SPC/Fisheries 20/WP 6
June 6, 1988

ORIGINAL: ENGLISH

SOUTH PACIFIC COMMISSION

TWENTIETH REGIONAL TECHNICAL MEETING ON FISHERIES
(Noumea, New Caledonia, 1 - 5 August, 1988)

TUNA TAGGING ABOARD SKIFFS IN KIRIBATI
(Paper Prepared by the Secretariat)

Background

1. An ad hoc meeting of Fisheries Officers and Fishery Specialists held in March 1988 at the South Pacific Commission headquarters discussed the implementation and activity plans for the upcoming Regional Tuna Tagging Project. The primary objective of the project is to study the amount that different tuna fisheries in the region interact with each other. Assessing the potential effects that large-scale commercial fisheries may have on traditional and local small-scale fishing methods is an explicit component of this work.

2. Kiribati has one of the most active commercial small-boat tuna fleets in the Pacific and also has extensive licensing agreements with Distant Water Fishing Nations. The Kiribati Fisheries Division staff have thus made clear the desire to know what levels of foreign fishing can be maintained without harming local fishing conditions. The South Pacific Commission has established a programme of tuna tagging trials to experiment with tagging techniques that might be employed to answer this and related questions. Tagging operations using small-scale fishing operations are relatively inexpensive and increase the awareness level among these fishing sectors regarding research activities. They also serve to keep scientists in touch with the problems and issues that these groups face.

3. In December 1986, the SPC conducted a pilot study on the feasibility of opportunistic tuna tagging aboard locally operated pole-and-line vessels within the region (SPC 1987). The objective of this study was to examine cooperative arrangements with locally run fishing companies to economically tag fish. The current study extends this concept to small-scale skiff tuna fishing. This report documents the results and observations of the trial tagging activities.

Project Activities

4. The South Pacific Commission assigned Tuna and Billfish Assessment Programme scientist James Ianelli to carry out the trial tagging project. Betio, the main port of Tarawa, was chosen for the study location because the largest skiff-fishing fleet is based there. Staff of the Kiribati Fisheries Division made arrangements for project implementation by holding several discussions with the local Fishermen's Association.

5. The following summarises the daily activities during the tagging trials :

April 17	Arrived Kiribati;
April 18	Met with Betio fishermen and arranged for a boat;
April 19	Fishing Maiana Bank, 67 fish tagged;
April 20	Fishing Maiana Bank, 39 fish tagged;
April 21	Fishing Maiana Bank, 26 fish tagged;
April 22	Fishing Maiana Bank, 135 fish tagged;
April 23	No fishing due to bad weather;
April 24	Fishing Maiana Bank, 189 fish tagged;
April 25	Fishing Maiana Bank, 47 fish tagged (tags finished);
April 26	Recording catches made by other boats, report writing;
April 27	Project trials complete.

Fishing

The Boats

6. The skiffs involved in pole-and-line tuna fishing are typically made of plywood and are between 5 and 7 metres long and about 2 metres wide. The freeboard is typically 1 metre and the hulls have fine vee-shaped bow entries that flatten aft for planing. Most of the 30+ boats that fish regularly are equipped with 40hp outboard motors. The fishermen care for the boats by bringing them onto the beach to a shed or shady spot when not in use. Several boats had elaborate fresh paint work and the outboard engines were well maintained. The boat used for most of the trials was smaller (5 m) and had less freeboard than average.

Fishing gear

7. For trolling, the fishermen use standard red and white tuna feathers or plastic skirts on 100 kg test monofilament hand-line with Mustad™ double hooks (size 7/0) and a swivel about 2 metres from the hook. The lures are set about 50-60 metres behind the boat. The fishing poles measure about 5 metres long and are made of bamboo or fiberglass or a combination of both. The poles are fitted with an 80 kg monofilament line the same length as the pole with a pearl-shell lure at the end. Sometimes a pole is equipped with several sets of line and lure combinations so that lures can be easily switched to accommodate the response of the feeding school.

Terminology

8. Because few skiff fishermen speak English an effort was made to record some commonly used terms for future reference. Some common Gilbertese terms related to tuna fishing and their English equivalents were recorded as follows from the local fishermen :

ENGLISH	GILBERTESE	ENGLISH	GILBERTESE
- pearl shell lure	kaneati	- tuna fishing pole	kainroa
- pole-&-line fishing	noaroa	- skiffs	skiffs
- trolling	katiki	- hook	matawa
- yellowfin (small)	baiura	- yellowfin (big)	ingimea
- bigeye	kau-ka-noanimata	- skipjack	te ati
- dolphin fish	takua	- tuna school	te man
- splashing school	buroburo	- jumping school	ewe
- fast-moving school	te tari	- raft (FAD)	boera
- pearl shell	baeao	- hackle (feather)	burae
- trolling lure head	te atu	- double hook (troll)	matawa uakai
- booby bird	kota	- sooty tern	kunei
- white-headed tern	te io	- frigate bird	te itei
- tropic bird	te taake		

Fishing Methods

9. On a typical day of fishing the Maiana Bank the boats leave harbour by 0445hrs and steam for about 1 to 1.5 hours before fishing commences. The fish were biting well until about 0830 hrs after which time the schools of fish tended to pick up speed and spread out. The success of the early morning schools influenced the time the boats would return to port. As these boats generally do not carry ice for the fish (the catch is stored under the floorboards) they usually returned after 6 hours - often sooner.

10. Most skiffs operate with three crew, a helmsman and two others. The helmsman concentrates on the schools and on manoeuvring the boat into favourable spots. The two others concentrate on their trolling lines and keep watch for surface activity. The method of fishing seems to depend on the behaviour of a school at a given point in time. When the school is fast moving or deep, all three fishermen use trolling lines. If there are signs of the school surfacing (e.g. boils at the surface or trolling-line strikes) the helmsman may begin trolling with his pole-and-line. He does this by facing forward with the butt of the pole wedged under his inboard leg so that the pole extends off the skiff's stern quarter. This leaves his hands free to run the motor. The other two crew continue trolling with the lines as illustrated in Figure 1. When either or both of them get a strike the helmsman stops the boat, stands and begins to dash the pearl-shell lure across the surface of the water. If successful with the pole fishing by the time the other lures are brought in, the other two crew will engage their poles.With all trolling, as soon as a fish is hooked the boat is stopped. The line with the fish will be gently hauled in while the other is pulled in quickly with a jerking motion in order to try to attract another strike. This feature of the operation increases the chances to tag troll-caught fish because hook injury tends to be less severe.

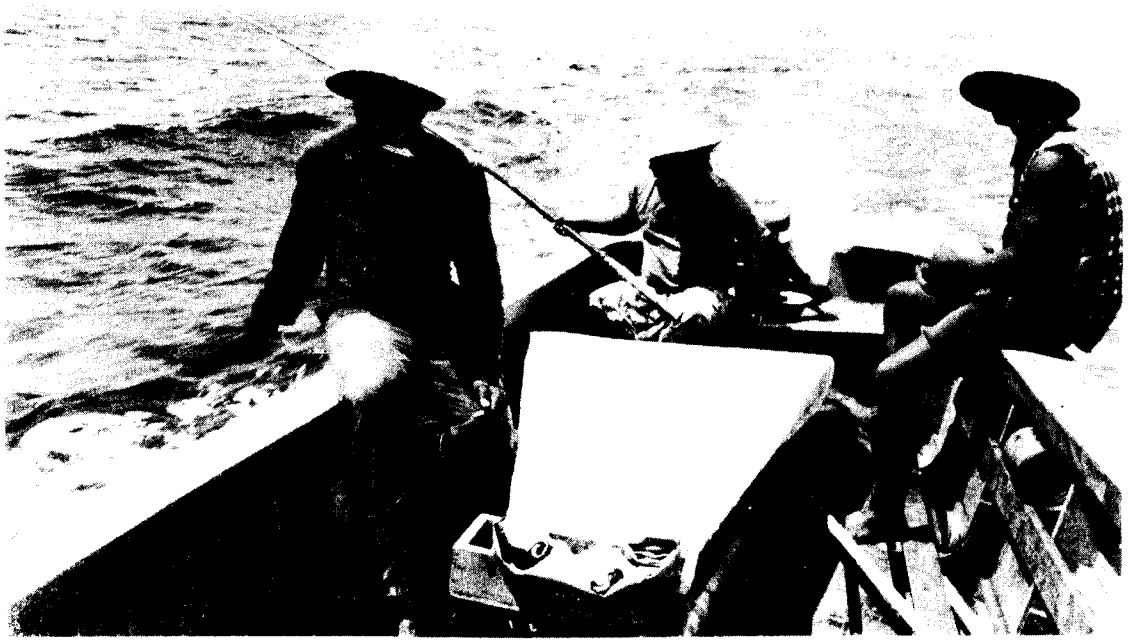


FIGURE 1. A common configuration for trolling on tuna schools aboard a Kiribati skiff. When a fish strikes one or both of the trolling handlines, the helmsman stops the boat and jigs with his pole in an attempt to attract another strike.

11. Another configuration used prior to regular pole-fishing was to have two crew trolling with their poles off the stern quarters and the third fishing with a trolling handline. When schools are clearly feeding on the surface and good for pole fishing, care is taken to bring all the trolling handlines in and make a slow approach to get in position. The motors are always turned off during the poling operation. On occasion, 10 or more other skiffs may fish within 5 or 10 metres of each other. At other times, when the local pole-and-line vessel was actively fishing, the skiffs came even closer together and would jockey for position near the bow or stern of the pole-and-line vessel. Figure 2 shows pole-and-line fish coming aboard for tagging from the skiffs. When the pole-and-line vessel was present, the biting tended to be more predictable and more sustainable.

FIGURE 2. Pearl-shell pole-and-line fishing. Notice the proximity of local Japanese-style baitboat. These skiffs take advantage of the live-bait used by the larger boat to bring and hold tuna at the surface.

Tagging

Equipment

12. Below is a list of the equipment carried on board the boat:

-cradle
-gloves
-writing slates
-pencils
-extra tags (in groups of 10)
-drinking water
-raincoat
-camera
-loaded canvas tagholder
-tape recorder (> 90 min. cass.)
-plastic bags
-ruler (to check cradle calibration)
-extra tag applicators
-hat
-backpack
-extra rope

13. Most of the equipment used was according to the standards set out in Kearney and Gillett (1982). The cradle frame was made of wood and was originally used on board one of the local Kiribati pole-and-line vessels for tagging carried out in December 1986. This cradle was modified by cutting the legs so that it rested on a triangular base with a height of approximately 50 cm. This height was ideal for the fishermen as it was several centimetres below the gunwhale and made it easy to pole fish into the cradle. It was also comfortable for tagging because the tagger could easily balance on the gunwhale during the operation of unhooking fish and tagging.

14. The device to hold the tag applicators loaded with tags was made of heavy rubberised canvas available at one of the local stores in Betio, Tarawa. The material measured roughly 1 x 2 metres. The applicators were made fast to the material by simply using them to puncture holes in the material. For each tag applicator, first one hole was made approximately 5 cm from the long edge of the material and then another about 3 cm above the first hole. The tag applicators were spaced at 2 cm intervals running perpendicular to the length of the material. The two holes for each tag applicator kept them firmly in place and enough material remained above and below the applicator to make a flap to cover the points and prevent tags from spilling out when not in use. Numbers in groups of 10 (0-9) were labelled on the 3 cm of material that covered part of the applicator. This allowed the tagger to load any series of 10 tags into the holder. The starting point of a tag series was marked with tape prior to fishing.

15. Figure 3 shows the tag holder with tags exposed and wrapped up for storage and transport. The advantages of using the canvas-type tag-holder over the conventional wood blocks aboard the skiffs were noted as :

a) being easy to handle without fear of capsizing or losing tags;
b) being lightweight;
c) not being exposed in a way that a stray fish can disrupt the tags during the flurry of poling fish;
d) being inexpensive;
e) easy loading;
f) simple and fast to make.

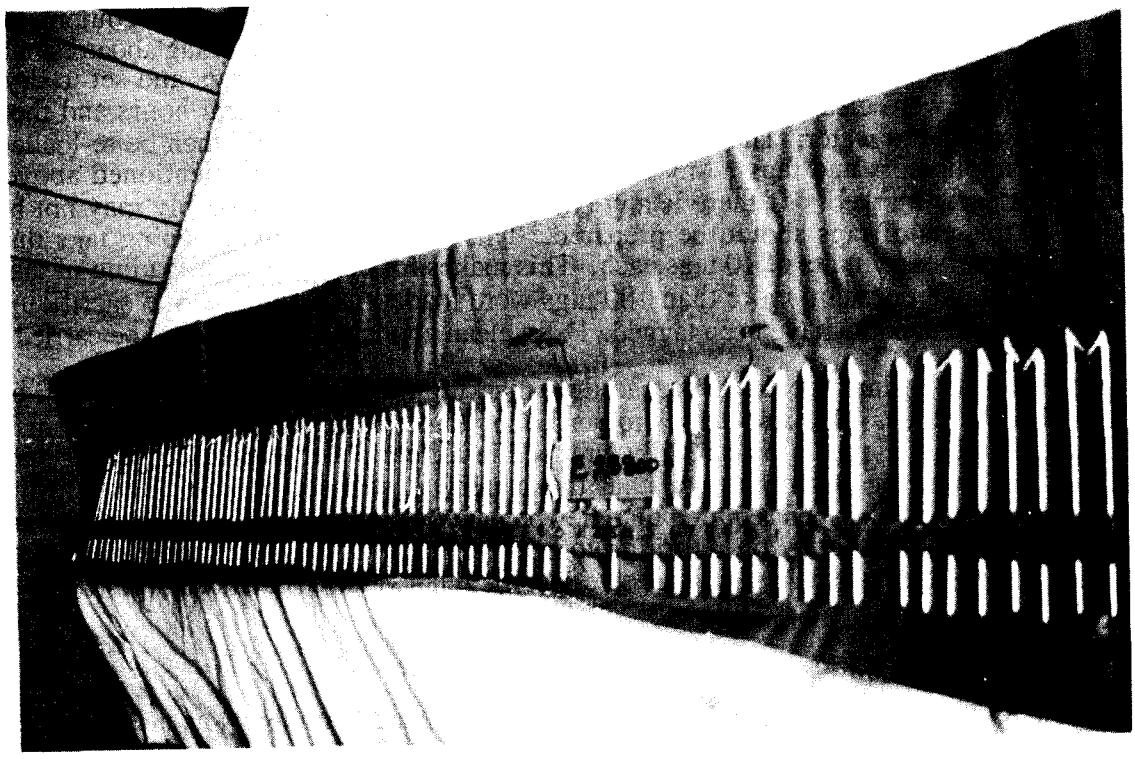
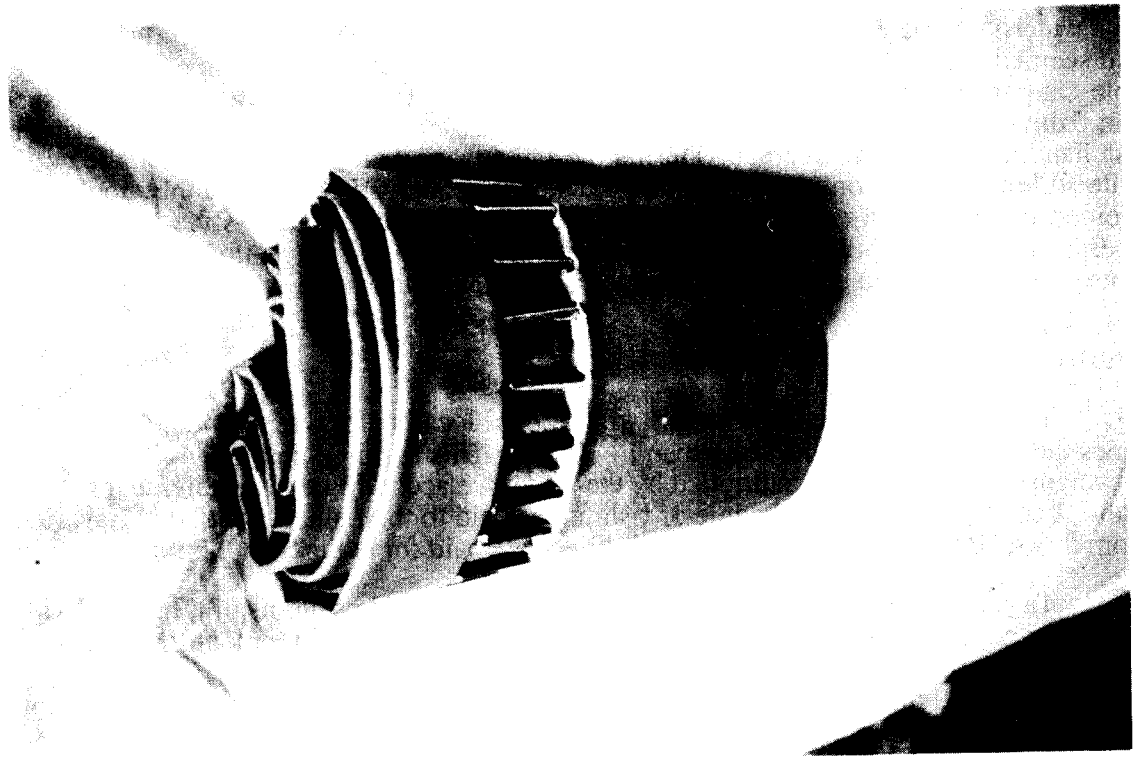


FIGURE 3. The tag holder with applicators and tags exposed (above) and rolled up for storage and transport (below).



Preparation

16. Although preparation for a day of tagging is implied by discussion of the equipment, it is included as a separate section because of its importance to successfully tag aboard small skiffs. After a day of tagging, all the equipment should be washed down and set to dry. The applicators were cleaned by soaking in a bleach solution for several hours and then rinsed with clean hot water. The tag-holding canvas, when dry, should then be re-loaded with clean applicators and tags. Any missing tags within a series, as mentioned above, should be clearly marked. If there is any chance that the loaded tag supply may not be enough, extra sets of tags should be prepared. This is best done by grouping tags that continue in a series by units of 10 tags each. This makes for easy at-sea re-loading of tags if needed. On one occasion more than 100 tags were loaded in the boat while sacrificing only a few fish that could have been tagged. Extra clean applicators should also be carried.

17. The writing slate should be prepared by marking in the next numbers that will be used in the tag series. This also serves to verify any tags missing from a series. A small cassette tape recorder should be carefully wrapped in a clear plastic bag after making sure that the tape is at the beginning and that the battery is still serviceable. Because the agreement with the fishermen required that they be paid on a daily basis, all tagged fish had to be processed immediately on returning to port. This involved converting lengths of tagged fish to weights and calculating the size specific retail value of each fish.

Tagging Method

18. Fish were closely examined prior to tagging to ensure that there was no damage to the eye or other vital part of the fish. Fish judged as not being suitable were not tagged. Initially, some fish were released with excessive jaw damage but after rendering the trolling hooks barbless, the condition of troll-caught fish improved. For troll-caught fish the crew would simply put the fish into the cradle and the tagger would remove the hook, check for injury, and then measure, tag, and release the fish. On all occasions fish for tagging were never handled roughly or by the tail as excess mucous loss and torn tendons decreases the tagged fish's chances for survival. For troll-caught fish all tag information was recorded on a waterproof slate as well as on a tape recorder. This double recording proved valuable and seemed prudent should the slate fall overboard or the tape recorder malfunction. The pole-caught fish were handled similarly but were easier to unhook. Because of the speed that fish would come aboard during poling it is critical for the tagger to have dexterity and fish handling practice to keep up. During these times it was not possible to use the writing slate so lengths were only tape recorded. The pole-caught fish were cleanly hooked and seemed to be in better condition than when taken by the Japanese-style pole-and-line operations. When poled into the skiff, fish travel less distance through the air and consequently appear to be in better condition after capture than with other methods

Fee Arrangement

19. The fee arrangement for tagging fish aboard local skiffs was negotiated to be three times the landed value to the fishermen by weight. This required that lengths be converted to weights and the weights multiplied by the unit price according to the individual fish size. Table 1 shows the normal schedule of fish prices paid to the fishermen. The only variance from this schedule was that fish less than 4 lbs were paid for at the $0.30/lb rate.

20. Tagged fish were paid on the same day of fishing and printouts of all the individual fish were made for verification and as a receipt of funds. An agreement to this end was drafted and signed by the SPC tagger and the boat owner. Clearly stated in the agreement was that fish caught that were not suitable for tagging due to hook damage or other injury would not be tagged or paid for by the SPC.

TABLE 1. Schedule of fish prices paid to local skiff fishermen (in Australian dollars).

Species	Weight range	Price/lb
YFT,BET,SKJ	4-8 lbs	$0.30
YFT,BET,SKJ	8-20 lbs	$0.35
YFT,BET	> 20 lbs	$0.45

Results

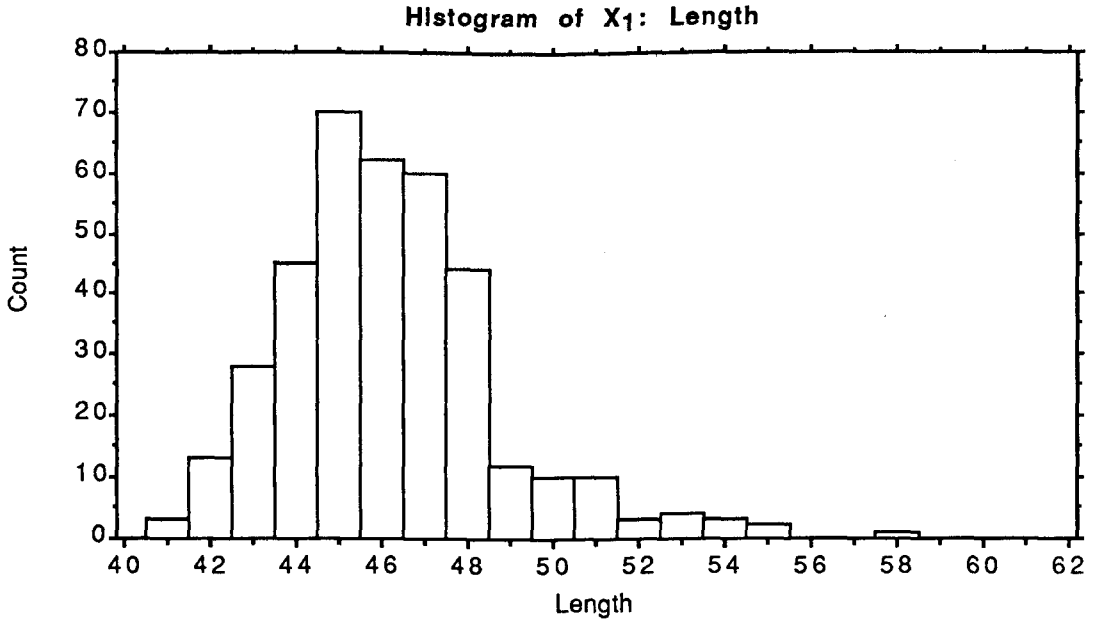
21. Six days fishing yielded 503 tagged tuna releases. Of these, 371 were skipjack, 115 yellowfin, and 17 bigeye. All tagged fish were released in the vicinity of Maiana Bank south of Tarawa (Figure 4). The capture method of the tagged fish was primarily pole-and-line (405 individuals) while troll-caught fish made significant contributions to the catch on days when the fish were not biting well (98 individuals). Initially, the troll-caught fish had a high rejection rate and were unsuitable for tagging. After the hooks were made barbless (by crimping with a pair of pincers) the condition of troll-caught fish improved. Table 2 shows the daily tagged fish information and catch not suitable for tagging.

TABLE 2. Daily record of tagged tuna releases and catch not suitable for tagging (NOTE: for April 25 the large numbers of yellowfin are due to commercially fishing when tags had run out; figures in Australian dollars).

		Fish tagged					Catch not suitable for tagging		
Date	Tot.No	SKJ	YFT	BET	Cost/ Fish	kg. tagged	SKJ	YFT	BET
19-Apr-88	67	57	5	5	$4.48	150	8	3	2
20-Apr-88	39	25	13	1	$4.72	91	12	6	0
21-Apr-88	26	22	4	0	$4.27	56	6	2	0
22-Apr-88	135	119	10	6	$3.75	255	18	3	3
24-Apr-88	189	124	62	3	$4.18	396	21	9	0
25-Apr-88	47	24	21	2	$4.33	102	28	144	8
	503	371	115	17	$4.17	1,050	93	167	13

22. The length distributions of the tagged fish by species and gear type are given in Figure 4. The average weight of the tagged fish was estimated to be 1.93 kg for skipjack, 2.33 kg for yellowfin, and 3.02 kg for bigeye. The overall average cost per tagged fish was A$4.17.

Skipjack



Yellowfin

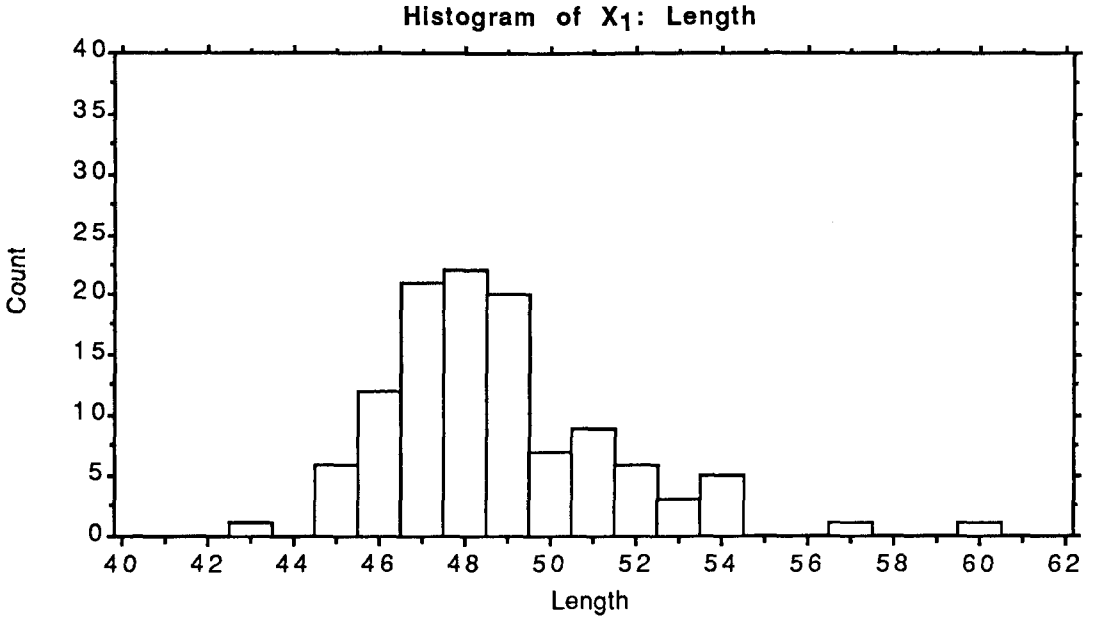


FIGURE 4. Length frequency histograms of tagged fish by species during the period of the tagging trials (continued on the next page).

Bigeye

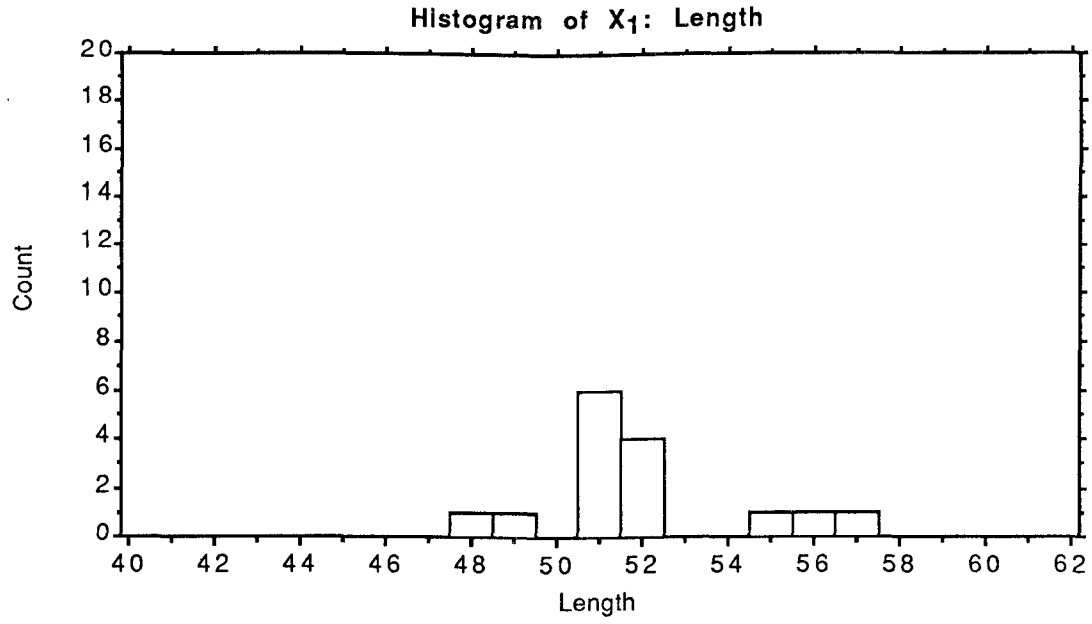


FIGURE 4 (cont'd). Length frequency histograms of tagged fish by species during the period of the tagging trials.

23. Accommodation aboard the skiffs was straight-forward and plenty of space was available for the full-sized tagging cradle on both the 5 and 7 metre skiffs that were used. The Gilbertese fishermen, like many other pole-fishermen, believe that if a fish is not landed in the boat and falls back into the water the school will dive and go away. The fishermen aboard the skiffs used for tagging were not bothered with this after several schools were fished with no bad effects on the biting. As a courtesy they requested that the fish be thrown back in the water on the side of the boat opposite the other skiffs in order to reduce potential criticism from their peers.

24. On the last day of operation all the tags were used up and the boat continued to fish commercially. In less than half an hour, more than 372 kg of yellowfin were landed. Based on this observation it was clear that, as with tagging from a pole-and-line vessel, the poling rate was faster when fishing commercially than when fishing for tagging. It was not possible to quantify the skiff's reduction in catch rate due to tagging, however, given the low average cost per tagged fish and the fishermen's eagerness to cooperate with the tagging operation, the overall arrangement was highly favourable.

25. The skiffs successfully fished pure yellowfin schools on several occasions. The ability to concentrate tag releases on yellowfin in this fishery, however, is lower than what is desired by the large-scale tagging programme that is to commence early 1989. The fishermen stated that an incentive scheme that paid only double the landed value for tagged skipjack and four times the landed value of yellowfin would be acceptable to them. This may increase the proportion of yellowfin releases but would also raise the unit price of tagged fish because of the higher fee and because the fishermen would probably target on larger, more valuable yellowfin.

Summary and Discussion

Fishing Conditions

26. The fleet of skiffs selling tuna to Te Mautari Limited, the national fishing company, have averaged as much as 32 metric tonnes per month in some years (Figure 5). During these years the value of the catch sold by skiff fishermen was over A$500,000 per annum and thus is important to the local economy. In 1987 the catch was lower for these boats and poor conditions were also experienced by the local pole-and-line fleet (M. McInnes, pers. comm.). The weather in Kiribati during 1987 was unusual with frequent strong westerly winds. This may have affected the skiff fishermen's ability to operate in the usual fishing grounds and also reduced the regularity of their fishing trips.

27. Another possible contribution to the poor catch rates during 1987 may be the *El Niño southern oscillation* phenomena (ENSO) during a period of about 18 months starting in mid-1986. The ENSO phenomena causes westerly wind and high sea surface temperature anomalies in Kiribati. An ENSO also occurred in 1982 which may explain the lower average catch per month during that year. In 1982 the westerly wind anomaly was less pronounced than in 1987 (Anon. 1987). While the stocks of (skipjack) tuna in the region do not appear to be over-fished based on current analyses of the SPC Tuna and Billfish Assessment Programme and on earlier tagging work carried out by the SPC, there are observed fluctuations in catch levels that clearly need to be monitored as the tuna fisheries of the region continue to develop.

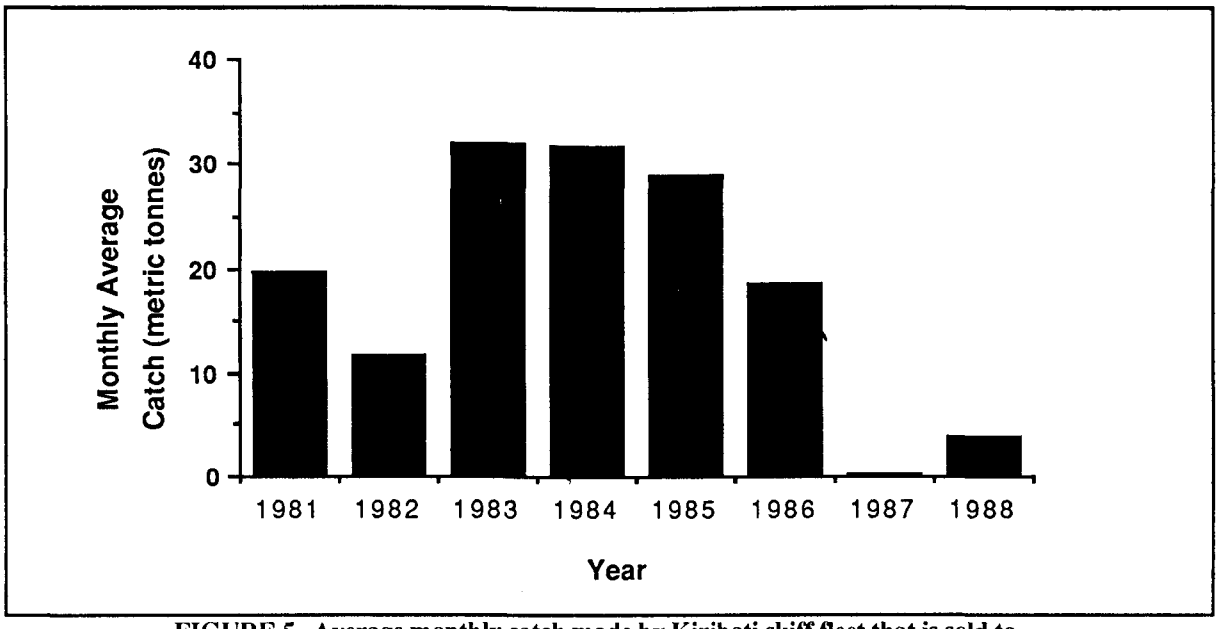


FIGURE 5. Average monthly catch made by Kiribati skiff fleet that is sold to Te Mautari Limited, the national fishing company.

28. The success of tagging significant numbers of fish from small-scale fishing boats relies primarily on the fishing conditions that prevail at the time of operation. During the period of this visit more fish were tagged than expected. The fishing conditions during the trials were about 75% better than the overall fleet in previous times. The estimated average catch per trip was 100 kg. The average catch of tagged fish was 175 kg per trip during the trial tagging period. This figure would have been higher had the tagger not been limited in the number of tags brought to Kiribati.

29. In comparison with other small-scale tagging efforts, the normal catch of about 100 kg per trip is similar to what Gillett (1985) calculated as the average catch of 30 fish per day from large skiffs (bonitiers) fishing using a similar method in French Polynesia.

Tagging

30. The fee arrangement for tagging fish worked well based on payment of three times the local landed value of tagged fish weight. The boat owner indicated that had fishing conditions been worse the arrangement would still have been agreeable. On a per-fish basis, A$4.17 compares favourably with A$6.55 per tagged fish paid during opportunistic tagging trials held aboard Te Mautari Limited vessels in December 1986 (180 fish were tagged and released). Estimates of costs per tagged fish from large-scale programmes such as the SPC's Skipjack Survey and Assessment Programme are more than A$17.00 per tagged fish using the cost of vessel charter divided by total number of releases.

31. Operationally, the local Kiribati skiffs are well suited to be used for tagging fish. Over 80% of all fish tagged were pole-caught using pearl-shell lures. The condition of these fish for tagging is normally excellent and the fishermen easily adapted to landing poled fish into the tagging cradle. The 5 metre skiff was less comfortable than the 7 metre one but was no less practical. Future projects of this type should budget for extra safety equipment (flares, emergency indicator beacon, compass) as several of these boats are lost at sea each year.

32. The upcoming Regional Tagging Programme will be attempting to concentrate on tagging yellowfin tuna. The local skiffs in Kiribati are able to successfully pole-fish pure yellowfin schools, however, they are limited in doing so because of difficulties finding such schools. The number and size of yellowfin schools may be proportionately small compared to skipjack which makes concentrating on yellowfin difficult. Discrete spots of mostly yellowfin were fished successfully most days but seemed to be only feeding--and hence vulnerable--for a limited time. After or before these times nearly pure skipjack schools were feeding and dominated the catch. This leads to the conclusion that the potential for tagging more yellowfin than skipjack aboard local Kiribati skiffs is poor unless an arrangement that would result in fewer total tagged fish was acceptable. An alternative incentive scheme that would pay double the landed value for tagged skipjack and 3-4 times the landed value for tagged yellowfin may help increase the proportion of yellowfin released but may also cause the fishermen to go after larger fish which would inflate the cost of tagging considerably.

33. Finally, information about the goals of tagging projects was communicated as far as possible. An announcement was prepared and translated by the Fisheries Division staff regarding the project and was broadcast on the local radio. A new T-shirt was also designed as incentive for returning recaptured fish.

34. At the time of printing, 2 tagged skipjack have been recaptured from Maiana Bank near where the releases were made. Both fish were originally caught using the pearl-shell pole-fishing technique.

Acknowledgements

35. I would like to thank the staff of the Fisheries Division, in particular CFO Tekabu Tikai, Being Yeeting, and Dr. Chris Mees--without their help the trials would not have been possible. Mr. Simon Bland and the staff of Te Mautari Ltd. provided every assistance in using their facilities and with collecting the ancillary data. Finally, I would like to thank the skiff fishermen of Betio for hosting me aboard their boats, in particular, Mr. Akori Tongarua.

References

Anon. 1987. Climate diagnostics bulletins. Climate Analysis Center, *National Weather Service, NOAA* .

Gillett, R.D. 1985. Tuna tagging using Tahitian bonitier vessels. Unpublished Trip Report, March 1985. South Pacific Commission, Noumea, New Caledonia.

Kearney, R.E. and R.D. Gillett. 1982. Methods used by the Skipjack Survey and Assessment Programme for tagging skipjack and other tuna. In Kearney, R.E. (ed.). Methods used by the South Pacific Commission for the survey and assessment of skipjack and baitfish resources. Tuna and Billfish Assessment Programme Technical Report No. 7, South Pacific Commission, Noumea, New Caledonia.

SPC. 1987. Summary Tuna and Billfish Assesment Programme activities . Working Paper 5. *Nineteenth Regional Technical Meeting on Fisheries 3-7 August 1987.* 29 pp. South Pacific Commission, Noumea, New Caledonia.

SPC/Fisheries 20/WP.6/Add. 1
25 July 1988

ORIGINAL: ENGLISH

SOUTH PACIFIC COMMISSION

TWENTIETH REGIONAL TECHNICAL MEETING ON FISHERIES

(Noumea, New Caledonia, 1 - 5 August 1988)

TUNA TAGGING ABOARD SKIFFS IN KIRIBATI

(Paper Prepared by the Secretariat)

ERRATUM

Page 9, para. 21, 3rd line ____ "Figure 4" should read "Figure 4a"

Note : Figure 4a attached.

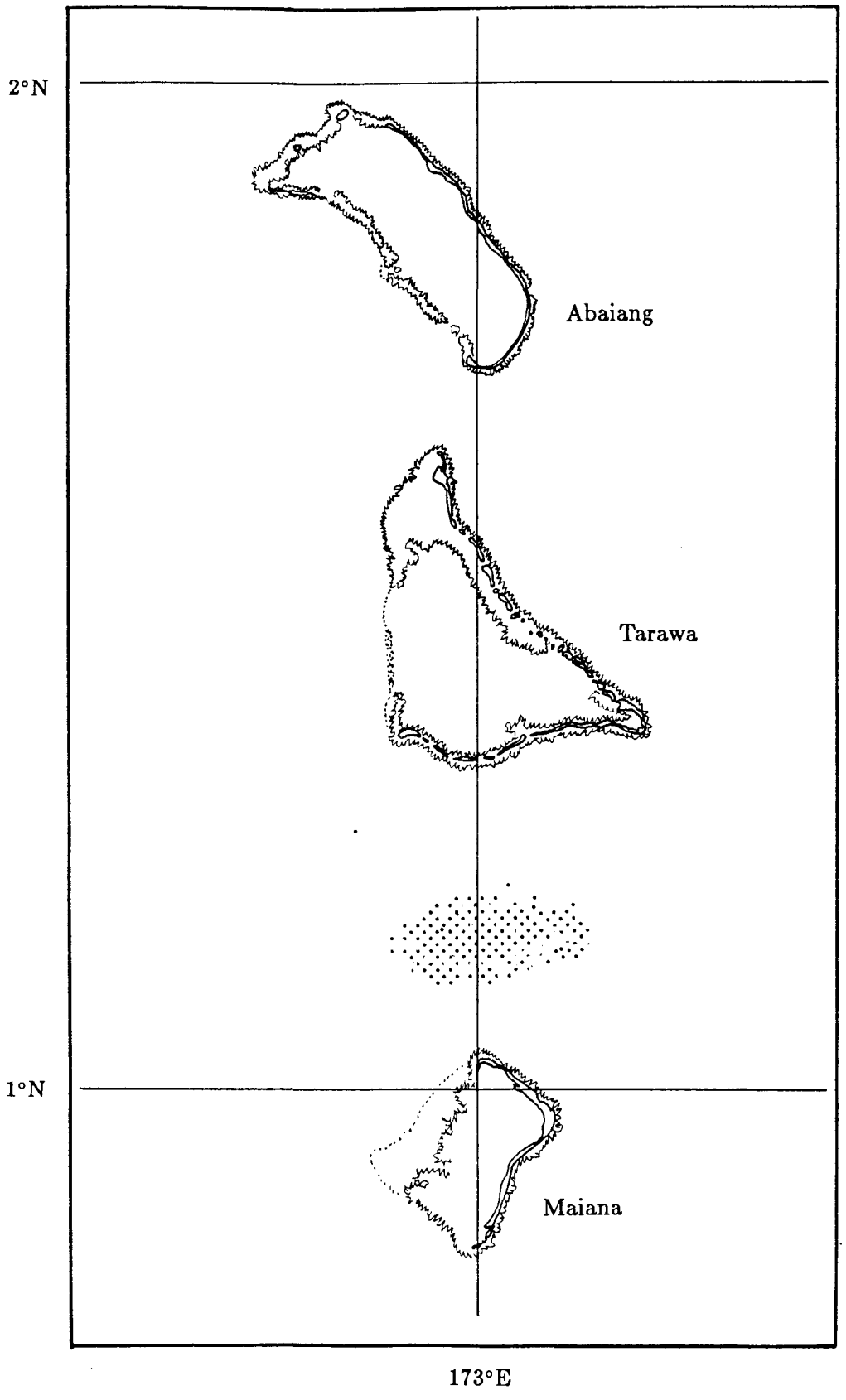


FIGURE 4a. Area of tagging operations during the trial period, April 18-25, 1988.