(AF) 53－11
(FI) 78－2

REPORT
ON
A DEVELOPMENT SURVEY OF FISHERY RESOURCES
IN
THE GILBERT ISLANDS

June 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

The Gilbert Islands are expected to become independent from the United Kingdom in near future. The phosphate rock which has constituted the economic basis of the Islands is now nearing exhaustion, and the development of the abundant fishery resources which replaces the phosphate rock has become the matter of urgency. In such a situation, the Government of Gilbert Islands which had been requesting Japan to cooperate in her fishery development, dispatched to Japan in July 1976 its chief Minister asking for an early implementation of fishery cooperation.

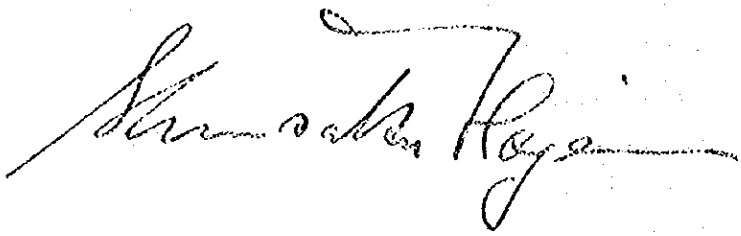
Recognizing the importance of the fishery in development to the Gilbert Islands and with a view to promoting friendly relations with the Islands in the same Pacific, the Government of Japan decided to positively respond to the request and the Japan International Cooperation Agency dispatched a preliminary survey team to the Gilbert Islands for 17 days stating from November 26, 1976, to conduct a survey on background of this request and collect information required for the fisheries development.

Based on the result of the survey, the Government of Japan made a recommendation to the Gilbert Islands to conduct a coastal survey mainly consisted of the skipjack bait fishing. As the Government of Gilbert Islands accepted the recommendation, the Agency dispatched a team in June 1977 to discuss the details of the survey to be conducted. Based on the Scope of Work agreed upon, a coastal survey was conducted from Setpember 18, 1977 to March 18, 1978.

The present report presents the result of the coastal survey mentioned above. I hope that the report will serve to facilitate a smooth cooperation between two countries and contribute to the fisheries development of the Gilbert Islands.

I wish to express my sincere appreciation to the Government and people of the Gilbert Islands who have extended kind cooperation to our teams.

June 1978



Shinsaku Hogen
President

C O N T E N T S

LIST OF TABLE & FIGURE

I. SUMMARY

Marine survey on skipjack, bottom fishes and bait fishes for skipjack pole-and-line fishing was conducted by the skipjack pole-and-line fishing vessel, Daini Kyōryō-Maru (59.98 ton) based at Betio Port located at Tarawa Island of the Gilbert Islands for 119 days from November 7, 1977 to March 5, 1978. The summary of the survey result is as follows:

Table 1. Catch by Navigation

Order of Navigation	Survey Area	Period		Number of days	Catch			
		Started	Ended		Bait Fish (bucket)	Pole-and-line (kg)	Trolling (kg)	Vertical Long Line (kg)
1	Abaiang Marakei	'77 11. 7	11.16	9	90	2,094		
2	Butaritari	11.17	11.25	8	210	2,738		
3	Maiana Abemama	11.29	12. 5	6	19	1,225		
4	Abemama Aranuka	12. 6	12.13	7	106	3,864		
5	Tabiteuea	12.16	12.20	4	40	759		
6	Nonouti Beru Onotoa	12.25	'78 1. 2	8	2	571		
7	Butaritari	1. 4	1.10	6	133	853		
8	Abaiang Maiana	1.12	1.16	4	121	137		
9	Abaiang Abemama	1.18	1.24	6	146	1,258		
10	Butaritari	1.26	2. 1	6	121	124		
11	Abemama	2. 3	2. 9	6	142	429		
12	Nonouti Maiana	2.10	2.18	8	78	1,542		
13	Abaiang Maiana	2.20	2.26	6	85	2,416		
14	Maiana Tarawa	2.27	3. 5	6	78		361	1,358
Total		119 days		90	1,371	18,010	361	1,358

Note: About 3 kg in one bucket

II. PURPOSE OF THE SURVEY

The purpose of the survey was to clarify the abundance of bait fishes for skipjack pole-and-line fishing and their aptitude as bait fishes in the waters of the Gilbert Islands, and to conduct the survey on distribution of skipjack in order to examine the possibility of the skipjack resources development in the islands.

III. OUTLINE OF THE SURVEY

1. Important Items of the Survey

1) Catching test of bait fishes and survey on kinds, distribution and behavior of bait fishes around the lagoon in the Gilbert Islands.
2) Keeping test of bait fishes using bait pen.
3) Endurance test of bait fishes in live bait well on board.
4) Aptitude test of bait fishes by skipjack pole-and-line fishing and skipjack catching test.
5) Skipjack catching test by trolling.
6) Bottom fish catching test by vertical long line.
7) Aptitude test of cultured milkfish as bait fish.

2. Survey Vessel

Table 2. Specification of Survey Vessel

Name of Vessel	Daini Kyōryō-Maru
Owner	Kentoku Kanna
Registered No. (Fishing vessel)	ON 2-0214
Material of vessel	Wood
Date of construction	September, 1968
Gross tonnage	59.98 tons
Principal measures	21.54 x 4.70 x 2.17
Engine	Main-Akasaka Diesel 380 ps 1 unit Aux.-Yanmar Diesel 48 ps 2 units
Radio equipment	SSB transceiver 1 set
Navigation equipment	Rador, Fish finder
Refrigerator equipment	None
Complement	25 persons

3. Period and Area of the Survey

3-1. Vessel Chartering Period

From October 6, 1977 to March 30, 1978: Total 176 days

3-2. Period of the Survey Conducted

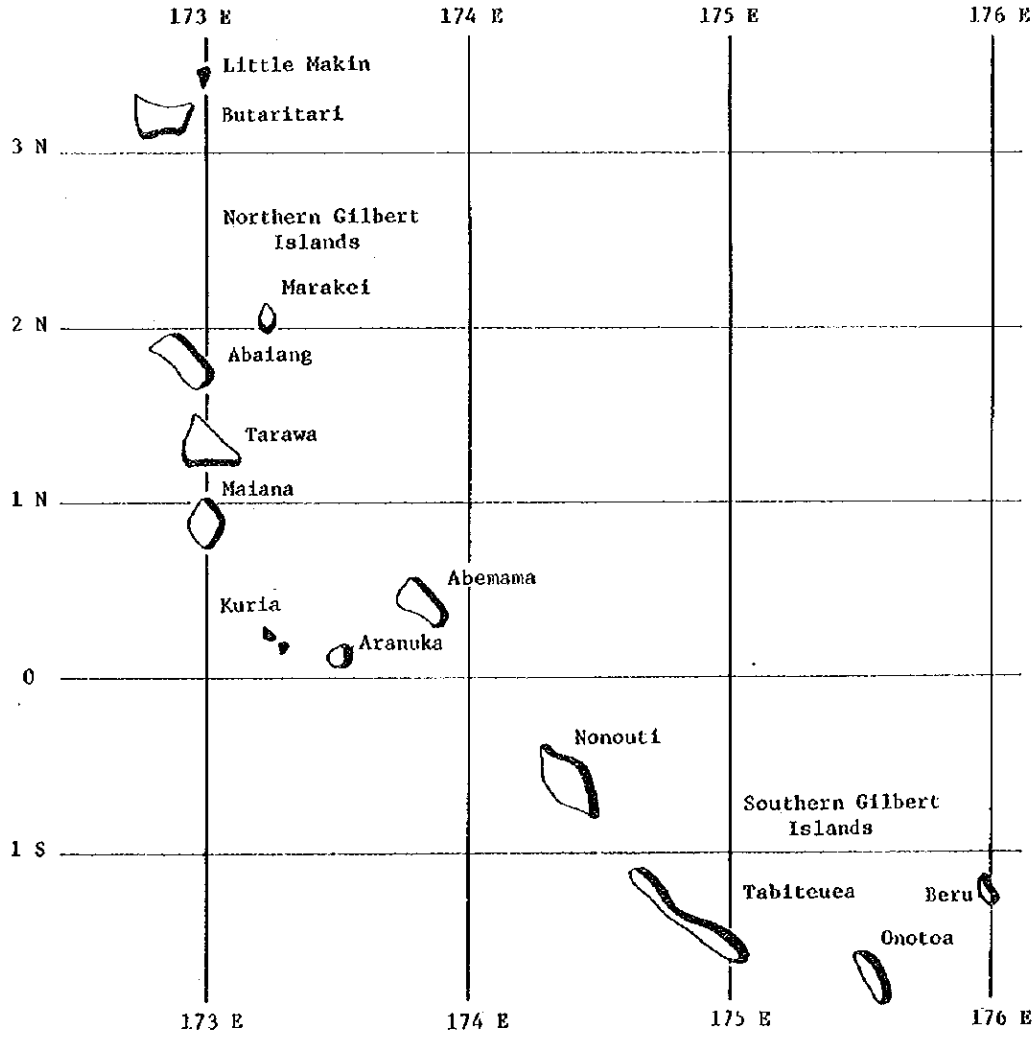
From November 7, 1977 to March 5, 1978: Total 119 days

3-3. Survey Area

Areas around and in and out of the lagoon of the following islands among the Gilbert Islands:

Tarawa, Abaiang, Marakei, Butaritari, Maiana, Abemama, Kuria, Aranuka, Nonouti, Onotoa, Beru, Tabiteuea.

Figure 1. Survey Area



4. Staff Formation

4-1. Research Specialists and Crew

Research Specialists

Takuji Hirota, Iwao Shindō — Total 2 persons

Crew

Saburō Kishimoto	Master Fisherman
Katsunori Kawamitsu	Captain
Kōjiro Ohguro	Chief Engineer
Rinnosuke Kiyomiya	Chief Radio Operator
Others 6 persons	Total 10 persons

4-2. Staff Formation by Navigation

Table 3. Staff Formation by Navigation

Order of Navigation	Research Specialist	Japanese Crew	Local Crew	Officer in Locality	Total
1	Hirota, Shindō	10	12	1	25
2	Hirota	10	12	1	24
3	Shindō	10	12	1	24
4	Hirota	10	10	2	23
5	Shindō	10	10	1	22
6	Shindō	10	9	0	20
7	Shindō	10	9	2	22
8	Hirota	10	12	1	24
9	Shindō	10	11	1	23
10	Hirota	10	11	2	24
11	Shindō	10	12	0	23
12	Hirota	10	12	1	24
13	Shindō	10	10	1	22
14	Hirota	10	9	0	20

5. Itinerary of Survey Vessel

5-1. Itinerary of Survey Vessel

Table 4. Itinerary of Survey Vessel

Date	Items	Order of Navigation	Navigation Status					Remarks
			Anchored	Sailed	Operated	Not operated	Total	
Oct.6,'77	Started charter vessel		1				1	Supply, material loading
7	Lv. Hiseki	Outgoing		13			13	
20	Ar. Ponape		9				9	Supply, material unloading
29	Lv. Ponape			5			5	
Nov.3	Ar. Tarawa		4				4	Preparation for fishing
7	Lv. Tarawa	1			9		9	Survey around Abaiang and Marakei
16	Ar. Tarawa		1				1	Supply
17	Lv. Tarawa	2			8		8	Survey around Butaritari
25	Ar. Tarawa		2			2	4	Supply, rough sea, repairing of boat
29	Lv. Tarawa	3		1	4	1	6	Survey around Abemama and Maiana
Dec.5	Ar. Tarawa		1				1	Supply, repairing of boat
6	Lv. Tarawa	4		2	4	1	7	Survey around Abemama and Aranuka
13	Ar. Tarawa		2		1		3	Supply, repairing of boat
16	Lv. Tarawa	5		1	2	1	4	Survey around Tabiteuea
20	Ar. Tarawa		4		1		5	Supply, repairing of boat
25	Lv. Tarawa	6		3	5		8	Survey around Nonouti, Beru and Onotoa
Jan.2,'78	Ar. Tarawa		2				2	Supply, repairing of boat
4	Lv. Tarawa	7		1	5		6	Survey around Butaritari
10	Ar. Tarawa		2				2	Supply
12	Lv. Tarawa	8			4		4	Survey around Abaiang and Maiana
16	Ar. Tarawa		2				2	Supply, repairing of boat
18	Lv. Tarawa	9		1	5		6	Survey around Abaiang and Abemama
24	Ar. Tarawa		2				2	Supply, repairing of boat
26	Lv. Tarawa	10			5	1	6	Survey around Butaritari
Feb.1	Ar. Tarawa		2				2	Supply
3	Lv. Tarawa	11	1		5		6	Survey around Abemama
9	Ar. Tarawa		1				1	Supply
10	Lv. Tarawa	12		2	6		8	Survey around Nonouti and Maiana
18	Ar. Tarawa		2				2	Supply
20	Lv. Tarawa	13	1	1	4		6	Survey around Abaiang and Maiana
26	Ar. Tarawa		1				1	Supply
27	Lv. Tarawa	14	1		4	1	6	Survey of trolling and vertical long line around Maiana
Mar.5	Ar. Tarawa		3				3	Preparation for closing, supply
8	Lv. Tarawa	Returning		10			10	
18	Ar. Guam		2				2	Supply
20	Lv. Guam			8			8	
28	Ar. Hiseki		3				3	Material unloading
30	Finished chartering							
Total			51	46	72	7	176	

5-2. Outline of Navigation Status

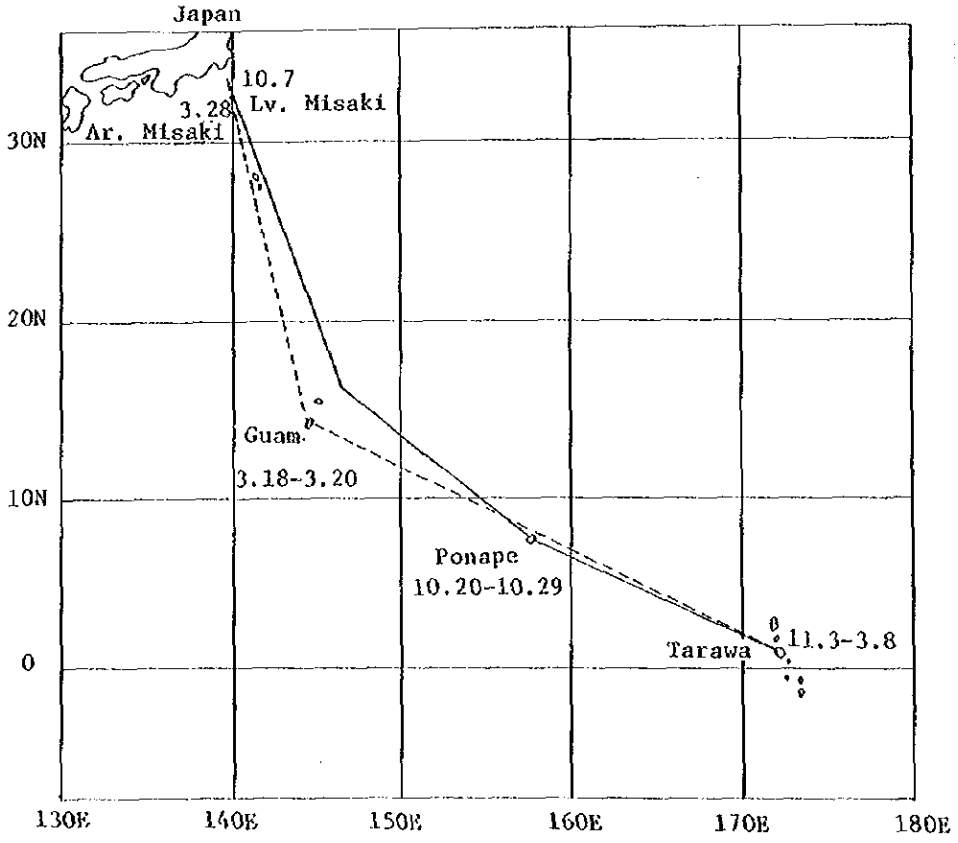
Table 5. Outline of Navigation Status

Division	Contents	Number of days	Total
Anchored	Japan	4	49
	Port of call	11	
	On the spot	34	
Sailed	Outgoing and returning navigation	36	48
	Fishing ground transfers	12	
Operated	Search, operation	72	72
Not operated	Rough sea, accidents	7	7
Total			176

5-3. Navigation Trail

Figure 2. Navigation Trail

Sold line : Outgoing navigation
Dotted line: Returning navigation



IV. CONTENTS OF THE SURVEY

1. Object of the Survey

1-1. Bait Fish Catch and Keeping Test

Bait fish catching and the keeping test using bait pens were conducted and surveys on the distribution, qualifying fishing methods and possibility of the stable supply of bait fishes in the waters around the lagoon of the Gilbert Islands were conducted.

1-2. Keeping Test of Bait Fishes and Catching Test of Skipjack

Along with the keeping test of bait fishes, the catching test of skipjack was conducted in the live bait well on board in order to survey the aptitude of bait fishes and the distribution of skipjack.

1-3. Catching Test by Trolling and Vertical Long Line Fishing

The catching test of pelagic by trolling and catching test of bottom fishes by vertical long line were carried out in order to survey the possibility of fishings other than the skipjack pole-and-line fishing.

2. Survey Items

2-1. Survey on Bait Fish

2-1-1. Survey on Fishing Ground Environment

Meteorological observations (weather, wind direction and force, air temperature and pressure) and oceanographic observations (wave, water temperature, transparency, depth, bottom materials and current) were made for each operation.

2-1-2. Catching Test

By carrying out the catching test using stick-held dip net, drive-in net, and purse seine fishings; and attaching the number of fish schools at each operation, the moon age, position, operation hour, and number of catches by fishing methods and fish kinds were recorded.

2-1-3. Biological Survey

The configuration of the fish kind of catches were surveyed. For major fish kinds, 20 fishes were extracted at a time in random by fish schools and kinds in order to measure the body length, and maturity degree of sexual gonad, and to check the sex. Also, 100 fishes were extracted at a time in the same way, and the body length was measured.

2-1-4. Keeping Test

Survival test in bait pens for transportation and keeping, and in live bait well were carried out, and the transition of the survival condition was observed.

2-2. Catching Survey on Skipjack

2-2-1. Survey on Fishing Ground Environment

Meteorological observations (weather, wind direction and force, air temperature and pressure) and oceanographic observations (wave, water temperature) were made for each finding of fish schools.

2-2-2. Catching Test

The number of fish schools was attached at each finding of fish schools, and the moon age, position, operation hour, status of schools, amount of used bait fishes by fish kinds, and amount of catches using pole-and-line fishing by fish kinds were recorded.

2-2-3. Distribution of Fish Schools by Visual Observation

The presence of fish schools was confirmed by visual observation. By checking the size of fish kinds and schools, the number of fish schools was attached to only those that were caught, and the moon age, position, finding hour, status of fish schools, and fish kinds were recorded.

2-2-4. Biological Survey

By taking 20 fishes by fish schools and kinds at a time in random (totaling 280 fishes in 14 times), the body length, weight, sex, maturity degree of the sexual gonad and stomach contents were recorded. Also, 100 fishes were taken at a time in the same way in order to measure the body length.

2-3. Survey on Fishing Gears and Methods

2-3-1. Bait Fishing

Stick-held Dip Net .. Fishes were attracted by fish lamps during the night, and were caught using stick-held dip net.

Drive-in Net ..... The presence of the fish school was confirmed during daytime and by menacing and guiding the fish school by men's hand, they were caught by driving them in to the drive-in net.

Purse Seine ..... The presence of the fish school was confirmed during daytime, and by carrying the purse seine by men's hand into the sea, the fish school was surrounded and caught.

2-3-2. Keeping Test of Bait Fishes

By pulling the bait pens used for transportation purpose which contained bait fishes by boats, and by setting the bait pens used for keeping purpose to the fixed position or using a live bait well on board, the keeping test of bait fishes was carried out.

2-3-3. Skipjack Fishing

Fish schools were guided towards the vessel by throwing in live baits and water-spraying, and by the pole-and-line fishing using feather jigs, the catching test was conducted.

2-3-4. Survey on Bottom Fishes and Trolling Catch

The catching test of bottom fishes living near the reef using the vertical long line was conducted. Also, the catching test of pelagic fishes living in the open sea using the trolling gear was conducted.

2-4. Tagging Test

269 fishes including skipjack and yellowfin tuna were released using the tags supplied by the Tōhoku Regional Fishery Research Laboratory, and for each releasing, the date, position, estimated weight and body length were recorded.

V. FINDINGS OF THE SURVEY

1. Survey on Bait Fishes

1-1. Topography

The Gilbert Islands are the group of lagoon islands arranged in the direction of NW-SE having the equator in between. Among the 12 islands which were the objects of the survey area, 11 islands, excepting the Kuria Island, form the lagoon. Their long and slender axis extends in the direction of NW-SE, and the west side at which lagoons are formed is the fishing ground of bait fishes.

Lagoons are connected to the open sea by their rifts, but these water ways are generally narrow and shallow. Thus, the islands in which the main vessel can pass through are limited to the following 6 islands: Tarawa, Abaiang, Butaritari, Abemama, Nonouti and Tabiteuea; however, since the swell of the open sea directly enters into lagoons and extremely high waves are formed near the entrance in the period of seasonal easterly winds, it would be difficult for the vessel to enter into the lagoon of the islands other than Tarawa and Butaritari. There are only few favorable anchoring spots outside the lagoon.

1-2. Fishing Ground Environment

Although it is generally said that the weather in the period from late March to late October is stable and fine with the easterly wind of the beaufort scale 2-4, the survey period was in a season of strong westerly wind often accompanied by storms from late November. Although from early February, it was switched to a northly wind, the survey suffered a lot in a bad weather until its completion.

Any lagoon, which is opened to the open sea from the western side, is easily directly affected by the swell and westerly wind. In the season of westerly wind, the condition of the water of lagoons becomes easily rough, and the water becomes white and muddy due to the soaring up of sands and muds lying at the sea bottom.

In this kind of case, the fish school of bait fishes does not easily appear.

1-3. Distribution and Behavior of Fish Schools

At the area outside the lagoon, any fishes which will be the bait fish was not caught. Among the fishes caught in the lagoon, those which could be used for skipjack pole-and-line fishing were as follows:

Japanese Name	Scientific Name	English Name	Local Name
(1) Nishin family	Clupeidae		
Mizun	Harengula ovalis	Gold-spot herring	Te Tarabuti
	Harengula punctata		
(2) Tougoroiwashi family	Atherinidae		
Yakushimaiwashi	Pranesus pinguis	Hardy head or Silver-side	Te Rerekoti
(3) Urumeiwashi family	Dussumieriidae		
Minamikibinago	Spratelloides delicatulus	Blue-backed sprat	
Niseginiwashi	Dussumieria hasseltii		
(4) Tenjikudai family	Apogonidae		
Tenjikudai	Archamia Lineatus	Cardinal fish	
(5) Aji family			
Muroaji	Decapterus lajang	Mackeral-scad	

1-3-1. Harengula Ovalis

Being the most important bait fish in the area of this survey, Harengula ovalis accounted for 84% of the overall catch of bait fishes. A lot were caught in lagoons of Tarawa and northward, Abaiang, and Butaritari, while only few were caught in the southward, Maiana, Aranuka and Abemama, and in the further southern islands, none of them were found. Since there are records telling the great amount of catch in Maiana and Abemama, their appearance even in the southern area is possible depending on the period. They migrate forming a highly densed fish school, but it seems that they will not rise in deep waters.

When the high tide is nearly in the maximum state, they come around the coast and rise nearly up to the surface. In shallow places, since they will approach even to the depth as 70-80 cm, the visual observation of fish schools can be easily made, however, since they will not come up to the surface, when the water is muddy or wavy, the observation becomes difficult. At the highest tide, they will move to deep areas, but in a shoaling coast, there are tendencies that they remain near the coast even at the highest tide. In this case, they move along the coastal line forming into a school of a long and narrow band. They are extremely active and their movements are quick.

Since they will spread in all directions when they are menaced, guiding them to an expected direction by menacing can be hardly done. Generally, there is a tendency that their appearances increase at major tide and decrease at minor tide. There are many cases when Spratelloides delicatulus are mingled with the fish school of Harengula ovalis. Due to the fact that the growth of the gonad is observed around November and fries become numerous from December to January, it is speculated that the spawning takes place from November to December. Although they have a nature to gather around lamps, it is not remarkable. When the underwater lamp is used, they will not approach to the area around the center of the lamp, but they will swim irregularly surrounding the lamp at distance. The body length distribution of Harengula ovalis by survey areas is as shown in Figures 3, 4 and 5. It was found out that there are differences by areas. The ranges were 30-95 mm in Butaritari, 50-85 mm in Abaiang, and 30-95 mm in Abemama.

Figure 3. Body Length Distribution of Harengula Ovalis (Butaritari)

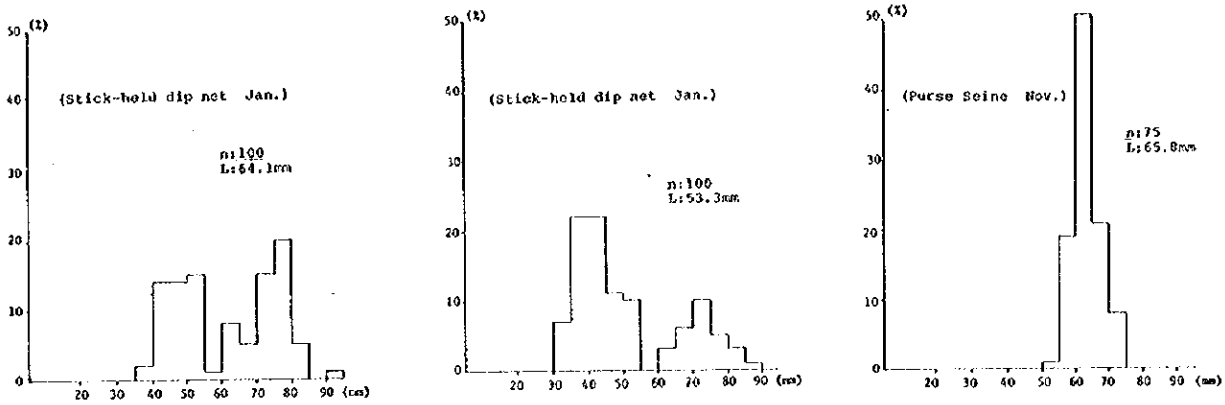


Figure 4. Body Length Distribution of Harengula Ovalis (Abaiang)

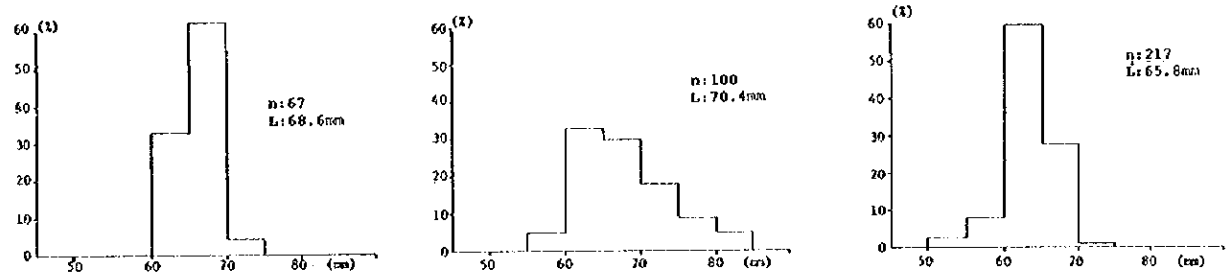
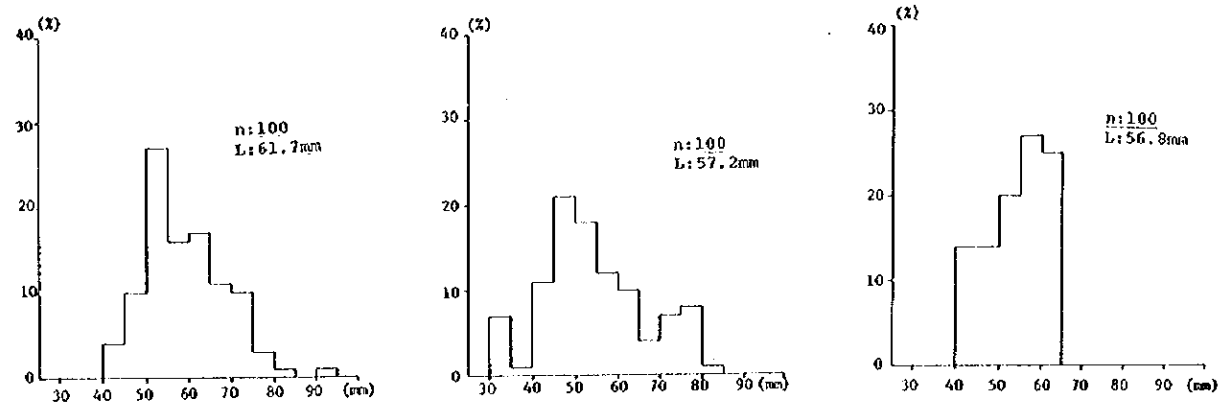


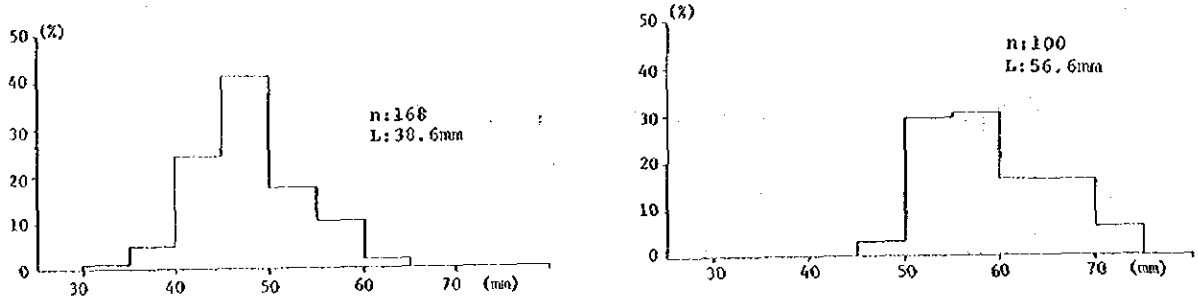
Figure 5. Body Length Distribution of Harengula Ovalis (Abemama)



1-3-2. Pranesus pinguis

Pranesus pinguis accounted for 6.2% of the overall catch of bait fishes. They rather mingle with the fish school of Harengula ovalis than migrate independent in a separate school. When they form into a separate school independently, the school is small. The status of distribution is the same as Harengula ovalis. Their nature to gather around lamps is more remarkable than that of Harengula ovalis. The body length distribution of caught Pranesus pinguis is illustrated in Figure 6. The body length ranged from 30 to 75 mm, and in those from 45 to 50 mm, mode was observed.

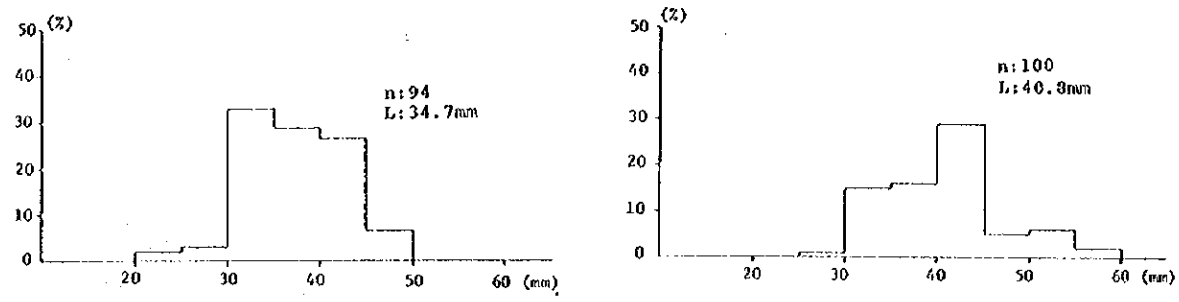
Figure 6. Body Length Distribution of Pranesus Pinguis



1-3-3. Spratelluides delicatulus

Spratelloides delicatulus accounted for 5.3% of the overall catch of bait fishes. The fish school has never been observed during daytime. Since they have a nature to gather around lamps, they are caught by stick-held dip net fishing. Adult fishes reach a length of about 7 cm, but since they have thin figures, small-sized ones can casely escape from the net. Although they were mainly caught in Abaiang, Butaritari and Abemama, it seems that they live in lagoons surrounding the entire area of the Gilbert Islands. The body length distribution of caught Spratelloides delicatulus is illustrated in Figure 7. The body length ranged from 20 to 60 mm, and in those from 30 to 45 mm, mode was observed.

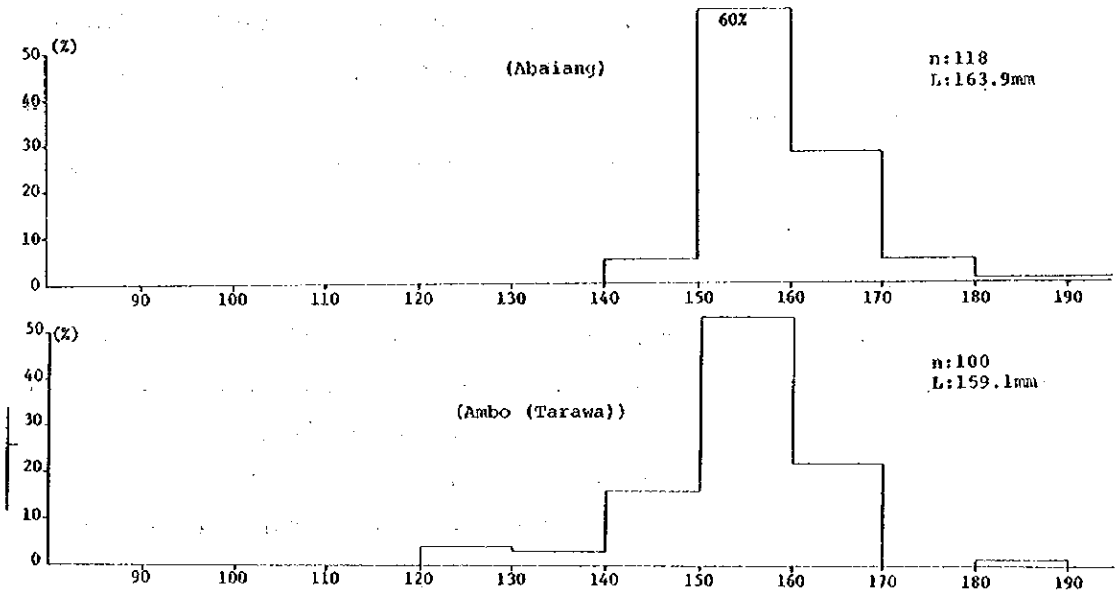
Figure 7. Body Length Distribution of Spratelloides Delicatulus

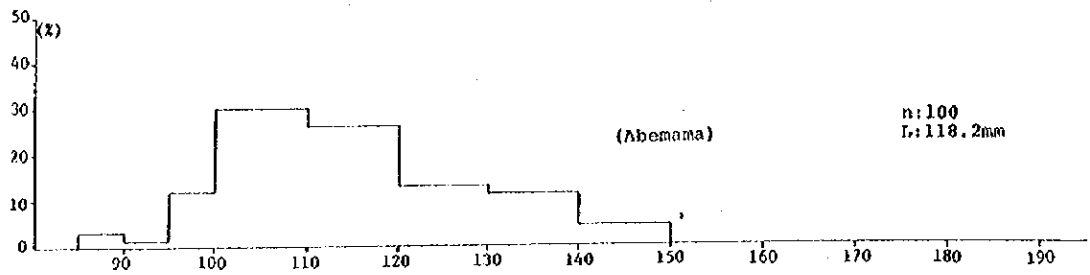


1-3-4. Dussumieria hasseltii

Dussumieria hasseltii accounted for 3.4% of the overall catch of bait fishes. The fish school has never been observed during daytime. Since they have a nature to gather around lamps, they are caught by stick-held dip net fishing during the night. The fish school is small. They are caught in Tarawa and Abaiang. Appropriate number of those were extracted at random and the body length distribution, which is illustrated in Figure 8, was studied. The body length ranged variously and different mode was observed depending on the area.

Figure 8. Body Length Distribution of Dussumieria Hasseltii





1-3-5. Apogonidae

Apogonidae were caught with other fishes by stick-held dip net during the night; however, the amount was extremely few. It seems that they live in lagoons surrounding the entire area of the Gilbert Islands.

1-3-6. Decapterus lajang (Mackeral-scad)

Mackeral-scad were caught only once with Dussumieria hasseltii by stick-held dip net in the lagoon of Tarawa, during the night.

1-4. Catching Test

Although 3 types of fishing gear, stick-held dip net, drive-in net and lift net, were provided for catching bait fishes; since Harengula ovalis, the main object, have no tendency to gather to the center of the lamp, the use of lift net was suspended. Also, since guiding Harengula ovalis by menacing is difficult due to their activeness and quickness, the sole use of drive-in net was halted. Small-sized purse seine for hand operation was made and the drive-in net was used as a supplementary fishing gear of purse seine.

1-4-1. Stick-held Dip Net

Using underwater lamps of the main ship and the boat in the area above 6 m water depth during the night, fish school was gathered. Then, the school gathered around the underwater lamp of the boat was guided to the underwater lamp of the main ship and they were caught by stick-held dip net. When the lamp is lighted for a long time,

large fishes will gather and disperse bait fishes, so it is necessary to observe the status of gathered fishes after turning on the light and lift up the net with 2-3 hours. The catch by stick-held dip net accounts for 32.8% of the total bait fish catch, and fish kinds are varied.

1-4-2. Purse Seine

With the movement of a flock of birds as a mark, the search was carried out around the shore by boat during daytime. While confirming the presence of the fish school in the shallow area, the purse seine net was carried by hand, and the fish school was surrounded and caught. If difficulties arise in carrying the net by hands due to water depth, the net is thrown in from the boat. After surrounding the fish school by purse seine, they are transferred to a drive-in net. Further, they are transferred to the bait pen for transportation and are tugged to the main ship by the boat. The catch by purse seine accounts for 67.2% of the total bait fish catch.

1-5. Keeping Test

1-5-1. Transportation by Bait Pen

Since purse seine operation is ordinarily conducted in the area of less than one meter depth around the shore, the distance to the main ship is more than one kilometer. The catches are kept in the bait pen and are tugged by the boat, but many fishes are harmed due to their touching with the net. In case of Harengula ovalis, about 10% dies during transportation, and about 40%, within 2 hours after being received in the live fish well. After a day, the survival rate will be about 40%, but the death rate decreases after then, and about 30% endures to live long. In case the fish body is less than 5.5 cm or the sea condition is bad during transportation and more than 50 buckets (3 kg x 50 = 150 kg) of bait fishes are kept in a bait pen (1 side: 2 m, hexagon, depth: 2 m), the death rate will rise up. Since Harengula ovalis are naturally active and shrewd, they try to flee from the net with a furious movement, thus causing themselves to be harmed. In most of the died fishes, bleeding in eyes and descaling can be seen.

1-5-2. Catch by Stick-held Dip Net

In this case, since fishes are directly put into the live fish well from the net, they get less damage, and they are easily kept in healthy conditions. In case of Harengula ovalis, about 30% will die in 12 hours after the catch, but the death rate decreases after then.

In both cases, 1-5-1 and 1-5-2, although their durability depends on the degree of damage and shock and sea conditions, healthy Harengula ovalis over 6 cm in body length have higher degree of durability. Thus, although they are kept in a live fish well of which water-exchange is done naturally, or the vessel anchors in the port, if the live fish well is maintained well, they surely can endure to survive for about a week, and if bait fishes are thrown into the live fish well of which circulation is forcibily done, it is expected that they could be kept inside the vessel for about a month.

Because some contaminations were found in the sea water of the live fish well due to the aged main ship, condition to conduct a keeping test was not fulfilled.

1-5-3. Keeping Test by Fixed Bait Pen

Bait pen with the size, 3m x 6 sides, depth: 3m, was used. Since large catch by stick-held dip net cannot be expected, among 78 buckets of Harengula ovalis (body length: 5.5 - 7 cm) caught by purse seine, about 50 buckets of healthy ones were selected, and kept in the bait pen. Without feeding them, 6 days observations were carried out. Although 5 buckets were confirmed to be dead in 24 hours after being put into the bait pen, no more died afterwards. On the 6th day, when observation was conducted, the bottom part of the bait pen had been torn by biting, and the remaining fishes were discovered to be only 15 buckets causing for us to halt the keeping test.

Keeping Harengula ovalis for a long period in a large bait pen is considered to be possible if feeding is done; however, since large fishes or sharks live in the lagoons, protective measures against net damage is required.

Table 6. Record of Keeping Test in Fixed Bait Pen

Operation Number		75 and 76	Size of bait pen	3m x 6 sides, depth: 3m
Fishing ground		Tarawa lagoon, Eita	Taking-in date	1978.2.28 11:30
Date		1978.2.28 9:30-10:30	Number of bait fish taken in	Harengula Ovalis 50 buckets Caranx sp. about 30 pcs
Keeping place	Position	01-22.2N 173-05.5E	Remarks	1 bucket = about 3 kg Harengula ovalis body length 5.5 - 7 cm Caranx sp. body length 10 - 12 cm
	Distance from shore	0.5 miles		
	Water depth	8 m		

Observation Date	Time	Description	Received	Died	Remained	Water Temp.	Trans-parency	Remarks
'78. 2.28	11:30	Keeping started	50	0	50	29.7	4	
3. 1	11:30	Underwater observation		5	45	28.0		
3. 2	10:00	"		0	45	28.0		Bad weather R. NW-4
3. 3	09:00	"		0	45	27.1	3.0	
3. 4	09:00	"		0	45	28.0		
3. 5	07:30	"		Unknown	15		4.5	Put into bait pen

Remarks: Unit is in bucket.

1-6. Aptitude Test of Milkfish

Total of 1,568 kg milkfishes (Chanos chanos) were supplied 13 times from the FAO/UNDP Milkfish Culture Center located at Ambo of the Tarawa Island. The aptitude test of skipjack as bait fish and the durability of milkfish were conducted throughout 12 navigations. Milkfish to be used as bait fishes were put in the bait pen net of the culture pool first, and after 2-3 days, they are transferred to the live fish well of the boat and are shipped to the main ship. Although fishes continously received great shocks by ocean waves and during the transportation of 1 km, the death rate during transportation is about 5%, and those which die within 12 hours after being transferred to the live well account for 5 percent. There are no fish which die thereafter. These remained fishes had endured the

keeping test for 6 days without being fed in the well of which water-exchange is done naturally. It is expected that keeping of fish inside vessel over 1 month of period is possible if appropriate managements and feeding are carried out. Milkfishes are said to have the nature to endure the water temperature of 40°C in culture pools, and they are strong in coping with the lack of oxygen and environmental change. However, those which were contaminated by the virus in the culture pool died within 12 hours after being put into the live fish well of the main ship. Also, since milkfish grows fast, it is said that the fry will reach a size that is appropriate for bait fish (body length 6-7 cm) in 7 to 8 weeks.

2. Skipjack Catching Test

2-1. Fishing Ground Environment and Distribution of Fish School

Since South Equator Current flows in the Gilbert Islands, generally, current between WNW and W is observed; however, the tidal flow in the area between islands and around complicates the current, and the surface water temperature ranges from 28 to 29°C. Lack of bait fish limited the operation of the main ship only to the coastal area within 15 miles from the shore and around the islands. Despite the unfavorable sea condition during the survey, the presence of abundant skipjack schools with yellowfin tuna being mixed was confirmed. However, since the islands which can supply bait fishes are limited the fishing ground is also limited.

Many fish schools were observed in the coastal area of each island, especially in the area around 2-3 to 7-8 miles distance from the shore. Most of them were small skipjack schools with yellowfin tuna being mixed and did not move very fast. Especially the schools in and around the coasts are usually mixed with rainbow runner and little tuna.

Since abundant stolephorus sp. are present in these areas, many of them are birds associated, jumper schools or breezer schools, baiting is not generally well.

The areas with especially many fish schools are north and west Butaritari, west Abaiang, north Marakei, west and south Tarawa, areas around Maiana, between Abemama and Aranuka, and between Aranuka and Nonouti, and south Tabiteuea.

2-2. Survey of Catch

By using bait fishes caught by the crew of the main ship through stick-held dip net and purse seine, and milkfishes provided by the FAO/UNDP Aqua-culture Center, skipjack pole-and-line fish catch test was conducted using feather jig. The fish school distribution by properties and the distribution of fish kinds are illustrated in Figures 9 and 10 respectively.

Figure 9. Fish School Distribution by Properties

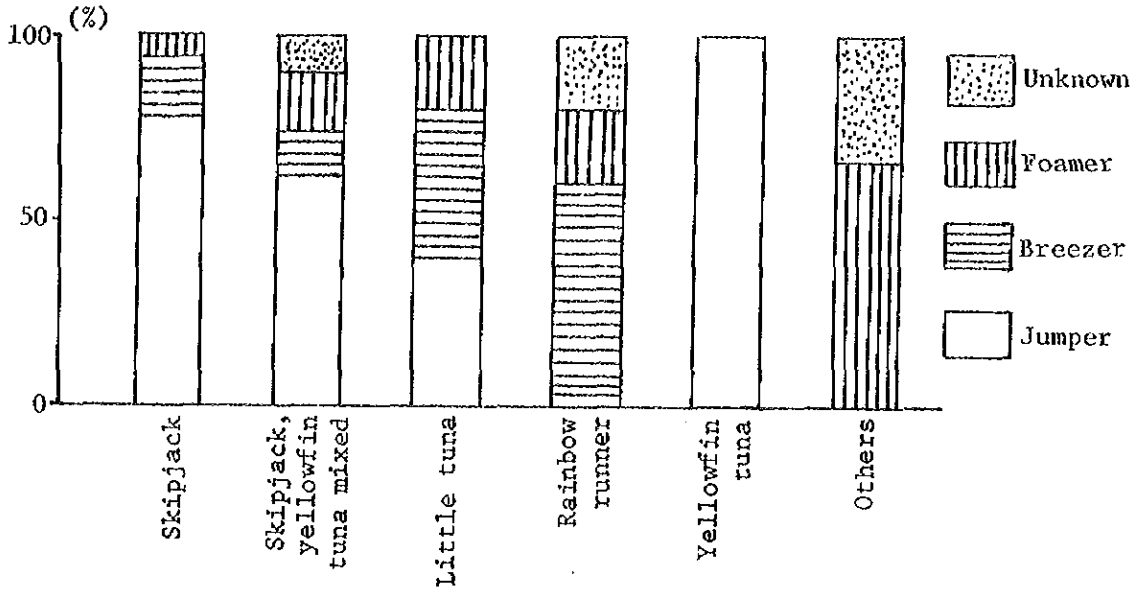
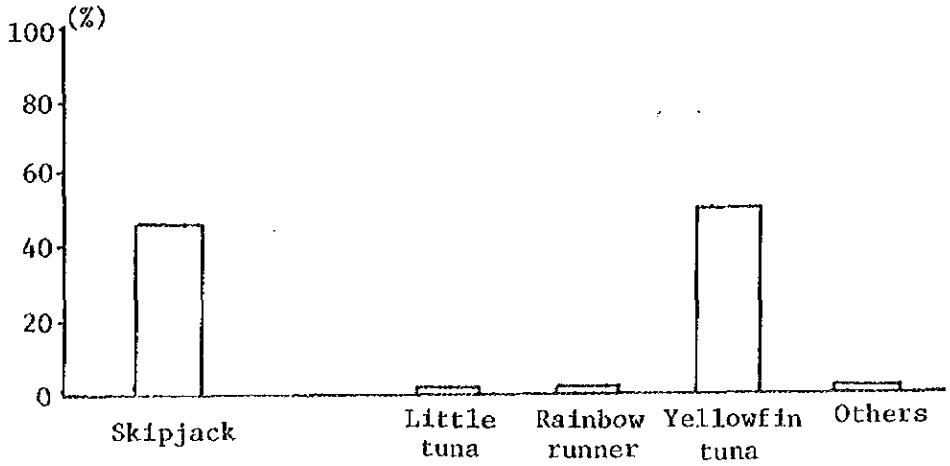


Figure 10. Distribution of Fish Kinds
(Skipjack Pole-and-Line Fishing)



2-3. Biological Survey

Twenty fishes were sampled 14 times chosen by fish kinds at random (totaling 280 fishes), the weight was measured, and gonad and stomach contents were observed. The body length ranged from 36 to 69 cm and in those from 45 to 50 cm, mode was observed. Also, the weight ranged from 0.9 to 7.0 kg and generally, most of them were small fish and their gonads were immature. (Cf. Figures 11 and 12)

Figure 11. Skipjack Body Length Distribution

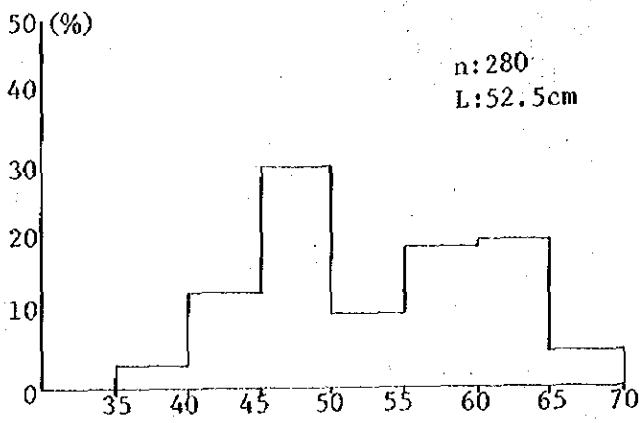
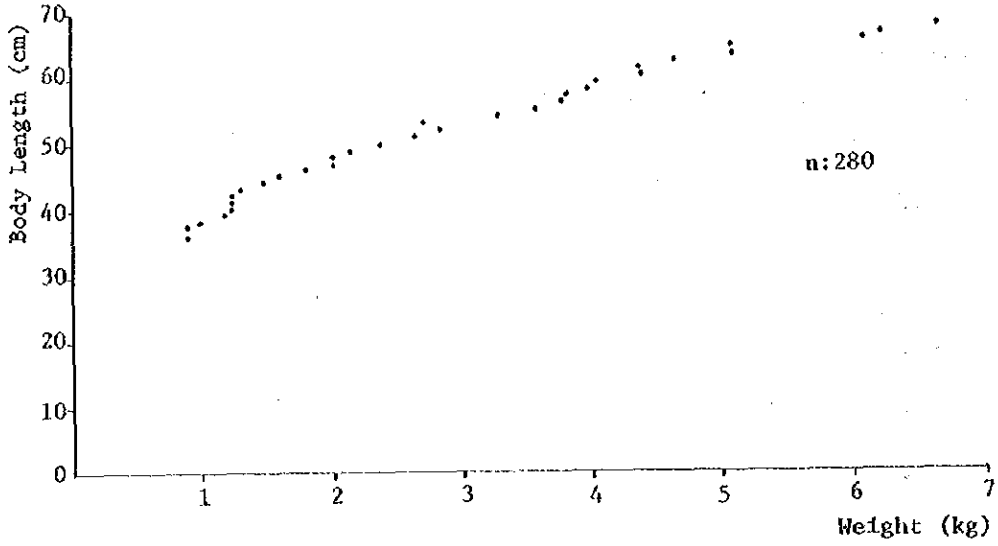


Figure 12. Relation between Body Length and Weight of Skipjack



(Note) The average figure of 280 fishes measured by body length were used for the weight.

2-4. Aptitude Test of Bait Fishes

Harengula ovalis and milkfish were the fishes mainly used in this test. For other fish kinds, since they could not take a sole possession of the live fish well and were mixed with Harengula ovalis due to small quantity, enough observation could not be made.

2-4-1. Harengula ovalis

Among natural bait fish resources, Harengula ovalis accounts for the largest amount and is easy to catch and keep. Further, their durability in the live fish well on board is surpassing and their size is suitable. When baits are thrown into the sea from the vessel at the fishing ground, since they have a nature to form into a school immediately and follow the vessel while swimming near the surface, among the natural bait fishes, they are most suitable for skipjack fishing. However, they have a defect in lacking the resistance against harms notwithstanding they are easy to get harms on their body due to their activeness.

2-4-2. Milkfish

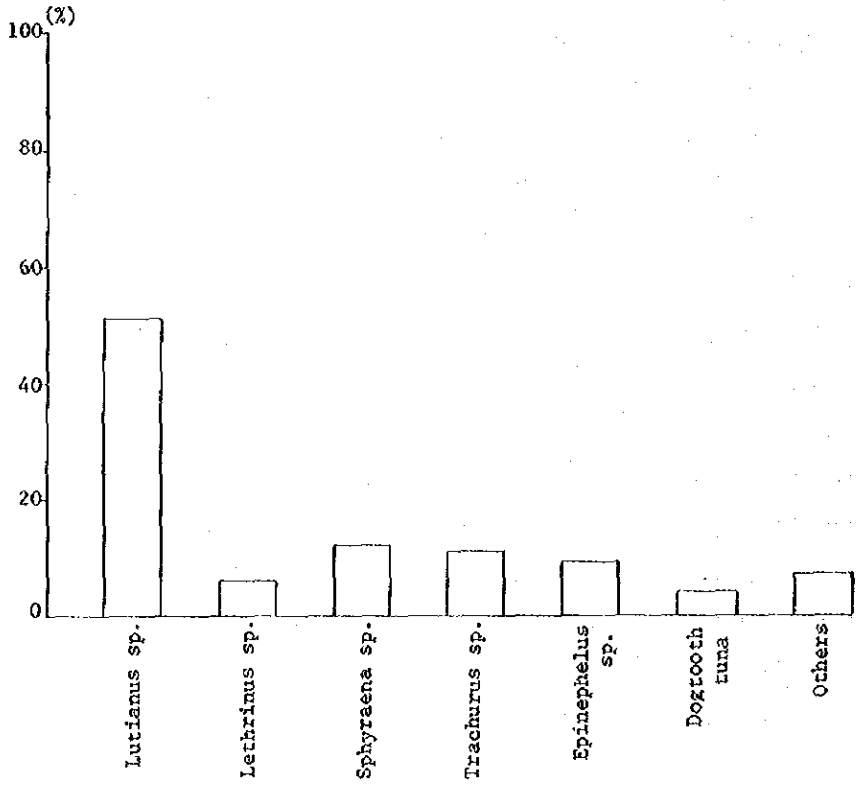
Having a wide range of adaptability for salt density, they have an extremely high rate of survival. Although it may have been due to the cultured fishes which were used in the test, their actions are mild and they get less damage during transportation. Their death rate during transportation by boat is about 5%, while that of Harengula ovalis was more than 50 percent. The provided milkfishes were of the sizes ranging from 5 to 15 cm. Although their actions are mild when baits are thrown in, since they have a nature to follow the vessel forming into a school like Harengula ovalis, they have a surpassed aptitude for skipjack fishing. When the equivalent amount of milkfish and Harengula ovalis were thrown in as baits and the stomach contents of caught skipjacks and yellowfin tuna were observed, milkfish tended to account for a larger amount.

Concerning the natural milkfish, only one record that they were caught by purse seine in Abaiang on November, 1977 exists.

3. Catching Test by Vertical Long Line

When anchor was dropped at the outer edge of the lagoons of Butaritari, Tarawa, and Maiana, preparatory surveys of bottom fishes were conducted using vertical long line; however, since the outer edge of Maiana lagoon was estimated to be a favorable fishing ground having a advantageous topographical conditions, the catching test of bottom fish by vertical long line was conducted. The distribution of the caught fishes is illustrated in Figure 13, and Lutianus sp. accounted for the most.

Figure 13. Distribution by Fish Kind
(Vertical long line)

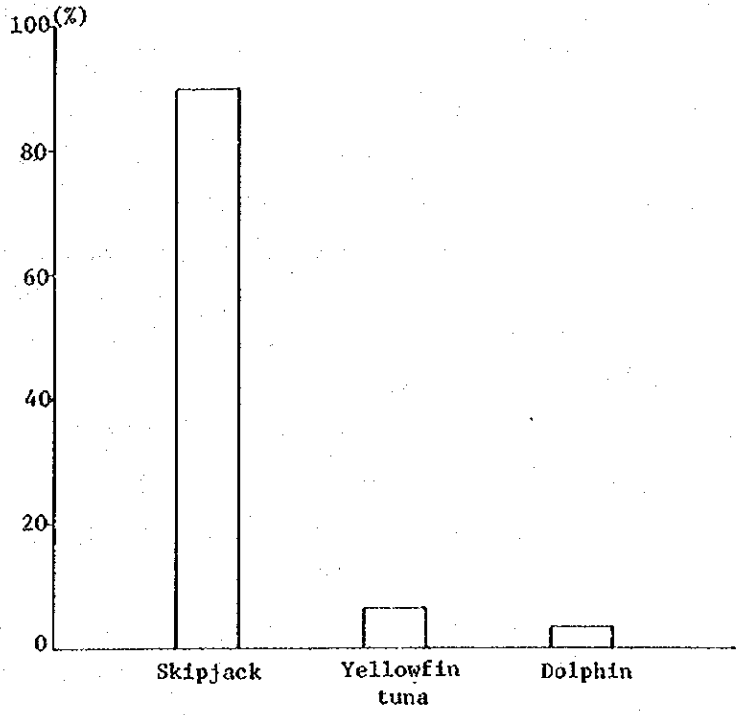


4. Catching Test by Trolling

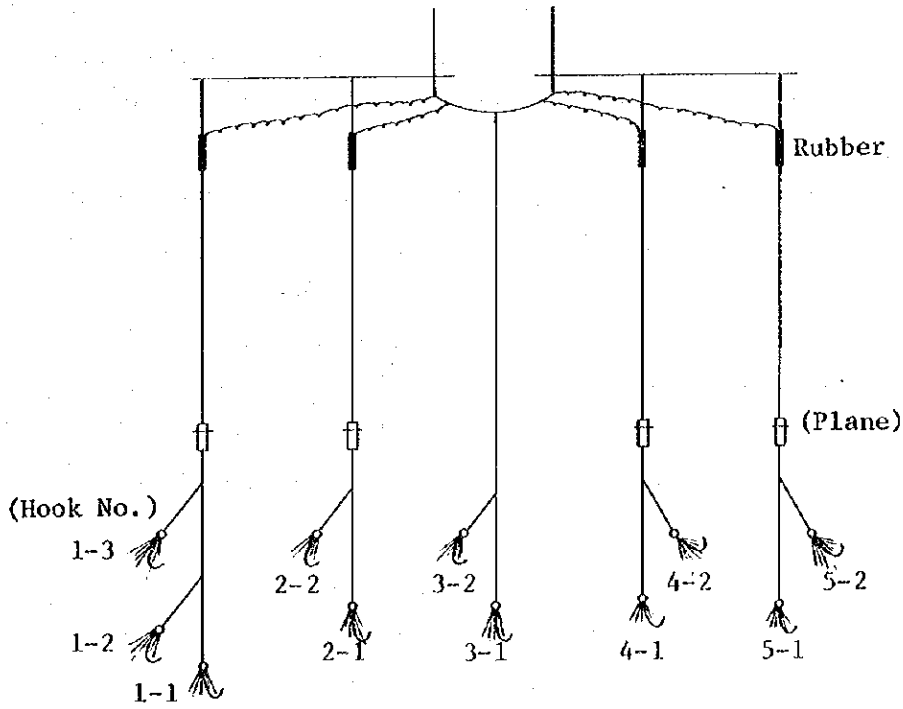
As a measure to search fish schools, 2 sets of trolling gears are constantly used in the fishing ground; however, in this case, since it became hard to take records, the catching test by trolling were conducted by especially using 5 sets of the fishing gear.

The distribution of caught fishes is illustrated in Figure 14, and skipjack accounted for the most.

Figure 14. Distribution by Fish Kind
(Trolling)



Configuration of Fishing Gear



VI. CONCLUSION

1. Fishing Period of Bait Fish

Most part of the period of this survey were covered with an unstable weather with westerly wind of this area and seasonal rain. We often encountered squalls with heavy rains. The sea condition of lagoons was generally bad, and the water became muddy due to swells and waves and bait fishes did not appear much. Especially during December, January and February, the sea conditions were bad, and not only that bait fishes appeared less, but both the bait fish catching operation and keeping by bait pen were often faced with difficulties. In this period, it takes about 3 days to catch the bait fish for 1 day of skipjack fishing.

In places where the specializations of skipjack fishing and bait fish supply are not established, an effective method is to catch the bait fish with one's own boat during the night, and to carry out the skipjack fishing during daytime. If this kind of operation mode cannot be established, the establishment of commercial fishing will be difficult. Therefore, in this season, the establishment of commercial skipjack pole-and-line fishery is considered to be impossible.

From late March to late October, the weather is said to be stable with easterly wind, and since the sea condition of lagoons will be mild, the appearance of bait fish school is expected in a large quantity during this period.

In the season of westerly wind, Stolephorus sp. are observed in a large quantity and the skipjack school with yellowfin tuna being mixed which follow Stolephorus sp. is abundant. Generally, for the baits that are thrown in from the boat, they are not well eaten. Although the opportunity for the catching test of Stolephorus sp. did not arise this time, we would like to consider it as one of the future subjects of the survey as bait fish which has the possibility to be caught in the skipjack fishing ground.

2. Use of Harengula Ovalis

Looking from the topographical aspect, each lagoon is suitable for the reproduction and growth of bait fishes. Among the fish living in lagoons, Harengula ovalis is most abundant, and the fact that they are extremely

effective as bait fish for skipjack fishing has been proved by this survey. During daytime when the sea condition is mild, Harengula ovalis formed into a school swim around from the deep area of lagoon to the shallow area near the coast riding on the flowing tide, and since they are easily caught, they are the important food sources of the local people. Although the living area of Harengula ovalis is still unknown, if they only live in the lagoons, the catch in a large quantity will create a shortage of resources and a great problem of living for the local people.

Therefore, in order to consider about the development of the skipjack fishery by natural bait fish, the ecology of Harengula ovalis, especially their migrating route and spawning activity should be studied, and the possibility of continuous reproduction has to be confirmed.

In case of carrying out the skipjack fishing in the coastal areas using Harengula ovalis, about 8% of Harengula ovalis catch as against the skipjack catch is expected to be necessary.

3. Use of Bait Pen Net for Keeping

In order to make higher the rate of activity of the skipjack fishing, it is desirable to be constantly able to supply the bait fish by keeping them in the bait pen inside the lagoon, but since sea weeds easily attach to the net, it is expected that the need to pull up the bait pen net and clean it with the cycle of about 10 days will arise. Therefore, from the point of view of convenience in handling, large bait pen is not practical.

4. Increment of Milkfish Production

With this survey, the surpassed durability of the milkfish and the high aptitude for the skipjack fishing have been proved. The scale of the development of skipjack fishery in this area, from the aspect of supply of bait fishes, will depend on the capacity of supply of milkfish along with the amount of resources of Harengula ovalis, the natural bait fish.

If the stable supply of milkfish is established, it becomes possible to sell them to foreign ships. By carrying out a wide range of study of the distribution and ecology of seeds and introducing an active fishing method for collecting seeds, the enlargement of the scale of the aquaculture ground even in the other potential islands such as Butaritari and Abemama is desired to be considered.

ANNEX TABLES

CONTENTS OF ANNEX TABLE

Annex Table 1

Record of Noon Position

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
		Latitude	Longitude									
	'77.10. 7											Left Misaki
	8											
Outgoing navigation	9			c	E	2		1006.0	20.0			
	10			o	S	2		1016.0	25.5			
	11			b	SSE	1		1017.0	29.0			
	12			b	E	1		1017.0	27.0			
	13			b	ESE	2		1022.0	28.0			
	14			c	SE	5		1023.0	30.0			
	15			c	SE	5		1015.0	30.0	28.7		
	16			b	ESE	4		1018.0	29.0			
	17			bc	E	5		1012.0	29.0			
	18			c	E	3		1011.0	28.0			
	19			b	SE	4		1010.0	28.0			
	20			b	W	4		1012.0	29.0			16:00 Arrived at Ponape outer harbor
	21	Ponape port									Ponape port	Arrived at Ponape
	22	"										Water supply
	23	"										
	24	"										
	25	"										
	26	"										
	27	"		r	S	3		1013.0	27.0			
	28	"										
	29			b	SW	2		1012.0	30.0			Left Ponape

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
		Latitude	Longitude									
	'77.10.30			b	W	2		1012.0	29.0			
	31			b	NW	2		1012.0	29.0			
	11. 1	03-10.0N	168-26.0E	b	S	2		1011.0	28.0			
	2	02-02.0N	171-13.5E	bc	SW	2		1012.0	30.0			
1st navigation	3	Betio port									Betio port	08:30 Arrived at Betio, took proceedings
	4	"		o	NW	4		1010.0	28.8	30.4	"	12 crews got on board at the locality Material unloading
	5	"									"	Investigation of inner vessel
	6	"									"	Fishing gear assembling, oil supply
	7	01-22.4N	173-01.9E	b	E	1	1	1011.5	30.0	29.9	Tarawa lagoon	Water supply, 11:30 left Betio, lighting test
	8	"	"	b	E	1	1	1011.5	30.0	29.9	"	Stick-held dip net test, bait pen assembling
	9	"	"	b	E	1	1	1011.8	30.0	29.9	"	Bait fish survey
	10	"	"	b	E	Calm	1	1011.0	30.5	29.8	"	Bait fish survey, milkfish reception
	11	01-47.0N	172-42.0E	bc	E	2	1	1013.0	30.5	29.2	Abaiang offing	Bait fish survey, 07:30 took an offing, skipjack survey
	12	02-08.0N	173-15.0E	bc	E	2	1	1014.4	30.5	29.4	Marakei offing	Skipjack survey
	13	01-47.8N	173-03.6E	bc	ENE	2	1	1014.1	30.0	29.9	Abaiang lagoon	Bait fish survey
	14	"	"	b	E	1	1	1014.5	29.5	29.6	"	Bait fish survey
	15	01-47.6N	172-41.5E	c	E	2	2	1013.3	29.0	29.3	Abaiang offing	Bait fish survey, 07:45 took an offing, Skipjack survey
	16	01-34.0N	172-52.6E	bc	NE	2	2	1014.0	29.5	29.0	Tarawa offing	Skipjack pole-and-line survey, 14:50 arrived at Betio, supply
2nd navigation	17	Betio port									Betio port	14:30 left Betio, milkfish reception
	18	01-21.7N	172-56.4E	b	E	2		1009.0	30.0	30.0	Tarawa lagoon	Bait fish survey, 13:40 took an offing, skipjack survey
	19	03-04.4N	172-53.4E	b	E	2		1011.0	29.7	29.7	Butaritari lagoon	Bait fish survey
	20	03-11.0N	172-34.4E	r	N	3		1008.0	28.5	29.0	Butaritari offing	07:30 took an offing, skipjack survey, 16:55 returned to bait fishing ground
	21	03-02.3N	172-47.5E	r	SSE	4		1014.0	27.5	29.1	Butaritari lagoon	Bait fish survey

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
	'77.11.22	03-02.5N	172-47.3E	r	SSE	3		1013.0	27.0	28.4	Butaritari offing	Bait fish survey, 07:40 took an offing, visual observation, 12:00 returned to bait fishing ground
	23	03-19.0N	172-39.0E	bc	E	1		1012.0	29.0	29.2	"	Bait fish survey, 06:16 took an offing, skipjack survey, 15:40 returned to bait fishing ground
	24	03-02.2N	172-47.3E	o	WNW	2		1008.0	28.0	29.3	Butaritari lagoon	Bait fish survey, 15:40 took an offing, visual observation
	25	Betio port										Visual observation, 10:45 arrived at Betio, supply
	26	"										Rough sea, the boat was out of order
	27	"										
	28	"										The boat was repaired
3rd navigation	29	"		bc	N	2	1	1011.0	30.0	29.7		15:00 left Betio, milkfish reception, bait fish survey
	30	01-13.7N	173-00.0E								Maiana northern offing	08:05 took an offing, skipjack survey, 13:25 returned to bait fishing ground
	12. 1	Maiana		bc	NE	1	1	1010.0	30.0	29.9	Maiana lagoon	Bait fish survey, 16:55 left Maiana to Abemama
	2	Abemama									Abemama lagoon	08:00 arrived at bait fishing ground, bait fish survey, waited due to rough sea from the evening
	3	"		c	W	3	3	1011.2	29.0	28.9	"	Waited due to rough sea
	4	"		b	W	1	1	1012.0	29.5	29.1	"	Bait fish survey, the boat was out of order, 13:30 took an offing, visual observation
	5	Betio port		b	SW	2	1	1012.0	30.0	29.6	Tarawa southern offing	Skipjack survey, 12:05 arrived at Betio to have supply and repair
4th navigation	6	"		b	ESE	2	1	1009.0	29.8	30.0	Tarawa lagoon	Oil supply, 15:00 left Betio, bait fish survey
	7	01-21.7N	172-56.5E	c	W	4	3	1007.0	30.0	28.7	"	Bait fish survey, milkfish reception
	8			r	WSW	4	3	1010.0	28.5	28.6	"	Bait fish survey
	9	01-07.8N	173-03.0E	b	W	3	3	1008.0	30.3	29.0	Maiana northern offing	Skipjack survey, 15:00 arrived at Betio to unload fish, 17:00 left Betio
	10	Abemama		r	WSW	4	3	1009.5	28.0	28.7	Abemama lagoon	07:00 salvage work for an aground vessel, 15:00 bait fish survey
	11	00-24.3N	173-42.9E	r	N	3	3	1011.0	27.8	28.6	Aranuka northern offing	07:00 took an offing, skipjack survey, 14:00 salvage work for an aground vessel, 18:30 left

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
	'77.12.12	Aranuka		bc	NW	2	1	1011.0	29.6	28.6	Aranuka south-western offing	Visual observation, 09:00 arrived at bait fishing ground, bait fish survey, 17:00 left to Tarawa
	13	Betio port		o	Nil	Nil	0	1011.0	30.0	28.6	Betio port	07:00 arrived at Betio to have supply and repair of the table for the power generator on board
	14	Betio									Betio outer harbor	Bait fish lighting survey during night
	15	"		c	N	1	0	1010.8	28.0	28.1	"	Bait fish survey
5th navigation	16	01-16.0N	172-58.0E	o	S	5	4	1010.0	28.2	28.8	Tarawa lagoon	07:00 left Betio, milkfish reception, 10:00 took an offing
	17	00-56.0S	174-23.5E	c	SW	3	3	1009.0	28.5	28.4	Nonouti southern offing	Skipjack survey, 17:00 arrived at Tabiteuea, bait fish survey
	18	01-24.0S	174-43.0E	c-r	WSW	3	3	1006.0	29.7	28.7	Tabiteuea coast	Rough sea, return trip because of damage in the boat
	19	00-32.5S	174-37.6E	o	WSW	5	4	1009.0	29.8	28.2		On the way back but have difficulties in the rough sea
	20	01-02.0N	173-08.0E	o	WSW	5	4	1010.0	29.0	28.2		18:00 arrived at Betio
	21	Betio										Boat repair, water supply
	22	"										Oil supply, repair of boat completed
6th navigation	23	"										13:00 left Betio, milkfish reception, 17:00 returned to Betio
	24	"										Weather recovery
	25	01-00.9N	173-13.1E	b	W	3	3	1011.5	30.0	28.4		08:00 left Betio to the offing to continue navigation
	26	00-37.0S	174-09.0E	o	W	3	3	1011.5	29.7	28.4	Nonouti western offing	Skipjack survey, 16:00 arrived at Nonouti bait fishing ground
	27	Nonouti									Nonouti lagoon	Bait fish survey
	28	"									"	Bait fish survey, fish school unseen, 13:00 left to Onotoa
	29	Onotoa		b	W	3	2	1012.5	29.0	28.4	Onotoa lagoon	07:10 arrived at Onotoa anchoring spot, bait fish survey, fish school unseen
	30	Beru		b	W	2	2	1012.8	29.0	28.5	Beru coast	06:20 left Onotoa, 11:35 arrived at Beru anchoring spot, lighting survey
	31	01-21.0S	175-42.0E	o	W	4	3	1011.2	28.5	28.5	Beru lagoon	09:30 left Beru to return
	'78. 1. 1	00-20.0N	173-40.1E	bc	W	3	3	1010.0	29.8	28.2		On the way back
	2	Betio										00:20 arrived at Betio to have supply

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
		Latitude	Longitude									
	'78. 1. 3	Betio		o	NW	2	2	1009.3	29.3	27.9		The boat was lifted for the trouble
7th navigation	4	left Betio		o	NW	2	2	1009.4	29.3	27.9	Tarawa lagoon	The boat was recovered, 09:55 left, milkfish reception, 13:00 took an offing
	5	03-16.0N	172-54.0E	o	NW	3	3	1008.4	29.0	28.3	Butaritari offing	Skipjack survey, 15:20 arrived at Butaritari bait fishing ground
	6	Butaritari		r	SSW	4	2	1010.0	27.6	28.3	Butaritari lagoon	Bait fish survey
	7	"		r	SW	3	2	1011.8	27.5	27.9	"	Bait fish survey, 07:00 took an offing, returned to the bait fishing ground due to rough sea
	8	03-14.6N	172-55.4E	o	SW	3	3	1011.4	27.5	28.1	"	07:25 took an offing, skipjack survey, 18:05 arrived at bait fishing ground
	9	02-47.0N	172-52.0E	bc	SE	3	2	1013.2	28.9	28.4	"	08:40 took an offing, visual observation
	10	01-36.0N	172-54.0E	b	N	2	2	1015.8	29.9	28.5	Abaiang eastern offing	Skipjack survey, 14:55 arrived at Betio
	11	Betio										Supply
8th navigation	12			b	SE	1	1	1012.5	29.3	29.2	Tarawa lagoon	07:40 left Betio, bait fish survey, milkfish reception
	13	01-08.1N	172-54.6E	bc	NE	4			28.5	28.2		07:00 took an offing, skipjack survey, 17:00 returned, bait fish survey
	14	Abaiang									Abaiang lagoon	07:30 left, 11:37 arrived at Abaiang bait fishing ground for survey
	15	01-59.2N	172-56.1E	o	NE	4		1011.0	29.1	28.2	Tarawa offing	07:00 took an offing, skipjack survey, 22:00 arrived at Tarawa bait fishing ground
	16	01-07.5N	173-00.0E	o	NE	3		1010.5	29.0	28.0	Tarawa offing	08:05 took an offing, skipjack survey, 17:00 arrived at Betio
	17	Betio			NE	3		1013.0	29.8	29.1		Boat was repaired due to trouble, supply
9th navigation	18	01-39.0N	172-54.0E	b	NE	2	1	1011.9	28.5	28.4	Abaiang lagoon	09:20 left Betio, 14:00 arrived at Abaiang bait fishing ground for survey
	19	Abaiang		c	S	2	2	1010.8	28.0	28.2	"	Bait fish survey, 12:00 left Abaiang to the offing, visual observation
	20	00-06.5N	173-30.5E	bc	E	3	2	1010.3	28.9	28.3	From Kuria to Abemama (offing)	Skipjack survey, 17:50 entered around Abemama lagoon for bait fish survey
	21	Abemama		bc	E	2	1	1011.0	28.5	28.5	Abemama lagoon	Bait fish survey
	22	00-25.0N	173-40.0E	bc	SE	1	1	1010.3	28.7	28.6	Abemama eastern offing	07:10 took an offing, skipjack survey, 13:40 arrived at bait fishing ground for survey
	23	Abemama		r	SE	1	0	1011.0	27.3	28.3	Abemama lagoon	Bait fish survey, 18:00 left to return

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
		Latitude	Longitude									
	'78.1. 24	Betio		b	NE	4		1008.5	27.7	28.2		10:40 arrived at Betio to have supply, boat was repaired due to trouble
	25	"		r	NE	4		1008.0	28.0	28.3		Boat was recovered
10th navigation	26	01-21.7N	173-03.8E	o	NE	4	3	1009.4	27.5	27.6	Tarawa lagoon	08:40 left Betio, bait fish survey
	27	01-50.0N	172-45.0E	o	N	4	3	1008.0	28.5	28.0	Abaiang western offing	07:00 took an offing, skipjack survey
	28	03-10.5N	172-37.3E	b	NE	4	3	1007.0	30.0	27.6	Butaritari lagoon	Bait fish survey, became rough sea
	29	03-02.2N	172-47.4E	b	N	4	3	1008.0	28.2	27.6	"	Bait fish survey, became rough sea
	30	03-02.4N	172-47.4E	o	N	4	3	1008.0	30.2	27.4	"	Bait fish survey, became rough sea
	31	03-04.0N	172-53.2E	b	NNE	4	3	1008.0	29.8	27.4	"	12:40 took an offing, visual observation
	2. 1	01-48.5N	172-50.3E	r	N	4	3	1008.5	28.0	27.5	Abaiang northern offing	Skipjack survey, 17:04 arrived at Betio
	2	01-21.9N	172-55.9E	r	N	4	3	1007.0	26.2			Supply
11th navigation	3	01-21.6N	173-02.6E	b	N	1	1	1008.5	28.8	26.3	Tarawa lagoon	10:00 left Betio, bait fish survey
	4	01-17.8N	172-51.8E	bc	SW	2	1	1010.5	28.0		Tarawa southern offing	09:30 took an offing, skipjack survey
	5			c	SW	3	2	1009.0	29.0	28.4	Abemama northern offing	Skipjack survey, 16:22 arrived at Abemama bait fishing ground for survey
	6	00-24.5N	173-54.7E	b	E	2	1	1010.8	29.0	28.5	Abemama lagoon	Bait fish survey
	7			b	ENE	1	1	1010.5	29.5	29.5	Maiana offing	Visual observation, 22:45 arrived at Betio
	8			bc	W	3	2	1011.5	28.5	28.6	Tarawa lagoon	Fish catches were unloaded, 11:22 left to bait fishing ground for survey
	9	01-21.8N	172-56.0E	r	W	4	2	1009.5	28.7	28.2	"	Bait fish survey, 10:50 arrived at Betio to have supply
12th navigation	10	01-21.8N	172-56.0E	b	N	3	2	1011.0	29.0	29.2	"	15:04 left Betio
	11	01-22.2N	173-07.5E	b	N	3	2	1011.0	29.8	29.2	"	08:00 milkfish reception, bait fish survey
	12	01-04.8N	172-55.6E	b	N	1	1	1010.0	29.1	29.0	Tarawa southern offing	07:01 took an offing, skipjack survey
	13	00-38.6N	174-08.0E	b	N	2	1	1010.0	29.8	29.1	Nonouti northern offing	Skipjack survey, 17:03 arrived at Nonouti bait fishing ground for survey
	14			bc	N	1	1	1011.0	30.0	29.3	Nonouti lagoon	Bait fish survey, 11:30 left to Betio, visual observation
	15	01-22.0N	172-56.0E	b	NE	2	1	1009.0	29.8		Tarawa lagoon	09:34 arrived at Betio to unload fish catches, 12:16 left to bait fishing ground, bait fish survey

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
	'78. 2.16	00-51.0N	172-54.0E	bc	NE	3		1009.0	28.5		Tarawa southern offing	03:30 took an offing, skipjack survey, 18:10 arrived at Betio outer harbor
	17	01-22.3N	173-05.6E	o	N	4		1011.0	30.0		Tarawa lagoon	10:23 left outer harbor to bait fishing ground, bait fish survey
	18	01-22.0N	172-56.0E	c	N/E	5	4	1008.0	29.0		"	Bait fish survey, 09:40 arrived at Betio for supply
	19	Betio										Rest
13th navigation	20	"		b	N	4	3	1015.2	30.0	28.5	Tarawa lagoon	12:05 left Betio to bait fishing ground, waited due to bad weather, milkfish reception
	21	01-05.0N	172-55.6E	o	N	4	3	1014.0	29.1	29.0	Tarawa southern offing	07:05 took an offing, skipjack survey, 16:35 arrived at bait fishing ground to survey
	22	01-21.5N	172-56.0E	bc	N	4	3	1013.2	29.0	28.5	Tarawa lagoon	Bait fish survey
	23	01-50.0N	172-59.8E	b	N	3	3	1015.5	28.6	29.4	Abaiang lagoon	03:20 left, 08:00 arrived at Abaiang, bait fish survey
	24	01-21.6N	173-02.3E	b	NE	3	3	1015.6	29.8	29.4	Tarawa lagoon	06:50 left to Tarawa anchoring spot, 14:05 bait fish survey
	25	01-09.5N	172-54.6E	b	NE	4	3	1014.8	30.0	29.6	Maiana offing	Milkfish reception, 08:05 took an offing, skipjack survey, 18:15 arrived at Maiana anchoring spot
	26	01-08.0N	172-58.0E	b	N	3	3	1013.5	30.5	29.6	"	Bottom fishing test, 07:00 took an offing for skipjack survey, 15:20 arrived at Betio to unload fish catches
	27	Betio		b	N	2	2	1015.0	29.6		Tarawa lagoon	Supply, 1 rolling material was loaded 16:00 left Betio, bait fish survey
	28	01-22.2N	173-05.5E	bc	N/E	2	2	1015.0	29.1	29.7	"	Bait fish survey, test of bait pen culture commenced, 14:17 arrived at Betio
	3. 1	Betio										Became rough sea, ice was loaded
	2	00-59.0N	172-53.0E	r	N	4	3	1015.5	28.0		Maiana offing	07:10 left Betio, trolling survey, vertical long line survey, became rough sea
	3	00-55.6N	172-55.0E	b	NE	1	1	1013.2	30.5	29.7	Maiana reef	Vertical long line
	4	01-20.1N	172-54.0E	bc	NW	2	1	1012.0	29.3		Tarawa offing	Vertical long line survey, trolling survey, 15:30 arrived at bait fishing ground
	5	Betio		r	NNW	3	3	1012.5	27.0			Bait pens were loaded, 09:00 arrived at Betio to unload fish catches
	6	"										Materials were loaded
	7	"										Checking of remaining materials, supply

Navigation Order	Date	Noon position		Weather	Wind direction	Wind force	Sea condition	Air pressure	Air temp.	Water surface temp.	Area	Remarks
		Latitude	Longitude									
	'78. 3. 8	left Betio										10:30 left Betio to return
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											Arrived at Guam Island
	19											
	20											Left Guam Island
	21											
	22											
	23											
	24											
	25											
	26											
	27											
	28											Arrived at Misaki

Annex Table 2-1

Record of Skipjack Pole-and-Line Catching Test

Date		'77.11.11	'77.11.11	'77.11.11	'77.11.12	'77.11.12	'77.11.15
Moon age		29.3	29.3	29.3	0.8	0.8	3.8
School No.		1	2	3	4	5	6
Time	Located	12:40	14:30	16:30	08:45	11:30	09:20
	Chum started	12:45	14:57	16:32	09:05	11:40	09:45
	Catch started		15:05	16:35		11:42	
	Catch finished		16:00	16:45		12:55	
Position	Latitude	01-47N	01-49N	01-52N	01-55N	02-13N	01-44N
	Longitude	172-47E	172-43E	172-47E	173-26E	173-19E	172-47E
Fish school	Species	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Yellowfin tuna
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds Associated
	Status	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper
	Size	Small	Small	Small	Small	Small	Small
	Baiting tendency	None	Bad	Somewhat good	None	Bad	None
Bait fish	Species	Harengula ovalis	Harengula ovalis	Milkfish Harengula ovalis	Milkfish	Milkfish	Harengula ovalis
	Amount used	2	20	3	0.4	8	
Weather		b	b	b	bc	bc	bc
Wind direction and force		E1	E1	E1	E2	E2	E1
Air temperature(°C)		29.0	29.0	29.0	30.5	30.5	29.0
Air pressure (mb)		1015.8	1014.0	1015.0	1014.6	1014.6	
Water surface temperature (°C)		29.4	29.5	29.5	29.3	29.2	29.1
Sea condition		1	1	1	1	1	
Fish catch	Skipjack						
	No. of fish		121			269	
	Ave. weight (kg)		4.4			1.3	
	Catch amount (kg)		532			356	
	Yellowfin tuna						
	No. of fish					7	
	Ave. weight (kg)					4.5	
	Catch amount (kg)					32	
	Little tuna						
	No. of fish			7			
	Catch amount (kg)			14			
	Rainbow runner						
	No. of fish			17			
	Catch amount (kg)			26			
	Others						
	No. of fish					1	
	Catch amount (kg)					2	
	Total						
	No. of fish		121	24		277	
	Catch amount (kg)		532	40		390	

'77.11.15	'77.11.15	'77.11.15	'77.11.16	'77.11.16	'77.11.18	'77.11.20
3.8	3.8	3.8	4.8	4.8	6.8	8.8
7	8	9	10	11	12	13
11:25	12:15	16:25	06:15	07:00	16:55	11:45
11:30	12:35	16:35	06:25	07:20	17:10	11:48
	12:40	16:36	06:30	07:25	17:12	
	13:00	18:10	06:50	07:50	17:23	
01-45N	01-50N	01-43N	01-37N	01-43N	01-43N	03-10N
172-42E	172-42E	172-42E	172-38E	172-42E	172-47E	172-36E
Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Jumper	Jumper	Foamer	Jumper	Jumper	Jumper	Jumper
Small	Small	Medium	Small	Small	Small	Small
None	Bad	Bad	Bad	Bad	Somewhat good	None
Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Milkfish	Spratelloides delicatulus
		10	4	3	10	2
bc	c	c	bc	bc	bc	sq
E2	E2	ENE1	NE2	NE2	ESE2	N3
29.0	29.0	29.3	29.5	29.5	30.0	28.5
1013.5	1013.3	1012.2	1017.0	1017.8	1015.0	1013.5
29.2	29.3	29.2	29.1	29.0	29.5	29.5
		1	1	1	2	3
	14	191	9	11	8	
	2.1	4.5	3.3	3.3	2.5	
	29	852	30	36	20	
	44				76	
	4.2				4.5	
	185				344	
	58	191	9	11	84	
	214	852	30	36	364	

Date		'77.11.20	'77.11.20	'77.11.23	'77.11.30	'77.11.30	'77.11.30
Moon age		8.8	8.8	11.8	18.8	18.8	18.8
School No.		14	15	16	17	18	19
Time	Located	12:30	13:05	09:30	09:00	09:20	10:50
	Chum started	12:35	13:10	09:40	09:10	09:40	11:20
	Catch started		13:12	09:42			
	Catch finished		13:50	13:10			
Position	Latitude	03-15N	03-21N	03-19N	01-24N	01-22N	01-15N
	Longitude	172-36E	172-40E	172-39E	172-53E	172-52E	172-55E
Fish school	Species	Skipjack	Yellowfin tuna	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Rainbow runner
	Kind	Plain School	Birds associated Shark	Birds associated Shark mixed	Birds associated	Birds associated	Birds associated
	Status	Jumper	Jumper	Foamer	Jumper	Jumper	Breezer
	Size	Small	Small	Medium	Small	Small	Small
	Baiting tendency	None	Good	Bad	None	None	None
Bait fish	Species	Spratelloides delicatulus	Milkfish Spratelloides delicatulus	Harengula ovalis Spratelloides delicatulus	Milkfish	Milkfish	Milkfish
	Amount used	6	22	100	1	1	1
Weather				c	bc	bc	bc
Wind direction and force				NE2	SW1	SW1	SW1
Air temperature(°C)		29.3	29.5	29.0	28.8	28.8	29.5
Air pressure(mb)		1012.0	1012.0	1013.5	1016.0	1015.8	1014.8
Water surface temperature (°C)		29.5	29.5	29.2	28.6	28.8	29.1
Sea condition				2	1	1	1
Fish catch	Skipjack No. of fish			52			
	Ave. weight (kg)			1.9			
	Catch amount (kg)			99			
	Yellowfin tuna No. of fish		87	466			
	Ave. weight (kg)		4.2	3.9			
	Catch amount (kg)		364	1,810			
	Little tuna No. of fish			24			
	Catch amount (kg)			55			
	Rainbow runner No. of fish			35			
	Catch amount (kg)			46			
	Others No. of fish						
	Catch amount (kg)						
	Total No. of fish		87	577			
	Catch amount (kg)		364	2,010			

'77.11.30	'77.12. 5	'77.12. 5	'77.12. 5	'77.12. 9	'77.12.11	'77.12.11
18.8	23.8	23.8	23.8	27.8		
20	21	22	23	24	25	26
12:10	07:30	08:35	09:20	10:20	09:00	11:05
12:40	07:55	08:40	09:35	10:35	09:15	11:28
12:45	08:00	08:45		10:38	09:17	11:30
13:20	08:30	09:15		12:00	09:55	11:40
01-06N	01-15N	01-16N	01-18N	01-08N	00-23N	00-24N
173-00E	172-58E	172-58E	172-57E	173-02E	173-44E	173-42E
Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Foamer	Breezer	Foamer	Foamer	Jumper	Jumper	Jumper
Medium	Medium	Medium	Small	Medium	Small	Small
Bad	Bad	Bad	None	Somewhat good	Good	Bad
Milkfish	Sea bream	Sea bream	Sea bream	Harengula ovalis Milkfish	Milkfish Spratelloides delicatulus	Milkfish Spratelloides delicatulus
22	8	6	2	65	10	2
bc	c	c	c	bc	o	r
SW1	SW2	SW2	SW2	W3	NW4	NW4
30.0	29.0	29.0	29.0	29.5	27.8	27.8
1014.0	1011.5	1011.5	1011.5	1009.5	1011.0	1011.0
29.9	28.9	28.9	28.9	28.9	28.6	28.6
1	2	2	2	2	4	3
14	20	16		454	87	31
3.8	2.7	2.7		1.8	3.5	1.2
54	54	43		817	305	38
276	11	1		792		
3.7	3.6	3.0		2.3		
1,021	40	3		1,822		
2						
10						
292	31	17		1,246	87	31
1,085	94	46		2,639	305	38

Date		'77.12.11	'77.12.17	'77.12.17	'77.12.17	'77.12.17	'77.12.17
Moon age			6.4	6.4	6.4	6.4	6.4
School No.		27	28	29	30	31	32
Time	Located	12:15	09:00	10:05	11:10	12:40	13:25
	Chum started	12:33	09:20	10:30	11:30	13:00	13:45
	Catch started	12:35		10:35	11:35	13:05	13:50
	Catch finished	13:00		11:00	12:15	13:15	14:10
Position	Latitude	00-26N	00-51S	01-00S	00-56S	00-59S	01-03S
	Longitude	173-43E	174-14E	174-21E	174-23E	174-24E	174-30E
Fish school	Species	Skipjack	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Jumper	Breezer	Breezer	Drifting material	Breezer	Jumper
	Size	Medium	Medium	Medium	Medium	Small	Small
	Baiting tendency	Good	None	Bad	Bad	None	Bad
Bait fish	Species	Milkfish	Harengula ovalis	Harengula ovalis	Harengula ovalis Milkfish	Harengula ovalis	Harengula ovalis
	Amount used	5	2	13	20	2	5
Weather		r	r	o	c	c	c
Wind direction and force		N4	SW3	SW3	SW3	SW3	SW3
Air temperature(°C)		27.8	28.0	28.8	28.8	29.0	29.0
Air pressure(mb)		1011.0	1012.0	1011.0	1009.5	1009.0	1008.0
Water surface temperature (°C)		28.6	28.5	28.4	28.4	28.4	28.4
Sea condition		3	3	3	3	3	3
Fish catch	Skipjack No. of fish	232		31	60		15
	Ave. weight (kg)	3.8		4.3	1.9		2.8
	Catch amount (kg)	882		133	114		42
	Yellowfin tuna No. of fish				36		
	Ave. weight (kg)				1.8		
	Catch amount (kg)				65		
	Little tuna No. of fish						
	Catch amount (kg)						
	Rainbow runner No. of fish						
	Catch amount (kg)						
	Others No. of fish				11		
	Catch amount (kg)				33		
	Total No. of fish	232		31	107		15
	Catch amount (kg)	882		133	212		42

'77.12.17	'77.12.26	'77.12.26	'77.12.26	'78. 1. 5	'78. 1. 5	'78. 1. 5
6.4	15.5	15.5	15.5	25.4	25.4	25.4
33	34	35	36	37	38	39
16:30	07:10	08:30	09:30	09:05	09:45	10:50
16:55	07:30	09:00	09:45	09:30	10:10	11:05
17:00		09:05	09:50		10:15	
17:20		09:20	10:20		10:25	
01-16S	00-28S	00-30S	00-32S	03-20N	03-22N	03-25N
174-36E	174-11E	174-10E	174-05E	172-42E	172-46E	172-55E
Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Breezer	Jumper	Breezer	Breezer	Breezer	Jumper	Jumper
Medium	Small	Medium	Large	Small	Small	Small
Bad	None	Bad	Bad	None	Bad	None
Harengula ovalis Milkfish	Milkfish	Milkfish	Milkfish	Milkfish	Milkfish	Milkfish
13	1	9	10	2	3	2
c	o	o	c	r	r	r
SW2	W3	W3	W3	NW3	NW3	NW3
29.5	28.0	28.5	28.8	29.0	28.7	29.0
1008.0	1013.2	1013.3	1013.1	1009.0	1008.4	1008.3
28.4	28.2	28.2	28.4	28.3	28.3	28.3
2	3	3	3	3	3	3
25		15	24			
2.0		2.8	2.8			
50		42	68			
115			144		1	
2.8			3.0		1.5	
322			432		1.5	
			7			
			21			
			4			
			8			
					3	
					15	
140		15	179		4	
372		42	529		16.5	

Date		'78. 1. 5	'78. 1. 5	'78. 1. 8	'78. 1. 8	'78. 1. 8	'78. 1.10
Moon age		25.4	25.4	28.4	28.4	28.4	0.9
School No.		40	41	42	43	44	45
Time	Located	11:10	13:10	11:50	12:25	13:25	07:00
	Chum started	11:30	13:35	12:20	12:30	13:50	07:20
	Catch started		13:35	12:20		13:55	07:25
	Catch finished		14:00	12:25		14:05	07:40
Position	Latitude	03-22N	03-07N	03-15N	03-15N	03-04N	01-50N
	Longitude	172-57E	172-40E	172-59E	173-00E	173-00E	173-08E
Fish school	Species	Skipjack others mixed	Skipjack Yellowfin tuna mixed	Rainbow runner	Yellowfin tuna	Mixed school	Skipjack Yellowfin tuna mixed
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Breezer	Jumper	Breezer	Jumper	Foamer	Drifting log
	Size	Small	Small	Medium	Small	Small	Medium
	Baiting tendency	None	Bad	Bad	None	Bad	Bad
Bait fish	Species	Milkfish	Milkfish	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis Atherinidae sp.
	Amount used	3	27	4	2	10	10
Weather		r	r	o	o	c	bc
Wind direction and force		NW3	N2	SW3	SW3	SW3	NE2
Air temp. (°C)		29.0	28.5	27.0	27.0	28.4	28.8
Air pressure (mb)		1008.9	1007.0	1011.0	1011.0	1009.2	1015.0
Water surface temperature (°C)		28.3	28.3	28.1	28.1	28.1	28.1
Sea condition		3	2	3	3	3	1
Fish catch	Skipjack No. of fish		4				2
	Ave. weight (kg)		2.5				1.5
	Catch amount (kg)		10				3
	Yellowfin tuna No. of fish		131				20
	Ave. weight (kg)		4.6				1.3
	Catch amount (kg)		602				26
	Little tuna No. of fish					3	
	Catch amount (kg)					9	
	Rainbow runner No. of fish			8			
	Catch amount (kg)			12			
	Others No. of fish		16			5	3
	Catch amount (kg)		70			10	5
	Total No. of fish		151	8		8	25
	Catch amount (kg)		682	12		19	34

'78. 1.10	'78. 1.10	'78. 1.10	'78. 1.13	'78. 1.13	'78. 1.13	'78. 1.13
0.9	0.9	0.9	3.9	3.9	3.9	3.9
46	47	48	49	50	51	52
08:25	11:00	13:20	08:30	09:10	10:20	11:20
09:05	11:25	13:50	08:40	09:15	10:30	11:30
09:05	11:30	13:53				
09:40	11:35	14:10				
01-45N	01-38N	01-23N	01-22N	01-20N	01-13N	01-09N
173-06E	172-54E	172-52E	172-48E	172-51E	172-55E	172-51E
Skipjack Yellowfin tuna mixed	Yellowfin tuna	Mixed	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Foamer	Jumper	Foamer	Jumper	Jumper	Jumper	Jumper
Medium	Small	Medium	Small	Medium	Small	Medium
Bad	None	Bad	None	None	None	None
Harengula ovalis Atherinidae sp.	Harengula ovalis Atherinidae sp.	Harengula ovalis Atherinidae sp.	Harengula ovalis Milkfish	Harengula ovalis Milkfish	Harengula ovalis Milkfish	Harengula ovalis Milkfish
30	5	5	1	3	3	5
b	b	b				bc
NE2	N2	N2				NE4
29.3	29.8	29.8				28.5
1016.0	1015.5	1013.3				1012.0
28.3	28.5	28.5				28.2
1	1	1				3
17		2				
51		6				
30		2				
30		3				
47		4				
81		9				

Date		'78. 1.13	'78. 1.13	'78. 1.13	'78. 1.15	'78. 1.15	'78. 1.15
Moon age		3.9	3.9	3.9	5.9	5.9	5.9
School No.		53	54	55	56	57	58
Time	Located	13:15	15:30	16:05	09:00	13:00	14:30
	Chum started	13:20	15:35	16:10	09:10	13:10	14:35
	Catch started		15:35				14:37
	Catch finished		15:45				14:50
Position	Latitude	01-12N	01-16N	01-19N	01-41.3N	01-59N	01-54.5N
	Longitude	172-59E	172-52E	172-54E	173-01E	172-52E	172-44E
Fish school	Species	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper
	Size	Small	Medium	Small	Medium	Large	Medium
	Baiting tendency	None	Bad	None	None	None	Bad
Bait fish	Species	Harengula ovalis Milkfish	Milkfish	Milkfish	Harengula ovalis	Harengula ovalis	Harengula ovalis
	Amount used	3	6	3	8	10	12
Weather						o	
Wind direction and force						NE4	
Air temp. (°C)						29.2	
Air pressure (mb)						1011.0	
Water surface temperature (°C)						28.2	
Sea condition						3	
Fish catch	Skipjack No. of fish						
	Ave. weight (kg)						
	Catch amount (kg)						
	Yellowfin tuna No. of fish		12				12
	Ave. weight (kg)		3.0				2.4
	Catch amount (kg)		36				29.1
	Little tuna No. of fish						
	Catch amount (kg)						
	Rainbow runner No. of fish						
	Catch amount (kg)						
	Others No. of fish						
	Catch amount (kg)						
	Total No. of fish		12				12
	Catch amount (kg)		36				29.1

'78. 1.15	'78. 1.16	'78. 1.16	'78. 1.20	'78. 1.22	'78. 1.22	'78. 1.22
5.9	6.9	6.9	10.9	12.9	12.9	12.9
59	60	61	62	63	64	65
15:15	09:30	15:30	14:30	08:50	09:45	10:20
15:20	09:38	15:35	15:00	09:30	09:48	10:45
15:20		15:37		09:32	09:50	10:50
15:35		16:05		09:45	10:15	11:10
01-51N	01-17.5N	01-22.5N	00-13N	00-27N	00-27N	00-28N
172-46E	172-54.5E	172-54E	173-43E	173-40E	173-40E	173-41E
Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack	Mixed school	Yellowfin tuna	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Jumper	Jumper	Jumper	Foamer	Breezer	Jumper	Foamer
Large	Small	Small	Small	Small	Medium	Medium
Bad	None	Bad	None	Bad	Bad	Bad
Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis
10	8	12	1	5	20	10
		o	bc	bc	bc	bc
		NE4	ENE3	E1	E1	E1
			28.9	28.4	28.4	28.4
		1011.0	1007.3	1011.3	1011.3	1010.9
			28.4	28.3	28.3	28.3
		4	3	1	1	1
						17
						2.7
						46
8					26	
3.5					4.5	
28					117	
				5		
				10		
				4		
				6		
		33				
		44				
8		33		9	26	17
28		44		16	117	46

Date		'78. 1.22	'78. 1.22	'78. 1.28	'78. 1.28	'78. 1.28	'78. 1.28
Moon age		12.9	12.9	18.9	18.9	18.9	18.9
School No.		66	67	68	69	70	71
Time	Located	11:20	12:25	08:15	10:25	12:20	14:00
	Chum started	11:45	12:48	08:20	10:35	12:30	14:10
	Catch started	11:50	12:50			12:32	14:13
	Catch finished	12:20	13:30			12:37	14:25
Position	Latitude	00-25N	00-23N	03-05N	03-12N	03-10N	03-07N
	Longitude	173-40E	173-41E	172-38E	172-34E	172-36E	172-34E
Fish school	Species	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack	Skipjack
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Foamer	Foamer	Jumper	Jumper	Jumper	Breezer
	Size	Large	Medium	Small	Small	Small	Small
	Baiting tendency	Bad	Somewhat good	None	None	Bad	Bad
Bait fish	Species	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis 3	Milkfish	Milkfish
	Amount used	15	15	4	Milkfish 5	10	12
Weather		bc	bc	c	c	c	bc
Wind direction and force		E1	E1	N5	N5	NE4	NNE4
Air temp. (°C)		28.7	28.7	29.5	29.5	29.9	29.8
Air pressure (mb)		1010.3	1009.8	1007.0	1007.0	1007.0	1006.0
Water surface temperature (°C)		28.6	28.6	27.6	27.7	27.6	27.9
Sea condition		1	1	4	4	4	4
Fish catch	Skipjack No. of fish	55	23			4	35
	Ave. weight (kg)	2.8	3.2			2.5	2.0
	Catch amount (kg)	154	74			10	68
	Yellowfin tuna No. of fish	78	111				
	Ave. weight (kg)	4.5	4.5				
	Catch amount (kg)	351	500				
	Little tuna No. of fish						
	Catch amount (kg)						
	Rainbow runner No. of fish						
	Catch amount (kg)						
	Others No. of fish						
	Catch amount (kg)						
	Total No. of fish	133	134			4	35
	Catch amount (kg)	505	574			10	68

'78. 1.28	'78. 2. 1	'78. 2. 1	'78. 2. 1	'78. 2. 4	'78. 2. 4	'78. 2. 4
18.9	21.9	21.9	21.9	24.9	24.9	24.9
72	73	74	75	76	77	78
15:30	08:05	11:00	12:50	10:40	13:20	14:00
15:35	08:15	11:10	13:00	11:00	13:43	14:20
15:38					13:45	14:25
15:45					13:50	14:30
03-05N	01-56N	01-53N	01-52N	01-24N	01-10N	01-11N
172-42E	172-35E	172-45E	172-48E	172-52E	172-52E	172-54E
Skipjack	Skipjack	Skipjack	Skipjack	Little tuna	Skipjack	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Jumper	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper
Small	Small	Small	Small	Small	Small	Small
Bad	None	None	None	None	Bad	Bad
Milkfish 6 Harengula ovalis 10	Harengula ovalis Milkfish 10	Harengula ovalis Milkfish 10	Harengula ovalis Milkfish 20	Harengula ovalis 2	Harengula ovalis 5	Harengula ovalis 5
bc	r	r	r	bc	c	c
NNE4	NE5	NE4	NE4	SW2	W2	W2
29.7					28.3	28.5
1005.0				1012.0	1010.0	1009.8
27.7	27.7	27.7	27.7	27.7	28.2	28.2
4	4	4	4	2	2	2
23					12	20
2.0					1.9	1.9
46					23	38
						1
						3
23					12	21
46					23	41

Date		'78. 2. 4	'78. 2. 4	'78. 2. 4	'78. 2. 4	'78. 2. 5	'78. 2. 5
Moon age		24.9	24.9	24.9	24.9	25.9	25.9
School No.		79	80	81	82	83	84
Time	Located	14:35	15:00	16:30	17:40	12:05	12:50
	Chum started	14:50	15:10	17:00	18:00	12:35	13:08
	Catch started	14:55	15:15		18:05	12:40	13:10
	Catch finished	15:00	15:30		18:10	12:45	13:20
Position	Latitude	01-10N	01-08N	01-06N	01-05N	00-27N	00-26N
	Longitude	172-55E	172-58E	173-04E	173-03E	173-44E	173-43E
Fish school	Species	Skipjack	Skipjack	Skipjack	Skipjack	Rainbow runner	Mixed
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Breezer	Breezer	Breezer	Breezer	Breezer	Foamer
	Size	Small	Medium	Medium	Small	Small	Medium
	Baiting tendency	Bad	Bad	None	Bad	Bad	Bad
Bait fish	Species	Harengula ovalis	Harengula ovalis	Milkfish	Harengula ovalis Milkfish	Milkfish	Milkfish
	Amount used	10	15	2	5	4	5
Weather		c	c	c	c	bc	bc
Wind direction and force		W2	W2	W2	W2	E1	E1
Air temp. (°C)		28.5	28.5	27.5	27.5	29.5	29.5
Air pressure (mb)		1009.2	1009.6	1008.9	1009.5	1010.8	1010.8
Water surface temperature (°C)		28.2	28.2	28.2	28.2	28.6	28.6
Sea condition		2	2	2	2	1	1
Fish catch	Skipjack						
	No. of fish	15	40		6		
	Ave. weight (kg)	1.9	1.9		2.9		
	Catch amount (kg)	29	76		12		
	Yellowfin tuna						
	No. of fish						
	Ave. weight (kg)						
	Catch amount (kg)						
	Little tuna						
	No. of fish						2
	Catch amount (kg)						6
	Rainbow runner						
	No. of fish					2	
	Catch amount (kg)					5	
	Others						
	No. of fish						
	Catch amount (kg)						
	Total						
	No. of fish	15	40		6	2	2
	Catch amount (kg)	29	76		12	5	6

'78. 2. 5	'78. 2. 7	'78. 2. 7	'78. 2. 7	'78. 2. 7	'78. 2. 7	'78. 2. 7
25.9	27.9	27.9	27.9	27.9	27.9	27.9
85	86	87	88	89	90	91
13:55	07:15	07:40	10:30	11:15	12:50	15:35
14:25	07:25	07:55	11:00	11:50	13:20	16:10
14:30	07:30	08:00			13:25	16:15
14:50	07:35	08:15			13:45	16:35
00-24N	00-25N	00-26N	00-37N	00-42N	00-50N	00-45N
173-44E	173-45E	173-44E	173-30E	173-25E	173-20E	173-00E
Mixed	Little tuna	Mixed	Skipjack	Skipjack	Skipjack	Skipjack
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
Breezer	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper
Medium	Small	Small	Small	Small	Medium	Medium
Bad	Bad	Bad	None	None	Bad	Bad
Milkfish	Dussumieri-idae	Dussumieri-idae	Dussumieri-idae	Harengula ovalis	Harengula ovalis Dus-sumieriidae	Harengula ovalis Milkfish
11	2	2	2	2	6	6
bc	b	b	b	b	b	b
E1	E1	E1	E1	E1	E1	E1
29.5	28.5	28.7	29.0	29.2	29.3	29.9
1008.8	1012.0	1012.9	1012.0	1012.2	1011.0	1009.8
28.9	28.4	28.6	29.7	29.0	29.4	29.6
1	1	1	1	1	1	1
					26	29
					3.8	2.9
					99	83
1		3				
3.0		2.7				
3		8				
4	4					
8	6					
4						
10						
						1
						20
9	4	3			26	30
21	6	8			99	103

Date		'78. 2.12	'78. 2.12	'78. 2.12	'78. 2.12	'78. 2.12	'78. 2.12
Moon age		4.5	4.5	4.5	4.5	4.5	4.5
School No.		92	93	94	95	96	97
Time	Located	12:05	12:45	13:45	14:50	17:00	17:28
	Chum started	12:23	12:48	13:50	15:03	17:08	17:30
	Catch started				15:10	17:15	17:35
	Catch finished				15:15	17:15	17:45
Position	Latitude	01-02N	00-59N	00-52N	00-50.5N	00-43.5N	00-43.5N
	Longitude	172-54.5E	172-53.5E	172-56E	172-53E	172-57.5E	172-58E
Fish school	Species	Unknown	Skipjack	Skipjack	Skipjack	Skipjack	Mixed school
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status		Jumper	Jumper	Jumper	Jumper	Foamer
	Size	Small	Small	Small	Small	Small	Small
	Baiting tendency	None	None	None	Bad	Good	Good
Bait fish	Species	Milkfish	Milkfish	Milkfish	Milkfish	Harengula ovalis Milkfish	Harengula ovalis Milkfish
	Amount used	1	2	3	4	6	3
Weather		bc	bc	bc	bc	bc	bc
Wind direction and force		N3	N3	N3	N3	N3	N3
Air temp. (°C)		29.1	29.1				29.3
Air pressure (mb)		1010.0	1010.0				
Water surface temperature (°C)		29.0	28.5				
Sea condition		3	3	3	3	3	3
Fish catch	Skipjack No. of fish					46	
	Ave. weight (kg)					4.3	
	Catch amount (kg)					199	
	Yellowfin tuna No. of fish						
	Ave. weight (kg)						
	Catch amount (kg)						
	Little tuna No. of fish						
	Catch amount (kg)						
	Rainbow runner No. of fish				7		
	Catch amount (kg)				8.4		
	Others No. of fish						25
	Catch amount (kg)						90
	Total No. of fish				7	46	25
	Catch amount (kg)				8.4	199	90

'78. 2.13	'78. 2.13	'78. 2.13	'78. 2.13	'78. 2.13	'78. 2.16	'78. 2.16
5.5	5.5	5.5	5.5	5.5	8.5	8.5
98	99	100	101	102	103	104
08:50	10:54	12:00	13:33	14:00	07:30	12:00
09:10	11:10	12:05	13:35	14:10	07:40	12:10
09:14		12:06		14:10		12:12
09:18		12:30		15:30		13:20
00-44S	00-36.5S	00-39.6S	00-45.5S	00-45S	01-02N	00-51.5N
174-11.5E	174-08E	174-08E	174-11E	174-15E	173-07E	172-54E
Rainbow runner	Unknown	Rainbow runner	Skipjack	Skipjack	Skipjack	Yellowfin tuna
Birds associated	Birds associated	Birds associated	Plain school	Birds associated	Birds associated	Birds associated
Foamer			Jumper	Jumper	Jumper	Jumper
Medium	Small	Large	Small	Large	Small	Medium
Bad	None	Bad	None	Good	None	Good
Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis	Harengula ovalis
1	2	8	1	8	1	8
c	bc	bc	c	o	bc	bc
N4	N3	N2	NE2	NE2	NNE4	NE3
29.3	29.6	29.8	29.8	29.7	28.0	28.5
1009.0	1010.0	1010.0	1010.0	1010.0	1009.0	1009.0
		29.1				
3	2	2	2	2	3	3
				443		1
				1.3		3.0
				576		3
		1		2		160
		3.0		1.6		3.6
		3.0		8		573
		2				
		3				
1		40				
1.4		56				
						6
						22
1		43		445		167
1.4		62		584		598

Date		'78. 2.21	'78. 2.21	'78. 2.21	'78. 2.21	'78. 2.25	'78. 2.25
Moon age		13.5	13.5	13.5	13.5	17.5	17.5
School No.		105	106	107	108	109	110
Time	Located	10:20	11:05	12:00	12:40	13:00	13:50
	Chum started	10:50	11:35	12:10	13:00	13:20	14:20
	Catch started	10:50	11:40	12:15	13:00	13:25	14:30
	Catch finished	11:00	11:55	12:25	13:15	13:40	14:35
Position	Latitude	01-10N	01-06N	01-05N	01-09N	01-03N	01-00N
	Longitude	172-55E	172-56E	172-56E	172-55E	172-55E	172-54E
Fish school	Species	Skipjack Yellowfin tuna mixed	Skipjack Yellowfin tuna mixed	Skipjack	Mixed	Skipjack	Skipjack
	Kind	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated
	Status	Jumper	Jumper	Jumper	Drifting log	Jumper	Jumper
	Size	Small	Small	Small	Medium	Small	Small
	Baiting tendency	Bad	Somewhat good	Somewhat good	Good	Somewhat good	Bad
Bait fish	Species	Milkfish	Milkfish	Milkfish	Milkfish	Harengula ovalis	Harengula ovalis
	Amount used	2	10	5	2	15	5
Weather		c	o	o	c	b	b
Wind direction and force		N4	N4	N4	N4	NE4	NE4
Air temp. (°C)		29.8	29.2	29.1	29.5	30.0	29.9
Air pressure (mb)		1015.8	1015.3	1014.6	1013.5	1014.0	1013.0
Water surface temperature (°C)		28.6	29.0	29.0	29.0	29.6	29.6
Sea condition		3	3	3	3	3	3
Fish catch	Skipjack						
	No. of fish	2	98	95	37	82	17
	Ave. weight (kg)	2.0	2.1	2.1	1.3	2.5	2.2
	Catch amount (kg)	4	206	200	48	205	37
	Yellowfin tuna						
	No. of fish	5	11		60		
	Ave. weight (kg)	3.2	3.0		1.0		
	Catch amount (kg)	16	33		60		
	Little tuna						
	No. of fish						
	Catch amount (kg)						
	Rainbow runner						
	No. of fish				67		
	Catch amount (kg)				67		
	Others						
	No. of fish						
	Catch amount (kg)						
	Total						
	No. of fish	7	109	95	164	82	17
	Catch amount (kg)	20	239	200	175	205	37

'78. 2.25	'78. 2.25	'78. 2.25	'78. 2.26	'78. 2.26	'78. 2.26	'78. 2.26	
17.5	17.5	17.5	18.5	18.5	18.5	18.5	Total
111	112	113	114	115	116	117	
14:45	15:40	16:20	07:50	10:45	11:45	12:35	
15:15	16:00	16:50	08:40	11:15	12:20	12:50	
15:20		17:00	08:40	11:20	12:20	12:55	
15:35		17:20	08:45	11:35	12:30	13:10	
00-57N		00-52N	00-57N	01-02N	01-08N	01-10N	
172-51E		172-53E	172-52E	172-57E	172-58E	173-00E	
Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack Yellowfin tuna mixed	Skipjack	Skipjack	Skipjack	
Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	Birds associated	
Jumper	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper	
Small	Small	Small	Small	Small	Small	Small	
Bad	None	Bad	Bad	Somewhat good	Somewhat good	Bad	
Harengula ovalis	Harengula ovalis	Harengula ovalis Milkfish	Milkfish	Harengula ovalis Milkfish	Harengula ovalis Milkfish	Harengula ovalis Milkfish	
15	10	20	5	8	7	3	
b	b	bc	bc	b	b	b	
NE4	NE3	NE3	N3	N3	N3	N3	
29.9	30.0	29.8	29.5	30.5	30.5	30.5	
1012.6	1012.2	1012.3	1014.8	1014.2	1013.5	1013.0	
29.6	29.6	29.6	29.1	29.6	29.6	29.6	
3	3	3	3	3	3	3	
20		87		210	145	2	3,275
4.2		6.2		2.2	2.2	2.0	2.52
84		539		462	319	4	8,253
24			2	10			2,736
4.0			3.0	3.0			3.27
96			6	30			8,966
							77
							189
							221
							278
							107
							324
44		87	2	220	145	2	6,887
180		539	6	492	319	4	18,010

Annex Table 2-2, Record of Skipjack Pole-and-Line Catch by Navigation

Navigation Order		1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Navigation Period	Started	'77 11. 7	11.17	11.29	12. 6	12.16	12.25	'78 1. 4	1.12	1.18	1.26	2. 3	2.10	2.20	
	Ended	11.16	11.25	12. 5	12.13	12.20	'78 1. 2	1.10	1.16	1.24	2. 1	2. 9	2.18	2.26	
Skipjack															
	No. of fish	615	60	50	804	131	39	6		95	62	128	490	795	3,275
	Catch (kg)	1,835	119	151	2,042	339	110	13		274	124	360	778	2,108	8,253
	Ave. weight (kg)	2.98	1.98	3.02	2.54	2.58	2.82	2.16		2.88	2.00	2.81	1.58	2.65	2.52
Yellowfin tuna															
	No. of fish	51	629	288	792	151	144	152	32	215		4	166	112	2,736
	Catch (kg)	217	2,518	1,064	1,822	387	432	629	93	968		11	584	241	8,966
	Ave. weight (kg)	4.25	4.00	3.69	2.30	2.56	3.00	4.14		4.50					3.27
Little tuna															
	No. of fish	7	24				7	22		5		10	2		77
	Catch (kg)	14	55				21	66		10		20	3		189
Rainbow runner															
	No. of fish	17	35				4	40		4		6	48	67	221
	Catch (kg)	26	46				8	45		6		15	65	67	278
Others															
	No. of fish	1		2		11		27	33			2	31		107
	Catch (kg)	2		10		33		100	44			23	112		324
Total															
	No. of fish	691	748	340	1,596	293	194	257	65	319	62	170	1,178	974	6,887
	Catch (kg)	2,094	2,738	1,225	3,864	759	571	853	137	1,258	124	429	1,542	2,416	18,010

Annex Table 3

Record of Bait Fish Catching Test
(Stick-held Dip Net)

Date		'77.11. 9	'77.11. 9	'77.11.10	'77.11.11	'77.11.14
Moon age		27.3	27.3	28.3	29.3	2.8
Operation No.		1	2	3	4	5
Position	Latitude	01-22.4N	01-22.4N	01-22.4N	01-22.4N	01-47.5N
	Longitude	173-01.9E	173-01.9E	173-01.9E	173-01.9E	173-00.6E
Distance from shore (mile)		1.5	1.5	1.5	1.5	1.5
Bottom material		R	R	R	R	S
Depth (m)		13	13	13	13	23
Transparency (m)						15
Water surface temperature (°C)		30.0	29.9	29.8	29.7	29.2
Air temperature (°C)		28.5	29.5	28.5	28.0	28.0
Air pressure (mb)		1011.8	1012.5	1011.0	1011.0	1015.0
Weather		b	b	b	b	b
Wind direction and force		E1	SW1	Calm	E1	SE1
Current		W+	W+	0	0	0
Fish attraction		Bad	Somewhat good	Bad	Bad	Good
Operation time	Started	04:05	21:20	03:40	04:30	04:45
	Ended	04:30	21:40	04:05	04:55	05:10
Catch	Clupeidae	12	8	2	3	
	Atherinidae					
	Dussumieriidae					10
	Carangidae					
	Total	12 B/K	8 B/K	2 B/K	3 B/K	10 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks						Dussumieria hasseltii 10

'77.11.15	'77.11.18	'77.11.19	'77.11.21	'77.11.22	'77.11.23
3.8	6.8	7.8	9.8		
6	7	8	9	10	11
01-47.5N	01-39.8N	03-04.3N	03-03.8N	03-07.2N	03-07.2N
173-01.8E	172-53.0E	172-53.4E	172-49.5E	172-47.4E	172-47.4E
1.1	3.0	0.6	0.5	0.5	0.5
R	Coral	Coral	Coral	Coral	Coral
9	16	16	27	7	7
	9				
29.4	29.8	29.6	28.4	28.4	28.5
28.0	28.5	29.0	27.0	27.8	28.0
1014.0	1016.5	1016.0	1013.0	1012.0	1013.0
bc	b	bc	sq	r	r
E2	ESE3	NE1	NNE3	NE3	W1
NW+	WNW+	SSW+			
Good	Bad	Good	Good	Good	Good
04:40	05:00	20:55	04:45	05:10	05:10
05:10	05:25	21:25	06:00	05:30	05:30
6		2		20	20
	15	13	6	30	10
	2				
6 B/K	17 B/K	15 B/K	6 B/K	50 B/K	30 B/K
	Thick in 5 to 7m	Thick in 3 to 5m			
Good	Good	Good	Bad	Good	Good
	Mackerel-scad 2 Dussumieria hasseltii 15	Spratelloides delicatulus 13	Spratelloides delicatulus 6	Spratelloides delicatulus 30	Spratelloides delicatulus 10

Date		77.11.24	'77.12. 4	'77.12.11	'77.12.14	'77.12.15
Moon age			22.8		3.4	4.4
Operation No.		12	13	14	15	16
Position	Latitude	03-07.2N	00-25.1N	00-20.9N	01-21.6N	01-21.8N
	Longitude	172-47.3E	173-52.7E	173-51.8E	172-55.6E	172-55.2E
Distance from shore (mile)		0.5	2.2	0.5	0.2	0.2
Bottom material		Coral	Coral	S	S	S
Depth (m)		7	22	12	12	12
Transparency (m)			8	12 & over	4	4
Water surface temperature (°C)		28.7	28.7	28.3	28.5	28.8
Air temperature (°C)		28.0	29.0	28.0	28.5	27.5
Air pressure (mb)		1010.0	1010.5	1009.0	1011.3	1011.6
Weather		r	b	c	c	c
Wind direction and force		NE2	W1	W4	N2	W2
Current			E+		W+	E+
Fish attraction		Bad	Bad	Bad	Bad	Bad
Operation time	Started	05:00	04:45	04:50	19:05	18:55
	Ended	05:20	05:15	05:20	19:30	19:20
Catch	Clupeidae			2	10	15
	Atherinidae					
	Dussumieridae	2				
	Carangidae					
	Total	2 B/K	0	2 B/K	10 B/K	15 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Spratelloides delicatulus 2	Harengula ovalis were not attracted to the lamp.		Many fries of Harengula ovalis escaped from the net.	30-40 of big horse mackerel and Spanish mackerel were mixed.

'77.12.16	'77.12.24	'77.12.26	'77.12.27	'77.12.29	'77.12.30
5.4	13.5	15.5	16.5	17.4	18.4
17			18		
01-21.8N	01-21.6N	00-41.2S	00-40.3S	01-48.0S	01-21.8S
172-55.2E	172-55.4E	174-24.9E	174-21.5E	175-29.7E	175-58.2E
0.2	0.6	2.7	4.8	2.5	1.8
S	S	S	S	S	S
12	12	17	28	10	22
4	4	7	8	10 & over	
28.5	27.2	27.4	28.0	29.0	28.2
27.5	28.5	28.0	28.0	28.4	28.4
1010.6	1011.0	1014.0	1013.0	1013.0	1012.5
c	bc	bc	o	bc	bc
NE1	W2	W3	WNW3	W3	NW2
E+		E+	E+++		E+++
Somewhat good	None	None	Bad	None	None
02:30			20:55		
02:55			21:20		
15					
			2		
15 B/K			2 B/K		
Good			Somewhat good		
	They were not attracted due to moon light.	They were not attracted.	All Spratelloides delicatulus escaped from the net due to their smallness. (1-2 cm)	No Sardines were seen.	The tide is like that of the river. Unseen

Date		'78. 1. 6	'78. 1. 6	'78. 1. 7	'78. 1. 8	'78. 1. 9
Moon age		26.4	26.4	27.4	28.4	29.4
Operation No.		19	20	21	22	23
Position	Latitude	03-02.3N	03-02.3N	03-02.3N	03-04.3N	03-03.2N
	Longitude	172-48.2E	172-48.2E	172-48.2E	172-46.7E	172-48.0E
Distance from shore (mile)		0.5	0.5	0.5	0.5	0.5
Bottom material		S	S	S	S	S
Depth (m)		8	8	8	7	8
Transparency (m)		4	4	4	5	4
Water surface temperature (°C)		28.3	27.8	27.8	27.8	27.6
Air temperature (°C)		27.5	27.2	25.8	27.2	28.0
Air pressure (mb)		1006.5	1011.7	1010.4	1010.0	1011.0
Weather		r	r	r	bc	bc
Wind direction and force		SW2	SW3	SW2	S2	SW2
Current		E+	E+	NE+	E+	E+
Fish attraction		Somewhat good	Somewhat good	Good	Good	Somewhat good
Operation	Started	04:55	20:45	04:55	05:00	04:55
	Ended	05:20	21:10	05:15	05:20	05:20
Catch	Clupeidae	14	15	40	30	15
	Atherinidae	6		5	5	3
	Dussumieriidae					
	Carangidae					
	Total	20 B/K	15 B/K	45 B/K	35 B/K	18 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks				Many Harengula ovalis escaped from the net due to their smallness.		

'78. 1.18	'78. 1.26	'78. 1.28	'78. 1.29	'78. 1.30	'78. 2. 3
8.9					23.9
24	25	26	27	28	
01-47.6N	01-21.6N	03-02.2N	03-03.5N	03-04.6N	01-21.5N
173-02.2E	172-02.5E	172-47.4E	172-48.3E	172-53.3E	172-55.6E
0.8	0.5	0.5	0.5	0.4	1.2
S	Coral	Coral	Coral	Coral	S
6	7	8	8	16	7
5			5.5	7	4
28.3		27.7	27.7	27.5	27.0
28.5		28.0	28.0	28.5	28.6
1012.4		1007.5	1007.0	1009.0	1011.0
bc		o	c	bc	r
NE1		NE3	NE4	NE5	SW2
0			SW+	SW++	
Bad	Somewhat good	Bad	Bad	Bad	Bad
20:55	21:40	21:40	21:40	21:40	
21:10	22:00	22:00	22:00	22:00	
5	10	5	9	6	
			3	6	
5 B/K	10 B/K	5 B/K	12 B/K	12 B/K	
Good	Good	Good	Good	Bad	
Since they were attracted to the lower part of fish lamp, transition among lamps is bad.					Only few were attracted, so the net was laid.

Date		'78. 2. 5	'78. 2. 6	'78. 2. 6	'78. 2. 7	'78. 2. 9
Moon age		25.9	26.9	26.9	27.9	29.9
Operation No.		29	30	31	32	33
Position	Latitude	00-24.5N	00-24.5N	00-27.1N	00-27.1N	01-28.0N
	Longitude	173-54.7E	173-54.7E	173-50.8E	173-50.8E	173-05.2E
Distance from shore (mile)		0.7	0.7	2	2	1.5
Bottom material		S	S	S	S	S
Depth (m)		8	8	11	11	13
Transparency (m)		4	4	8	8	7
Water surface temperature (°C)		28.5	28.0	28.9	28.3	28.3
Air temperature (°C)		29.0	29.0	28.0	28.0	28.0
Air pressure (mb)		1011.9	1011.0	1012.9	1010.8	1011.7
Weather		c	c	bc	b	c
Wind direction and force		E1	E1	E1	E1	W2
Current			SE+	W+	W+	E+
Fish attraction		Bad	Somewhat good	Bad	Somewhat good	Bad
Operation time	Started	20:15	05:15	21:30	05:10	05:00
	Ended	20:30	05:40	21:45	05:30	05:20
Catch	Clupeidae	1	2	4	1	5
	Atherinidae		2		1	
	Dussumieriidae	4	16	1	8	
	Carangidae					
	Total	5 B/K	20 B/K	5 B/K	10 B/K	5 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		All Spratelloides delicatulus 4 escaped from the net due to their smallness.	Most of Dussumieria hasseltii died inside the net.		Spratelloides delicatulus 4 Dussumieria hasseltii 4 Many Spratelloides delicatulus escaped from the net due to their smallness.	5-6 large Spanish mackerel were in the net.

'78. 2. 9	'78. 2.12	'78. 2.14	'78. 2.17	'78. 2.18	Total
29.9					
34	35	36	37	38	
01-28.0N	01-22.2N	00-41.1S	01-22.0N	01-22.3N	
173-05.2E	173-07.5E	174-21.3E	172-56.0E	173-07.3E	
1.5	0.3	5			
S	Coral	Coral			
13	16	20			
7					
28.3	28.3				
28.0	27.5		28.0	27.3	
1011.7	1010.5		1010.1	1008.0	
c	bc		o	r	
W2	NNE3	NE2	N5	N/E4	
E+					
Bad	Bad	Bad	Bad	Bad	
05:45	05:10	05:20	05:00	05:00	
06:00	05:40	05:50	05:20	06:00	
2	20			1	300
					31
					117
					2
2 B/K	20 B/K	0	0	1 B/K	450 B/K
Good	Good	Good	Bad	Bad	
		All Spratelloides delicatulus escaped from the net.	They were not attracted to the lamp. Current was strong.	Few Spratelloides delicatulus were mixed but escaped. Current was strong.	Dussumieriidae: Spratelloides delicatulus 71 Dussumieria hasseltii 46

Annex Table 4

Record of Bait Fish Catching Test
(Purse Seine)

Date		'77.11.13	'77.11.13	'77.11.13	'77.11.13	'77.11.14
Moon age		1.8	1.8	1.8	1.8	2.8
Operation No.		1	2	3	4	5
Position	Latitude	01-47.8N	01-47.8N	01-47.8N	01-47.8N	01-47.8N
	Longitude	173-02.6E	173-02.6E	173-02.6E	173-02.6E	173-02.6E
Distance from shore (m)		50	50	50	50	100
Bottom material		S	S	S	S	R
Depth (m)		1.5	1.5	1.5	1.5	1
Transparency (m)		1.5 & over	1.5 & over	1.5 & over	1.5 & over	1 & over
Water surface temperature (°C)		30.5	30.5	30.5		30.2
Air temperature (°C)		30.0	30.0	30.0		29.5
Air pressure (mb)						1014.5
Weather		bc	bc	bc	bc	b
Wind direction and force		ENE2	ENE2	ENE2	ENE2	E1
Current						NW+
Size of school		Small	Small	Small	Small	Small
Operation time	Started	15:50	16:15	16:45	17:25	10:30
	Ended	16:10	16:40	17:15	17:50	11:00
Catch	Clupeidae			2	2	15
	Dussumieriidae					
	Atherinidae					
	Sea bream					
	Total	0	0	2 B/K	2 B/K	15 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Failure in driving-in	Failure in driving-in	Failure in driving-in	Failure in driving-in	Birds associated and has color

'77.11.14	'78.11.14	'77.11.21	'77.11.21	'77.11.24	'77.11.24
2.8	2.8				
6	7	8	9	10	11
01-47.8N	01-47.8N	03-04.4N	03-02.2N	03-01.0N	03-01.0N
173-02.6E	173-02.6E	172-53.5E	172-47.4E	172-47.3E	172-47.3E
100	100	40	40	100	100
R	R	Coral sand	Coral	Coral sand	Coral sand
1.5	1.5	1	1	1	1
1.5 & over	1.5 & over	1 & over	1 & over	1 & over	1 & over
30.2			29.1		
29.5			27.5		
1014.5			1014.0		
b	b	r	r	o	o
E1	E1	SSE3	N3		
NW+	NW+				
Small	Small	Small	Small	Small	Small
11:10	11:50	09:30	13:25	09:30	09:55
11:30	12:20	10:00	14:00	09:50	10:20
20	10		28	5	20
			2		
20 B/K	10 B/K	0	30 B/K	5 B/K	20 B/K
Good	Good	Good	Good	Good	Good
Birds not associated and has color.	Birds not associated and has color.	Quick in escaping	Spratelloides delicatulus 2		

Date		'77.11.24	'77.11.24	'77.11.24	'77.12. 2	'77.12. 4
Moon age					20.8	22.8
Operation No.		12	13	14	15	16
Position	Latitude	03-01.0N	03-01.0N	03-01.0N	00-28.8N	00-26.8N
	Longitude	172-47.3E	172-47.3E	172-47.3E	173-49.7E	173-54.1E
Distance from shore (m)		100	100	100	20	20
Bottom material		Coral sand	Coral sand	S	S	Coral sand
Depth (m)		0.7	0.9	0.8	1.5	0.5
Transparency (m)		0.7 & over	0.9 & over	0.8 & over	0.5	0.5 & over
Water surface temperature (°C)					29.2	28.6
Air temperature (°C)					30.5	29.0
Air pressure (mb)					1010.0	1011.8
Weather		o	o	o	bc	b
Wind direction and force					Wl	Wl
Current					O	E+
Size of school		Small	Small	Small	Small	Extremely small
Operation time	Started	11:10	11:25	13:30	15:30	08:30
	Ended	11:15	11:50	13:55	16:10	08:45
Catch	Clupeidae	3	3		1	0.4
	Dussumieriidae					
	Atherinidae	27	2			
	Sea bream					1.6
	Total	30 B/K	5 B/K	0	1 B/K	2 B/K
Record on fish finder						
Net style		Good	Good	Good	Bad	Good
Remarks		Baiting is not active due to large number of Atherinidae.		Failure in throwing the net.	Took time in laying the net due to bad bottom condition. About 30 B/K escaped.	Birds not associated. Plain school

'77.12. 4	'77.12. 4	'77.12. 4	'77.12. 4	'77.12. 4	'77.12. 7
22.8	22.8	22.8	22.8	22.8	25.8
17	18	19	20	21	22
00-26.8N	00-26.8N	00-26.5N	00-26.5N	00-26.5N	01-22.0N
173-54.1E	173-54.1E	173-54.1E	173-54.1E	173-54.1E	173-04.0E
20	20	20	20	20	80
Coral sand	Coral sand	Coral sand	Coral sand	Coral sand	S
0.5	0.5	0.5	0.5	0.5	0.7
0.5 & over	0.5 & over	0.5 & over	0.5 & over	0.5 & over	0.7 & over
b	b	b	b	b	c
					W3
Extremely small	Extremely small	Extremely small	Extremely small	Extremely small	Small
08:55	09:15	09:40	11:00	11:30	09:40
09:10	09:35	10:00	11:20	11:45	10:10
0.5	0.5	0.5	1	0.5	5
4.5	2.5	2.5		3.5	
5 B/K	3 B/K	3 B/K	1 B/K	4 B/K	5 B/K
Good	Good	Good	Good	Good	Good
		Birds not associated. Plain school	Birds not associated. Plain school	Birds not associated. Plain school	Birds associated and has color.

Date		'77.12. 7	'77.12. 7	'77.12. 8	'77.12. 8	'77.12.12
Moon age		25.8	25.8	26.8	26.8	
Operation No.		23	24	25	26	27
Position	Latitude	01-22.0N	01-22.0N	01-22.0N	01-22.0N	Within Aranuka lagoon
	Longitude	173-04.0E	173-04.0E	173-04.0E	173-04.0E	
Distance from shore (m)		80	80	100	50	40
Bottom material		S	S	S	S	S
Depth (m)		0.7		1.2	1.8	0.6
Transparency (m)		0.7 & over		1.2 & over	1.8 & over	0.6 & over
Water surface temperature (°C)						
Air temperature (°C)						
Air pressure (mb)						
Weather		c	c	r	r	
Wind direction and force		W3	W3	W3	W3	
Current						
Size of school		Small	Small	Medium	Small	Extremely small
Operation time	Started	10:40	12:00	11:00	13:50	10:40
	Ended	11:10	12:25	11:30	14:10	11:05
Catch	Clupeidae	30	5	60		
	Dussumieriidae					
	Atherinidae					
	Sea bream					
	Total	30 B/K	5 B/K	60 B/K	0	0
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Birds associated and has color.	Has color. Failure in catching.	Birds associated and has color.	Has color. Because driving-in took time due to deepness of the water, it was a failure.	Plain school Failure

'77.12.12	'77.12.12	'77.12.12	'78. 1.13	'78. 1.13	'78. 1.13
2.9	2.9	2.9	3.9	3.9	3.9
28	29	30	31	32	33
Within Aranuka lagoon	Within Aranuka lagoon	Within Aranuka lagoon	01-21.5N	01-21.5N	01-21.5N
			173-03.0E	173-03.0E	173-03.0E
50	50	50	100	100	100
S	S	S	S	S	S
0.7	0.7	0.7	1	1	1
0.7 & over	0.7 & over	0.7 & over	1 & over	1 & over	1 & over
			29.2		
			29.3		
			1012.5		
			b	b	b
			SE1	SE1	SE1
Extremely small	Extremely small	Extremely small	Small	Small	Small
13:35	14:10	14:45	13:55	14:05	14:30
14:00	14:35	15:10	14:05	14:20	14:50
1	2	1	3	3	10
1 B/K	2 B/K	1 B/K	3 B/K	3 B/K	10 B/K
Good	Good	Good	Good	Good	Good
Extremely small plain school	Extremely small plain school	Extremely small plain school	Extremely small plain school	Extremely small plain school	

Date		'78. 1.13	'78. 1.14	'78. 1.14	'78. 1.14	'78. 1.18
Moon age		3.9	4.9	4.9	4.9	8.9
Operation No.		34	35	36	37	38
Position	Latitude	01-21.5N	01-47.8N	01-47.8N	01-47.8N	01-47.6N
	Longitude	173-03.0E	173-02.4E	173-02.4E	173-02.4E	173-02.7E
Distance from shore (m)		100	80	80	80	50
Bottom material		S	S	S	S	S
Depth (m)		1	0.8	0.8	0.8	1
Transparency (m)		1 & over	0.8 & over	0.8 & over	0.8 & over	1 & over
Water surface temperature (°C)						28.9
Air temperature (°C)						29.0
Air pressure (mb)			1012.0	1012.0	1012.0	1009.6
Weather		b	o	o	o	b
Wind direction and force		SE1	NE2	NE2	NE2	N1
Current						S+
Size of school		Small	Medium	Medium	Small	Small
Operation time	Started	15:00	13:30	15:20	15:40	14:15
	Ended	15:20	13:50	15:35	15:55	14:30
Catch	Clupeidae	15	60	20	10	15
	Dussumieriidae					
	Atherinidae					
	Sea bream					
	Total	15 B/K	60 B/K	20 B/K	10 B/K	15 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks			Birds associated. Has color.	Birds associated. Has color.	Birds not associated. Jumper	Birds associated. Jumper

'78. 1.18	'78. 1.18	'78. 1.18	'78. 1.18	'78. 1.19	'78. 1.21
8.9	8.9	8.9	8.9	9.9	11.9
39	40	41	42	43	44
01-47.6N	01-47.6N	01-47.6N	01-47.6N	01-47.5N	00-25.0N
173-02.7E	173-02.7E	173-02.7E	173-02.7E	173-02.9E	173-55.2E
50	50	50	50	50	100
S	S	S	S	S	S
1	1	1		0.5	0.5
1 & over	1 & over	1 & over		0.5 & over	0.5 & over
				28.0	28.5
				26.5	28.5
				1012.9	1011.2
b	b	b	b	r	bc
N1	N1	N1	N1	ENE3	E2
					W+
Small	Small	Small	Medium	Extremely small	Medium
14:35	14:55	15:20	15:35	08:00	09:30
14:50	15:15	15:30	15:50	08:10	09:45
10	10	10	20	1	20
10 B/K	10 B/K	10 B/K	20 B/K	1 B/K	20 B/K
Good	Good	Good	Good	Good	Good
Birds associated. Jumper	Birds associated. Jumper	Birds associated. Jumper	Birds not associated. Has color.	Small plain school	Birds associated. Has color. Low tide. Taking-in took time due to shallow water.

Date		'78. 1.21	'78. 1.21	'78. 1.21	'78. 1.23	'78. 1.26
Moon age		11.9	11.9	11.9	13.9	16.9
Operation No.		45	46	47	48	49
Position	Latitude	00-25.0N	00-25.0N	00-24.7N	00-25.9N	01-21.2N
	Longitude	173-55.2E	173-55.2E	173-55.2E	173-54.7E	173-02.6E
Distance from shore (m)		100	100	150	150	80
Bottom material		S	S	S	S	S
Depth (m)		0.5	0.5	1.5	0.5	0.8
Transparency (m)		0.5 & over	0.5 & over	1.5 & over	0.5 & over	0.8 & over
Water surface temperature (°C)		28.5		28.5	28.3	
Air temperature (°C)		28.5		28.5	27.0	
Air pressure (mb)		1011.2		1008.6	1011.5	
Weather		bc	bc	bc	r	
Wind direction and force		E2	E2	E2	SE1	
Current		W+		O		
Size of school		Small	Small	Medium	Extremely small	Small
Operation time	Started	09:50	10:20	12:55	09:00	14:00
	Ended	10:05	10:35	13:20	09:15	14:20
Catch	Clupeidae	10	10	30	5	10
	Dussumieriidae					
	Atherinidae					
	Sea bream					
	Total	10 B/K	10 B/K	30 B/K	5 B/K	10 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Birds associated. Jumper	Birds associated. Jumper	Birds not associated. Has color. 60% escaped because taking-in took time due to deep water.	School had dispersed due to low tide. Extremely small.	

'78. 1.26	'78. 1.26	'78. 1.29	'78. 1.29	'78. 1.29	'78. 1.31
16.9	16.9	19.9	19.9	19.9	21.9
50	51	52	53	54	55
01-21.2N	01-21.2N	03-02.8N	03-02.8N	03-02.8N	03-04.0N
173-02.6E	173-02.6E	172-48.8E	172-48.8E	172-48.8E	172-53.2E
80	100	80	80	70	80
S	S	S	S	S	S and Coral
0.8	0.9	0.6	0.6	0.7	0.8
0.8 & over	0.9 & over	0.6 & over	0.6 & over	0.7 & over	0.8 & over
		27.7	27.7		27.5
		28.8	28.8		30.0
		1007.0	1007.0		1008.0
		bc	bc	bc	bc
		N/E4	N/E4	N/E4	N4
Extremely small	Extremely small	Large	Small	Small	Small
14:30	15:15	10:30	10:55	11:15	10:50
14:45	15:30	10:50	11:10	11:25	11:00
6	1	20	10		10
		10	5	5	
6 B/K	1 B/K	30 B/K	15 B/K	5 B/K	10 B/K
Good	Good	Good	Good	Good	Good
		Birds associated. Has color. Large school. They were not surrounded in due to the smallness of the net.			

Date		'78. 1.31	'78. 1.31	'78. 2. 3	'78. 2. 3	'78. 2. 3
Moon age		21.9	21.9	23.9	23.9	23.9
Operation No.		56	57	58	59	60
Position	Latitude	03-04.0N	03-04.0N	01-21.6N	01-21.6N	01-21.6N
	Longitude	172-53.2E	173-53.2E	173-03.5E	173-03.5E	173-03.5E
Distance from shore (m)		80	80	100	100	100
Bottom material		S and Coral	S and Coral	S	S	S
Depth (m)		0.8	0.8	1.2	1.2	1.2
Transparency (m)		0.8 & over	0.8 & over	1.2 & below	1.2 & below	1.2 & below
Water surface temperature (°C)		27.5		27.5	27.5	
Air temperature (°C)		30.0		29.5	29.5	
Air pressure (mb)		1008.0		1009.0	1009.0	
Weather		bc	bc	bc	bc	bc
Wind direction and force		N4	N4	N1	N1	N1
Current				W+	W+	
Size of school		Small	Small	Medium	Small	Small
Operation time	Started	11:10	11:30	14:20	14:40	15:00
	Ended	11:20	11:40	14:35	14:55	15:20
Catch	Clupeidae			30	10	15
	Dussumieriidae					
	Atherinidae	4	1			
	Sea bream					
	Total	4 B/K	1 B/K	30 B/K	10 B/K	15 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Birds associated. Jumper Small		Birds 2-3 Has color.	Birds not associated. Jumper school	Birds not associated. Jumper school

'78. 2. 3	'78. 2. 9	'78. 2. 9	'78. 2. 9	'78. 2. 9	'78. 2.11
23.9	29.9	29.9	29.9	29.9	3.5
61	62	63	64	65	66
01-21.6N	01-21.5N	01-21.5N	01-21.5N	01-21.5N	01-21.9N
173-03.5E	173-03.2E	173-03.2E	173-03.2E	173-03.2E	173-06.1E
100	100	100	100	100	40
S	S	S	S	S	S
1.2	1.2	1.2	1	1	1
1.2 & below	1.2 & over	1.2 & over	1 & over	1 & over	1 & over
	28.6	28.6	28.6	28.6	
	30.0	30.0	30.0	30.0	
	1012.5	1012.5	1013.0	1013.0	
bc	b	b	b	b	bc
N1	NW1	NW1	NW1	NW1	NNE3
	W+	W+	W+	W+	SW+
Small	Medium	Small	Small	Small	Small
15:30	08:10	08:30	08:45	09:00	17:30
15:45	08:25	08:40	08:55	09:15	17:50
15	10	5	5	5	10
15 B/K	10 B/K	5 B/K	5 B/K	5 B/K	10 B/K
Good	Good		Good	Good	Good
Birds not assoicated. Jumper school	Birds associated. Has color. Medium school Failure in driving-in.	Birds not associated. Jumper school They escaped due to quickness.	Birds not associated. Jumper Small school	Birds not associated. Jumper Small school	

Date		'78. 2.15	'78. 2.15	'78. 2.15	'78. 2.22	'78. 2.24
Moon age		7.5	7.5	7.5	14.5	16.5
Operation No.		67	68	69	70	71
Position	Latitude	01-21.8N	01-21.8N	01-21.8N	01-21.4N	01-21.7N
	Longitude	173-05.6E	173-05.6E	173-05.6E	172-55.4E	173-05.1E
Distance from shore (m)		60	60	60	50	100
Bottom material		S	S	S	S	S
Depth (m)		0.8	0.8	0.8	1.5	1
Transparency (m)		0.4	0.4	0.4	0.5	1 & over
Water surface temperature (°C)					28.6	29.4
Air temperature (°C)					29.0	29.8
Air pressure (°C)		1010.5	1010.5		1012.0	1013.5
Weather		bc	bc	bc	bc	bc
Wind direction and force		NNE	NNE	NNE	N4	NE3
Current						
Size of school		Medium	Small	Medium	Small	Medium
Operation time	Started	13:45	14:05	14:30	14:20	14:20
	Ended	14:00	14:20	14:50	14:35	14:35
Catch	Clupeidae	20	12	15	5	25
	Dossumieriidae					
	Atherinidae					
	Sea bream					
	Total	20 B/K	12 B/K	15 B/K	5 B/K	25 B/K
Record on fish finder						
Net style		Good	Good	Good	Good	Good
Remarks		Birds associated. Has color.	Birds associated. Jumper	Driving-in failed due to their quickness.		Birds associated. Has color.

'78. 2.24	'78. 2.24	'78. 2.24	'78. 2.28	'78. 2.28	Total
16.5	16.5	16.5	20.5	20.5	
72	73	74	75	76	
01-21.7N	01-21.7N	01-21.7N	01-21.9N	01-21.9N	
173-05.1E	173-05.1E	173-05.1E	173-05.5E	173-05.5E	
100	100	100	60	60	
S	S	S	S	S	
1	1	1	0.7	0.7	
1 & over	1 & over	1 & over	0.7 & over	0.7 & over	
29.4	29.4				
29.8	29.8				
1013.5					
bc	bc	bc	c	c	
NE3	NE3	NE3	N3	N3	
Medium	Small	Medium	Medium	Medium	
14:40	15:00	15:20	09:30	10:00	
14:55	15:15	15:35	09:55	10:30	
25	5	25	50	28	851
					2
					54
					14
25 B/K	5 B/K	25 B/K	50 B/K	28 B/K	921 B/K
Good	Good	Good	Good	Good	
Birds not associated. Jumper school	Birds not associated. Jumper. Surrounding failed due to their quickness.		Birds associated. Has color.	Birds associated. Jumper Surrounding failed.	

Annex Table 5. Record of Bottom Fish Catching Test

Date		'78. 2.25		'78. 3. 2		'78. 3. 3		'78. 3. 3		'78. 3. 3		'78. 3. 4		Total	
Moon age				22.6		23.6		23.6		23.6		24.6			
Operation No.		1		2		3		4		5		6			
Time	Operation started	18:30		19:00		09:30		14:00		19:00		05:00			
	Operation ended	20:00		22:30		11:30		18:00		22:00		07:00			
Position	Latitude	00-55.5N		00-53.0N		00-55.0N		00-55.6N		00-54.7N		00-55.4N			
	Longitude	172-55.5E		172-55.2E		172-54.8E		172-55.0E		172-55.0E		172-55.4E			
Bottom material		Coral		Coral		Coral		Coral		Coral		Coral			
Depth (m)		8		7		20		30 ~ 45		25 ~ 30		30			
Transparency (m)								22							
Weather		bc		r		bc		b		bc		bc			
Wind direction & force		NE4		SW5				NE1							
Air temperature (°C)		28.8						30.5							
Air pressure (mb)		1014.5						1013.2							
Water surface temperature (°C)		29.2						29.7							
Sea condition		3						Calm							
Fish kind \ Catch		No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg
Lutjanidae		39	81	21	84	103	165	94	133	95	203	15	22	367	688
Lethrinidae		11	31	1	4	3	12	14	19	5	14	3	5	37	85
Sphyraenidae		62	86	34	34	0	0	0	0	32	32	22	13	150	165
Carangidae		3	6	37	96	0	0	0	0	4	14	21	31	65	147
Epinephelidae		10	35	1	7	21	21	2	3	7	48	3	4	44	118
Gymnosaradae unicolor		1	3	1	11	3	21	3	21	0	0	0	0	8	56
Others		20	55	7	14	1	6	1	2	6	19	1	3	36	99
Total		146	297	102	250	131	225	114	178	149	330	65	78	707	1,358
Angler Number		12		6		12		12		12		12			

Annex Table 6

Record of Catches by Trolling

Date		'78. 3. 2	'78. 3. 2	'78. 3. 2	'78. 3. 2	'78. 3. 2
Moon age						
Operation time	Started	09:00	10:00	11:00	12:00	13:00
	Ended	09:59	10:59	11:59	12:59	13:59
Position	Latitude	01-15N	01-09N	01-02N	00-59N	00-59N
	Longitude	172-54E	172-53E	172-51E	172-53E	172-50E
Weather		o	o	r	r	r
Wind direction and force		N5	N5	N4	N4	N4
Air temperature (°C)				28.0	28.0	
Air pressure (mb)				1015.5	1015.5	
Water surface temperature (°C)						
Sea condition		4	4	4	4	4
Hook No.	1 - 1	SJ 6	0	DF 1 SJ 1	SJ 2	SJ 4
	1 - 2	0	0	YF 1	0	0
	1 - 3	0	0	0	0	0
	2 - 1	-	0	YF 1	DF 1 SJ 1	SJ 2
	2 - 2	-	0	YF 1	0	SJ 1
	3 - 1	SJ 2	SJ 2	0	0	SJ 2
	3 - 2	0	0	0	0	0
	4 - 1	SJ 3	SJ 1	SJ 1	SJ 1	SJ 4
	4 - 2	SJ 1	0	SJ 1	DF 1	SJ 1
	5 - 1	SJ 5	SJ 2	SJ 1	SJ 1	SJ 2
	5 - 2	0	SJ 1	YF 1	SJ 1	SJ 1

Catch	Fish kind	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg
	Skipjack	17	76.5	6	27.0	4	18.0	6	27.0	17	76.5
	Yellowfin tuna	0	0	0	0	4	16.0	0	0	0	0
	Dolphin	0	0	0	0	1	4.0	2	8.0	0	0
	Total	17	76.5	6	27.0	9	38.0	8	35.0	17	76.5

'78. 3. 2	'78. 3. 4	'78. 3. 4	'78. 3. 4	'78. 3. 4	Total
14:00	08:00	09:00	10:00	11:00	
15:00	08:59	09:59	10:59	12:00	
00-54N	01-01N	01-03N		01-18N	
172-52E	172-55E	172-56E		172-55E	
r	bc	bc	bc	bc	
N5	NW2	NW2	NW2	NW2	
				29.3	
		1012.0	1012.0	1012.0	
4					
YF 1 SJ 2	0	SJ 1	0	SJ 2	SJ-18, DF-1, YF-1
SJ 1	0	0	0	SJ 1	SJ-2, YF-1
0	SJ 1	0	0	0	SJ-1
YF 1 SJ 1	0	SJ 2	0	SJ 1	SJ-7, DF-1, YF-2
0	0	0	0	-	SJ-1, YF-1
SJ 1	SJ 1	0	0	SJ 3	SJ-11
0	0	0	0	0	
SJ 1	0	0	0	SJ 2	SJ-13
0	0	0	0	0	SJ-3, DF-1
SJ 3	SJ 1	SJ 1	0	SJ 1	SJ-17
0	0	0	0	0	SJ-3, YF-1

No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg	No. of fish	kg
9	40.5	3	10.5	4	14.0	0	0	10	35.0	76	325.0
2	8.0	0	0	0	0	0	0	0	0	6	24.0
0	0	0	0	0	0	0	0	0	0	3	12.0
11	48.5	3	10.5	4	14.0	0	0	10	35.0	85	361.0

Annex Table 7

Body Length Distribution of Skipjack

Area	West Abaiang		North Marakei		West Abaiang		North Maiana		North Maiana	
Date	'77.11.11		'77.11.12		'77.11.15		'77.11.30		'77.12. 9	
School No.	2		5		9		20		24	
Range of fork length (cm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
30										
31			1							
32			1							
33			2							
34			1							
35			6							
36			8							
37			7							
38			16							
39			6							
40			15							
41			18							
42			11				1		2	1.5
43			3				3		7	5.1
44			1				1		6	4.3
45			2				4		24	17.4
46			1				5		22	15.9
47			1				9		24	17.4
48			1				7		20	14.5
49							9		12	8.7
50					1		4		6	4.3
51	2	3.1					2		7	5.1
52					1		5		4	2.9
53	1	1.6					6			
54	3	4.7			1		3		1	0.7
55	3	4.7			3		1			
56	9	14.0			12		1		2	1.5
57	10	15.6			11		5		1	0.7
58	12	18.7			31		3			
59	14	21.9			17		1			
60	6	9.4			7		5			
61	1	1.6			7		8			
62	1	1.6					4			
63	2	3.1			1		6			
64					1		1			
65							3			
66					1		1			
67							1			
68					1					
69							1			
70										
71										
72										
73							1			
74										
75										
N	64		101		95		101		138	

Area	West Abemama		West Abemama		West Butaritari		South Maiana		West Nonouti	
Date	'77.12.11		'77.12.11		'78. 1.28		'78. 2.12		'78. 2.13	
School No.	25		27		71		96		102	
Range of fork length (cm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
30										
31										
32										
33										
34										
35										
36										
37			2	6.9					6	
38			1	3.5					15	
39			3	10.3					43	
40			2	6.9					29	
41			4	13.8	1	2.2			6	
42			6	20.7						
43			5	17.2	2	4.4			1	
44			3	10.3	3	6.5				
45			2	6.9	7	15.2				
46			1	3.5	5	10.8				
47					8	17.4				
48	1	1.4			7	15.2				
49	2	2.9			5	10.8				
50	2	2.9			4	8.7				
51	6	8.6								
52	3	4.3								
53	7	10.0			1	2.2	2	4.4		
54	12	17.1					1	2.2		
55	9	12.9			1	2.2	3	6.5		
56	8	11.4					6	13.0		
57	9	12.9					11	23.9		
58	8	11.4					8	17.4		
59	2	2.9			1	2.2	7	15.2		
60	1	1.4					3	6.5		
61							2	4.4		
62							3	6.5		
63										
64										
65										
66										
67										
68					1	2.2				
69										
70										
71										
72										
73										
74										
75										
N	70		29		46		46		100	

Area	North Malana		West Malana		West Malana		South Tarawa		Total	
Date	'78. 2.21		'78. 2.25		'78. 2.26		'78. 3. 2			
School No.	106		109		115					
Range of fork length (cm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
30										
31									1	0.1
32									1	0.1
33									2	0.2
34									1	0.1
35									6	0.6
36									8	0.7
37									15	1.4
38									32	2.9
39	2								54	5.0
40	2		1	1.3					49	4.5
41	7		2	2.6	4				42	3.8
42	15		4	5.1	10				49	4.5
43	23		9	11.5	11				64	5.9
44	19		10	12.8	15				58	5.3
45	12		14	17.9	16				81	7.4
46	6		10	12.8	18				68	6.3
47	4		8	10.2	13				67	6.2
48	5		6	7.7	5				52	4.8
49	3		5	6.4	5				41	3.8
50	2		2	2.6	1				22	2.0
51			1	1.3	2				20	1.8
52			2	2.6					15	1.4
53			1	1.3					18	1.7
54			3	3.9			1	5.0	25	2.3
55									20	1.8
56									38	3.5
57									47	4.3
58							1	5.0	63	5.8
59									42	3.8
60									22	2.0
61							2	10.0	20	1.8
62							4	20.0	12	1.1
63							5	25.0	14	1.3
64							4	20.0	6	0.6
65							1	5.0	4	0.4
66							2	10.0	4	0.4
67									1	0.1
68									2	0.2
69									1	0.1
70										
71										
72										
73									1	0.1
74										
75										
N	100		78		100		20		1088	100.0

Annex Table 8

Biological Survey on Skipjack

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length FL(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
2	1	59	4.5	o				o				o		
	2	51	2.8	o				o				o		
	3	60	4.5	o				o			Stolephorus sp.		o	
	4	59	4.3		o			o			"		o	
	5	61	4.4	o				o			"		o	
	6	62	4.6	o				o				o		
	7	59	4.3	o			o					o		
	8	56	4.0		o		o						o	
	9	58	4.3		o		o						o	
	10	58	4.0		o			o					o	
	11	58	4.3	o			o						o	
	12	61	4.5	o				o					o	
	13	62	4.8		o		o					o		
	14	60	4.3	o				o					o	
	15	66	5.8	o			o						o	
	16	63	4.9	o				o				o		
	17	59	4.2		o			o					o	
	18	61	4.6	o				o			Stolephorus sp., Hairtail, Small fish		o	
	19	63	4.5	o			o					o		
	20	60	4.2	o				o					o	
5	1	48	1.8	o			o					o		
	2	43.5	1.5		o		o					o		
	3	41.5	1.2			o					Squid	o		
	4	40.5	1.1		o		o					o		
	5	41.5	1.2			o								
	6	43	1.3			o								
	7	44.5	1.5		o		o					o		
	8	45	1.5			o						o		
	9	41	1.2			o						o		
	10	45	1.6		o		o					o		
	11	40	1.1		o		o					o		
	12	38	1.0		o		o					o		
	13	41	1.2		o		o					o		
	14	43.5	1.4	o			o					o		
	15	38	0.9		o		o					o		
	16	43.5	1.2			o						o		
	17	45	1.6		o		o					o		
	18	45	1.4	o			o					o		
	19	41.5	1.2			o						o		
	20	46	1.6		o		o					o		
9	1	62	4.4		o			o			Stolephorus sp.		o	
	2	61	4.4		o		o						o	
	3	69	6.0	o			o				Stolephorus sp., Squid, Filefish		o	
	4	60.5	4.4		o		o						o	
	5	60	4.2	o			o						o	
	6	61	4.3		o		o				Stolephorus sp., Squid		o	
	7	61	4.4	o			o				Stolephorus sp., Hairtail, Filefish		o	

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length Fl.(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
	8	62	4.6	o				o					o	
	9	61.5	4.4		o			o					o	
	10	60.5	4.0		o		o						o	
	11	61	4.5	o			o				Stolephorus sp., Filefish		o	
	12	62	4.3	o			o						o	
	13	61	4.3		o		o				Stolephorus sp., Filefish		o	
	14	61	4.4		o		o				Stolephorus sp., Squid		o	
	15	62	4.5	o			o				Stolephorus sp., Filefish		o	
	16	61	4.7		o			o					o	
	17	61	4.2		o		o						o	
	18	62	3.9	o			o				Stolephorus sp.		o	
	19	62	4.7	o			o				"		o	
	20	64	4.6	o			o						o	
16	1	40	1.5	o				o				o		
	2	50	2.5	o					o		Stolephorus sp.	o		
	3	44	1.5	o			o				"			o
	4	47	1.9	o			o				Stolephorus sp., Small fish		o	
	5	43	1.5		o		o				Stolephorus sp.		o	
	6	39	1.2	o			o				"		o	
	7	45	1.8	o				o			Stolephorus sp., Squid		o	
	8	57	3.8	o					o			o		
	9	49	2.2		o			o			Stolephorus sp.		o	
	10	46	1.9	o			o				"		o	
	11	42	1.6	o			o				"		o	
	12	46	1.9	o			o				"		o	
	13	46	1.9	o			o				"		o	
	14	46	2.1	o				o			"		o	
	15	41	1.4	o			o					o		
	16	39	1.4	o			o				Stolephorus sp.		o	
	17	36	0.9		o		o				"		o	
	18	45	1.9		o		o				"		o	
	19	46	2.4		o			o			"			o
	20	46	1.9	o			o				"		o	
21	1	52	2.9	o				o			Stolephorus sp.			o
	2	48	2.3		o		o				"			o
	3	47	2.2	o			o				"		o	
	4	59.5	4.2	o				o			"		o	
	5	46	2.0	o			o				"			o
	6	50.5	2.4	o			o				"			o
	7	48	2.5	o			o				"			o
	8	50	2.6	o			o				"		o	
	9	47.5	2.2	o			o				"			o
	10	55	3.2		o			o			"		o	
	11	52	3.0		o		o				"	o		
	12	55.5	3.6	o				o			"		o	
	13	50	2.5	o			o				"	o		
	14	48	2.1		o		o				"			o

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length Fl.(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
	15	43.5	1.6		o		o				Stolephorus sp.		o	
	16	46	1.9		o		o				"			o
	17	49	2.5		o		o				"			o
	18	51	2.7	o			o				"		o	
	19	50.5	2.6	o			o				"			o
	20	49.5	2.6	o			o				"			o
24	1	52	2.6	o				o				o		
	2	47	2.0	o			o				Milkfish 2			
	3	48	1.7	o			o					o		
	4	47	1.7		o			o				o		
	5	49	1.9		o			o				o		
	6	48	2.0	o				o			Milkfish 2		o	
	7	47	1.8		o			o				o		
	8	44	1.6		o			o			Milkfish 1			
	9	47	1.8		o			o				o		
	10	42	1.2	o			o					o		
	11	46	1.5		o			o				o		
	12	43	1.3	o			o					o		
	13	46	1.4	o			o					o		
	14	46	1.7	o			o					o		
	15	47	1.8	o			o					o		
	16	47	1.8	o			o					o		
	17	50	2.1		o			o			Milkfish			
	18	46	1.6		o			o			"			
	19	48	2.0	o				o			"	o		
	20	50	2.4		o			o			"			
25	1	59	4.0	o					o		Milkfish 7, Squid			
	2	61	3.6	o							Milkfish 1			
	3	59	3.2	o				o			Small carangidae sp.			
	4	59	3.4		o			o			Milkfish 1			
	5	59	3.7		o				o		Milkfish 2, Stolephorus sp., Small carangidae sp.			
	6	59	3.7	o					o		Milkfish 2, Stolephorus sp. 1			
	7	57	3.1		o			o			Milkfish 3			
	8	63	4.5	o					o		Milkfish 2			
	9	56	3.2		o			o			Small carangidae sp., Flying fish			o
	10	57	3.6		o			o			Milkfish 5, Stolephorus sp.			
	11	59	4.0	o				o			Milkfish 2, Stolephorus sp.			
	12	53	2.5		o			o			Milkfish 4, Small fish			o
	13	58	3.2	o				o			Milkfish 8			
	14	57	3.5	o				o			Squid		o	
	15	59	3.7		o				o		Milkfish 12			
	16	61	3.8		o				o		Milkfish 2, Stolephorus sp.			o
	17	51	2.3	o			o				Milkfish 4			
	18	57	3.2		o			o			Milkfish 1			
	19	62	4.3	o					o		Small carangidae sp.			
	20	58	3.4	o				o				o		

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length Fl.(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
26	1	40	1.1		o		o				Small fish		o	
	2	37	0.8		o		o				"		o	
	3	39	1.0			o	o				Stolephorus sp.			
	4	43	1.4			o	o					o		
	5	37	0.9		o		o				Milkfish 1, Small fish		o	
	6	41	1.3		o		o				Small fish			
	7	43	1.0			o	o					o		
	8	43	1.2			o	o				Milkfish 4			
	9	42	1.2		o		o				Milkfish 3			
	10	45	1.5		o			o				o		
	11	41	1.2		o		o				Milkfish 1			
	12	41	1.3		o		o					o		
	13	43	1.5		o		o				Milkfish 1			
	14	40	1.3		o		o				"			
	15	46	1.3		o		o					o		
	16	42	1.0		o		o					o		
	17	44	1.5		o			o			Milkfish 1			
	18	44	1.5		o		o				"			
	19	45	1.4		o			o				o		
	20	39	1.0		o		o					o		
29	1	62	4.6	o				o				o		
	2	48	2.1		o			o				o		
	3	59	4.1		o				o			o		
	4	57	3.6		o				o			o		
	5	54	3.1		o		o					o		
	6	61	4.7		o			o			Harengula ovalis 5	o		
	7	58	3.7		o			o				o		
	8	60	4.3	o				o				o		
	9	55	3.1		o		o					o		
	10	55	3.4	o			o					o		
	11	66	5.8	o				o				o		
	12	61	4.4	o				o				o		
	13	61.5	4.7		o				o		Stolephorus sp. 2	o		
	14	59	4.6		o				o			o		
	15	53	2.6		o		o				Harengula ovalis 5	o		
	16	46	1.7		o		o					o		
	17	58	4.3	o				o				o		
	18	62	4.6	o					o			o		
	19	60	4.5	o				o				o		
	20	59	4.5		o			o				o		
66	1	48.5	2.1		o			o			Stolephorus sp.		o	
	2	59	4.2		o				o		"		o	
	3	60	4.5		o			o			"		o	
	4	60	4.7	o				o			"		o	
	5	49.5	2.2		o			o			"		o	
	6	48.5	2.4	o				o			"		o	
	7	47	2.5		o			o			"		o	

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length FL.(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
	8	46.5	2.2	o					o		Stolephorus sp.		o	
	9	51	2.8	o					o		"	o		
	10	50	2.5		o				o		"	o		
	11	48.5	2.4		o			o			"		o	
	12	47.5	2.0		o		o				"	o		
	13	45.5	1.8		o		o				"	o		
	14	50.5	2.5	o				o			"	o		
	15	48.5	1.9	o			o				"	o		
	16	48.5	2.5		o				o		"	o		
	17	54.5	3.5		o			o			"	o		
	18	52.5	3.0	o				o			"	o		
	19	45.5	2.0	o			o				"		o	
	20	50.5	3.0		o				o		"		o	
71	1	47	2.0	o				o			Squid 2, Milkfish 1			
	2	48	2.0		o			o				o		
	3	47	1.9		o			o			Milkfish 3			
	4	68	3.5		o			o			Shrimp 1			
	5	45	1.7		o		o				Milkfish 2, Small fish 1			
	6	50	2.6		o				o		Squid 1, Milkfish 2			
	7	48	1.9	o				o			Milkfish 3			
	8	45	1.6		o		o				Milkfish 1			
	9	45	1.7	o				o			Squid 1, Milkfish 1			
	10	45	1.5	o			o				Milkfish 3			
	11	44	1.4	o			o					o		
	12	43	1.3		o		o				Milkfish 5, Squid 1			
	13	55	1.9	o				o			Milkfish 8			
	14	47	2.2	o				o			Squid 1, Milkfish 1			
	15	44	1.6		o		o					o		
	16	48	1.5		o			o			Milkfish 1			
	17	45	1.7		o			o				o		
	18	45	1.7	o			o				Milkfish 4, Squid 1			
	19	46	2.0	o				o			Milkfish 2, Small fish			
	20	46	2.0		o			o			Milkfish 5, Small fish			
78	1	45.5	1.6	o			o				Shrimp, Harengula ovalis 1	o		
	2	46	1.7		o		o					o		
	3	46.5	1.8		o		o					o		
	4	48	2.1		o			o				o		
	5	47.5	1.8	o			o					o		
	6	48.5	2.0		o		o					o		
	7	44.5	1.6		o		o				Harengula ovalis 1, Stolephorus sp.	o		
	8	47.5	1.8	o			o				Harengula ovalis 1, Stolephorus sp.	o		
	9	49.5	2.1		o		o					o		
	10	49.5	2.1		o		o					o		
	11	46.5	1.9	o			o					o		
	12	48	1.8		o		o				Harengula ovalis 1, Stolephorus sp.	o		
	13	47.5	1.7		o		o					o		
	14	46	1.5		o		o					o		

A=Immature, B=Maturing, C=Mature, D=Spawned, M=Male, F=Female

School No.	Fish No.	Body length FL(cm)	Weight (kg)	Sex			Maturity of gonad				Condition of stomach			
				M	F	?	A	B	C	D	Stomach contents	Empty	Half filled	Full
	15	49	2.2	o			o				Harengula ovalis 2, Stolephorus sp., Shrimp		o	
	16	48.5	2.1		o		o					o		
	17	49	2.0		o		o				Harengula ovalis 3	o		
	18	48.5	2.1		o		o					o		
	19	49.5	2.0	o			o					o		
	20	45	1.5		o		o					o		
96	1	58	4.2		o			o			Milkfish 2, Harengula ovalis 18			
	2	59	4.5		o			o			Harengula ovalis 7			
	3	56	4.2	o				o			Milkfish 1, Harengula ovalis 18			
	4	54	3.5	o			o				Harengula ovalis 14			
	5	60	4.5	o					o		Harengula ovalis 5			
	6	59	4.1	o					o		Harengula ovalis 5			
	7	57	4.5		o				o			o		
	8	58	4.4	o					o		Harengula ovalis 2			
	9	61	5.3	o					o		Harengula ovalis 10, Milkfish 4			
	10	60	5.0	o					o		Harengula ovalis 43			
	11	55	4.4	o					o		Harengula ovalis 16			
	12	57	4.5		o			o			Harengula ovalis 4			
	13	56	4.0		o			o			Harengula ovalis 4			
	14	58	4.0		o			o			Harengula ovalis 4	o		
	15	57	3.9	o				o			Harengula ovalis 8	o		
	16	57	4.5		o			o			Harengula ovalis 9	o		
	17	57	4.0		o			o			Harengula ovalis 16	o		
	18	56	4.0		o			o			Harengula ovalis 16	o		
	19	55	4.3		o				o		Harengula ovalis 1	o		
	20	59	4.7	o					o		Harengula ovalis 7	o		
113	1	66	6.3	o				o			Harengula ovalis 9	o		
	2	64	6.0	o				o			Harengula ovalis 11	o		
	3	66	6.2	o					o		Harengula ovalis 27	o		
	4	65.5	6.3		o				o			o		
	5	61	6.0		o				o		Harengula ovalis 2, Small fish 2	o		
	6	61.5	5.2		o				o		Harengula ovalis 1	o		
	7	65.5	6.3		o				o		Harengula ovalis 6	o		
	8	63.5	5.8	o				o			Harengula ovalis 5	o		
	9	63	5.7		o				o		Harengula ovalis 7	o		
	10	66	6.5	o					o		Small fish 1	o		
	11	64	6.3		o				o			o		
	12	64	6.1		o			o			Harengula ovalis 12	o		
	13	64	6.8		o				o		Harengula ovalis 2	o		
	14	66	6.6		o				o		Harengula ovalis 4	o		
	15	64.5	6.0		o			o			Harengula ovalis 4	o		
	16	63	6.0	o				o			Harengula ovalis 9	o		
	17	65	6.2	o				o			Milkfish 2, Harengula ovalis 2	o		
	18	66.5	6.8	o				o			Harengula ovalis 29	o		
	19	67	7.0	o				o			Harengula ovalis 25	o		
	20	66.5	6.1	o				o			Harengula ovalis 9	o		

Annex Table 9

Body Length Distribution of Bait Fishes

Area (lagoon)	Ambo (Tarawa)		Abaiang		Abaiang		Abaiang		Ambo (Tarawa)	
Date	'77.11. 9		'77.11.13		'77.11.14		'77.11.14		'77.11.18	
Operation No.	Stick-2		Purse-4		Stick-5		Purse-6		Stick-7	
Fish kind	Harengula ovalis		Harengula ovalis		Dussumieria hasseltii		Harengula ovalis		Dussumieria hasseltii	
Range of fork length (mm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
20 and over										
25 "										
30 "										
35 "										
40 "										
45 "										
50 "										
55 "										
60 "	6						5			
65 "	23		22	32.8			33			
70 "	29		42	62.7			30			
75 "	20		3	4.5			18			
80 "	16						9			
85 "	4						5			
90 "										
95 "	2									
100 "										
110 "										
120 "										
130 "									4	
140 "									3	
150 "					6	5.0			16	
160 "					71	60.0			54	
170 "					33	28.0			22	
180 "					6	5.0				
190 "					1	1.0			1	
200 "					1	1.0				
N	100		67		118		100		100	

Butaritari		Abemama		Bikenibeu (Tarawa)		Betio (Tarawa)		Butaritari		Butaritari	
'77.11.21		'77.12. 4		'77.12. 8		'77.12.15		'78. 1. 6		'78. 1. 7	
Purse-9		Purse-18		Purse-20		Stick-15		Stick-20		Stick-21	
Harengula ovalis		Pomadasyidae sp.		Harengula ovalis		Harengula ovalis		Harengula ovalis		Harengula ovalis	
No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
		4									
		5				18					
		2				24					
		1				23				7	
		1				10		2		22	
		4		1	1.9	15		14		22	
						2		14		11	
1	1.3	6		6	11.5	5		15		10	
14	18.7	9		5	9.7			1			
38	50.7	2		20	38.5	3		8		3	
16	21.3	5		18	34.6			5		6	
6	8.0			2	3.8			15		10	
		3						20		5	
		4						5		3	
		9								1	
		20						1			
		17									
		5									
		1									
		1									
		1									
75		100		52		100		100		100	

Area (lagoon)	Butaritari		Abaiang		Abaiang		Abemama		Abemama	
Date	'78. 1. 7		'78. 1.14		'78. 1.18		'78. 1.21		'78. 1.21	
Operation No.	Stick-21		Purse-36,37		Purse-42		Purse-44		Purse-47	
Fish kind	Pranesus pinguis		Harengula ovalis		Harengula ovalis		Harengula ovalis		Harengula ovalis	
Range of fork length (mm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
20 and over										
25 "										
30 "										
35 "					32				7	
40 "					2				1	
45 "	3				1		4		11	
50 "	29				1		10		21	
55 "	30		6	2.8	6		27		18	
60 "	16		18	8.2	10		16		12	
65 "	16		130	60.0	26		17		10	
70 "	6		60	27.7	15		11		4	
75 "			3	1.3	5		10		7	
80 "					2		3		8	
85 "							1		1	
90 "										
95 "							1			
100 "										
110 "										
120 "										
130 "										
140 "										
150 "										
160 "										
170 "										
180 "										
190 "										
200 "										
N	100		217		100		100		100	

Butaritari		Butaritari		Butaritari		Butaritari		Ambo (Tarawa)		Abemama	
'78. 1.30		'78. 1.30		'78. 1.30		'78. 1.31		'78. 2. 3		'78. 2. 6	
Stick-28		Stick-28		Stick-28		Purse-55		Purse-58		Stick-30	
Harengula ovalis		Pranesus pinguis		Spratelloides delicatulus		Harengula ovalis		Harengula ovalis		Harengula ovalis	
No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
				2	2.1						
				3	3.2						
1	1.2	2	1.2	31	33.0						
1	1.2	8	4.8	27	28.7						
12	14.1	41	24.4	25	26.6	10	6.7	5			
26	30.5	69	41.1	6	6.4	23	15.4	8		14	
21	24.7	28	16.6			29	19.5	9		14	
4	4.7	17	10.1			23	15.4	9		20	
9	10.6	3	1.8			14	9.4	4		27	
9	10.6					27	18.1	6		25	
2	2.3					14	9.4	12			
						7	4.7	16			
						2	1.4	15			
								14			
								2			
85		168		94		149		100		100	

Area (lagoon)	Abemama		Abemama		Bikenibeu (Tarawa)		Eita (Tarawa)		Eita (Tarawa)	
Date	'78. 2. 6		'78. 2. 6		'78. 2.12		'78. 2.15		'78. 2.24	
Operation No.	Stick-30		Stick-30		Stick-35		Purse-67		Purse-71	
Fish kind	Spratelloides delicatulus		Dussumieria hasseltii		Harengula ovalis		Harengula ovalis		Harengula ovalis	
Range of fork length (mm)	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%	No. of fish	%
20 and over										
25 "	1									
30 "	15									
35 "	16				5	3.5	3	1.9	1	
40 "	26				4	2.8	7	4.4	4	
45 "	29				9	6.3	33	20.8	9	
50 "	5				10	6.7	40	25.2	30	
55 "	6				9	6.3	38	23.9	29	
60 "	2				21	14.7	21	13.2	20	
65 "					31	21.8	5	3.1	5	
70 "					25	17.6	5	3.1	2	
75 "					23	16.0	7	4.4		
80 "					4	2.8				
85 "					2	1.5				
90 "			3							
95 "			1							
100 "			12							
110 "			30							
120 "			26							
130 "			13							
140 "			11							
150 "			4							
160 "										
170 "										
180 "										
190 "										
200 "										
N	100		100		143		159		100	

Annex Table 10

Biological Survey on Bait Fishes

A=Immature, B=Mature, C=Spawned
M=Male, F=Female

Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
Purse-3	1	Harengula ovalis	7.5	?			
	2		7.0	F	o		
	3		7.0	F	o		
	4		7.5	F	o		
	5		8.0	?			
	6		7.5	M	o		
	7		7.5	?			
	8		7.0	M	o		
	9		7.5	F	o		
	10		7.5	?			
	11		7.5	F	o		
	12		7.5	F	o		
	13		7.0	F	o		
	14		7.5	F	o		
	15		7.0	F	o		
	16		7.0	F	o		
	17		6.5	F	o		
	18		7.5	F	o		
	19		7.0	F	o		
	20		7.5	F	o		
Purse-6,7	1	Harengula ovalis	7.3	F	o		
	2		8.0	M	o		
	3		6.6	M	o		
	4		6.5	M	o		
	5		7.5	F	o		
	6		9.5	F	o		
	7		9.5	F	o		
	8		9.0	F	o		
	9		7.0	F	o		
	10		6.5	F	o		
	11		7.0	F	o		
	12		7.5	F	o		
	13		7.5	F	o		
	14		7.5	F	o		
	15		8.0	F	o		
	16		7.5	F	o		
	17		10.0	F		o	
	18		8.0	F		o	
	19		9.0	F		o	
	20		8.5	F		o	
Stick-5	1	Dussumieria hasseltii	17.0	F		o	
	2		17.5	F	o		
	3		18.0	M	o		
	4		16.5	M	o		
	5		18.0	F	o		
	6		17.5	M	o		
	7		17.0	F	o		
	8		17.0	M	o		
	9		17.0	?			
	10		18.0	F	o		
	11		17.5	M		o	
	12		17.5	F	o		
	13		19.5	F		o	
	14		16.5	F	o		
	15		17.0	M	o		
	16		17.5	F	o		
	17		18.0	F	o		
	18		17.5	F	o		
	19		17.5	M	o		
	20		18.0	F	o		
Stick-7	1	Dussumieria hasseltii	17.0	F		o	
	2		14.5	F	o		
	3		15.8	F	o		
	4		16.8	M	o		
	5		16.0	F	o		
	6		16.8	M	o		
	7		17.0	M	o		
	8		17.0	M	o		
	9		16.5	F	o		
	10		17.3	F		o	
	11		17.0	M	o		
	12		15.8	M	o		
	13		14.0	?			
	14		16.8	F		o	
	15		14.2	M	o		
	16		16.7	M		o	
	17		17.4	F	o		
	18		15.5	M	o		
	19		16.0	M	o		
	20		17.3	F	o		
Stick-8	1	Spratelloides delicatulus	5.0	?			
	2		4.5	?			
	3		3.9	?			
	4		3.5	?			
	5		4.2	?			
	6		3.3	?			
	7		3.1	?			
	8		2.2	?			
	9		3.4	?			
	10		2.7	?			

A=Immature, B=Mature, C=spawned
M=Male, F=Female

Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
	11		4.6	?			
	12		3.6	?			
	13		4.3	?			
	14		5.7	F		o	
	15		4.3	F	o		
	16		4.2	?			
	17		4.2	?			
	18		3.7	?			
	19		4.7	?			
	20		4.2	?			
Purse-9	1	Harengula ovalis	6.9	M		o	
	2		7.3	M		o	
	3		8.0	M		o	
	4		6.5	M		o	
	5		6.4	M		o	
	6		5.7	M		o	
	7		6.2	M		o	
	8		6.7	M		o	
	9		7.2	M		o	
	10		6.3	M		o	
	11		6.6	M		o	
	12		6.5	M		o	
	13		6.8	M		o	
	14		6.8	M		o	
	15		6.8	F		o	
	16		5.9	M		o	
	17		6.7	M		o	
	18		6.4	M		o	
	19		6.6	M		o	
	20		7.0	M		o	
Purse-16	1	Pomadasyidae sp.	10.8	F	o		
	2		7.0	F	o		
	3		17.0	M	o		
	4		13.3	F	o		
	5		8.6	?	o		
	6		7.5	M	o		
	7		11.3	F	o		
	8		11.3	M	o		
	9		11.3	F	o		
	10		9.0	M	o		
	11		7.0	F	o		
	12		9.5	M	o		
	13		10.2	F	o		
	14		10.5	F	o		
	15		9.8	F	o		

Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
	16		10.0	M	o		
	17		10.2	F	o		
	18		10.3	M	o		
	19		10.0	M	o		
	20		9.8	F	o		
Stick-16	1	Harengula ovalis	4.0	?			
	2		4.6	?			
	3		4.5	M	o		
	4		4.5	M	o		
	5		4.1	?			
	6		3.8	?			
	7		3.6	F	o		
	8		4.4	M	o		
	9		3.6	M	o		
	10		4.3	?			
	11		4.0	F	o		
	12		3.6	F	o		
	13		3.6	M	o		
	14		4.1	M	o		
	15		4.6	F	o		
	16		4.3	F	o		
	17		4.5	?			
	18		5.2	M	o		
	19		4.3	M	o		
	20		5.5	F	o		
Stick-20	1	Harengula ovalis	9.0	F	o		
	2		8.5	F	o		
	3		8.3	F	o		
	4		8.3	F	o		
	5		8.5	M	o		
	6		8.7	F	o		
	7		8.2	F	o		
	8		9.0	F	o		
	9		7.8	F	o		
	10		8.3	M	o		
	11		7.5	M	o		
	12		8.0	F	o		
	13		8.2	M	o		
	14		7.8	F	o		
	15		8.3	F	o		
	16		8.2	F	o		
	17		8.2	F	o		
	18		7.0	F	o		
	19		6.8	?	o		
	20		6.0	?	o		

A=Immature, B=Mature, C=Spawned
M=Male, F=Female

Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
Stick-21	1	Harengula ovalis	5.5	F	o		
	2		7.5	F	o		
	3		7.0	F	o		
	4		8.0	F	o		
	5		7.5	F	o		
	6		5.0	?	o		
	7		5.0	M	o		
	8		5.0	?	o		
	9		5.3	?	o		
	10		5.5	?	o		
	11		4.8	F	o		
	12		7.0	F	o		
	13		5.0	?	o		
	14		7.5	F	o		
	15		7.8	F	o		
	16		5.5	M	o		
	17		5.3	?	o		
	18		6.7	M	o		
	19		5.6	M	o		
	20		5.7	F	o		
Purse-41	1	Harengula ovalis	4.8	?	o		
	2		5.0	?	o		
	3		7.4	M	o		
	4		7.5	M		o	
	5		6.8	M	o		
	6		7.0	F	o		
	7		7.2	M		o	
	8		7.0	F	o		
	9		7.6	F	o		
	10		7.0	F	o		
	11		7.2	M	o		
	12		7.2	M	o		
	13		7.4	F	o		
	14		7.0	M	o		
	15		7.2	M		o	
	16		7.2	M	o		
	17		7.4	M		o	
	18		7.2	M	o		
	19		7.5	M	o		
	20		7.3	M	o		
Purse-44	1	Harengula ovalis	6.6	F	o		
	2		7.2	M	o		
	3		5.4	F	o		
	4		7.4	M	o		
	5		5.4	F	o		
	6		6.7	F	o		
	7		5.1	F	o		
	8		6.0	F	o		
	9		5.1	F	o		
	10		6.5	F	o		
	11		7.2	M		o	
	12		6.4	F	o		
	13		7.0	M		o	
	14		5.1	F	o		
	15		9.0	M			o
	16		6.7	M		o	
	17		7.2	M	o		
	18		5.2	F	o		
	19		6.3	F	o		
	20		6.5	F	o		
Purse-58	1	Harengula ovalis	8.8	F	o		
	2		6.9	F	o		
	3		8.2	F		o	
	4		6.7	?	o		
	5		5.6	?	o		
	6		8.8	F		o	
	7		5.5	?	o		
	8		6.0	?	o		
	9		7.5	M	o		
	10		6.5	?	o		
	11		5.5	?	o		
	12		8.3	F			o
	13		8.0	F			o
	14		5.5	?	o		
	15		6.4	?	o		
	16		8.4	F			o
	17		6.2	?	o		
	18		8.0	M	o		
	19		7.4	M	o		
	20		6.5	?	o		
Stick-30	1	Dussumieria hasseltii	14.0	F	o		
	2		15.0	F		o	
	3		12.0	F	o		
	4		15.5	F			o
	5		13.5	F	o		
	6		14.7	M	o		
	7		12.5	F	o		
	8		13.0	F	o		
	9		14.5	F		o	
	10		11.5	F	o		

A=Immature, B=Mature, C=Spawned
M=Male, F=Female

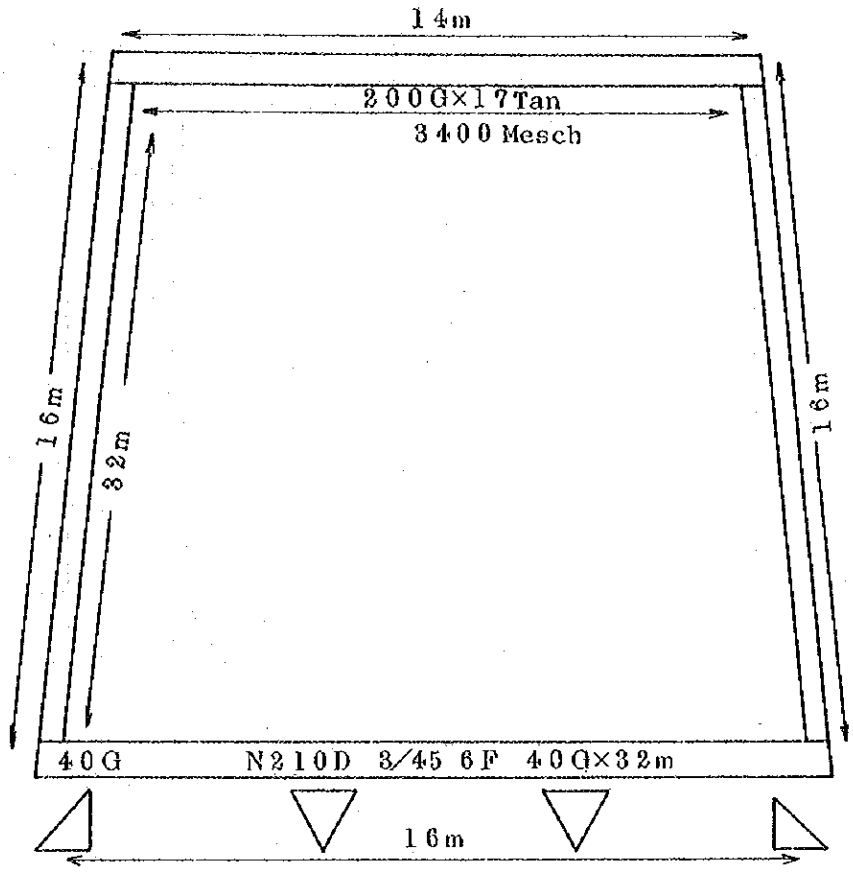
Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
	11		15.0	M		o	
	12		14.0	M		o	
	13		16.7	F			o
	14		13.0	M	o		
	15		13.5	M	o		
	16		12.5	M	o		
	17		12.5	M	o		
	18		14.0	M	o		
	19		13.0	F	o		
	20		13.0	F	o		
Stick-30	1	Harengula ovalis	6.7	M	o		
	2		6.7	F	o		
	3		6.5	F	o		
	4		6.3	F	o		
	5		6.2	?	o		
	6		4.9	M	o		
	7		6.7	F	o		
	8		5.6	M	o		
	9		6.8	F	o		
	10		5.2	?	o		
	11		6.8	M	o		
	12		7.1	F	o		
	13		6.6	F	o		
	14		6.2	F	o		
	15		6.5	F	o		
	16		5.2	F	o		
	17		6.3	F	o		
	18		4.8	F	o		
	19		6.0	M	o		
	20		6.6	F	o		
Stick-35	1	Harengula ovalis	6.5	M	o		
	2		7.3	M	o		
	3		7.7	F	o		
	4		6.7	M	o		
	5		7.1	F	o		
	6		8.0	F		o	
	7		7.7	M	o		
	8		6.2	M	o		
	9		7.4	M	o		
	10		7.2	F	o		
	11		6.7	M	o		
	12		7.1	F	o		
	13		7.3	M	o		
	14		5.1	M	o		
	15		8.0	F	o		

Operation No.	Fish No.	Fish kind	Body length (cm)	Sex	Gonad A	Gonad B	Gonad C
	16		7.1	F	o		
	17		7.6	F	o		
	18		7.3	M	o		
	19		7.4	M	o		
	20		7.4	M	o		
Purse-67	1	Harengula ovalis	6.2	M	o		
	2		6.0	?			
	3		6.2	?			
	4		6.2	?			
	5		6.5	M			
	6		6.7	F	o		
	7		7.2	M		o	
	8		6.4	F	o		
	9		6.6	?			
	10		6.0	?			
	11		7.1	F	o		
	12		6.7	F	o		
	13		7.2	M		o	
	14		6.1	?			
	15		6.7	M	o		
	16		5.7	?			
	17		6.8	F	o		
	18		6.2	?			
	19		6.0	?			
	20		6.1	?	o		
Purse-71	1	Harengula ovalis	6.4	M	o		
	2		6.2	M	o		
	3		6.3	F	o		
	4		6.6	M	o		
	5		6.6	F	o		
	6		6.7	F	o		
	7		6.4	M	o		
	8		6.2	F	o		
	9		5.5	M	o		
	10		6.3	M	o		
	11		6.7	F	o		
	12		5.6	F	o		
	13		5.7	M	o		
	14		5.2	?	o		
	15		6.7	M	o		
	16		6.3	F	o		
	17		7.1	M	o		
	18		6.8	M	o		
	19		6.6	M	o		
	20		5.7	?	o		

ANNEX FIGURES

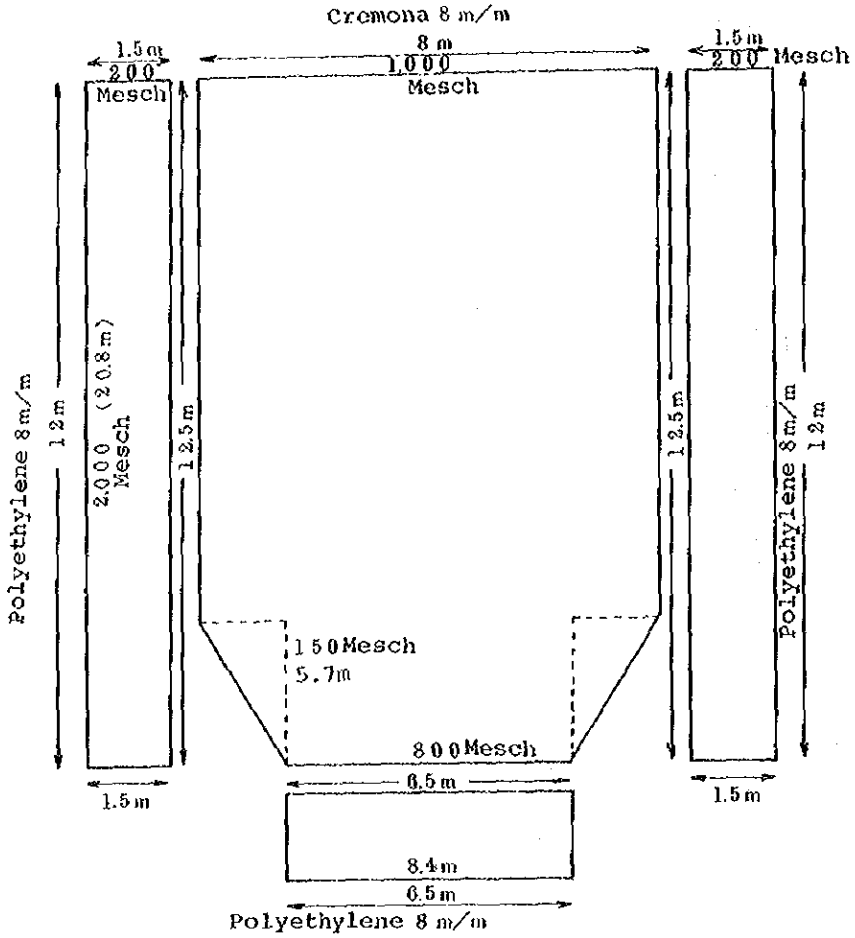
CONTENTS OF ANNEX FIGURE

Figure 1. Stick-held Dip Net



Netting	N210D 3/6 30F 200G x 32m	17 tan
"	N210D 3/15 24F 20G x 25m	1 "
"	N210D 3/45 6F 40G x 30m	1 "
Rope	Tylon 8m/m 160m	1 string
Sinker	(lead) 375g (#300) 64 pieces	24 kg
"	(") 50kg 4 "	20 kg
Round ring	ϕ 8 x 40m/m	30 pieces
Wire rope	9m/m 40m	2 strings
Bamboo fastening rope	Cremona 6m/m 100m	1 string
Bamboo frame	9 - 12m (ϕ100 x 120m/m)	16 pieces

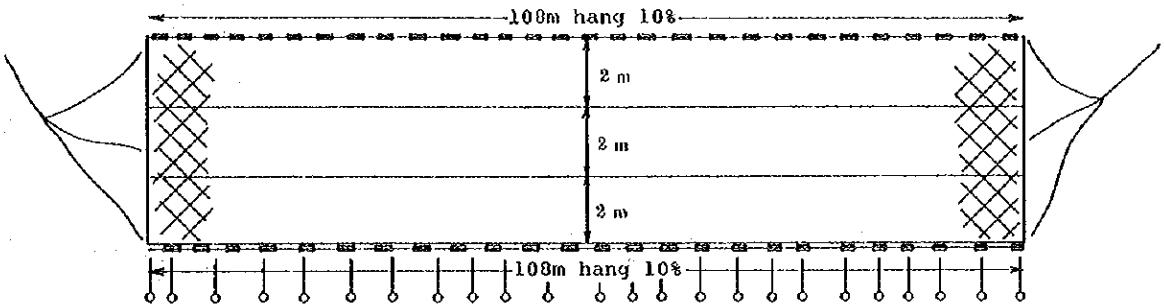
Figure 2. Drive-in Net



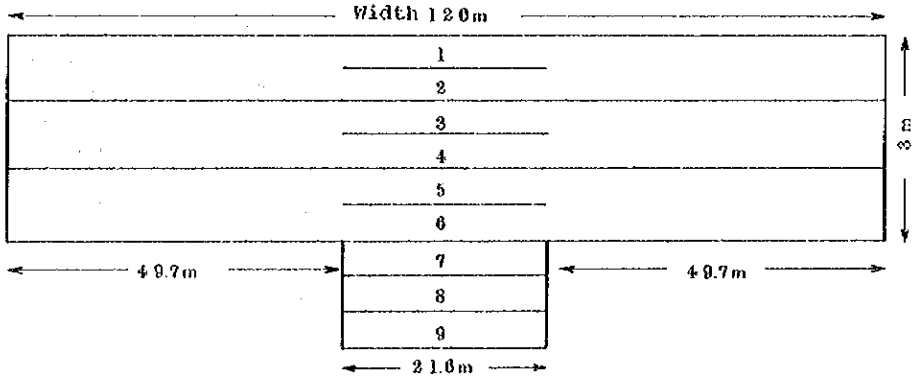
Netting	N210D 3/6 30F 200G x 20.8m	7 tan
"	N210D 3/6 30F 200G x 8.4m	1 "
Rope	Bottom side, cremona, 8m/m 50m	1 string
"	Float, polyethylene, 8m/m 30m	1 "
"	Scare, polyethylene, 12m/m 25m	1 "
"	Scare, cremona, 12m/m 25m	1 "
Short pole	(supporting pole) ϕ 20m/m 1.9m/m	2 pieces
" "	(supporting pole) ϕ 20m/m 2.2m/m	2 "
Ring	ϕ 6 x 40m/m	12 "
Float	(round shaped) 4A-8 110m/m (vinycon)	4 "
Sinker	(short) 113g (#30)	30 "
Float	(cylindrical) E-10/1	60 "

Figure 3. Purse Seine (Beach Net)

Sketch of the Finished Net



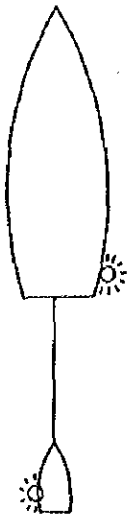
Sketch of the Middle Net



Netting	4 x 4 x 120	4 m/m
Floating rope	Cremona	3 m/m
Sinker rope	Eulon	9 m/m
Float	Large ϕ 100m/m Small ϕ 60m/m	
Leg lead		500 pieces
Leg ring	47m/m	40 "
Ring fastening rope	9m/m Eulon	
Edge pulling rope	9m/m Eulon	

Figure 4. Operation Order of Stick-held Dip Net Fishing

(1)

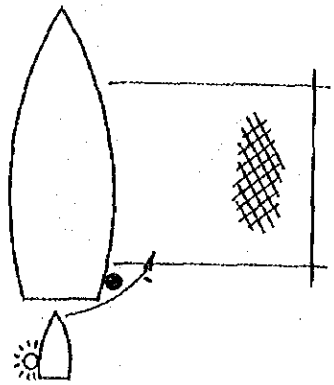


After anchoring, by lighting the fish attraction lamp start the fish attraction. "Bonito" mooring rope is to be 40-80m. Set the length appropriately each time. Fish attraction lamp: 2Kw Incandescent underwater fish attraction lamp
Main ship: 1
"Bonito": 1

(2)

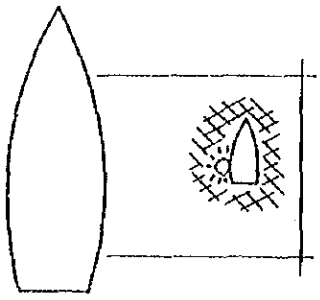
Draw "Bonito" towards the main ship by pulling the rope. 2 crews are to be on board at this time.

(3)



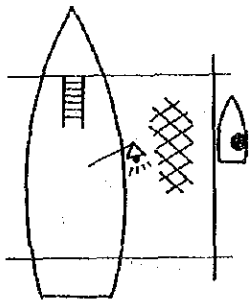
By turning off the underwater fish attraction lamp of the main ship, lower the illuminating power of "Bonito", and attract and float the fish school.

(4)



Move fish attraction lamps gradually to the center of the stick-held dip net in order to guide the fish school.

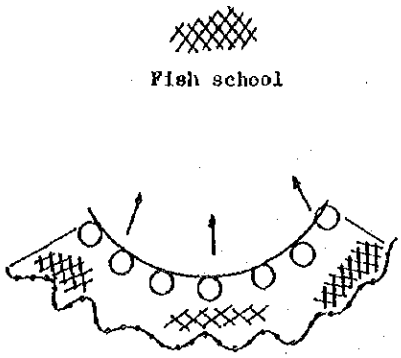
(5)



Pull up the net to the side of the ship move the fish school inside the fishing net, and put them in the live-fish pen of the main ship using buckets. In order to protect the school, light on the lamp on board the main ship.

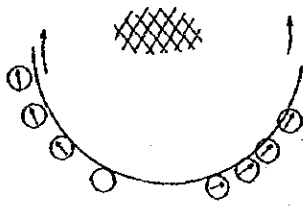
Figure 5. Operation Order by Purse Seine (Beach Net)

(1)



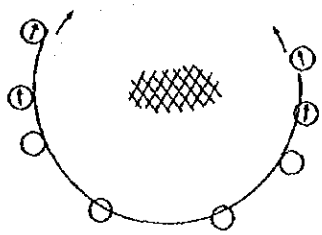
Water depth around 0.5-1.2m is appropriate. After visually confirming the rising school, 1 person is to carry the averaged 10m leg rope and quietly approach to the school as illustrated above.

(2)



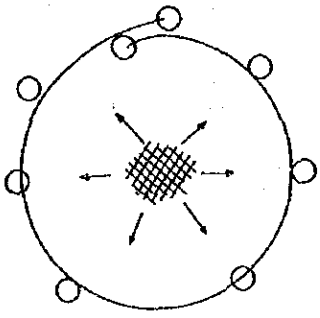
Approach to the school. Looking for the opportunity, the net is put in from the person in the center. Persons in the end are to drive the school in quickly and move forward.

(3)



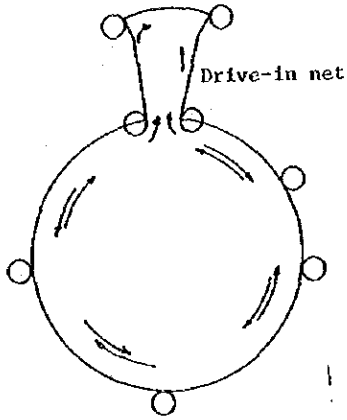
As in (2), all members are to act quickly and surround the school inside the net first.

(4)



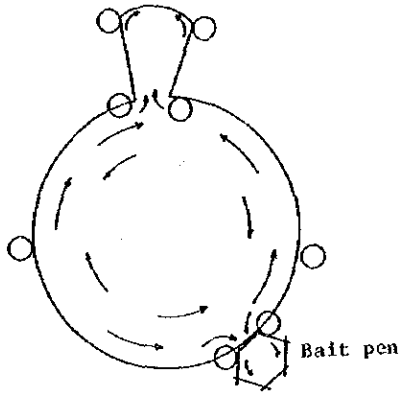
Surrounded sardines will act rapidly and wander around all directions. This is the most important time for taking-in. People around the net are to pull up the float rope for 30-40cm.
Prevent the sardines to be escaped as much as possible.

(5)



First, transfer the school to the drive-in net using the edge. At this time, sardines will circle around the net in both directions forming into 2 lines, so this method is best for taking-in. Also, since sardines happen to get into the net naturally, it is advantageous in the aspect that they will not yet tired.

(6)



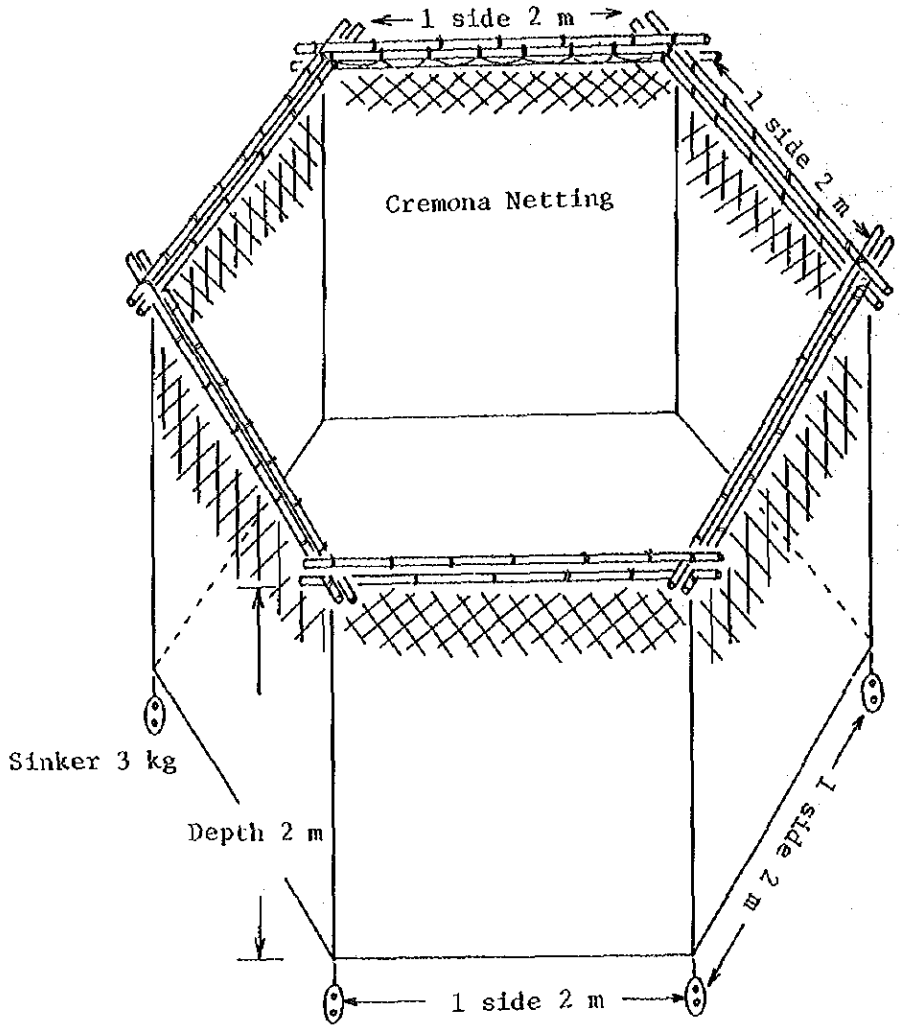
When more than 50 B/K are taken-in, it is also convenient to set a bait pen around the opposite side of the drive-in net.
In case of using a bait pen, sink the frame of the net side gradually.
With the above method, 80% of them can be caught in live fish form.

Figure 6. Bait Pen for Bait Fish Transportation

Medium Bait Pen

2m x 6, Depth: 2m

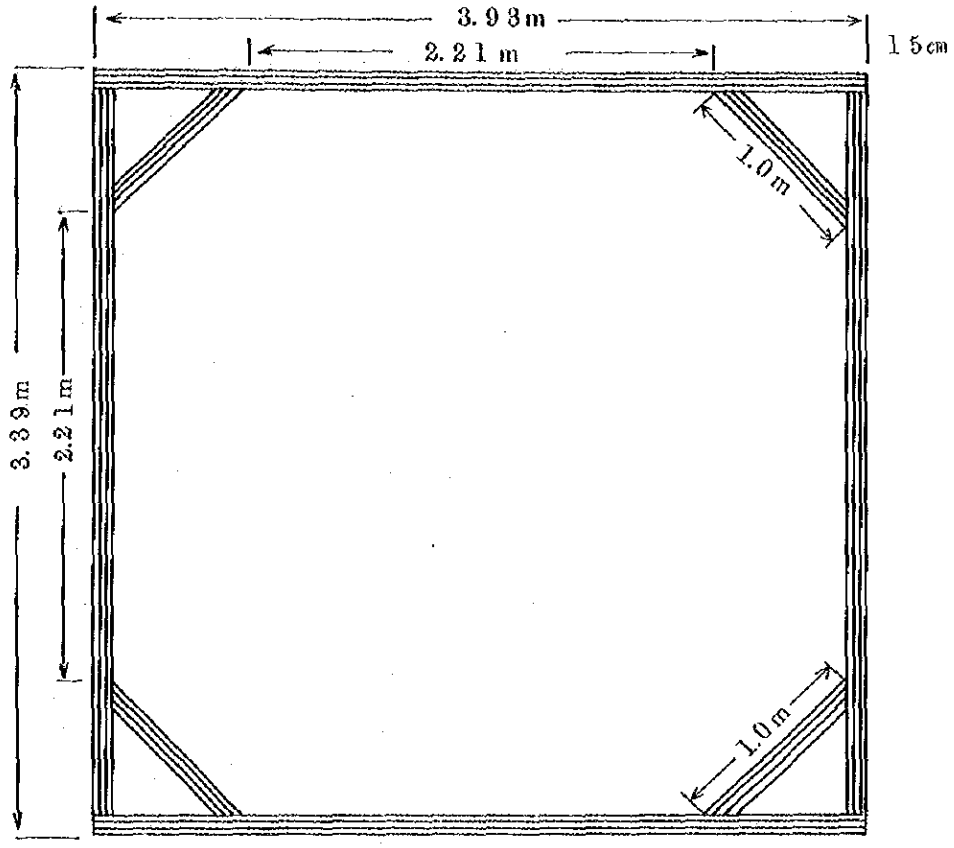
Bamboo (ϕ 10 - 13cm x 2.4m)



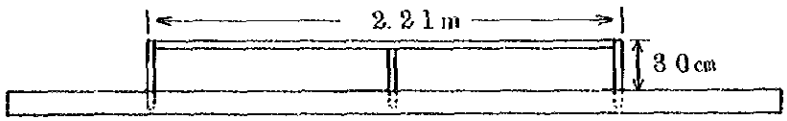
(Note) In case of tugging, 6 sinkers (3kg x 6) are not enough to cope with the tidal resistance, so an anchor of the "Bonito" (6kg) is used in the front side of tugging.

Figure 7. Large Bait Pen

Frontal View



Side View



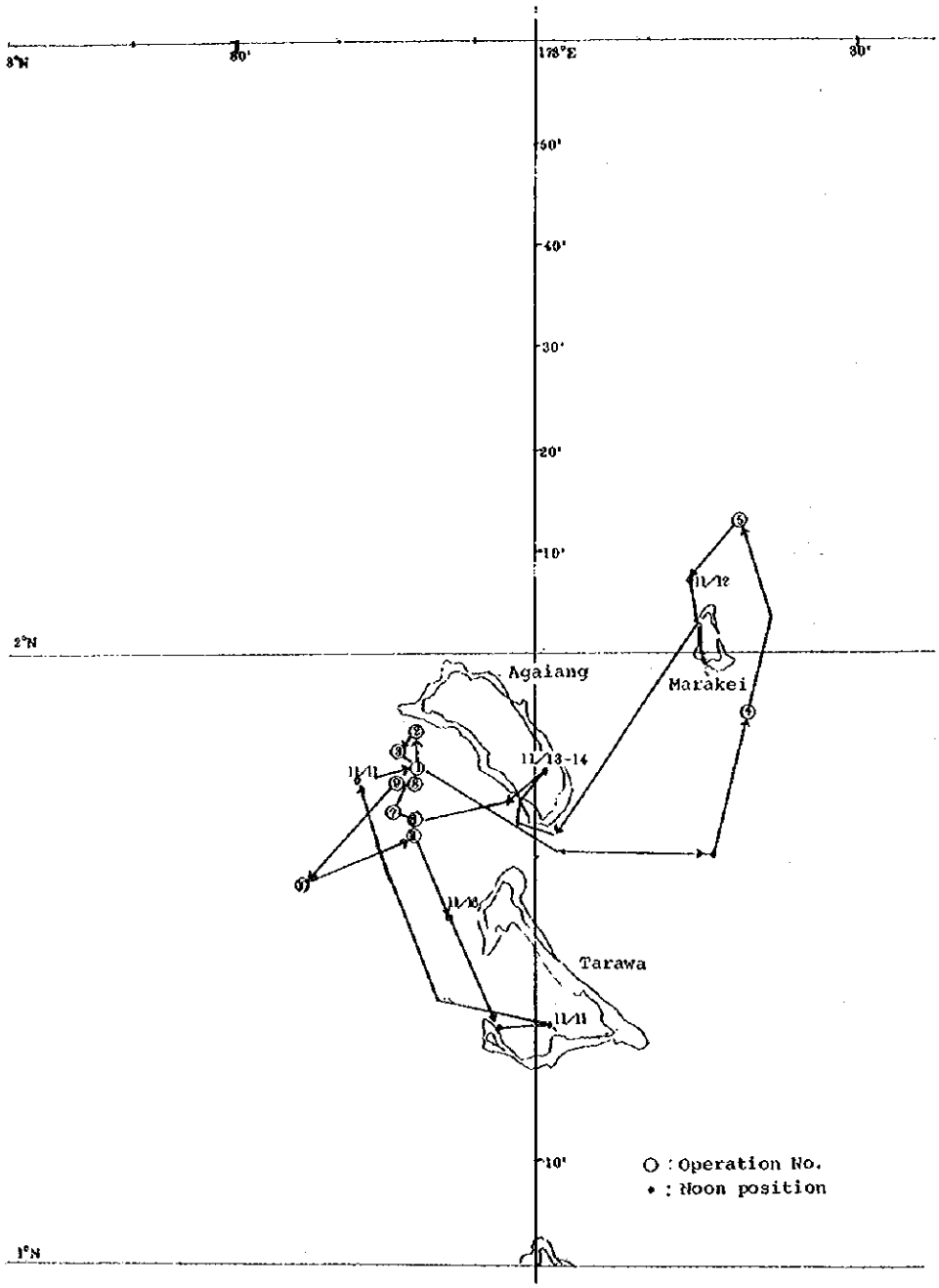
Netting Size 3m x hexagon depth 3m (Circumfrence within frame 18m)

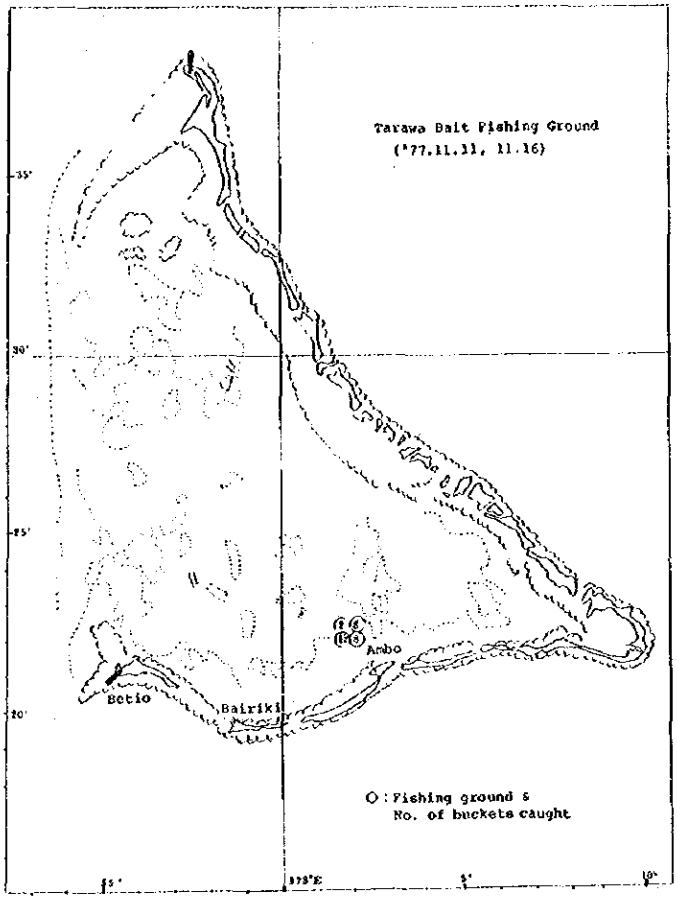
1. Wooden frame 15cm x 15cm length 3.93m
2. Salvage wedge 4cm x 4cm length 40cm
3. 9m/m bolt is used for assumbling the wooden frame.

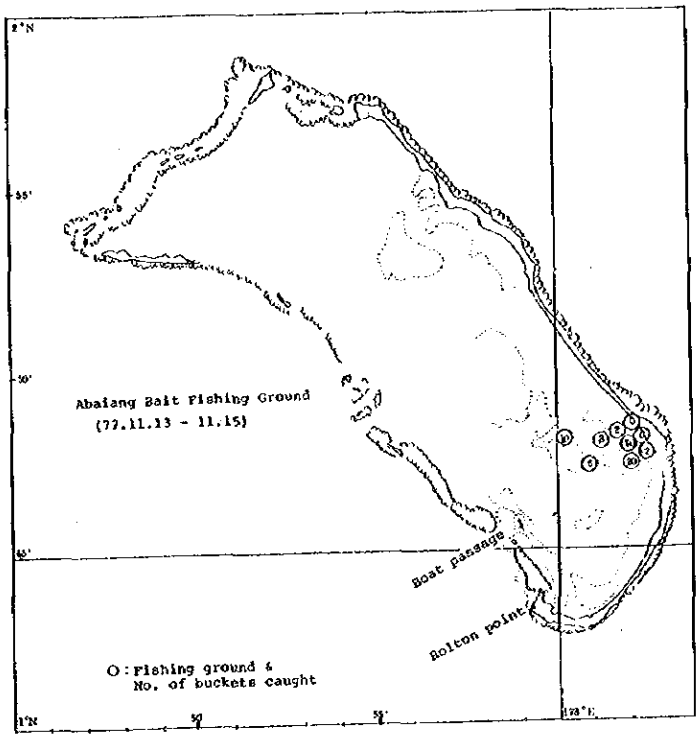
(Note) Taking into consideration the technical problem in making the bait pen frame at locality, we quite to make a hexagonal or octagonal frame, and since we made it within the size limit of the spare materials, the frame size is 5.16 meters smaller than the netting size.

Figure 8. Trail and Bait Fishing Ground by Navigation

(1) 1st Navigation: Tarawa, Marakei, Abaiang
November 3 - November 16, '77

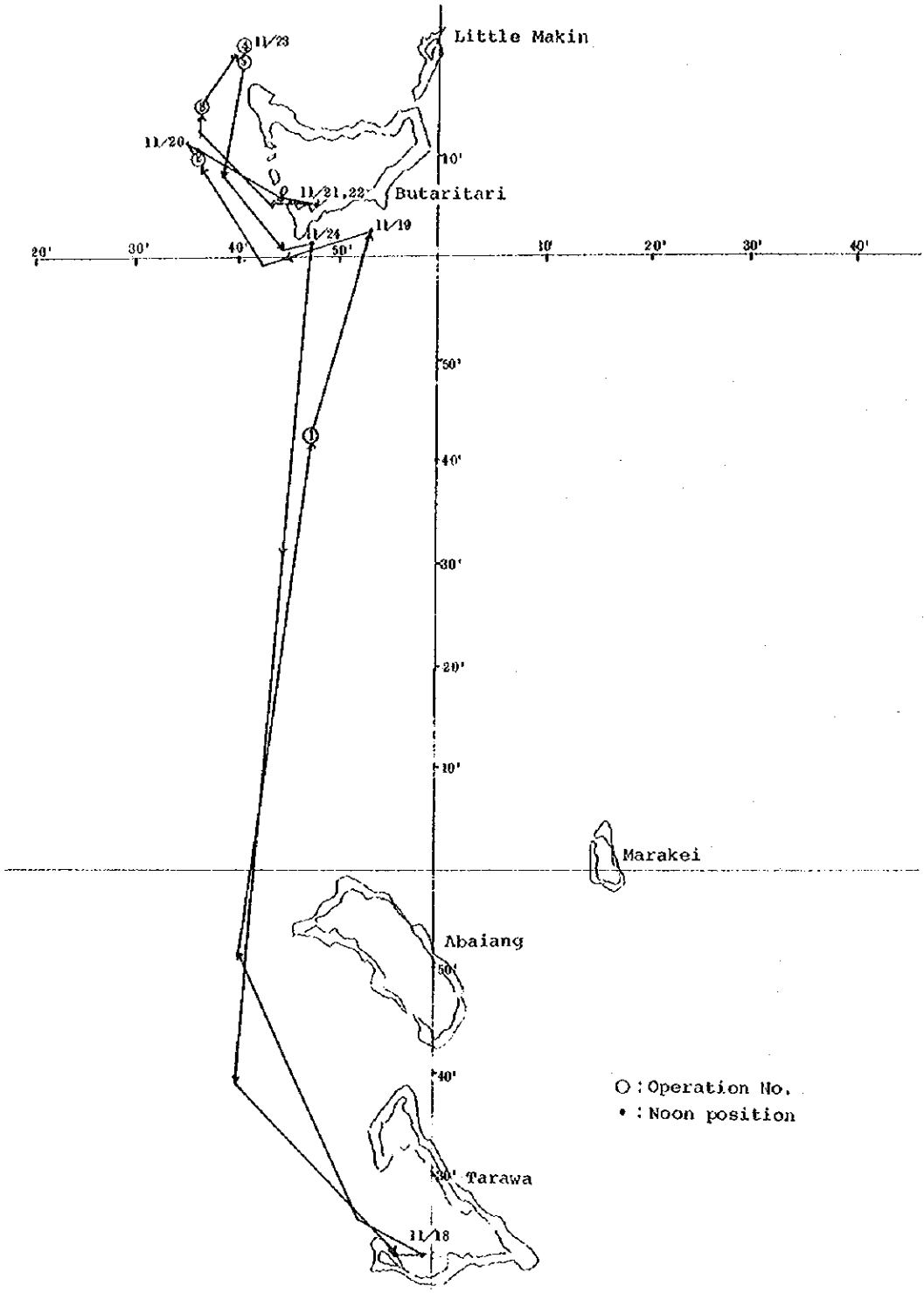


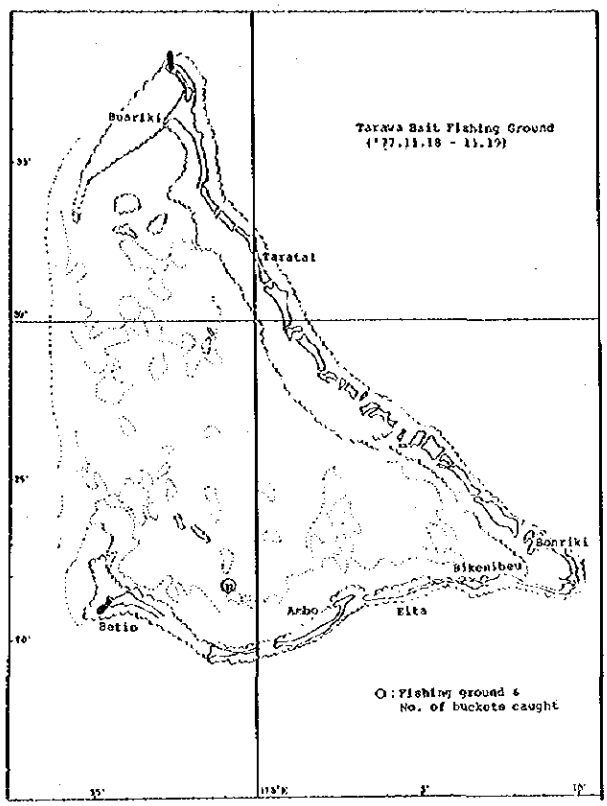

Tarawa Bait Fishing Ground
('77.11.11, 11.16)
Ambo
Betio
Bairiki
O : Fishing ground &
No. of buckets caught

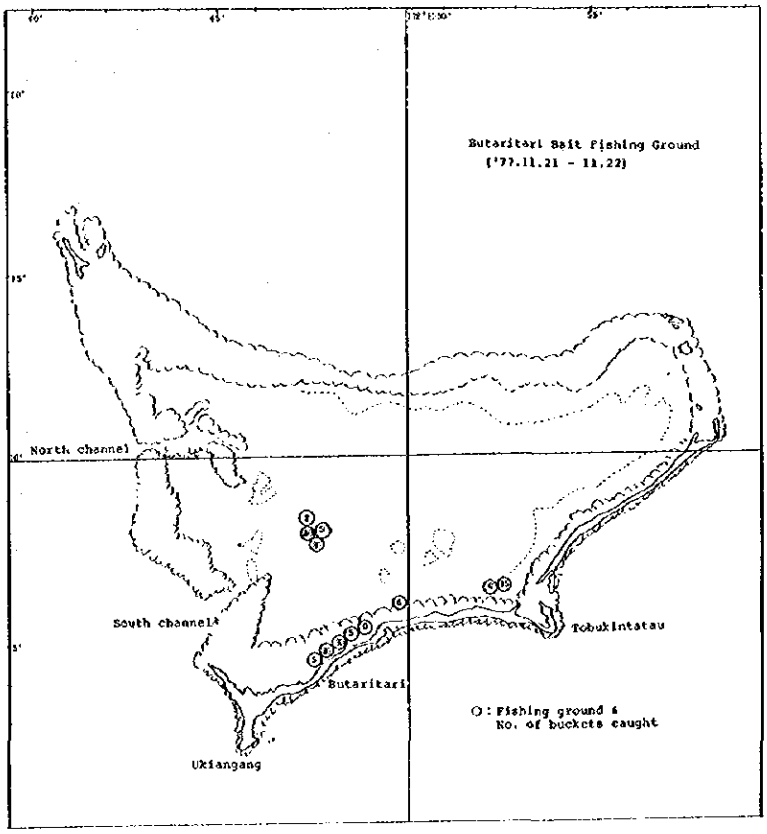

Abaiang Bait Fishing Ground
(77.11.13 - 11.15)
Boat passage
Bolton point
O : Fishing ground &
No. of buckets caught

(2) 2nd Navigation: Tarawa, Butaritari

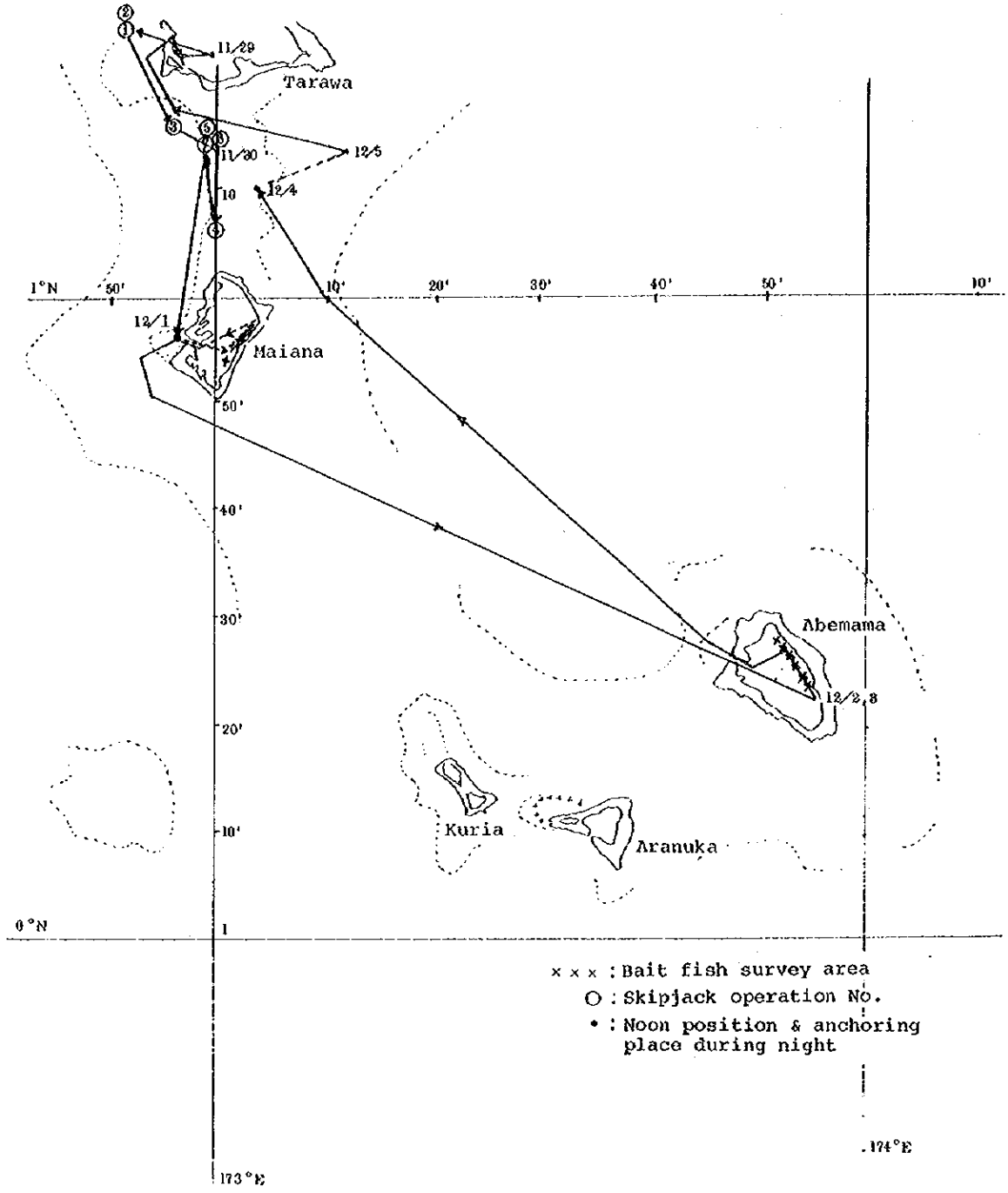
November 17 - November 25, '77

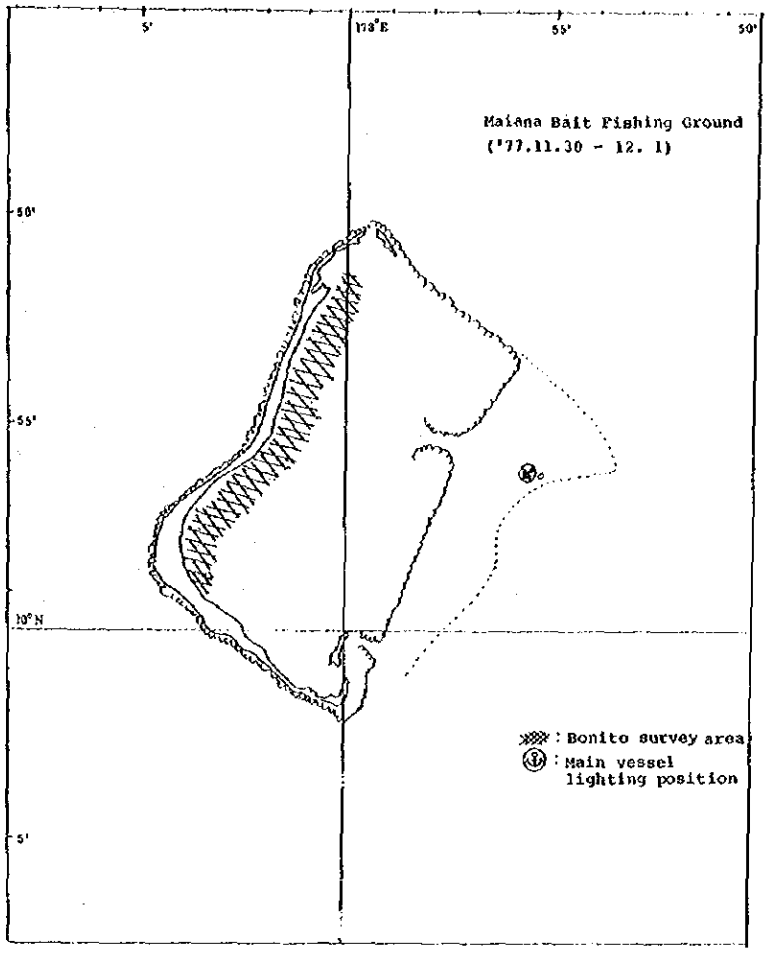


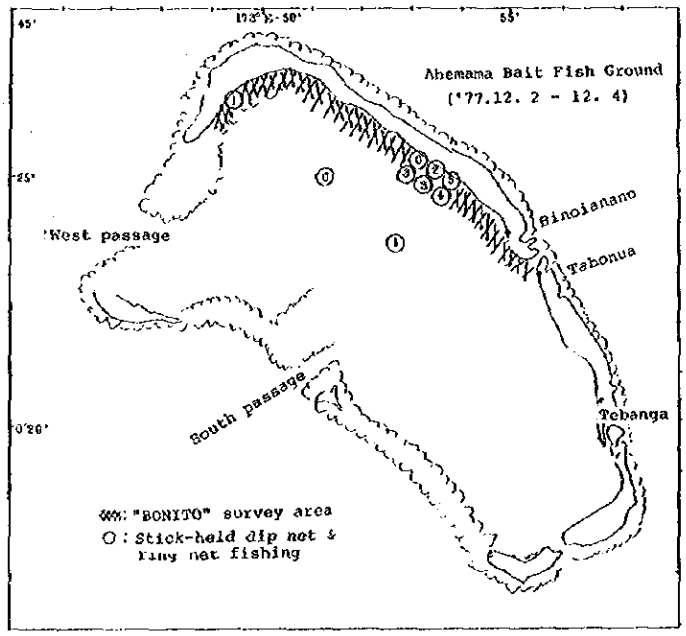

Tarawa Bait Fishing Ground
('77.11.18 - 11.19)
Buariki
Taratai
Bonriki
Bikenibeu
Arbo
Eita
Betio
O : Fishing ground &
No. of buckets caught


Butaritari Bait Fishing Ground
('77.11.21 - 11.22)
North channel
South channel
Tobukintatau
Butaritari
Ukiangang
O : Fishing ground &
No. of buckets caught

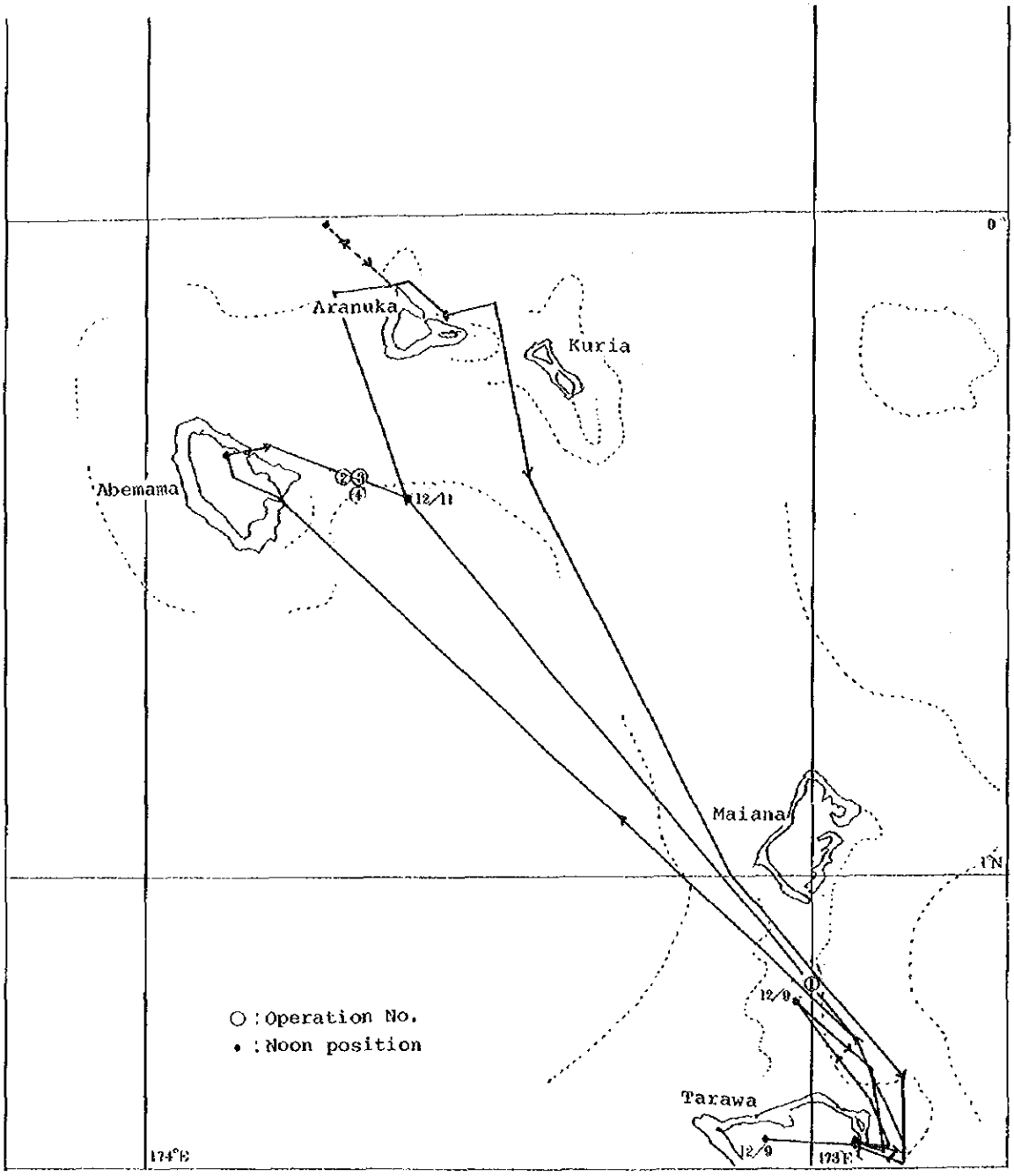
(3) 3rd Navigation: Tarawa, Maiana, Abemama
November 29 - December 5, '77

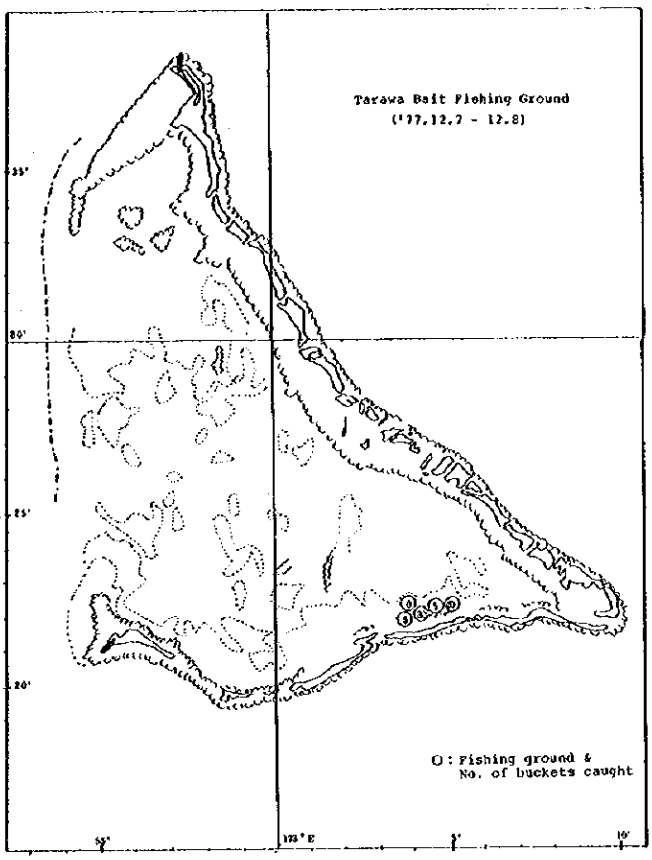


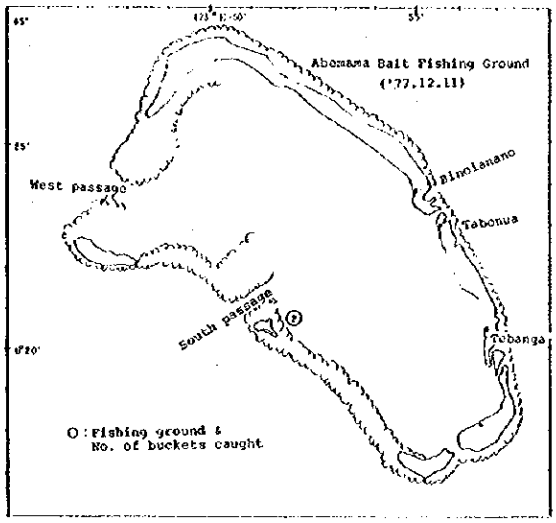

5'
173°E
55'
50'
Maiana Bait Fishing Ground
('77.11.30 - 12. 1)
50'
55'
10°N
5'
: Bonito survey area
: Main vessel
lighting position

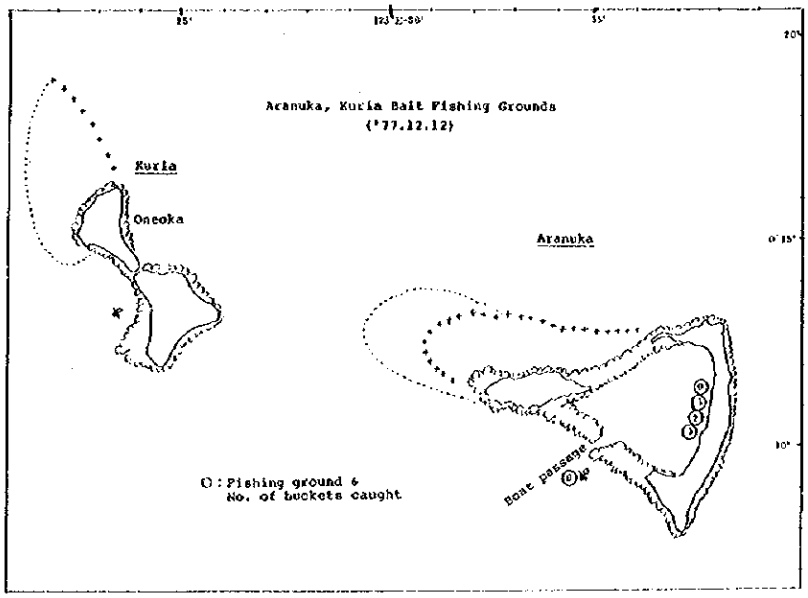

45'
173°E
50'
55'
Ahemama Bait Fish Ground
('77.12. 2 - 12. 4)
25'
West passage
Binoianano
Tabonua
South passage
Tebanga
0°20'
"BONITO" survey area
O : Stick-held dip net &
ring net fishing

(4) 4th Navigation: Tarawa, Abemama, Aranuka, Kuria
December 6 - December 13, '77



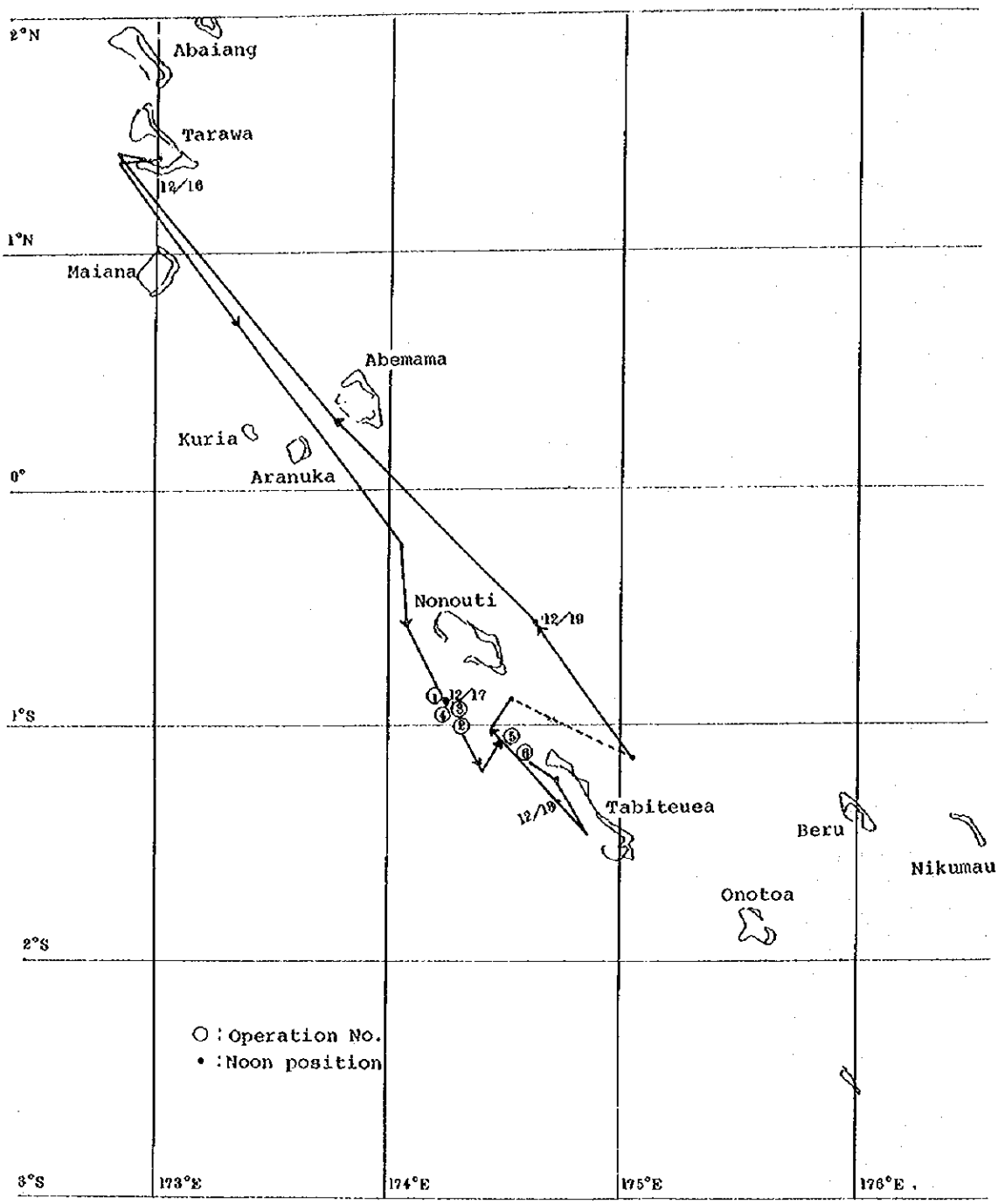

Tarawa Bait Fishing Ground
('77.12.7 - 12.8)
O : Fishing ground &
No. of buckets caught

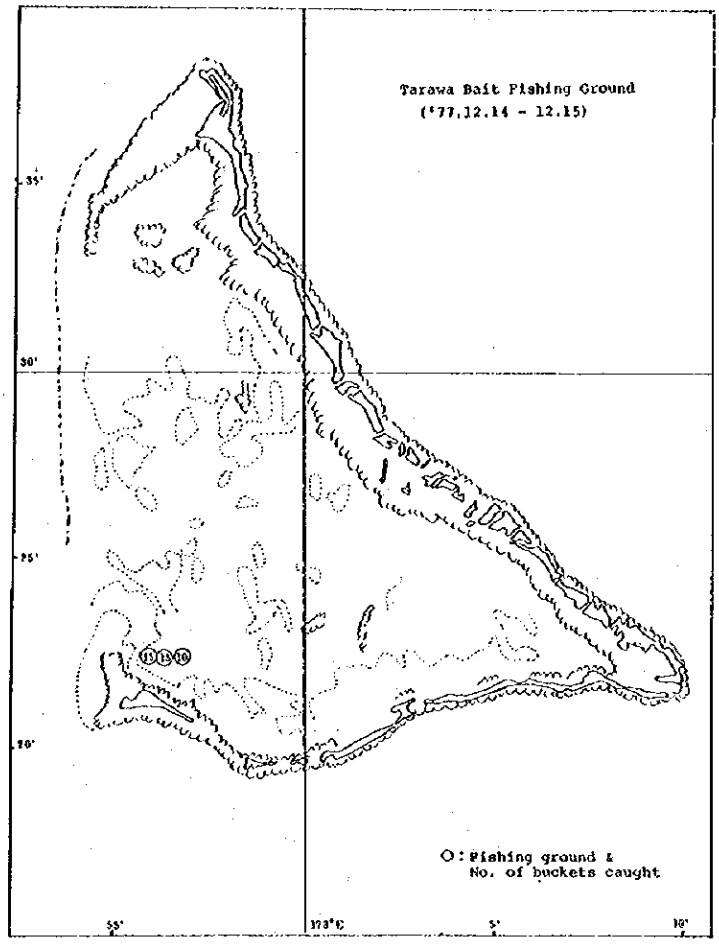

Abemama Bait Fishing Ground
('77.12.11)
West passage
Pimolanano
Tabonua
South passage
Tabanga
O : Fishing ground &
No. of buckets caught

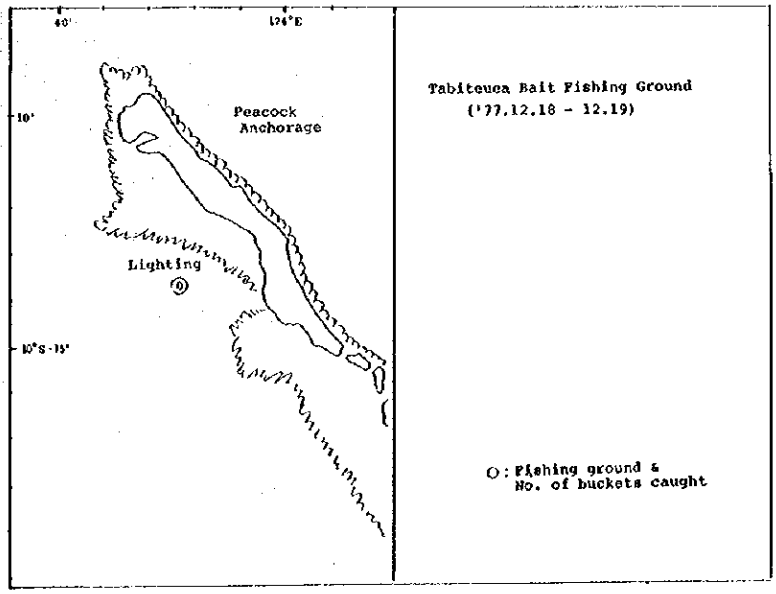

Aranuka, Kuria Bait Fishing Grounds
('77.12.12)
Kuria
Oneoka
Aranuka
Boat passage
O : Fishing ground &
No. of buckets caught

(5) 5th Navigation: Tarawa, Tabiteuea

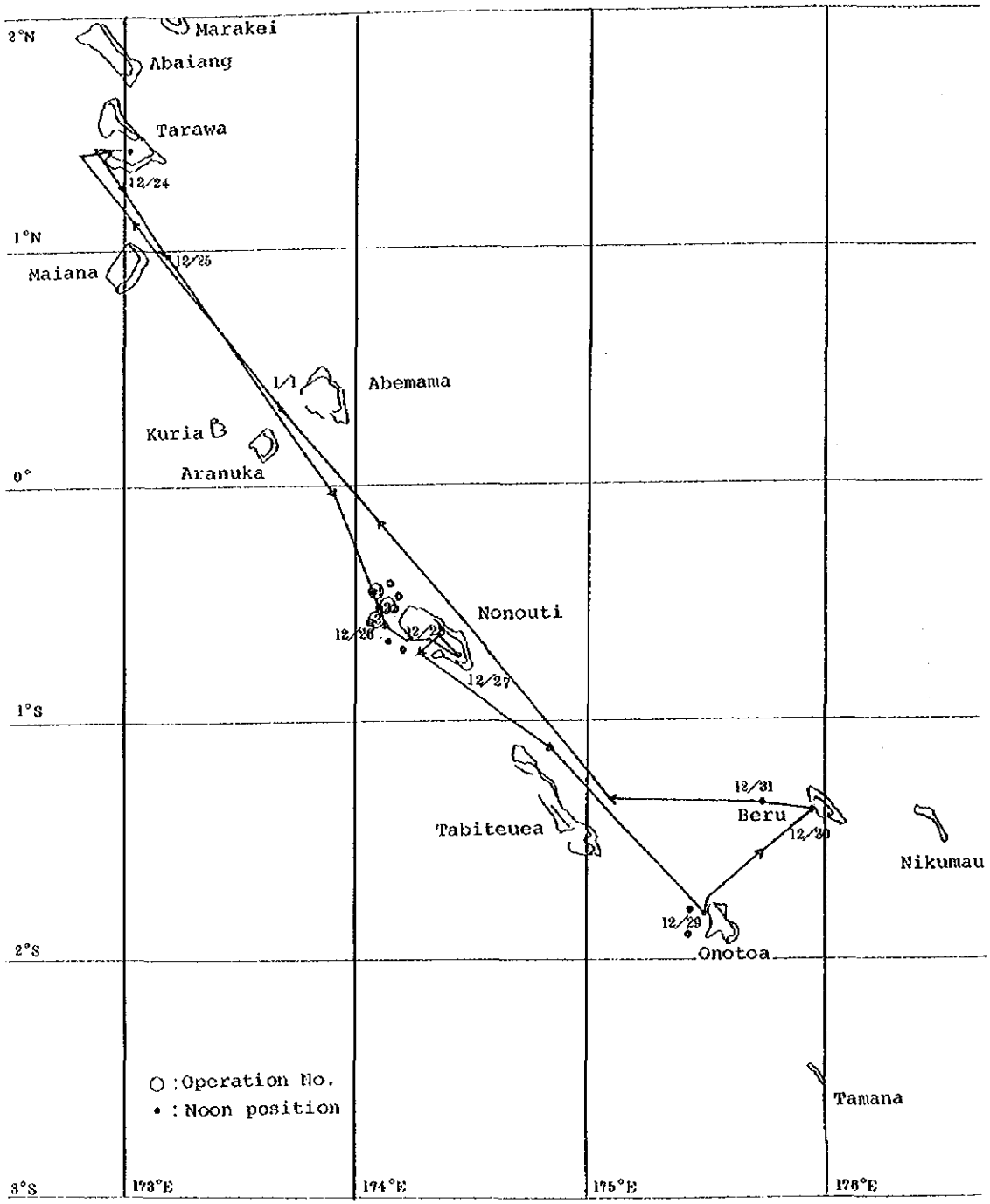
December 14 - December 20, '77

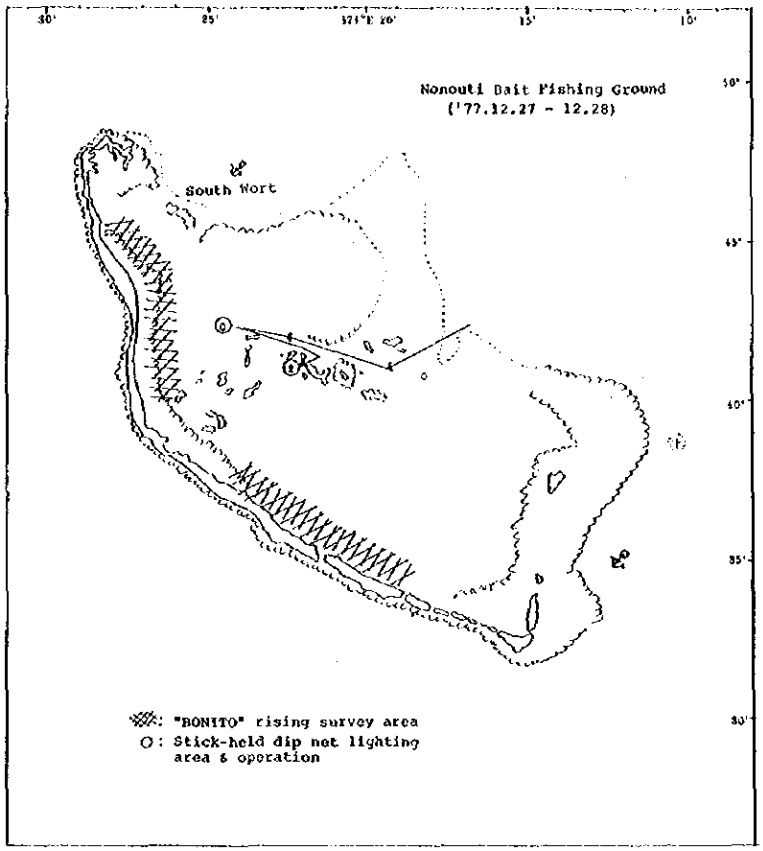


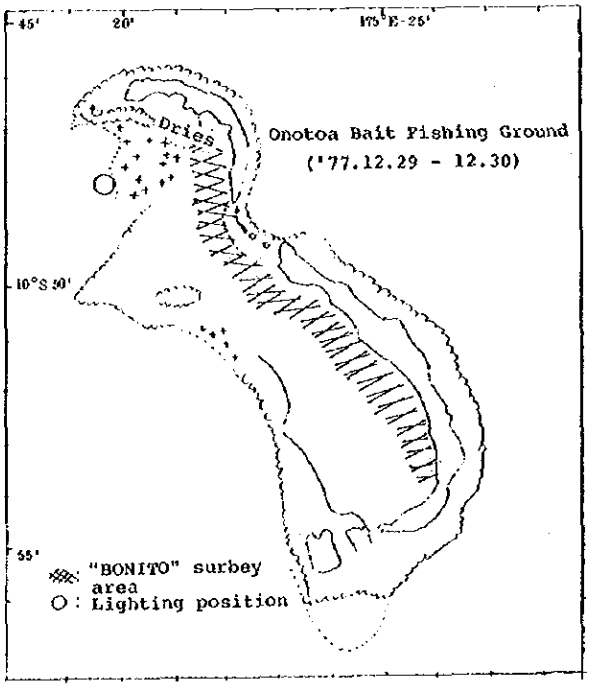

Tarawa Bait Fishing Ground
('77.12.14 - 12.15)
35'
30'
25'
20'
55'
173°E
5'
10'
O : Fishing ground &
No. of buckets caught

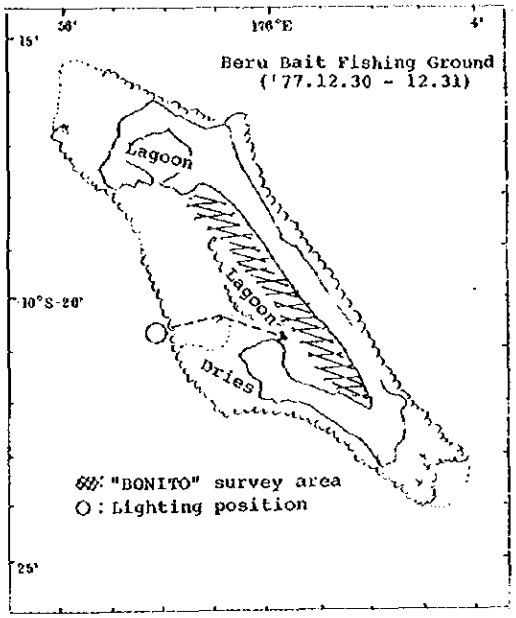

40'
174°E
10'
Peacock
Anchorage
Lighting
10°S-15'
Tabiteuea Bait Fishing Ground
('77.12.18 - 12.19)
O : Fishing ground &
No. of buckets caught

(6) 6th Navigation: Nonouti, Onotoa, Beru
December 25, '77 - January 2, '78



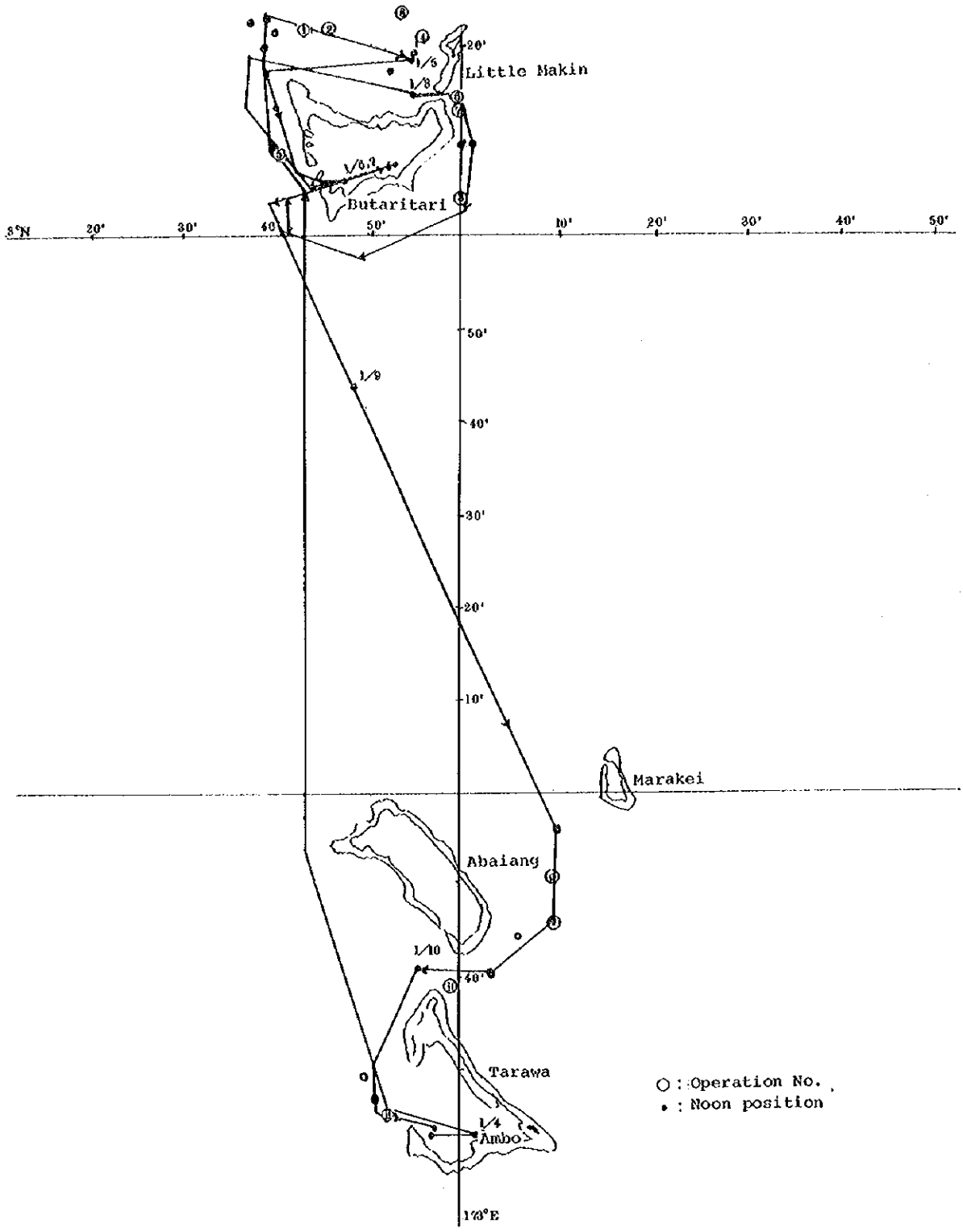

Nonouti Bait Fishing Ground
('77.12.27 - 12.28)
South Wort
"BONITO" rising survey area
O : Stick-held dip net lighting area & operation

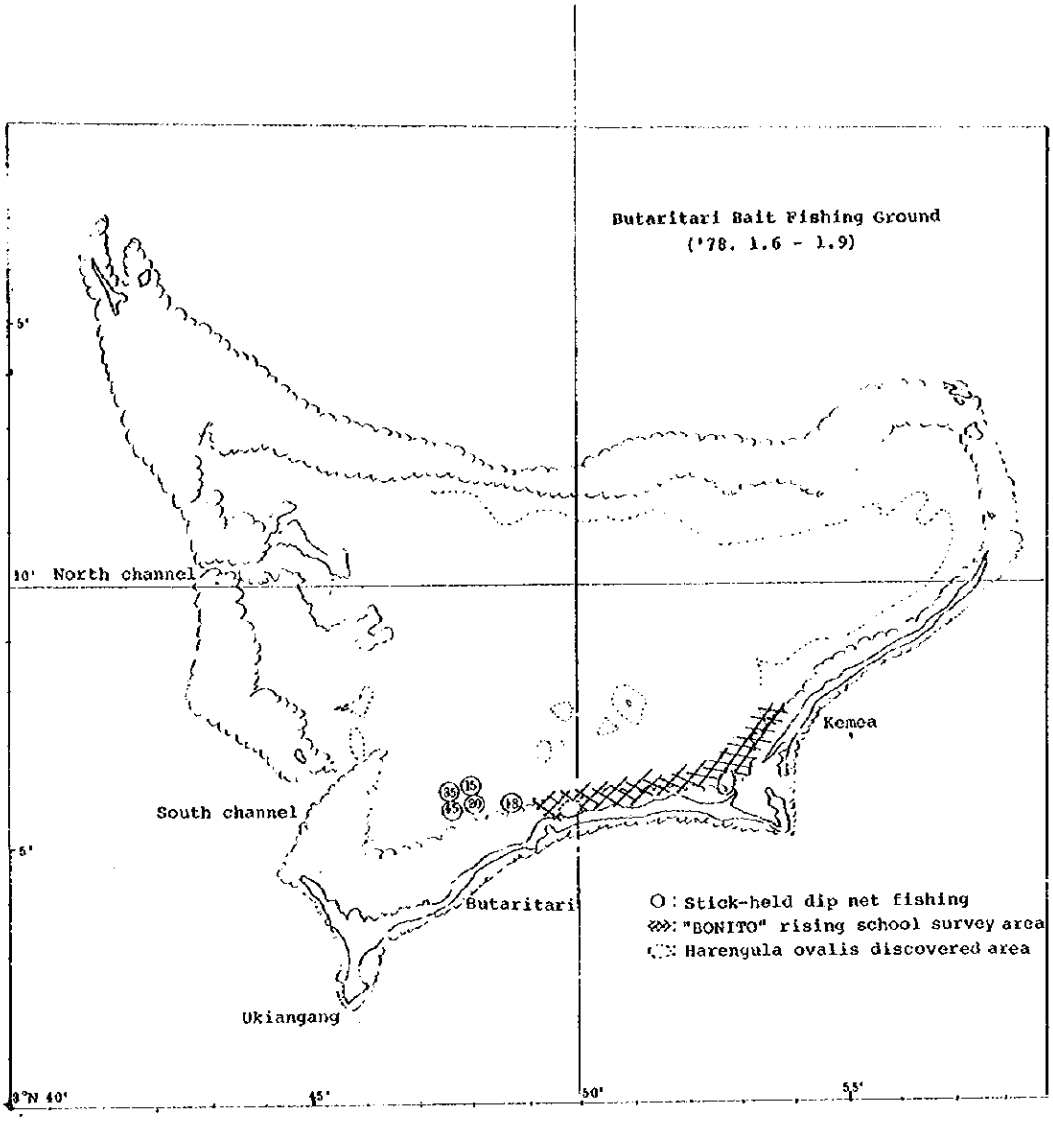

Onotoa Bait Fishing Ground
('77.12.29 - 12.30)
Dries
"BONITO" surbey area
O : Lighting position


Beru Bait Fishing Ground
('77.12.30 - 12.31)
Lagoon
Lagoon
Dries
"BONITO" survey area
O : Lighting position

(7) 7th Navigation: Butaritari, Tarawa

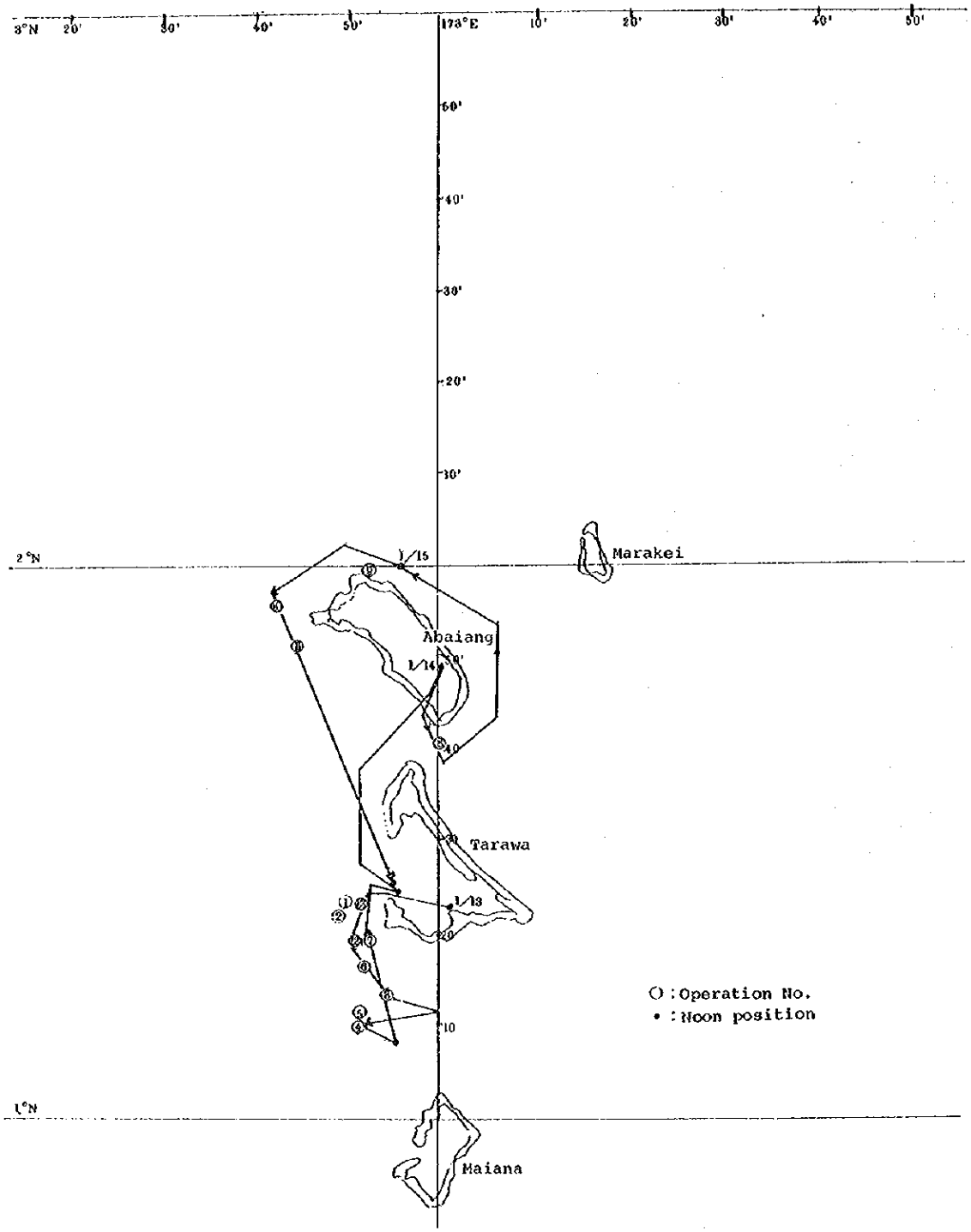
January 4 - January 10, '78

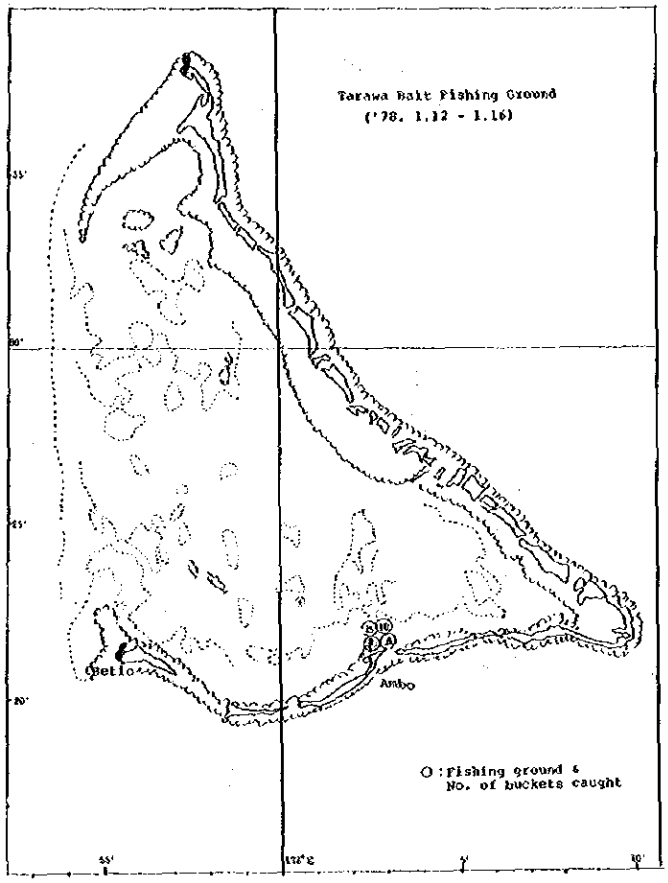


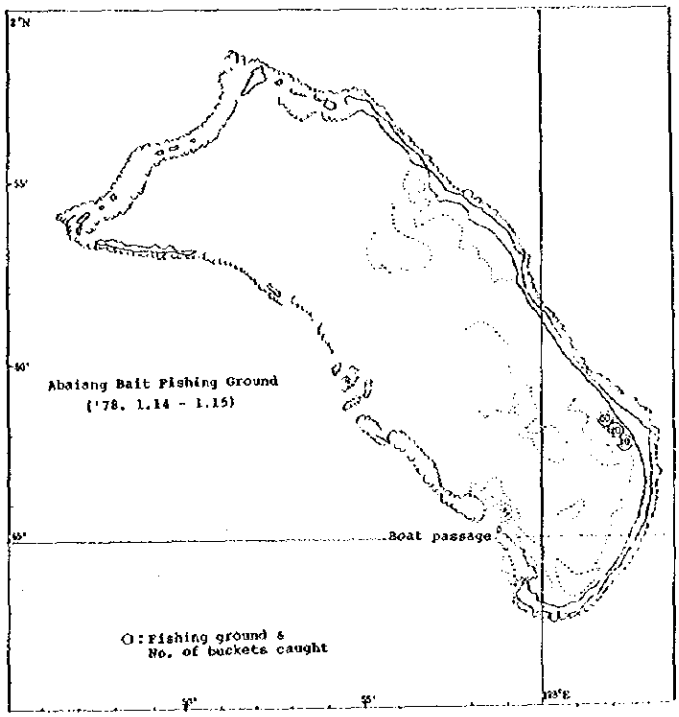

Butaritari Bait Fishing Ground
('78. 1.6 - 1.9)
North channel
South channel
Kemea
Butaritari
Ukiangang
O : Stick-held dip net fishing
"BONITO" rising school survey area
Harengula ovalis discovered area

(8) 8th Navigation: Tarawa, Abaiang

January 12 - January 16, '78

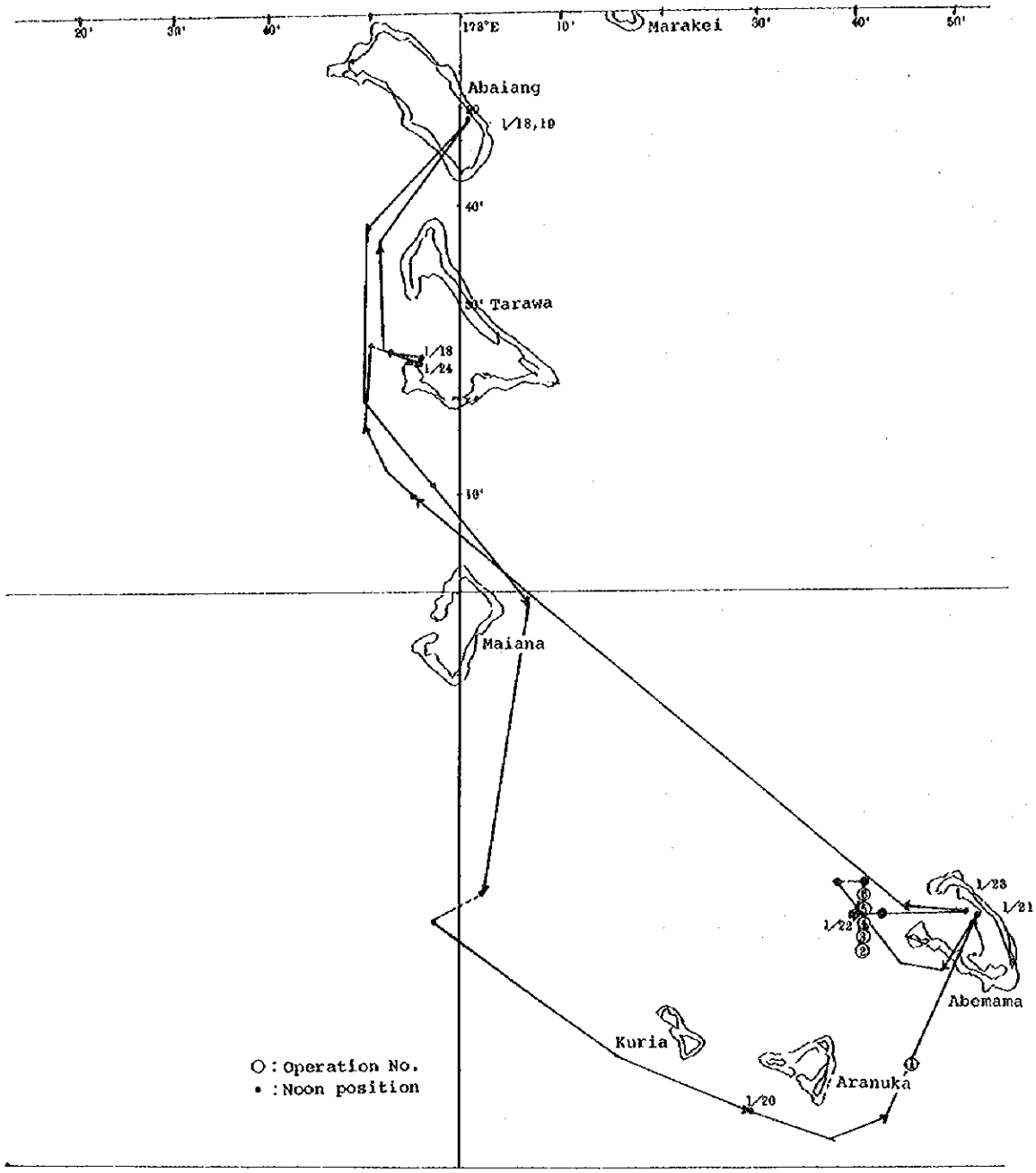


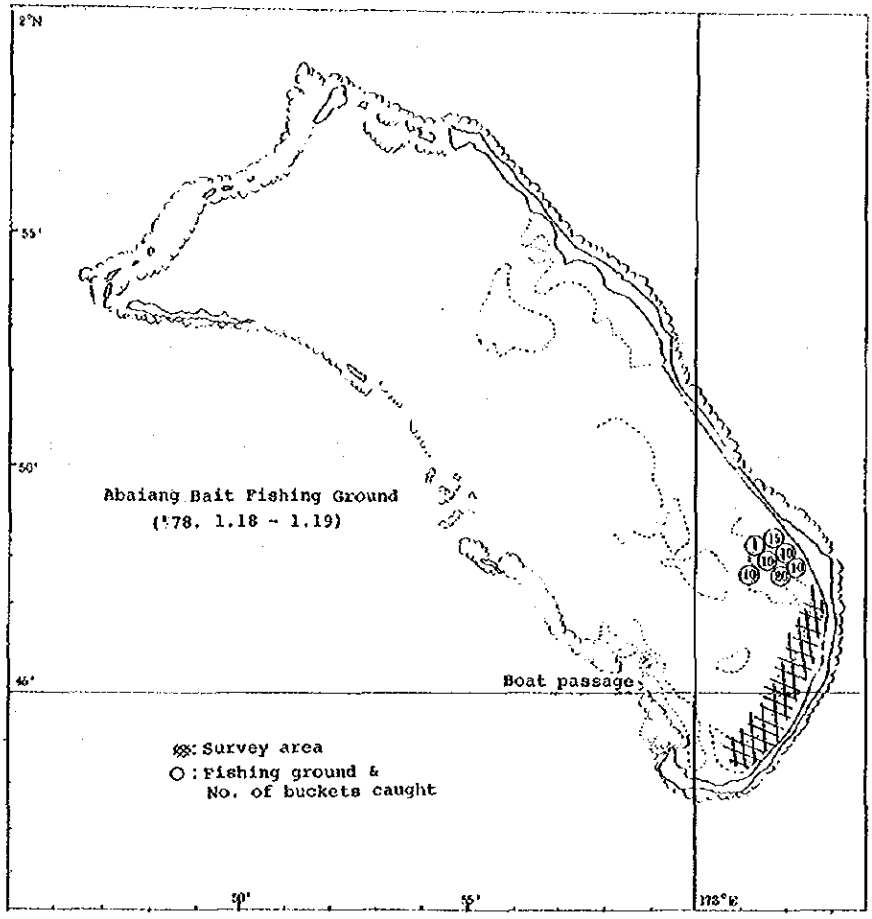

Tarawa Bait Fishing Ground
('78. 1.12 - 1.16)
Betio
Ambo
O : Fishing ground &
No. of buckets caught

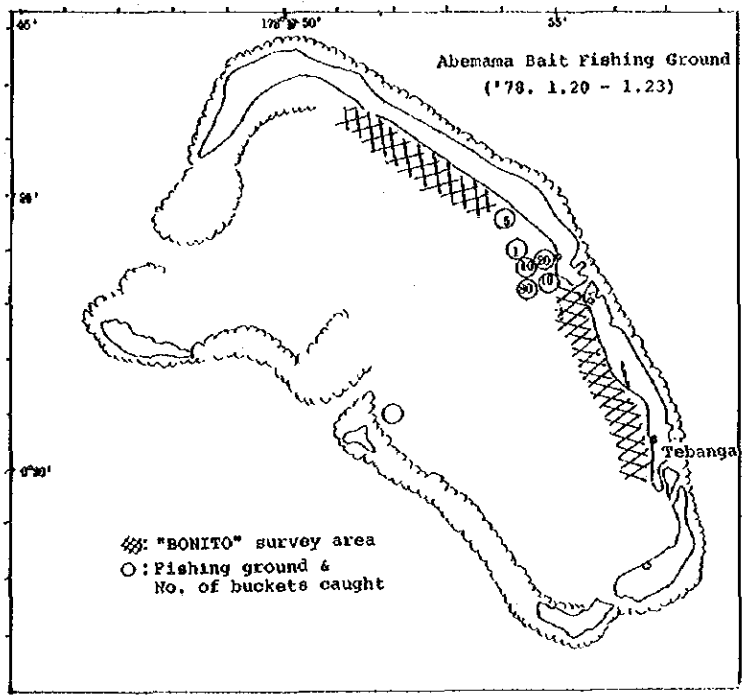

Abaiang Bait Fishing Ground
('78. 1.14 - 1.15)
Boat passage
O : Fishing ground &
No. of buckets caught

(9) 9th Navigation: Abaiang, Abemama

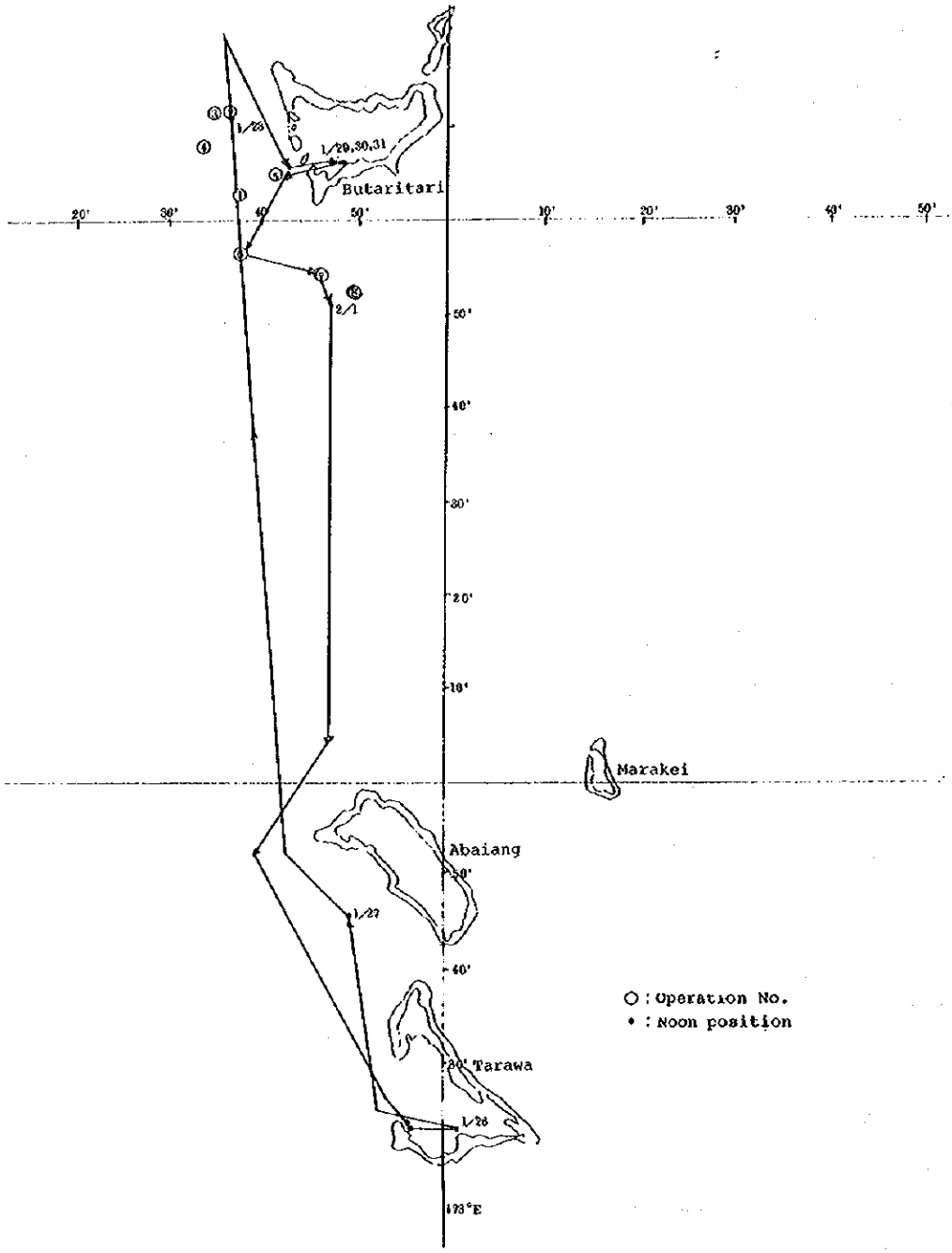
January 18 - January 24, '78

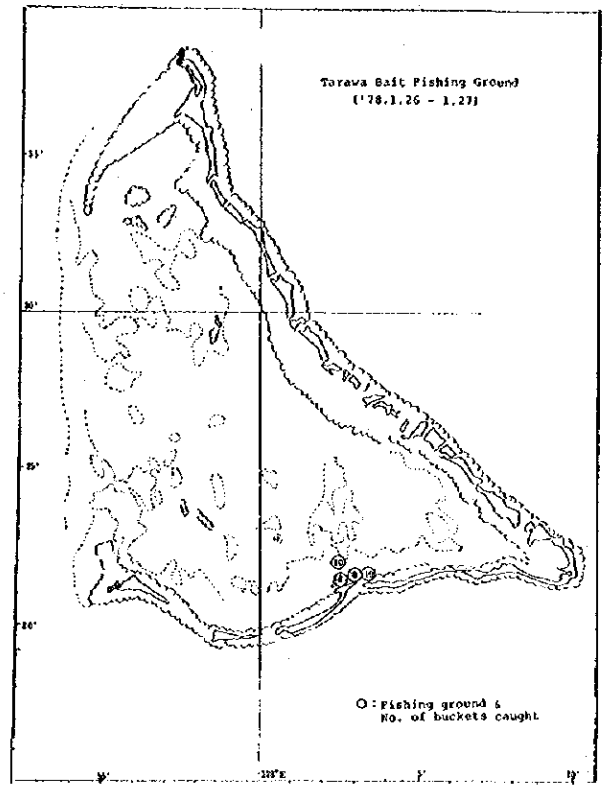


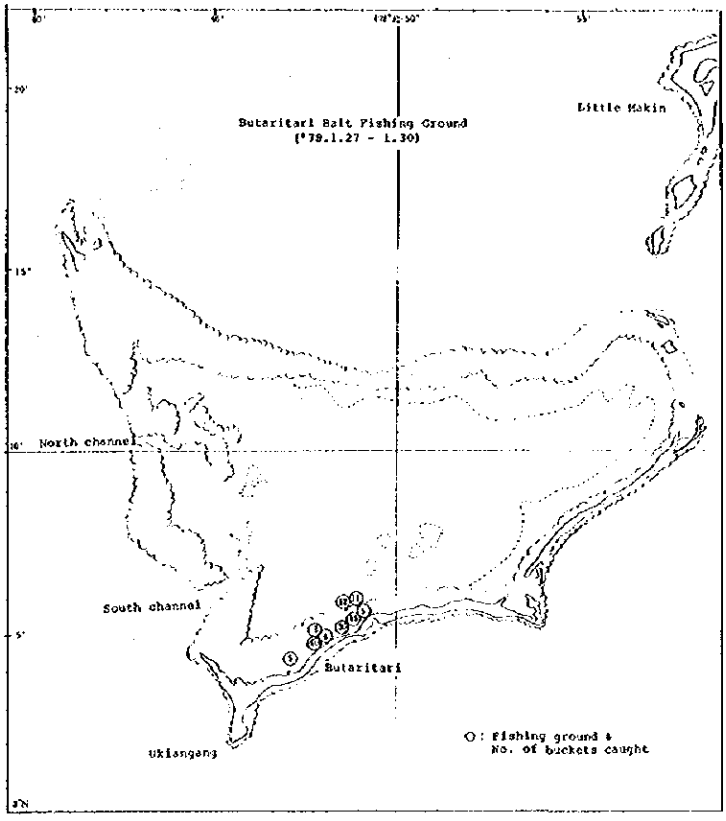

2°N
55'
50'
45'
Abaiang Bait Fishing Ground
('78. 1.18 - 1.19)
Boat passage
Survey area
O : Fishing ground &
No. of buckets caught
50'
55'
173°E


45'
50'
55'
Abemama Bait Fishing Ground
('78. 1.20 - 1.23)
Tebanga
"BONITO" survey area
O : Fishing ground &
No. of buckets caught

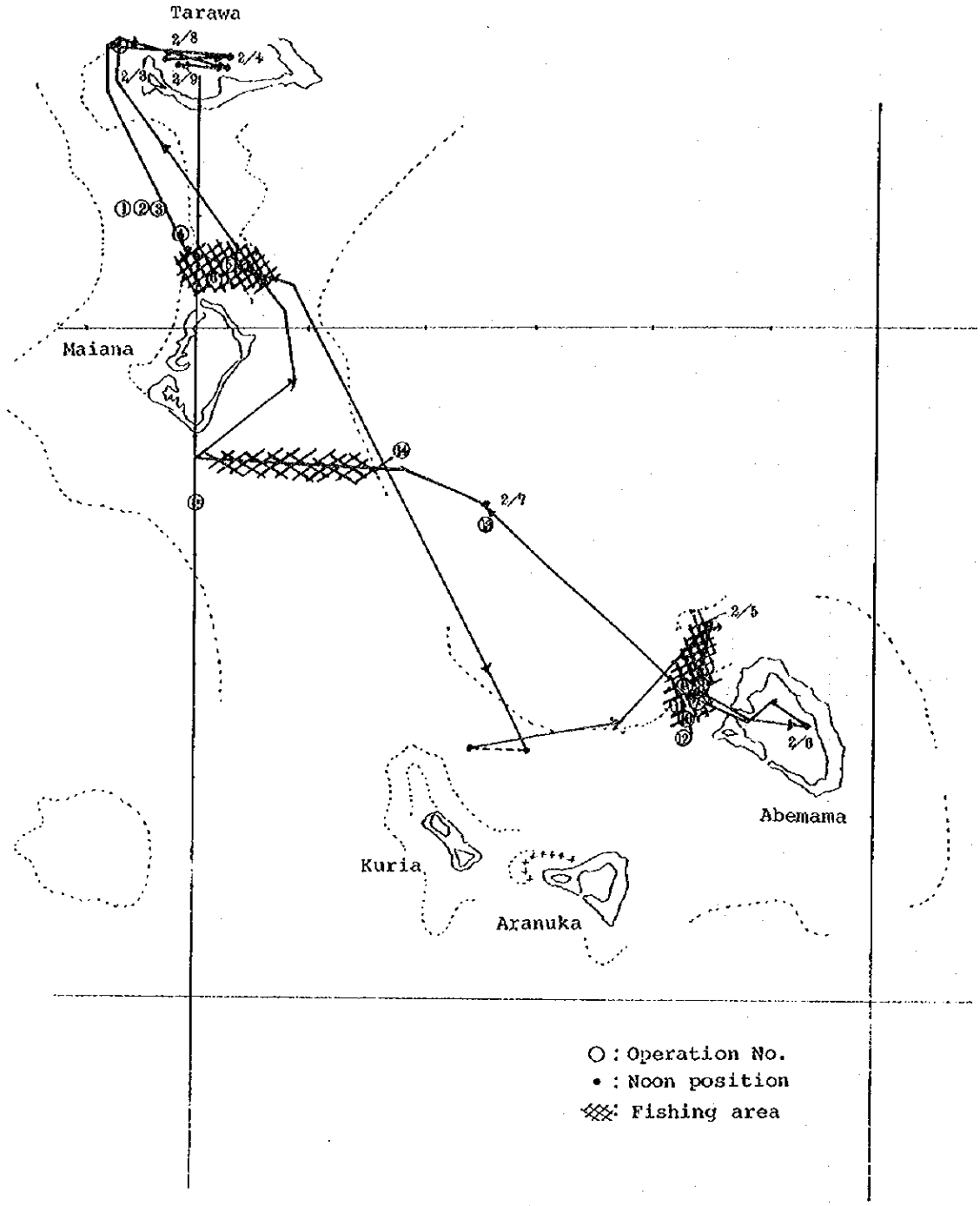
(10) 10th Navigation: Tarawa, Butaritari
January 26 - February 2, '78

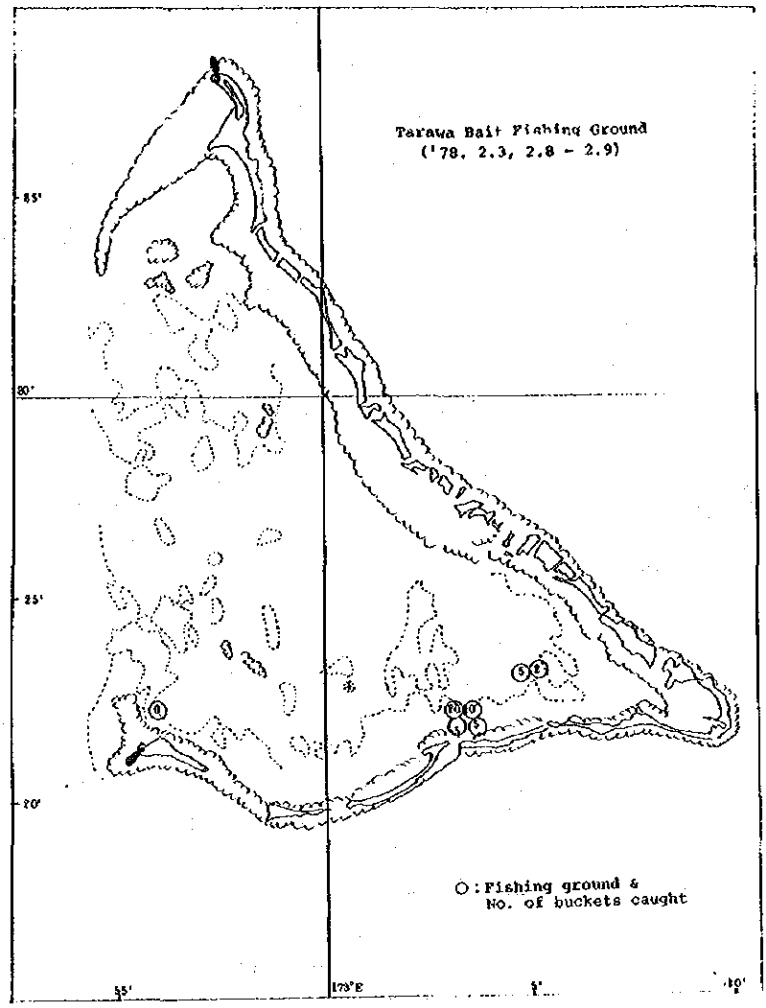


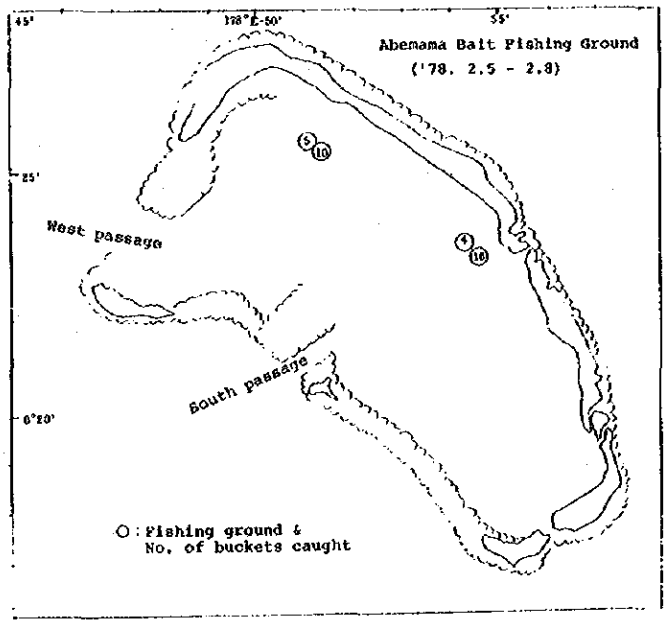

Torawa Bait Fishing Ground
('78.1.26 - 1.27)
○ : Fishing ground &
No. of buckets caught


Butaritari Bait Fishing Ground
('78.1.27 - 1.30)
Little Makin
North channel
South channel
Butaritari
Ukiangang
○ : Fishing ground &
No. of buckets caught

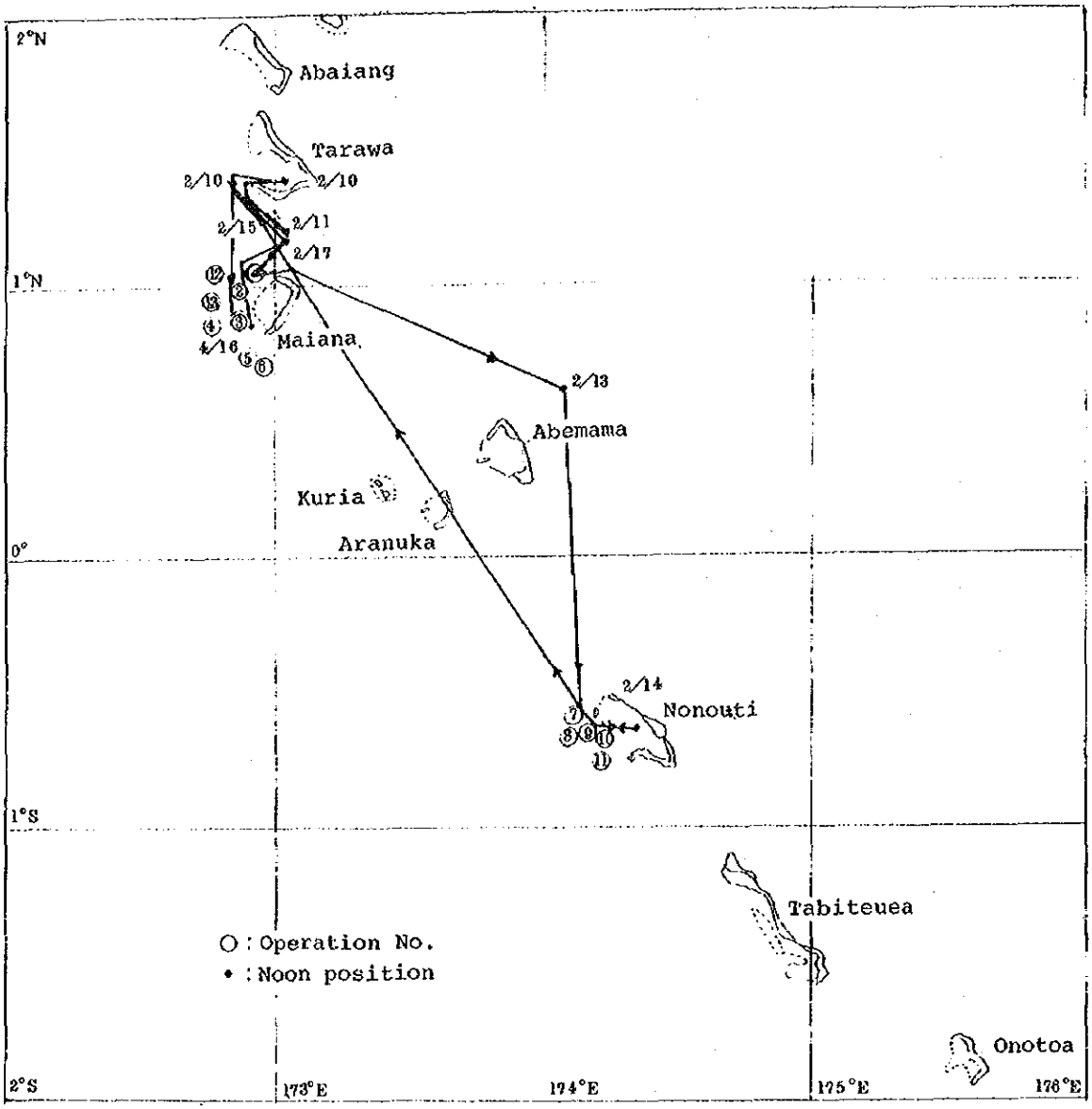
(11) 11th Navigation: Tarawa, Abemama
February 3 - February 9, '78

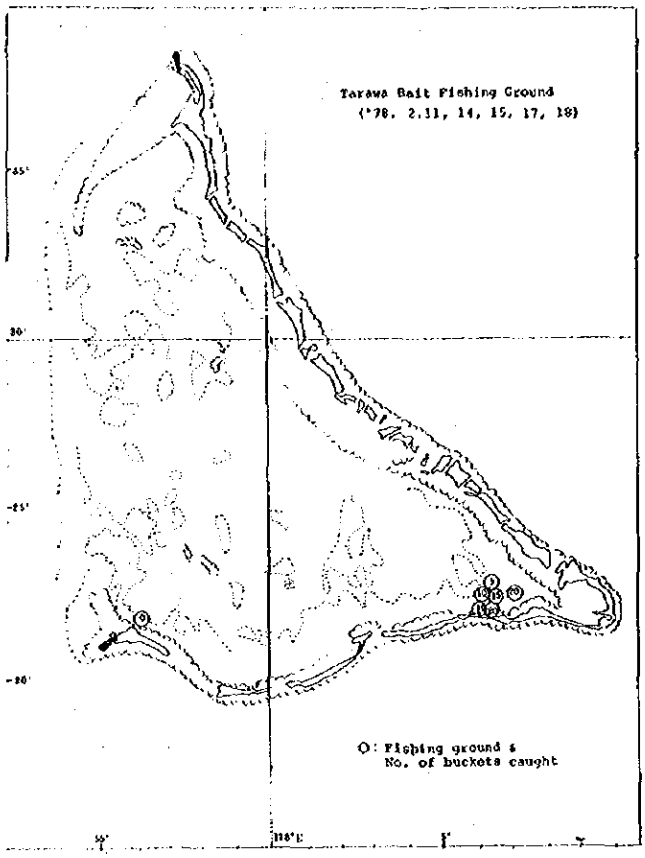


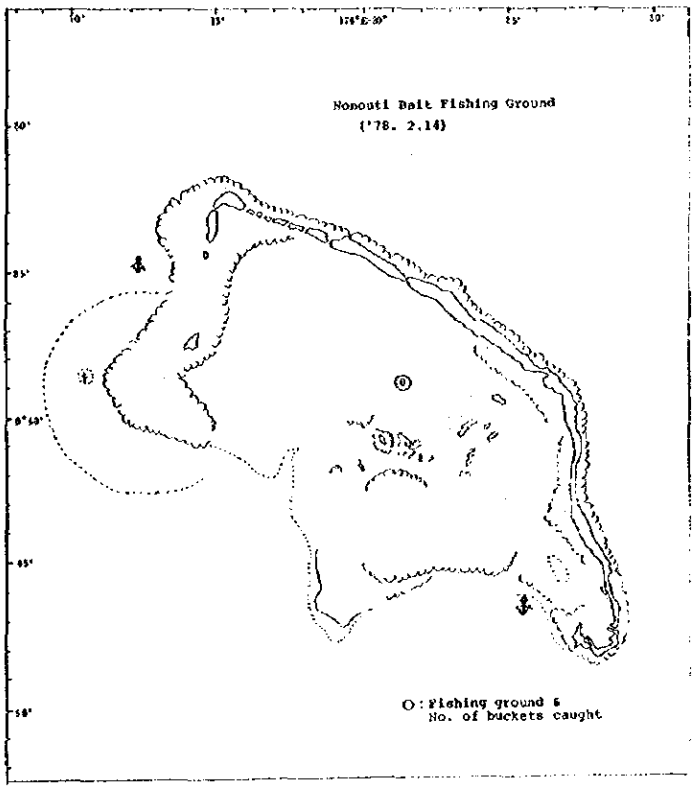

Tarawa Bait Fishing Ground
('78, 2.3, 2.8 - 2.9)
85'
80'
25'
20'
55'
173°E
5'
10'
○ : Fishing ground &
No. of buckets caught


45'
173°E-50'
55'
Abemama Bait Fishing Ground
('78, 2.5 - 2.8)
25'
West passage
South passage
0°20'
○ : Fishing ground &
No. of buckets caught

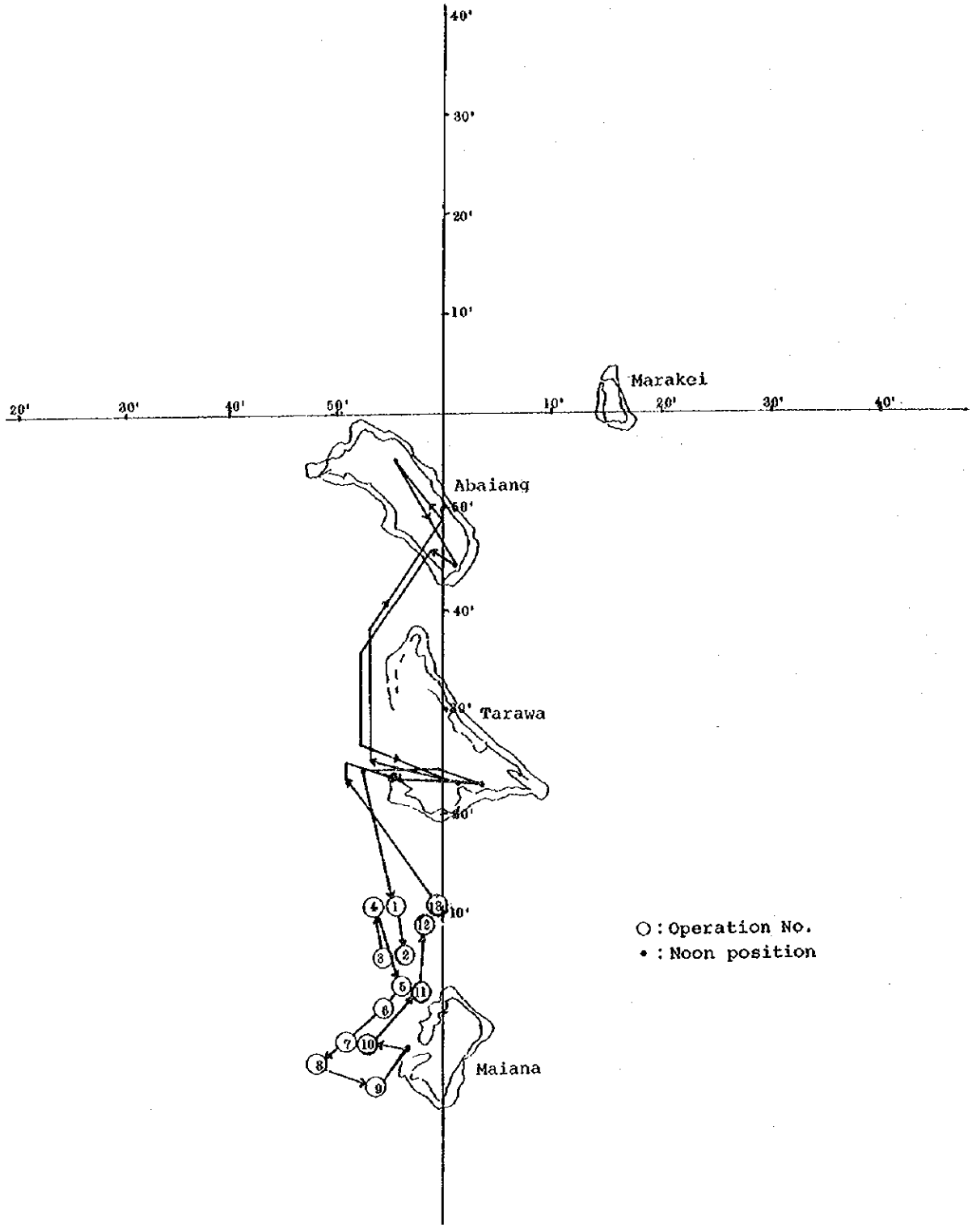
(12) 12th Navigation: Tarawa, Nonouti
February 10 - February 18, '78

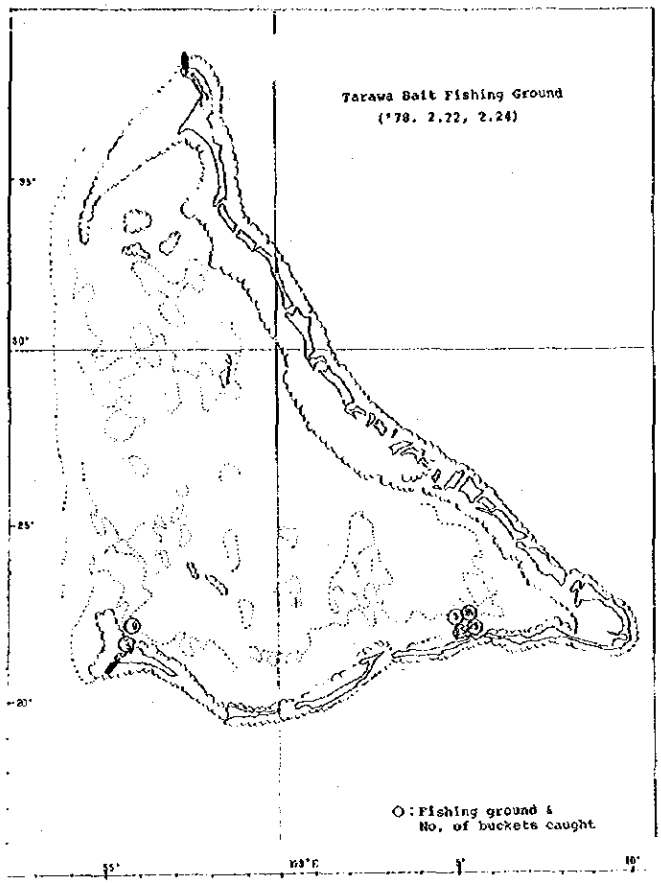


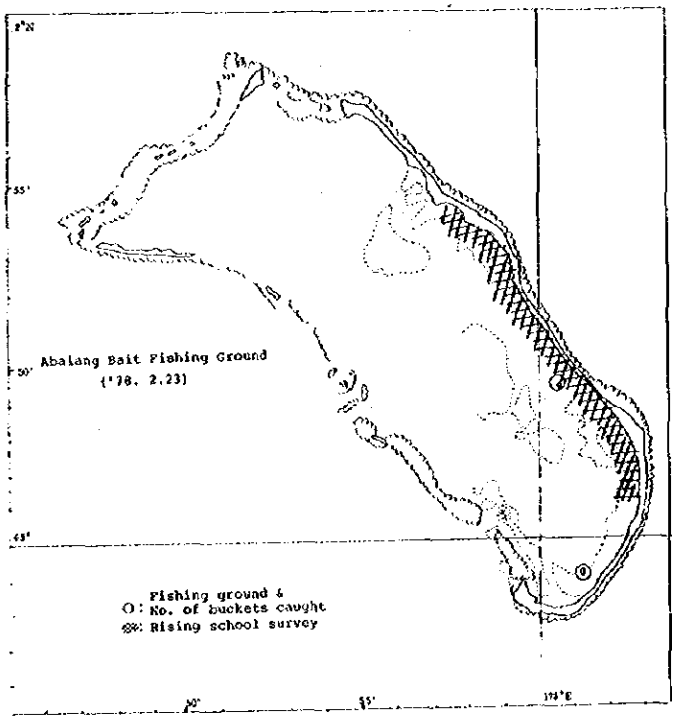

Tarawa Bait Fishing Ground
('78. 2.11, 14, 15, 17, 18)
O: Fishing ground &
No. of buckets caught


Nonouti Bait Fishing Ground
('78. 2.14)
O: Fishing ground &
No. of buckets caught

(13) 13th Navigation: Tarawa, Abaiang, Maiana
February 20 - February 26, '78

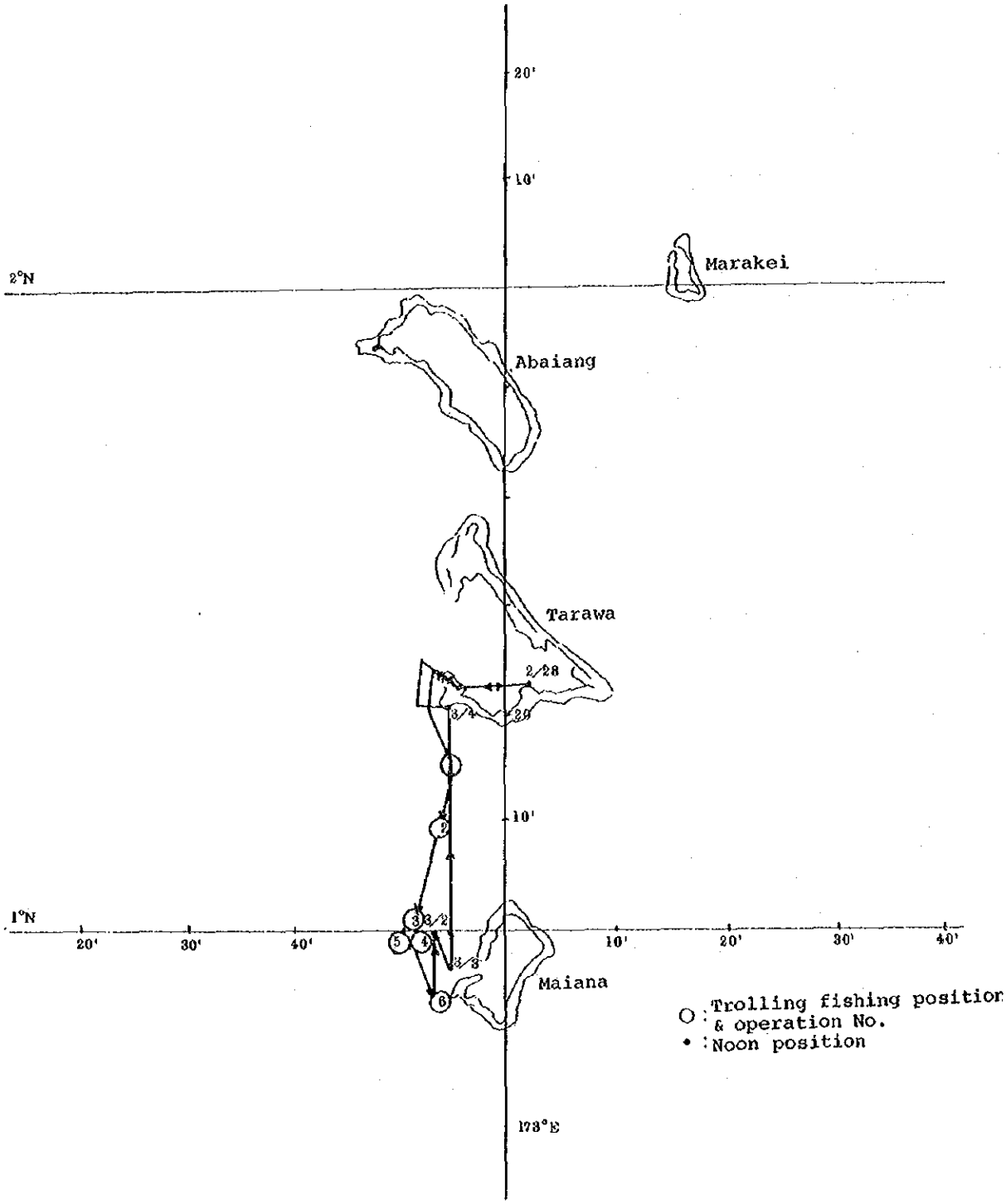


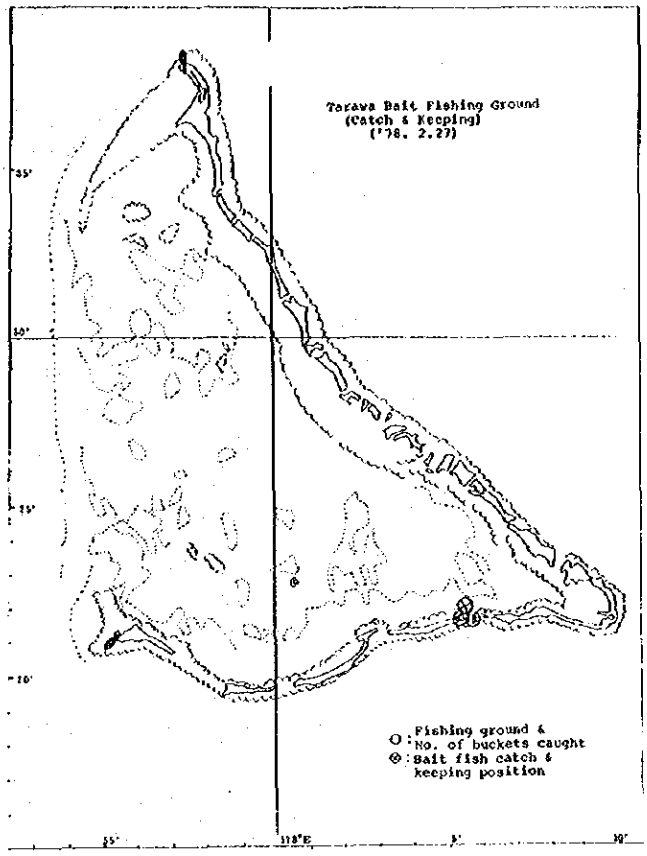

Tarawa Bait Fishing Ground
('78. 2.22, 2.24)
O : Fishing ground &
No. of buckets caught

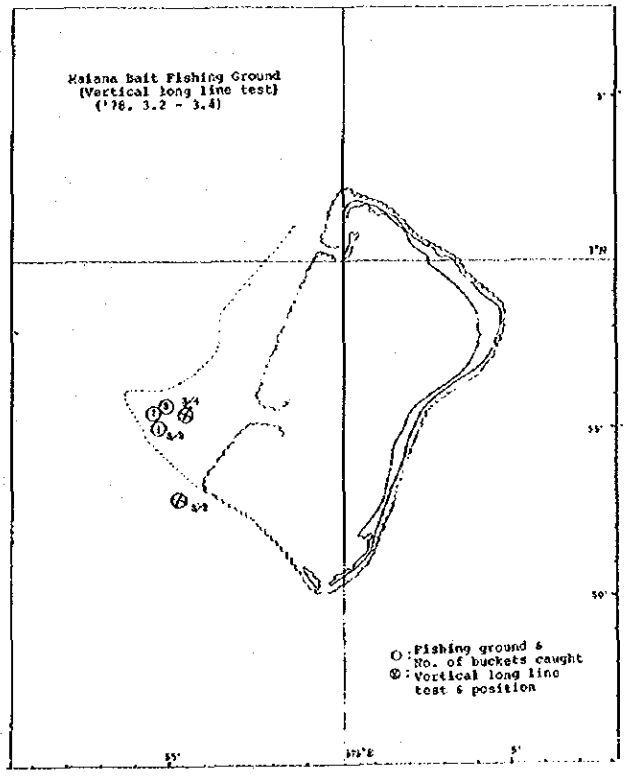

Abaiang Bait Fishing Ground
('78. 2.23)
Fishing ground &
O : No. of buckets caught
⊗: Rising school survey

(14) 14th Navigation: Tarawa, Miana

February 27 - March 5, '78




Tarawa Bait Fishing Ground
(Catch & Keeping)
('78. 2.27)
O : Fishing ground &
No. of buckets caught
⊗ : Bait fish catch &
keeping position


Kaiana Bait Fishing Ground
(Vertical long line test)
('78. 3.2 - 3.4)
O : Fishing ground &
No. of buckets caught
⊗ : Vertical long line
test & position

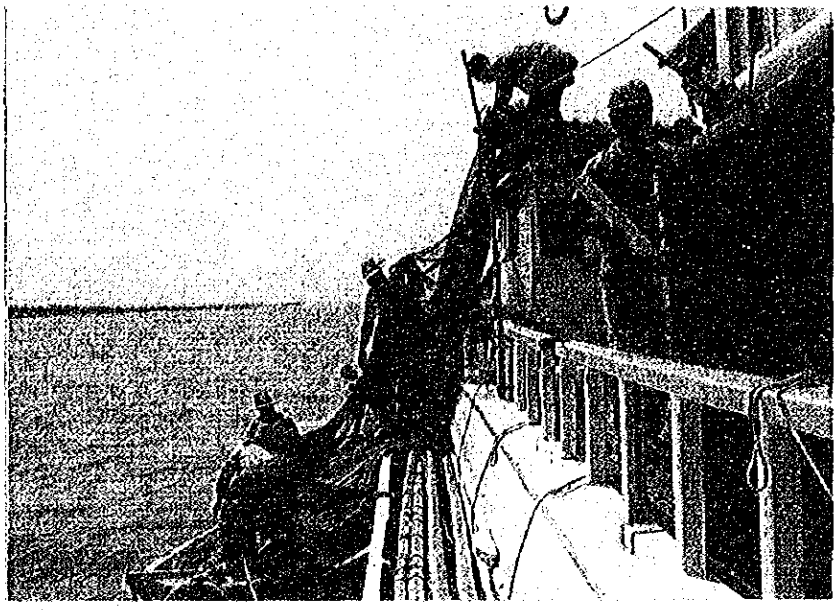
PHOTOGRAPHS

PHOTOGRAPHS

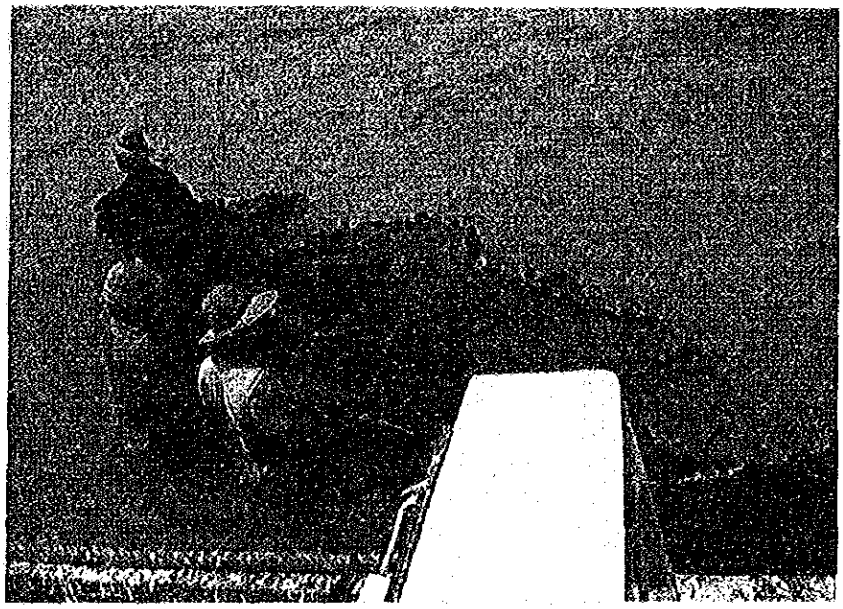
Bait Fish Fishery

Purse Seine Fishing

Object: Harengula ovalis, Atherinidae sp.

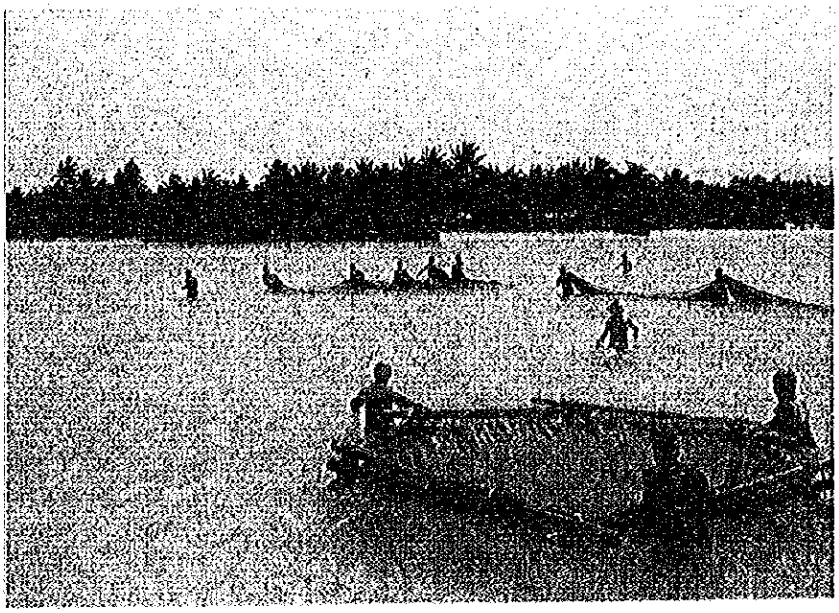


(1) Arrived at bait fish fishing ground.
The purse seine fishing gear is transferred from the main vessel to the boat.

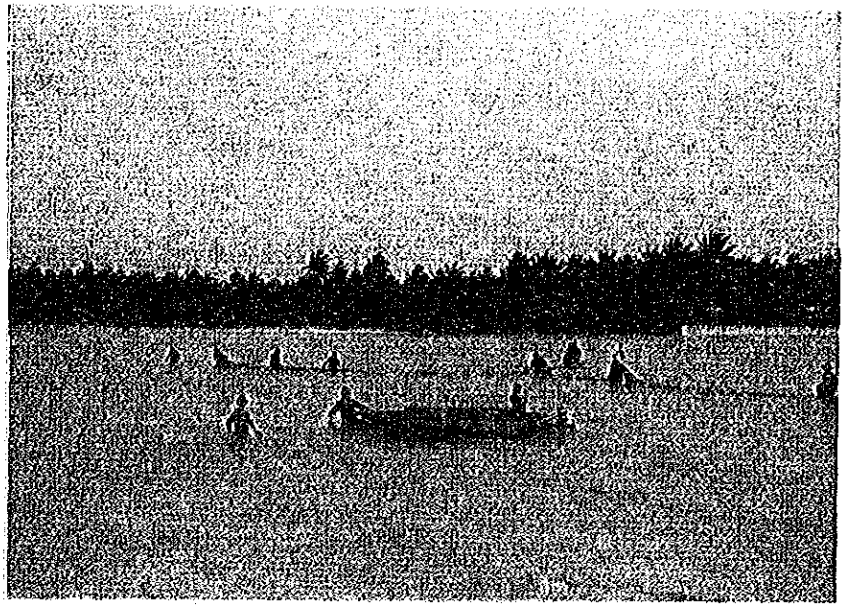


(2) Found fish school. The net is thrown into the sea from the boat.

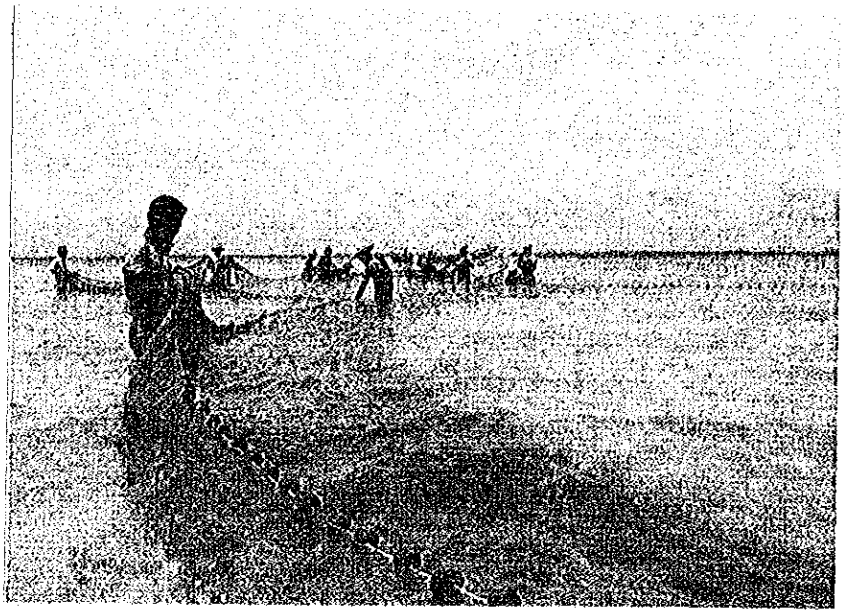
(3) Approached quietly to the fish school with the net in hands.



(4) Surrounded the fish school. Bait pen is waited to be used.



(5) Succeeded in surrounding.



(6) The fish school inside the net are transferred to the bait pen.