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FLYINGFISH GILL-NETTING IN SOUTH TARAWA

by

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Kam bati n rabwa ao are i eta ami ibuobuoki.

INTRODUCTION

There are several traditional fishing methods used to catch flying fish in Kiribati. An excerpt from Turbott (1950) is reproduced:

> "Night fishing with torches and scoop nets when the moon is full, night fishing with torches and scoop nets when there is no moon, fishing with torches and scoop nets at sunset, fishing with hooks and floats, trolling using lures made of coconut midrib,"

These methods including gillnetting which is more recent in the islands are still practised. On South Tarawa more advanced methods such as daytime gillnetting and dip or scoop netting with kerosene pressure lamps at night are more popular than trolling using lures or bait. The latter are more popular on the outer islands. Helmets with electric spotlights which are widely used in the Cook Islands (Powell, 1989a) are rarely used here in the Gilberts. Fishermen who brought back working helmets from Nauru affix a torch front part onto the helmet and connect it to a portable battery. Portable generators have not been heard of. Purse seining which is widely used in Cebu, Phillipines (Martin, 1938) is not practised.

In South Tarawa scoop or dip netting is performed at night using kerosene pressure lamps. A neatly bundled dry coconut leaf which is a traditional source of lighting in Kiribati as well as in the neighbouring islands like Tuvalu (Turbott, 1950) and Palau (Johannes, 1981) is rarely used. A large scoop net traditionally made of fine coconut string (of coconut husk) with a long pole 2-3 m long with a net at one end is used on a powered skiff or canoe. This method is widely used on most outer islands using coconut leaves or pressure lamps. Only a few fishermen can afford outboard motors, however, pressure lamps and powered canoes or skiffs are banned on Tamana and Arorae islands in the south (Mees, 1985; Inshore Fisheries Research Project, 1988). Only a certain number of coconut leaf torches per trip is allowed (pers. comm.).

Dip netting may be performed either at full moon or at any other times depending on the seasons known by each individual fisherman. Johannes (1981) described 12 dark nights of the moon
as the best times in Palau, this probably coincides with a period between the last and first quarters. Turbott (1950) noted the no moon night fishing times using scoop nets in Tuvalu and Kiribati.

Trolling is widely practised in the Gilberts (Turbott, 1950; Zann, 1980). It is normally done during the day but mainly in late afternoon during new moon (pers. comm.). This method is time consuming but only requires simple gear like a fine monofilament line (7 kg), several small hooks (smallest size), a lure or bait. In the olden days a fine fishing line made of coconut husk fibre woven with human hair was used.

Gill-netting is one of the latest methods introduced when fishing nets with fine mesh (20 - 25 mm) were made available. This method spread out fairy rapidly in some Pacific and Asian states. It is widely practised in most of the islands in the Gilbert group but is now banned on some islands (Makin, Tamana, Arorae) including Nauru, as it is believed that it depletes the stocks in a very short time. This claim had not yet been challenged.

Advancement in technology has allowed the introduction and use of more sophisticated modern techniques in catching this pelagic fish. Most I-Kiribati still stick to their old traditional methods, although modern techniques are also being adopted. Gill-netting appears to be the most popular and potentially more efficient method used in South Tarawa.

AIMS AND OBJECTIVES

The aims and objectives of the study are: i) to determine the best fishing seasons which may be associated with spawning runs; ii) to confirm traditional knowledge on the aggregating seasons (probably spawning seasons) of flying fish; iii) to set up a database and provide crucial information which may help in the conservation and management of the resource; iv) to determine catch per unit effort (CPUE) from a modern and traditional craft.

MATERIALS AND METHODS

Gill-netting is the principal method used to catch flying fish in this study.

An aluminum skiff of 3.35 meters length overall by 1.37 meters wide and 0.5 meters draft is powered by a 15 HP Yamaha and manned by two men. Two monofilament nets joined together measure 91.44 m at hanging ratio of 65-20 mm mesh depth. A traditional canoe about 3m by 0.5 m wide by 0.5 m draft can only be manually powered by one crew and the nets used are similar to those used on the skiff. The skiff uses about 3 1 of gasoline (benzine) per trip.

The fishermen fish at the ocean side, and within the boundary of Teaoraereke village all year round (Fig. 1). The normal time spent ranges between 11/2 -3h (between 4 and 7) in late afternoons especially when both the tide and weather permit. The catches are counted, time spent recorded, location noted and other observations are recorded for each fishing trip.

Extra floats are added to give the nets extra buoyancy so that the float line remains at the water surface. A buoy is anchored a few meters off the reef crest and well away from the wave-break zone. One end of the net is tied onto the buoy and cast outward and perpendicular to the reef or shoreline at about half knot. The outward end of the net is let go and the fishermen head back to the reef keeping their distance from the net. They keep a look out for any schools of flying fish coming close to the reef. When a school is spotted the boat (skiff or canoe) is skillfully maneuvered so the school runs into the net. The netted fish are quickly removed to avoid being preyed upon by sharks, barracudas and other predatory fish which are easily attracted by blood and the struggling fish caught in the net.

The size of the catch depends on the number and size of schools encountered, the capacity of the boat, and other factors. A skiff can hold between 300-500 individual fish, while a canoe can hold no more than 200 individuals.

Due to what it appears to be 'claimed ownership' of a fishing spot our fishermen were unable to fish freely within Teaoraereke village boundary, but were fishing essentially the same grounds.

RESULTS

Skiff:

For a skiff catch per unit effort (CPUE) is described as 2 crew per 2 h per 1 net per fishing trip. Table 1 and Figure 2 (block shading) show that March, April, May, August and October have what appear to be significantly higher mean CPUEs than the other months under observation (no fishing was done in January, June and July of 1992 due to unforeseen circumstances).

The 1992 results show a probably bimodal result, suggesting two inshore migrations of flying fish a year: one around April and the other around October. This observation, however, is inconclusive as there are no results for June and July.

The 1993 half year results (line shade) show low catches from January till March, a in April and the highest catches in May, June and July. Comparing the four-month period (February to May) for both years, the highest catches recorded are, in April and May for 1992 and 1993, respectively. While the trends are similar, however, the mean CPUEs for May, June and July (1993) are lower than April but higher than October, of 1992.

Canoe:

CPUE for a traditional canoe is described as 1 crew per 2 h per net per fishing trip. The canoe joined in the sampling activity from September of 1992. Table 2 and Figure 3 show that October has the highest CPUE during this period. CPUE for a skiff is also plotted and both graphs show similar trends, indicating a possible inshore migration peak in October and that schools along Teaoraereke reef spread out fairly evenly.

Moon phase and Tide:

Daily catches within each month were also examined and it is noted that flying fish appear to come close and even over the reef crest between 3 days before the first quarter and 3 days after the last quarter. Highest catches have been recorded between the first quarter and full moon, that is during transitional and spring tide.

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

In this section "inshore migration" and "spawning season" are used interchangeably. A "craft or boat" refers to either a skiff or canoe and are also used interchangeably.

There was no sampling done in January of 1992 as it was all dedicated to the preparatory and organizational phase. Again in June and July no sampling was made due to bad weather and very strong westerly currents, an unusual in Kiribati at this time of the year.

There remains some difficulty in the identification of the species and therefore both oceanic and coastal species have been grouped together in this report.

It appears from the results presented above that major or peak inshore migrations of flying fish probably occur three times a year in the waters of South Tarawa. Our 1992 results (Figs 2 and 3) show two possible major peak spawning or inshore migrations: one around April and the other in October. 1993 results ending in July indicate an extended spawning season from April to July. If August to December results of this year show a similar trend to that of 1992 then the suggested major spawning seasons are most likely.

In Atiu, Cook Islands, July to August is the peak spawning season (Mokoroa, 1984). Andrews (1987) noted that on Pukapuka Atoll, Cook Islands, the season for scoop netting of flying fish is May to October. An observation by Dalzell, et al, (1991) shows that flying fish are caught year round in Niue, but the best season extends from August to March. These observations appear to be similar to our 1993 results and it is hoped the trend for 1933 will follow a similar pattern for Pukapuka.

Mature flying fish in the tropics appear to spawn several times over the course of a year (Gillet and Ianelli, 1991), so our suggestion of three major peak spawning seasons a year appears probable.

Monthly inshore migrations have also been noted. On Atiu, Cook Islands, Mokoroa (1984) reported that spawning occurs in each month from June to December, with peaks in July and August. Johannes (1981) also noted 12 dark nights of the moon when flying fish is caught using palm frond torches and scoop nets. Their observations are very similar to ours.

Inshore small scale migrations, undoubtedly, correspond with spawning seasons which are probably associated with moon phase and tide. The 12 nights of the moon which Johannes (1981) reported is probably a period between the last and first quarter which is quite the opposite of what has been observed here, that is, between the first quarter and the full moon. However, one expects differences in spawning or migration seasons across the Pacific for a multitude of reasons, including geographical, biological, and physical factors, and more. Breder and Rosen (1966) reported that the same species of a flying fish, Parexocoetus mento spawns in the warm months from May to September in Japan. It spawns in October in Fiji.

In most cases ripe gonads are found in both males and females, but not in every individual. Some remain at either mature/maturing or spent stages, indicating a possibility of more than one species or several spawnings. This is reflected in the CPUE trends, the extent and span of the monthly migration, or the spawning season. This is not unusual as Breder and Rosen (1966) have described Parexocoetus mento which spawns over a period of four months.

Catches are generally high between the first and last quarter, but particularly during neap tides. Fishermen occasionally chase the schools into the nets in late afternoons from the reef crest area on neap tide. This is impossible during the transitional and spring tides. Kojima (1969) noted that Japanese flying fish spawning schools form around 4 pm and begin to go to the bottom around 8 pm. These are the times our fishermen normally go out to fish.

Highest catches have been observed between the first quarter and full moon. Does this mean that monthly peak spawning seasons occur during the transitional period or during the highest tide? On Atiu, Cook Islands, spawning occurs in each month from June to December with peaks in July and August (Mokoroa, 1984). The moon's phase is not specified but it supports a probable spawning period being observed.

Some lagoon fin fish like mullet correspond their spawning with full moon (pers. obs.) and migrate to the ocean side to spawn. It is understood that water temperature, wave movement and other factors play a role in the inducement of spawning. Is the slight change in water temperature and wave movement during transitional and spring tide period that play a significant role in flying fish spawning and which have caused them to migrate inshore?

Wave and current movement are also known to play a role in the fertilization process in marine organisms. A flying fish may also require the same mechanism and this is probably why highest catches have been recorded between the first quarter and full moon.

The general trend shown in Figure 2 suggests that flying fish are probably most abundant at the beginning of the year and slowly decline towards December. If the months of August till December of 1993 show lower catches than those of May, June and July of the same year then the trend which has been observed by local fishermen (personal communication) over the centuries is fairly accurate as far as our observation is concerned; however, no definite conclusions can be made at this stage.

Our fishermen have reported strong westerly currents during their fishing expeditions. The same observations have already been noted by local fishermen, that is from May to August. This strong westerly current appears to be seasonal as one can deduce from local fishermen's knowledge. Any association of this phenomenon with flying fish migration is not yet known.

While modern methods of catching flying fish provide a better means of fishing with less labour, a traditional method costs less and is more appropriate to most of the fisherfolks of Kiribati. In terms of efficiency (comparing CPUEs, Fig. 3) a powered skiff is not necessarily better than a traditional craft. The later uses less manpower, no fuel and catches almost the

same number of fish per fishing trip, 5.8 and 5.1 CPUE for the skiff and canoe, respectively, for the period of September to December. A canoe is more economical and as efficient as a powered skiff. An increase in manpower may improve the catch.

A general trend in abundance over a year period has been sketchily determined and therefore more information is required. Inshore migration or spawning seasons have also been determined but more data in needed to confirm the present observations. Abundance by species can only be acquired if the flying fish species in Tarawa waters and in Kiribati as whole, can be sorted. This would require lots of effort put into this aspect. Last but not least is more and more information is required on flying fish catches and the methods used in order to provide accurate information required in the conservation and management of the resource.

TABLES

Table 1.

Skiff: Catch per unit effort (CPUE)
MONTH

	NO. FISH DAYS 1992 /1993	TOTAL CATCH 1992/ 1992	CPUE 1992/1993
January	9*	14*	1.56*
February	1 4*	3 20*	3 5*
March	22 19*	364 69*	16.5 3.63*
April	18 3*	435 35.7*	24 11.89*
May	11 8*	131 165*	11.9 20.63*
June	0 3*	0 58*	0 19.3*
July	0 3*	0 58*	0 19.4*
August	13	125	9.6
September	5	8	1.6
October	6	104	17.3
November	8	21	2.6
December	1	2	2
TOTALS	85	1193	88.5

Table 2.

Canoe: Catch per unit effort (CPUE), 1992.

MONTH	NO. FISH DAYS	TOTAL CATCH	CPUE
September	18	92	5.1
October	11	112	10.2
November	13	37	2.8
December	18	38	2.1

Note the Following:

1. The skiff has 2 crew, the canoe1.
2. Mean length of time spent by both craft is 2 h.
3. Catch is for 1 net only.
4. Catch /unit effort = No. of fish per net per two hours per fishing trip
5. Data for the first 6 months of 1993 (*)are included in Figure 2.

FIGURES

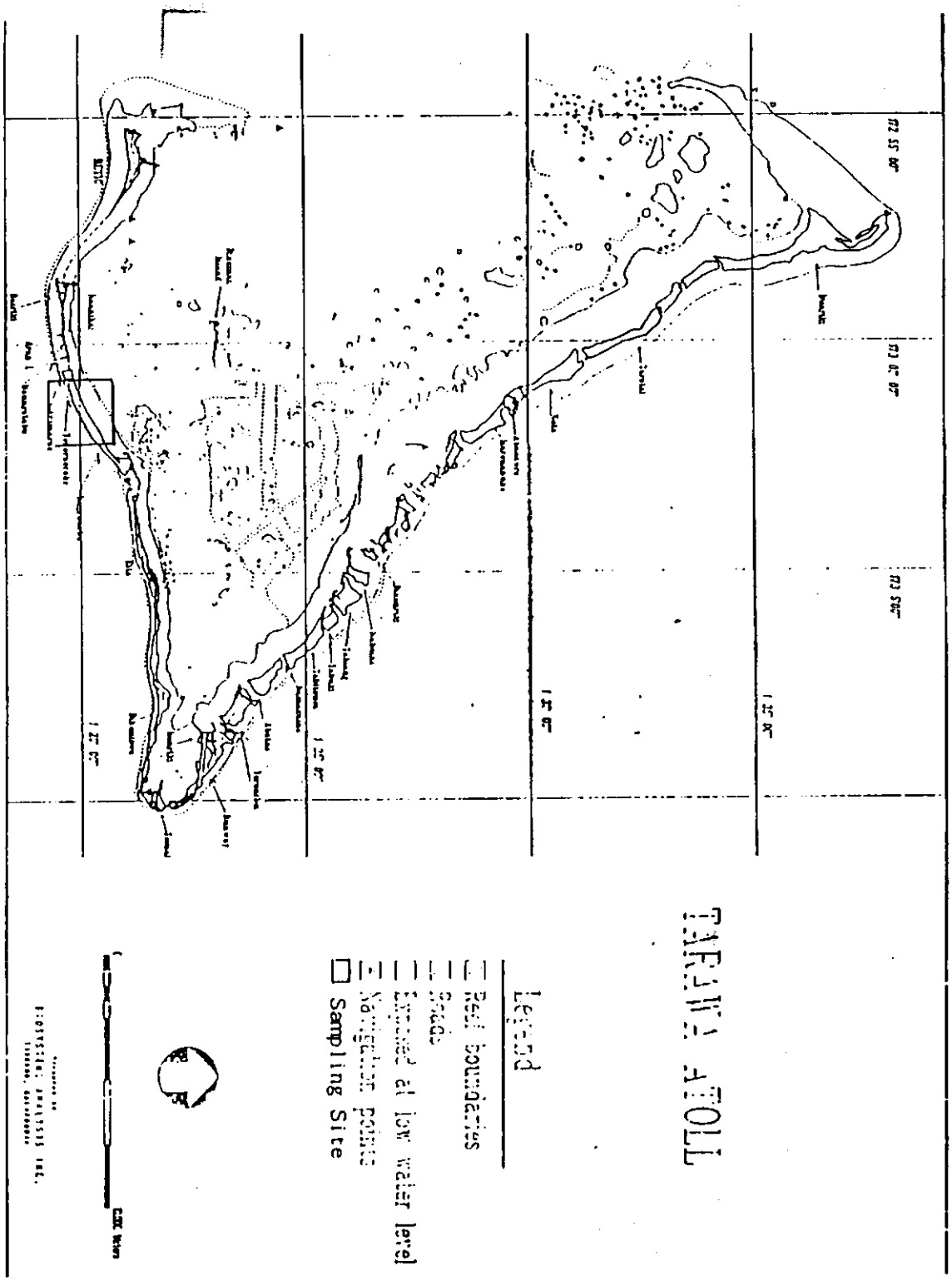

Figure 1. Map of Tarawa Atoll showing study site (boxed).

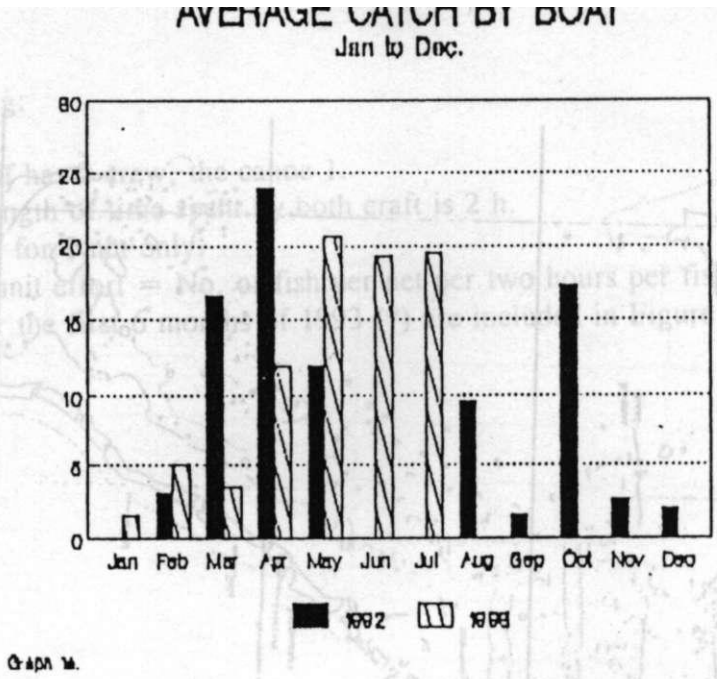

Figure 2. Histogram of CPUEs for 1992 and 1993.

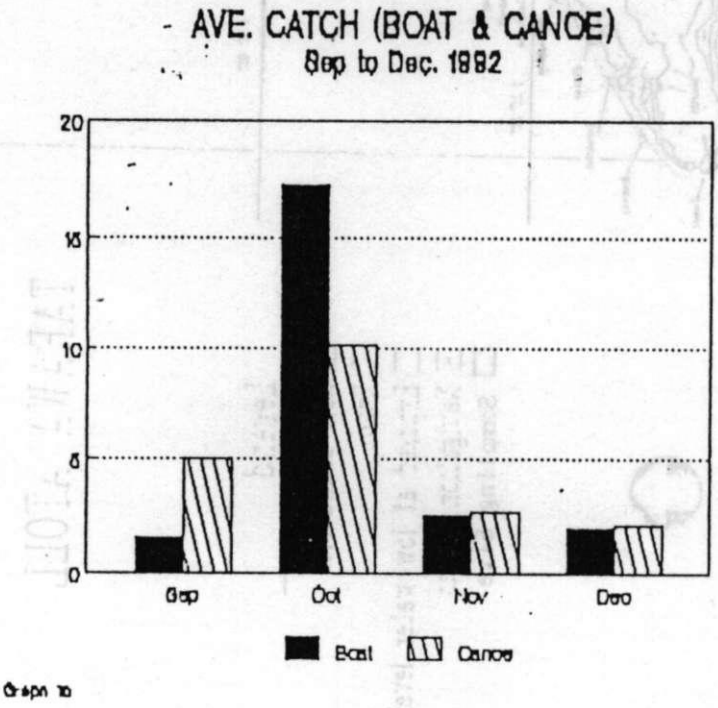

Figure 3. Histogram of CPUEs for skiff and canoe.

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