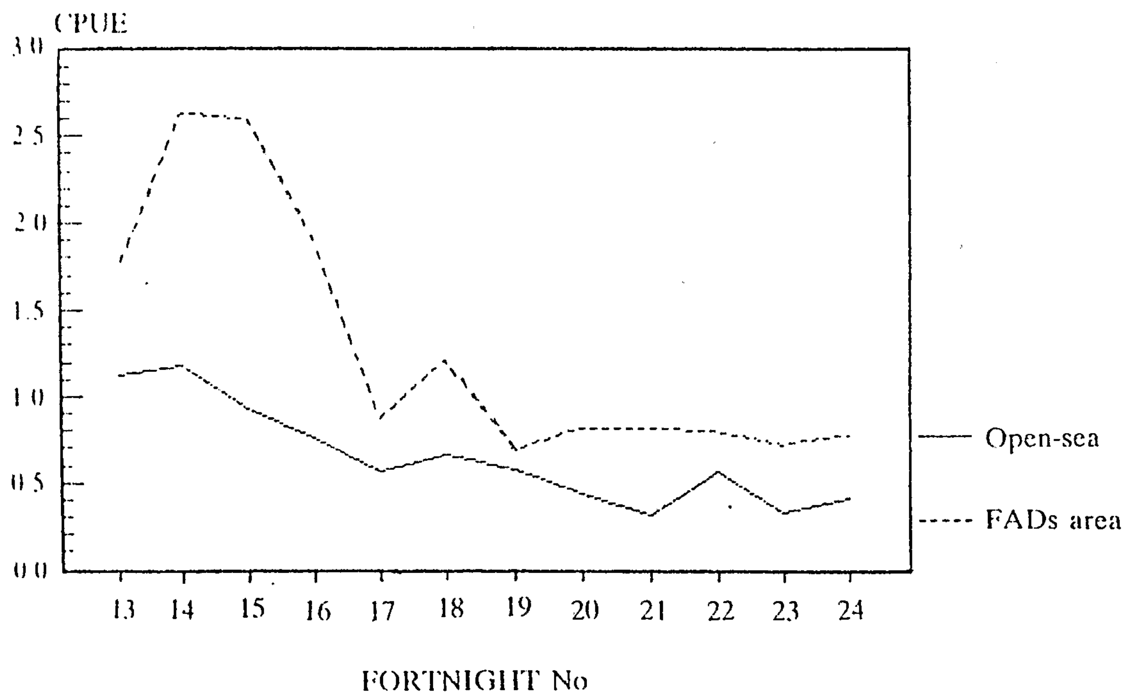


Fig. 5B

Figure 5. Non-motorized canoes catch per unit of effort (kg/trip) of yellowfin (fig. 5A) and skipjack tuna (fig. 5B) by area and fortnight.

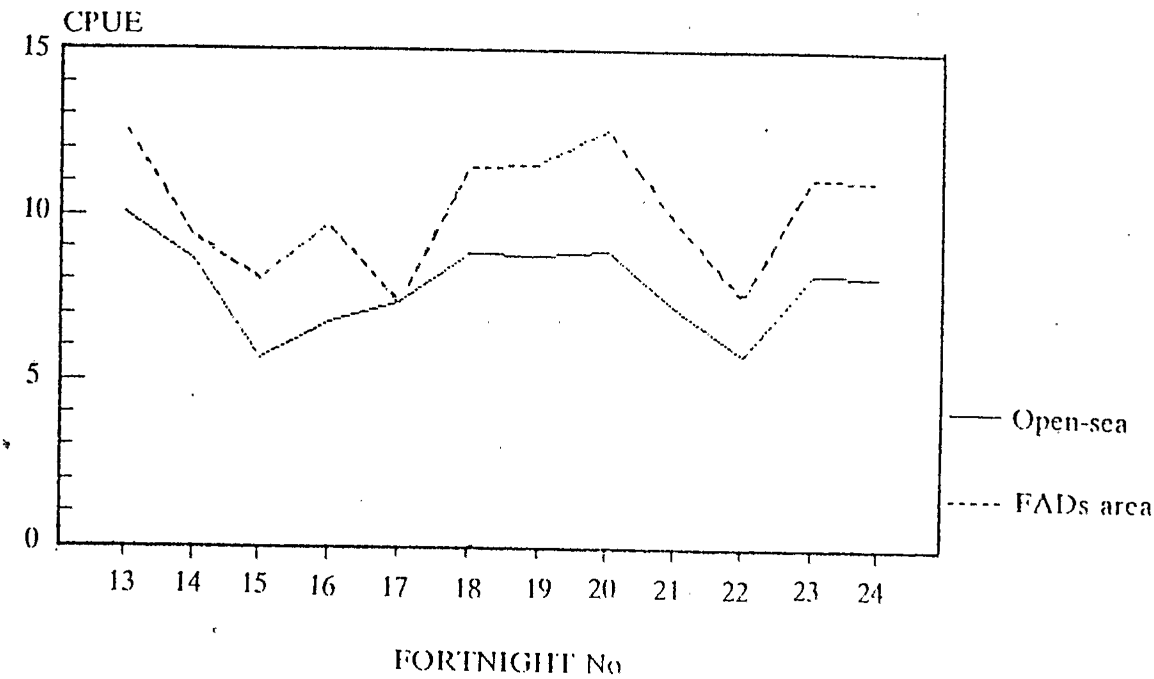


Fig. 6A

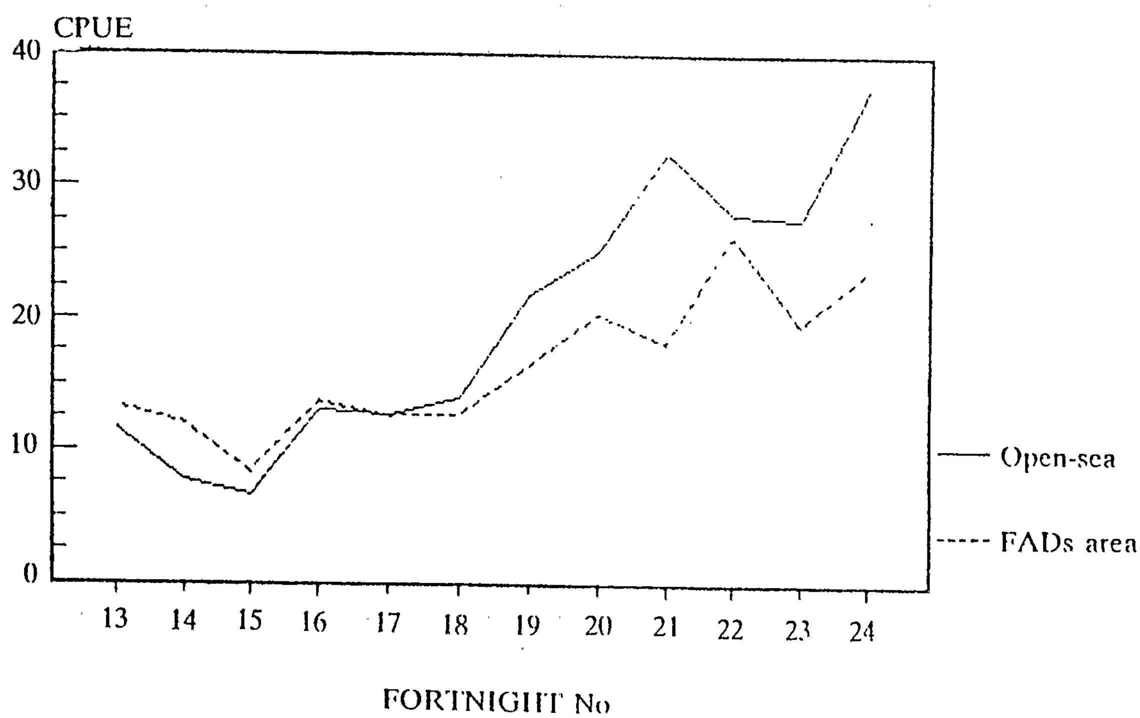
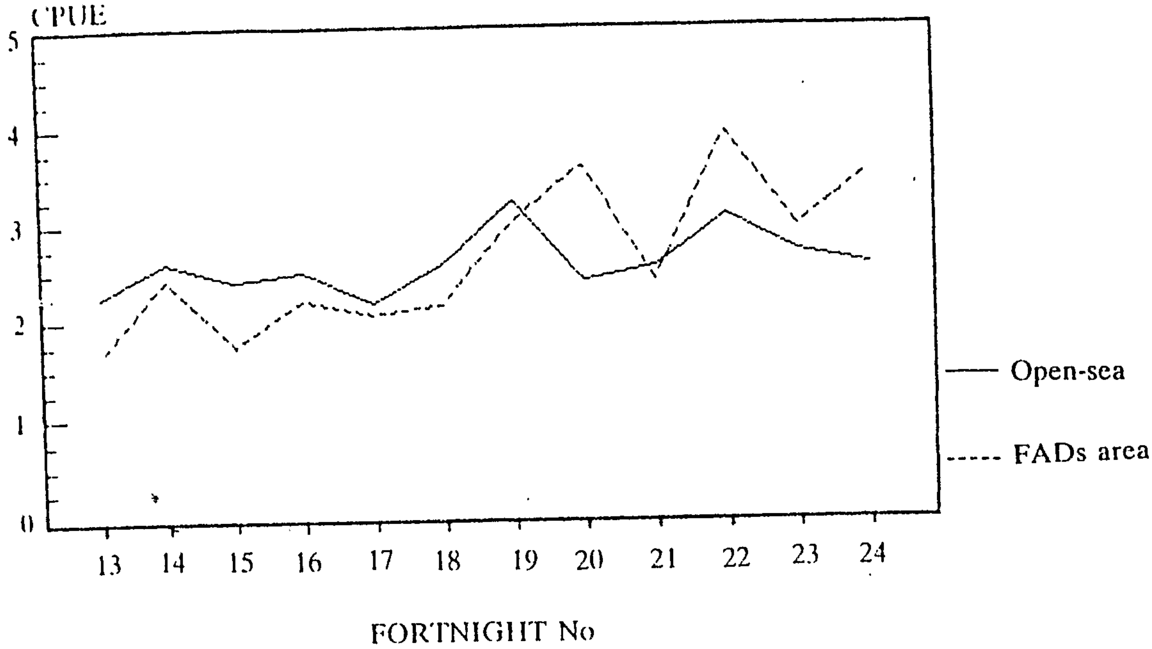


Fig. 6B

Figure 6. Motorized canoes catch per unit of effort (kg/trip) of yellowfin (fig. 6A) and skipjack tuna (fig. 6B) by area and fortnight.



--- Fig. 7A ---

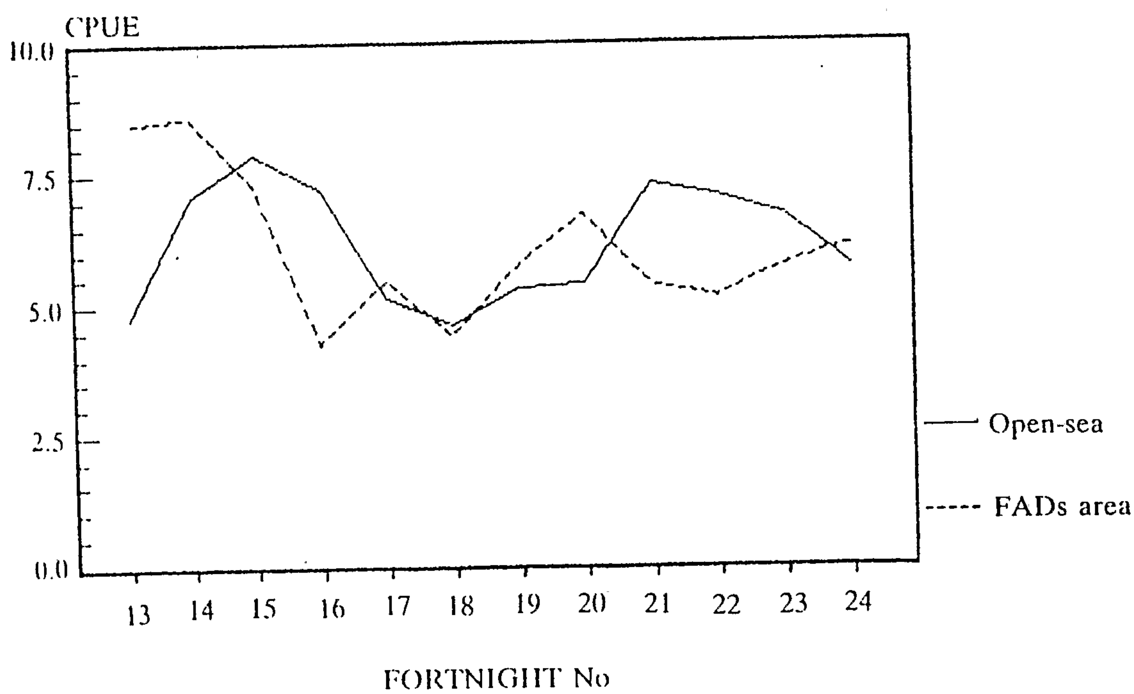
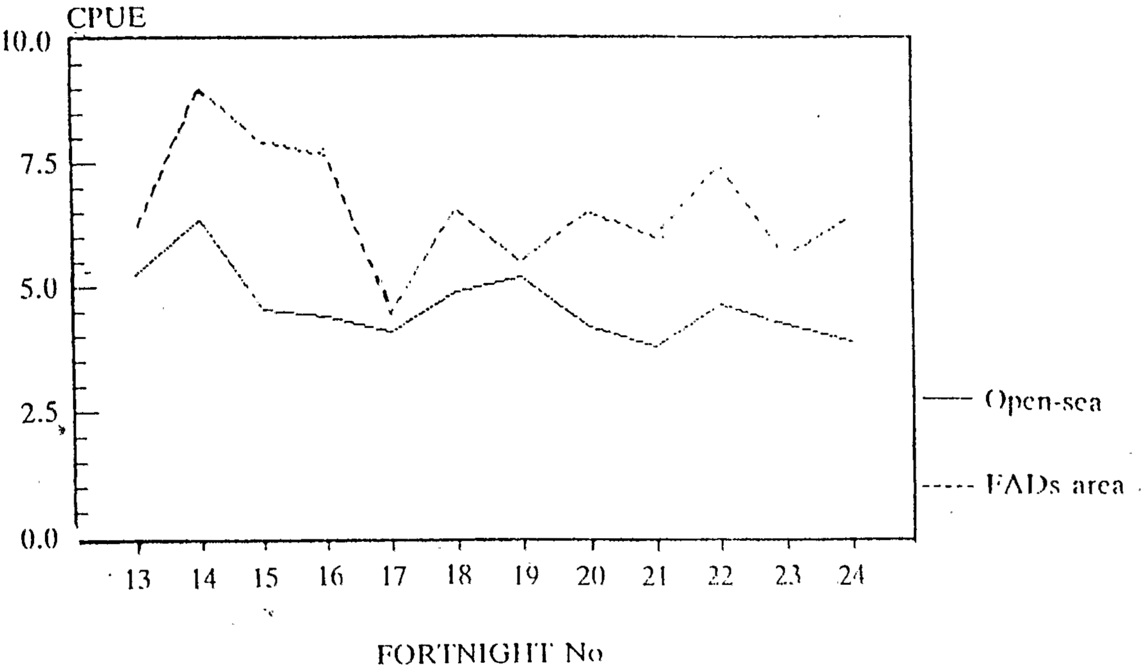


Fig. 7B

Figure 7. Catch per unit of effort (kg/trip) of mixed species (tuna excepted) by area and fortnight for non-motorized (7A) and motorized (7B) canoes.



--- Fig. 8A ---

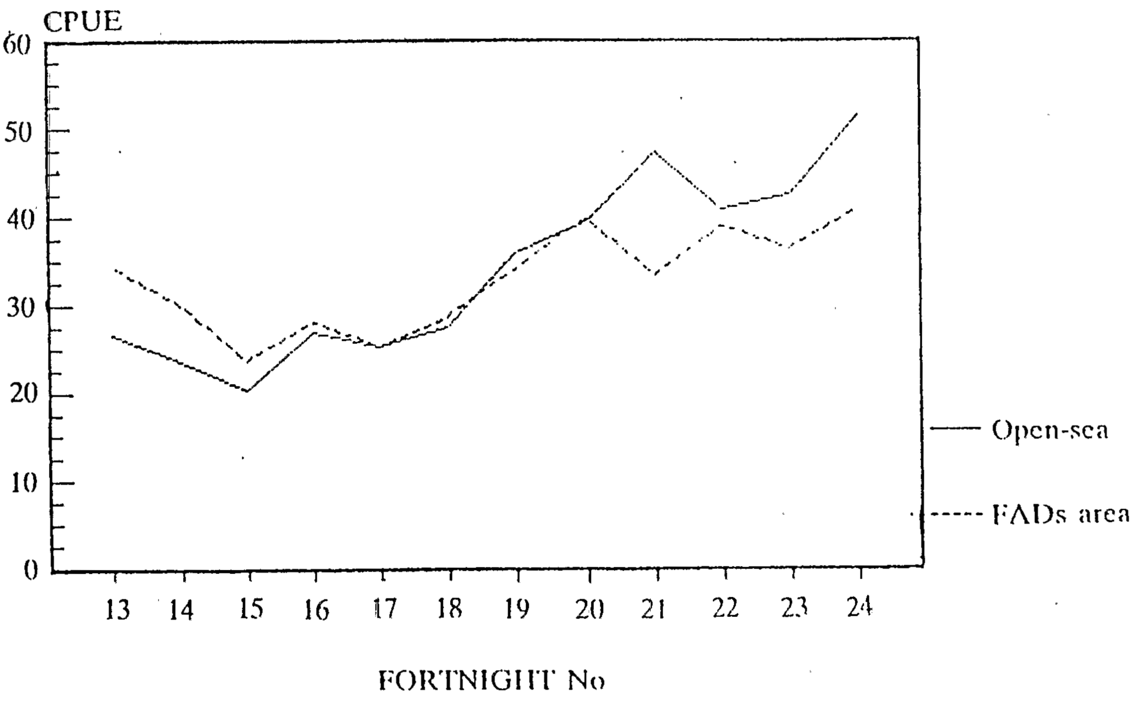


Fig. 8B

Figure 8. Catch per unit of effort (kg/trip) of combined species (tuna mixed) by area and fortnight for non-motorized (8A) and motorized (8B) canoes.

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