# OBSERVER TRIP ON UNITED STATES PURSE-SEINE VESSEL
## (November-December 1984)

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# PREFACE

The Tuna and Billfish Assessment Programme is an externally funded part of the work programme of the South Pacific Commission and is the successor of the Skipjack Survey and Assessment Programme. Current responsibilities of the Tuna Programme include compilation and maintenance of a fisheries statistics data base for the commercial fisheries in the region, and biological research on fish stocks which support this fishery. The work of the Programme is presently funded by donations from the governments of Australia, France, New Zealand, and the United States of America. The beneficiaries of this work are the island states of the South Pacific Commission who use the research results in the development and management of fisheries in their Exclusive Economic Zones.

The Technical Report series published by the Tuna Programme documents research results obtained by Programme staff. These reports cover a wide variety of topics and range in content from highly technical material of interest primarily to specialists, to material of much wider interest. The basis for these reports is the ongoing research of the Programme and includes information obtained by Programme staff during the pursuit of their current activities, data contained in the regional fisheries data base, and data obtained during the Skipjack Programme.

Tuna Programme staff frequently have the opportunity to make observer trips on fishing vessels of various nations. SPC observers board fishing vessels at the courtesy of the vessel operators, and the reliability of the information gathered by the observers depends on the willing co-operation of the vessel's crew. Therefore, SPC observers make no attempt to obtain information which could be used for surveillance or enforcement purposes.

The goals of these observer trips are to obtain general information about operations of different types of fishing vessels; to obtain specific information which assists Programme staff in interpreting fisheries statistics; to carry out biological sampling of the catch; and to make other observations which would assist fisheries officers in understanding the operations of the fisheries in their region.

The vessel owner, Julius Zolezzi, is to be thanked for the generous offer of the observer trip. Throughout the trip the entire crew of the Jeannine was extremely co-operative. The Captain, John Canepa, the Navigator, Jordan Souza, the Chief Engineer, Lee Silviera, and Mastman, Tom Zolezzi, were especially helpful.

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# OBSERVER TRIP ON UNITED STATES PURSE SEINE VESSEL
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## 1.0 INTRODUCTION

In recent years there has been a rapid increase in American purse seining activity in the western Pacific. From humble beginnings in the late 1940s, the first fully commercial operation began in 1979 and the fleet has subsequently increased to approximately 50 vessels at present. Their catch of tuna in the South Pacific Commission (SPC) area[1], in excess of 200 000 tonnes per year[2], is the largest of any fleet operating in the region.

An intimate knowledge of a fishery is essential to the study and assessment of any commercially exploited stock of fish. Tuna Programme scientists have had considerable experience with live-bait tuna fishing, and three observer trips on Japanese purse seiners have been undertaken. The purpose of the present trip was to acquire experience on a typical United States purse seiner operating in the western Pacific.

The American Tunaboat Association (ATA), in voluntary co-operation with the South Pacific Commission, approached vessel owners to arrange an observer trip. Several consented and a choice of vessels was offered. Primarily for reasons of timing, the Jeannine, owned by Julius Zolezzi, was selected. Mr Zolezzi kindly agreed to cover all living expenses for myself while on board his vessel.

## 2.0 VESSEL AND CREW

### 2.1 Vessel

The vessel selected for the observer trip, the Jeannine (Figure 1), appears typical of a United States purse seiner operating in the region. Arriving in the western Pacific in January 1982, the vessel has subsequently captured approximately 11 000 tonnes of tuna in 11 fishing trips.

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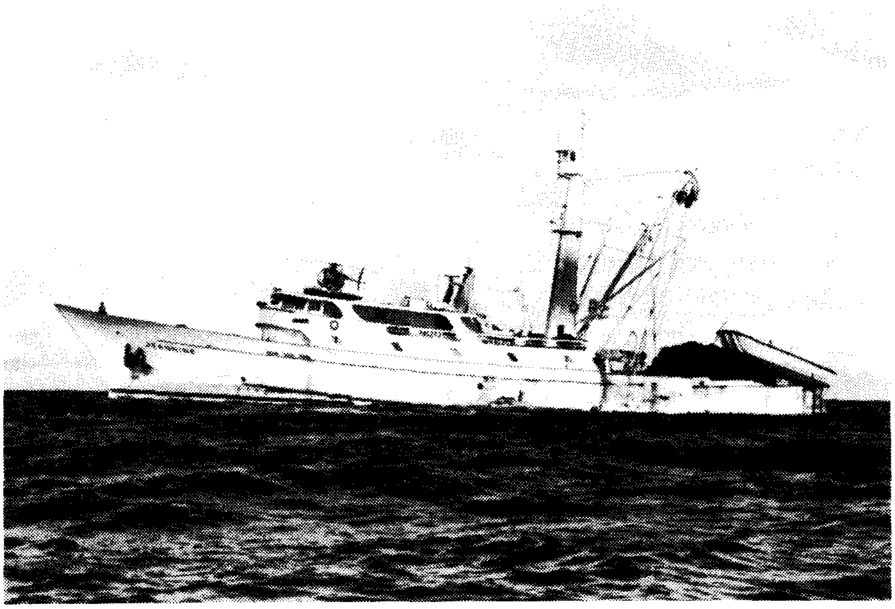
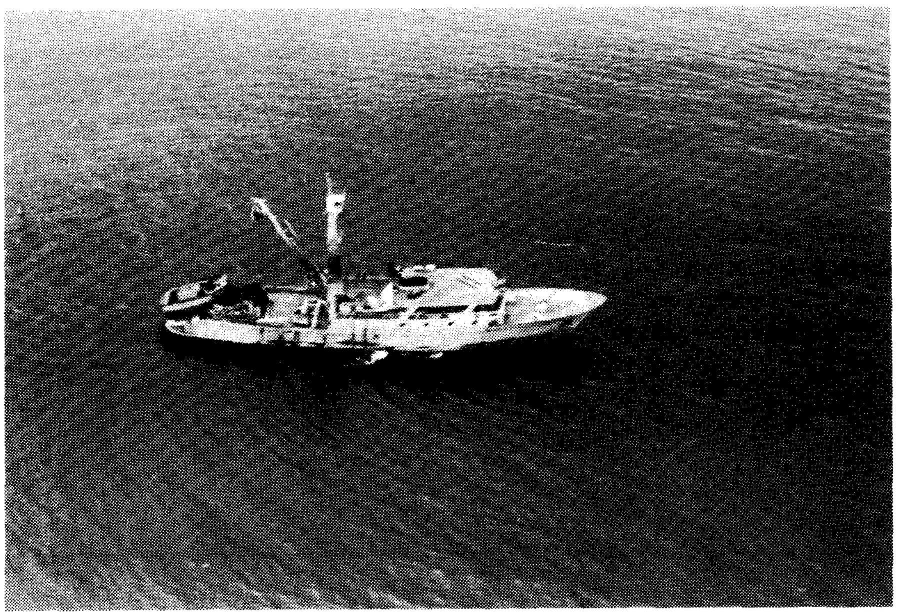
1. In this report the term tuna is not limited to yellowfin tuna, as is the usual practice in the American fleet.

2. Catches are reported in this report in metric tonnes.
   1 metric tonne = 1.1 short ton
   tonne = metric tonne
   ton = short ton

FIGURE 1. THE JEANNINE





Specifications of the vessel are as follows:

Vessel Name: Jeannine
Managing owner: Julius Zolezzi
Captain: John Canepa
Official number: (US) 56 0022
Radio call sign: WYX 3794
Year constructed: 1974, Tacoma Washington, USA
Builder: Martinac (hull no. 198)
Gross tonnage: 1189 tons
Net tonnage: 592 tons
Fish carrying capacity: 1260 tons, packed (1145 metric tonnes)
Length over all: 218 feet (66 metres)
Length at water line: 201 feet (61 metres)
Beam: 42 feet (12.8 metres)
Draft: 15.3 feet (4.7 metres)
Main engine: General Motors diesel, 3600 horsepower
Cruising speed: 13.5 knots
Maximum speed: 14 knots
Maximum autonomy: 120 days
Crew size: 18 to 20 men
Accommodation: 20 bunks
Net size: 840 fathoms x 132 fathoms x 1100 fathoms
(1536 m x 241 m x 2012 m)
Total daily fuel consumption: 3500-3800 U.S. gallons (13 249 - 14 384 litres) diesel for all machinery for 24 hours at cruising speed.
Amount of fuel carried for fishing trip: 225 000-250 000 U.S. gallons (871 717-946 353 litres)
Boats carried: 1 net skiff; 6 speed boats
Helicopter: Model - Hughes 500L
Max. speed - 130 knots
Cruising speed - 80 knots
Fuel consumption - 22 gallons (83 L) per hour
Autonomy at cruising speed - 3.5 hours
Number of fish wells: 19; one single and 9 double tanks
Fish storage temperature: 10°-15°F (-9° to -15°C)
Registered home port: San Diego, USA
Port where catch discharged: Pago Pago, American Samoa

## 2.2 Crew

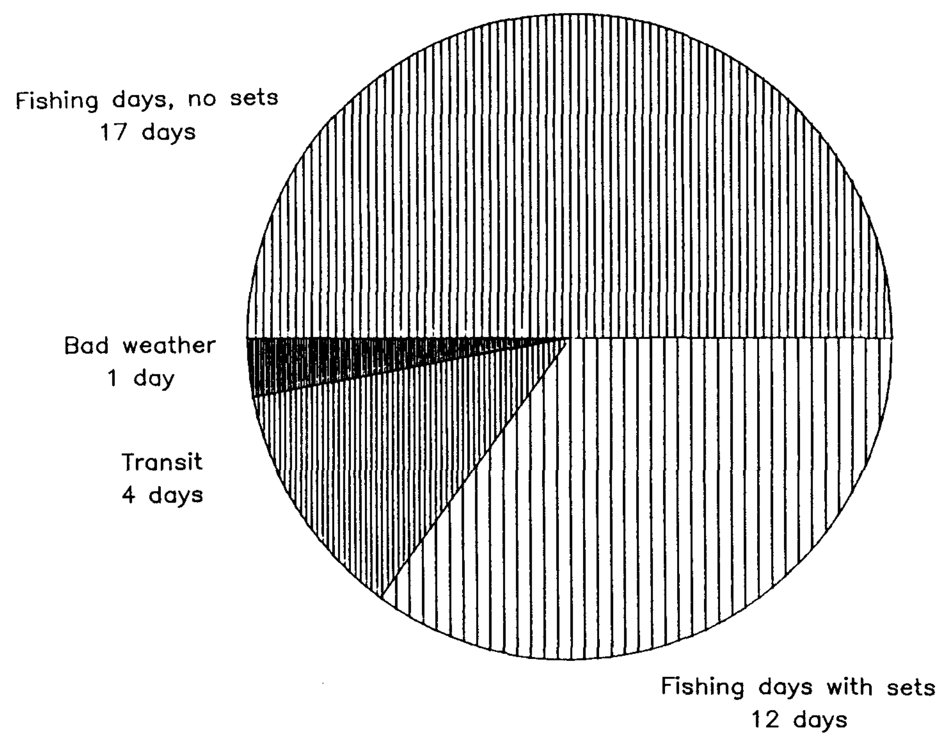
The Jeannine usually carries from 18 to 20 crew members for operations in the western Pacific. This crew includes captain, navigator, chief engineer, assistant engineer, deck boss, mast man, skiff man, helicopter pilot, helicopter mechanic, cook. Senior members of the crew have had decades of experience in both live-bait tuna fishing and subsequently purse seining in the eastern Pacific. About one-third of the present crew are Pacific Islanders from the Federated States of Micronesia, Tuvalu, and Western Samoa.

## 3.0 FISHING

### 3.1 Summary of Trip

Figure 2 shows the proportion of days spent during the observer trip on fishing and non-fishing activities. After departure from Pago Pago on November 4 there was a period of four days of steaming to the northwest, followed by nine days of unsuccessful searching for good logs or foaming schools. During these days of searching about 25 logs spotted from the helicopter or from binoculars on the vessel were examined by sonar for the presence of favourable concentrations of tuna. On the thirteenth day at sea, an appropriate log was located and the following day at dawn the net was set for the first time. Although over 60 tonnes of tuna were loaded from the set, it was judged that a sufficient amount of tuna was still associated with the log and the same log was set upon the following day. The catch was, however, less than five tonnes. The next day, an apparently good log was set on with even worse results. Five days of unsuccessful searching followed and on the twenty-second day at sea a foaming school was spotted and set on in the afternoon. All the tuna escaped, but another vessel nearby set on the same school and caught at least part of it. Poor visibility, due to heavy rain, resulted in little searching being carried out on the following day. On the twenty-fifth day, the _Jeannine_ made three sets on schools foaming on _Stolephorus buccaneeri_, a pelagic anchovy. The first two attempts were unsuccessful, while the third was only partially successful. The following morning 14 purse seiners registered in 6 different countries were visible, apparently attracted by information about the large number of foaming schools in the area. The _Jeannine_ made two sets, the latter of which occurred in the late afternoon and was successful in capturing 50 tonnes of skipjack. Two days were then spent looking for logs and then on the following four days dawn log sets were made with variable success. On 8 December, after 34 days at sea I departed the vessel by helicopter at Kavieng, Papua New Guinea.

FIGURE 2. TIME SPENT ABOARD THE _JEANNINE_



In general during the observer trip, the sea conditions were very calm. With the exception of the first portion of the trip (when the vessel was steaming), sea surface conditions would not have prevented setting the net.

Figure 3 shows the location of the 14 sets made during the trip, and Figures 4 and 5 give pursing and total time required for each of these sets respectively.

### 3.2 Technique

#### 3.2.1 Log sets

Logs are spotted by the Captain from the helicopter, the mast man from the crows nest, or by one of the deck crew from two spotting positions forward of the bridge. The decision of whether to set on the log is based on an inspection by scanning sonar on the Jeannine. If the log proves worthy of a set it is (a) marked with a radio beacon so the vessel can return to it later in the day or on a different day, or (b) if it is late in the afternoon, tied by a line to the Jeannine. Before dawn the crew rises, has breakfast, and prepares for the set. Prior to first light the vessel steams in a counter-clockwise direction around the log and the skiff is released, pulling the end of the net into the water, and within 8 to 11 minutes the log is fully encircled and pursing the bottom of the net begins. From 43 to 65 minutes after skiff release pursing is completed as indicated by the rings being hoisted out of the water. At this point, any fish within the net have very little chance of escaping. About an hour of net stacking follows and then any fish that may have been captured are brailed from the net onto the vessel.

#### 3.2.2 School fish sets

Schools which are appropriate for purse seining are those that are stationary and "foaming" at the surface. These are easily visible from a height and are therefore most often spotted by helicopter. The desirability of setting on a school is gauged both by the size and movement judged from the helicopter and the size and depth distribution indicated on the sonar. From the helicopter, the Captain may spend a long period of time studying a school to decide whether to set the net and, if so, what strategy to use. Setting the net is basically the same as for log sets except for (1) the vessel's movements are directed by the Captain from the helicopter, (2) the vessel moves at a greater speed, (3) the net is pursed faster, and (4) a variety of mechanisms are used to manoeuvre the fish (see Table 6).

### 3.3 Fishing Results

An estimated total of 198.5 tonnes of tuna were captured during the 14 sets made during the observer period. Of the retained tuna catch, 139.5 tonnes were estimated to be skipjack, 20 tonnes were yellowfin, and 2 tonnes were bigeye. Figure 6 details the catch and species composition for the observer trip.

FIGURE 3. THE FISHING ZONE

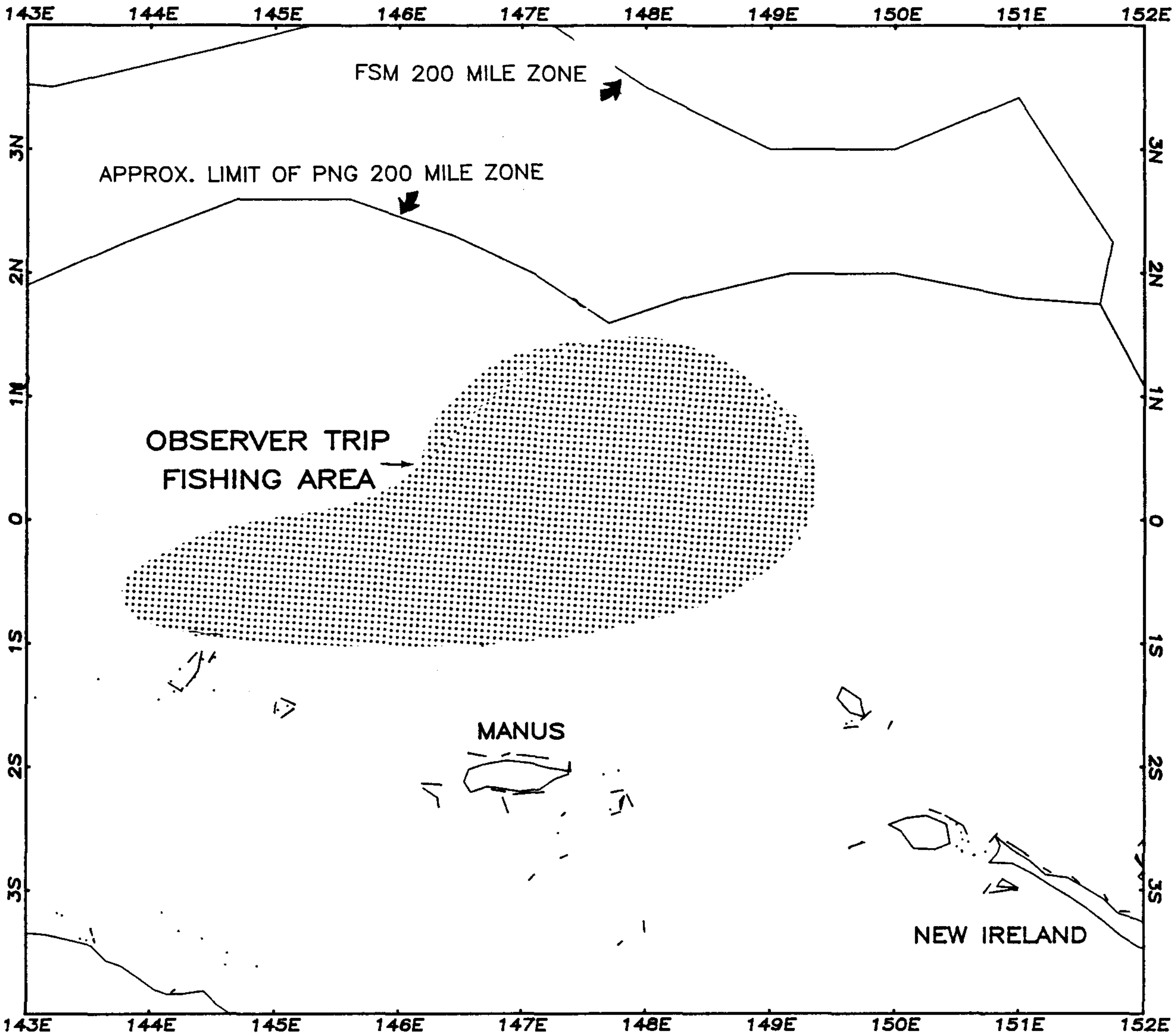


FIGURE 4. ELAPSED TIME FROM LETTING GO SKIFF TO RINGS UP

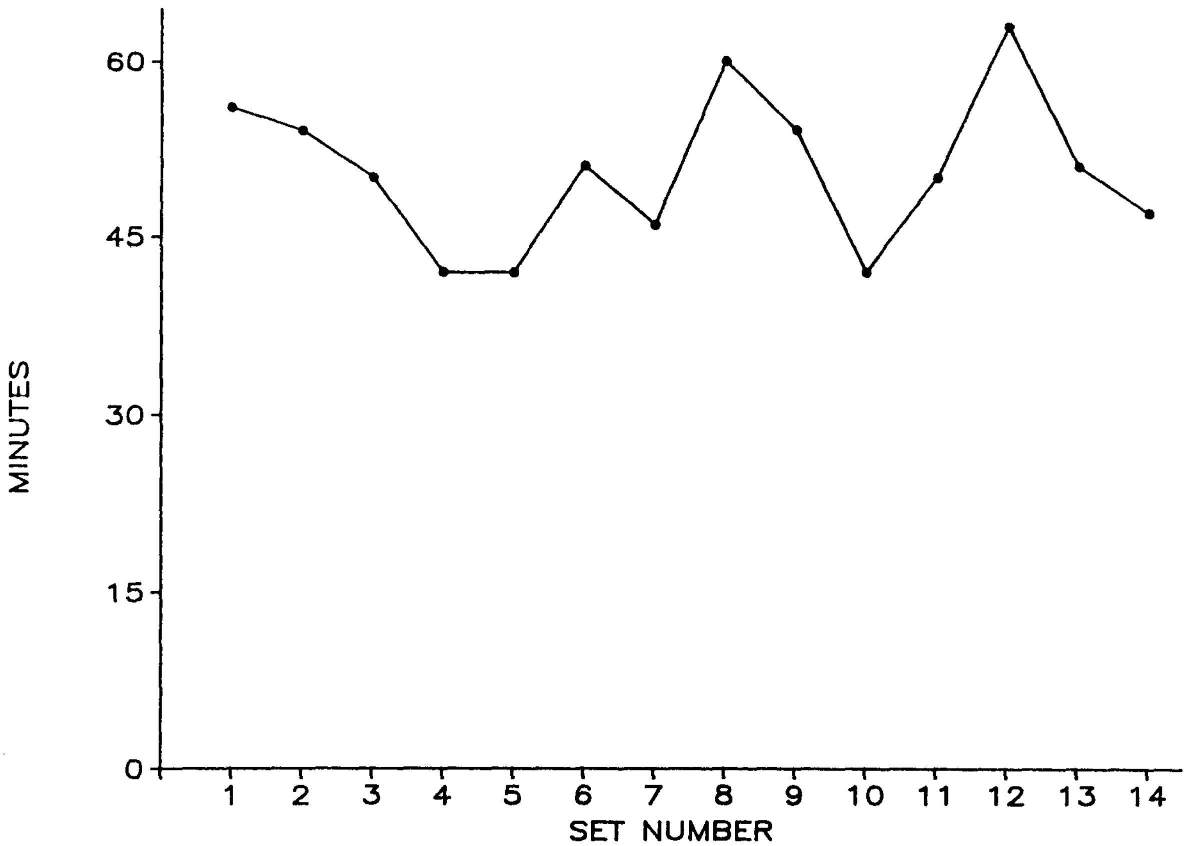



FIGURE 5. TOTAL TIME SKIFF IN WATER DURING SET

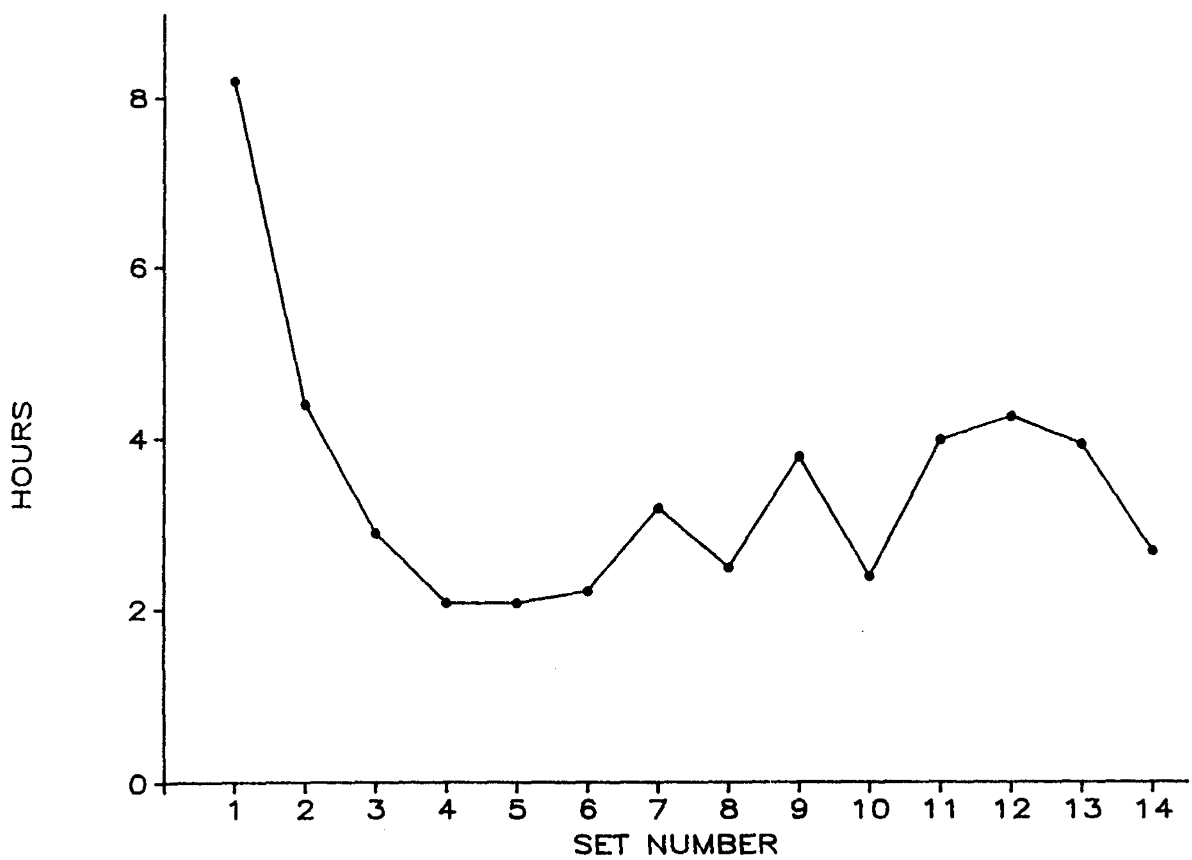
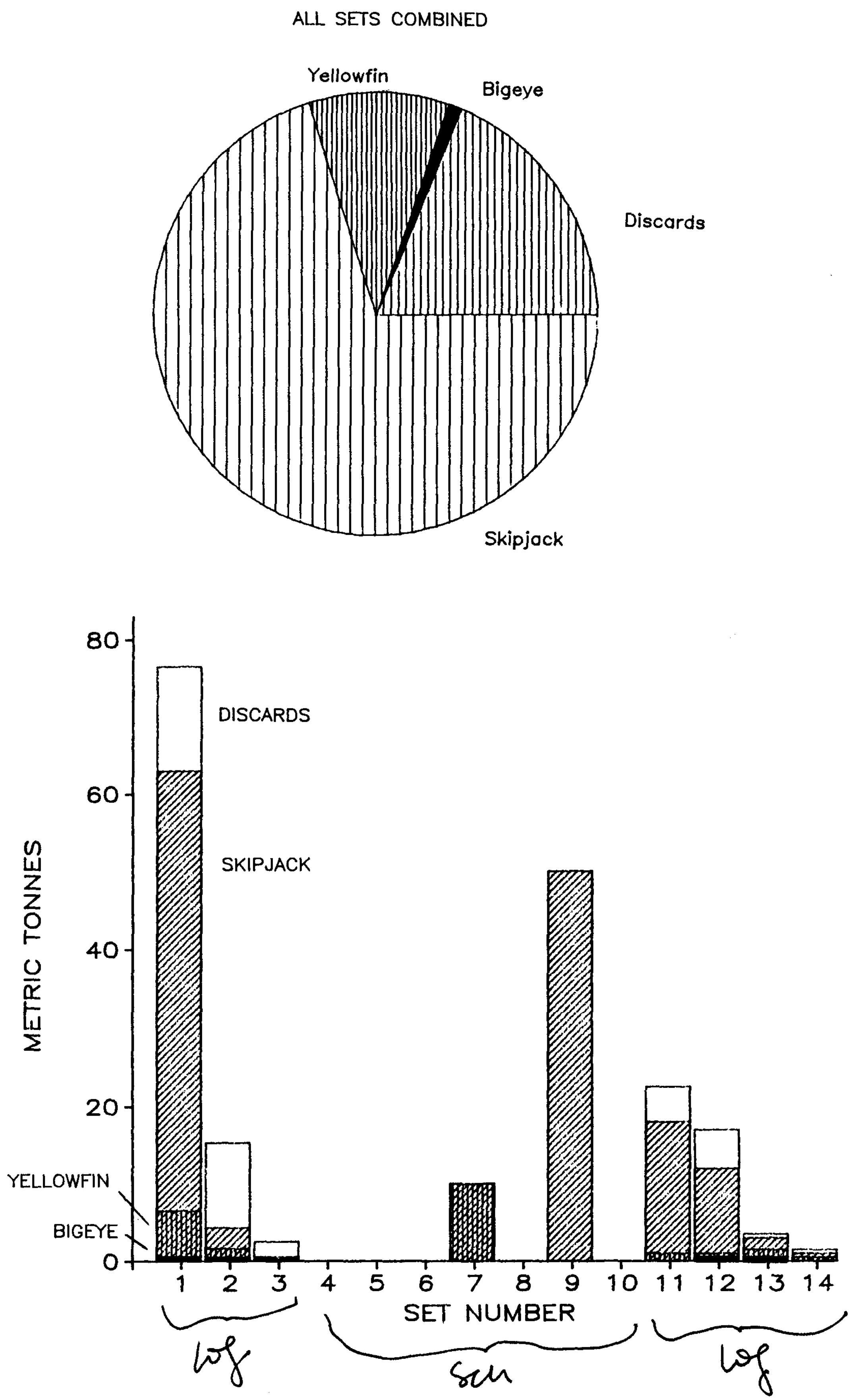


FIGURE 6. TUNA CATCH DETAILS



The retained tuna catch per set and cumulative retained tuna catch are given in Figures 7 and 8 respectively. The amount of tuna caught and retained per day at sea was 4.8 tonnes; 5.6 tonnes per fishing day, 11.6 tonnes per set of the net, and 20.2 tonnes per successful set. Of the 14 sets, 7 were made on logs and 7 on school fish. For log sets, 101.8 tonnes of tuna were captured and retained (14.5 tonnes per average set), and 60 tonnes came from school fish sets (8.6 tonnes average per set). Figure 9 gives catch details by type of set. The success rate of all sets (percentage of sets in which at least one tonne captured and retained) was 57 per cent, 86 per cent for log sets, and 29 per cent for school fish sets.

All purse seine operations discard a portion of their catch either because the species are not saleable or because the tuna are undersize. On this trip an exceptionally large amount, 37 tonnes, of undersized tuna (skipjack less than 1.8 kg and yellowfin less than 3.4 kg) was discarded. In addition, 11 tonnes of undesirable species were rejected, all of which came from the log sets. In decreasing order of importance by weight, rainbow runner (Elagatis bipinnulatus), blue marlin (Makaira nigricans), scad (Decapterus sp.), triggerfish (Canthidermis sp.) and sharks (Carcharinus sp.) were the major species discarded.

According to the officers of the Jeannine, the amount of fish rejected during the trip was much greater than on previous trips. It was stated that only on occasion is there ever a need to sort the catch. The amount of complaining from the deck crew over the extra work needed to sort the discards gives support to this claim. The quantity of discards on this observer trip was therefore not considered to be typical of the Jeannine operation nor of other seiners operating in the area and these figures should not be used for extrapolation.

In general, fishing was poor during the observer trip. The retained tuna catch, 161.3 tonnes, was only about 14 per cent of the capacity of the vessel for 34 days' absence from port. Factors cited by the vessel's officers for the reduced catch rate were: poor abundance of tuna on logs, small size of the tuna which were present on logs, and the non-appearance of a large number of foaming schools just prior and during the full moon. Other vessels fishing in the area had similar poor catches, although during the run of foaming schools on 29 to 30 December, some vessels made good catches including a reported 300 tons on one set.

The amount of undersized tuna (skipjack less than 1.8 kg and yellowfin less than 3.4 kg) rejected during the trip was much higher than that on previous trips according to the crew of the Jeannine.

## 4.0 CATCH SAMPLING

Each successful set made during the trip was sampled for length frequency (Figure 10) and species composition information (Figure 6). Species composition was estimated by a quick inspection of most brailing scoops and the fish were selected for measurement by snatching all of the fish from a certain area of the hopper immediately after the fish were dumped from the brailing scoop. This sampling was far from problem-free. Despite the relatively large size of the Jeannine, there was little space

FIGURE 7. RETAINED TUNA CATCH PER SET

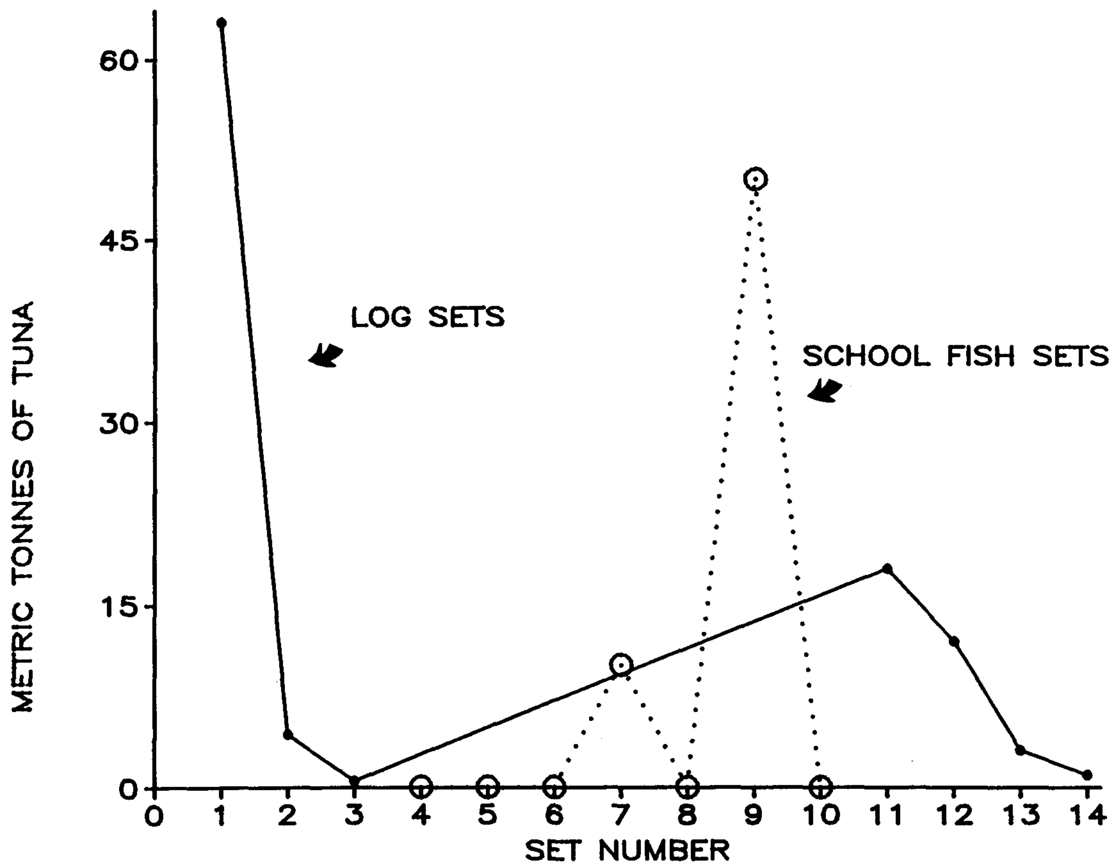



FIGURE 8. CUMULATIVE RETAINED TUNA CATCH

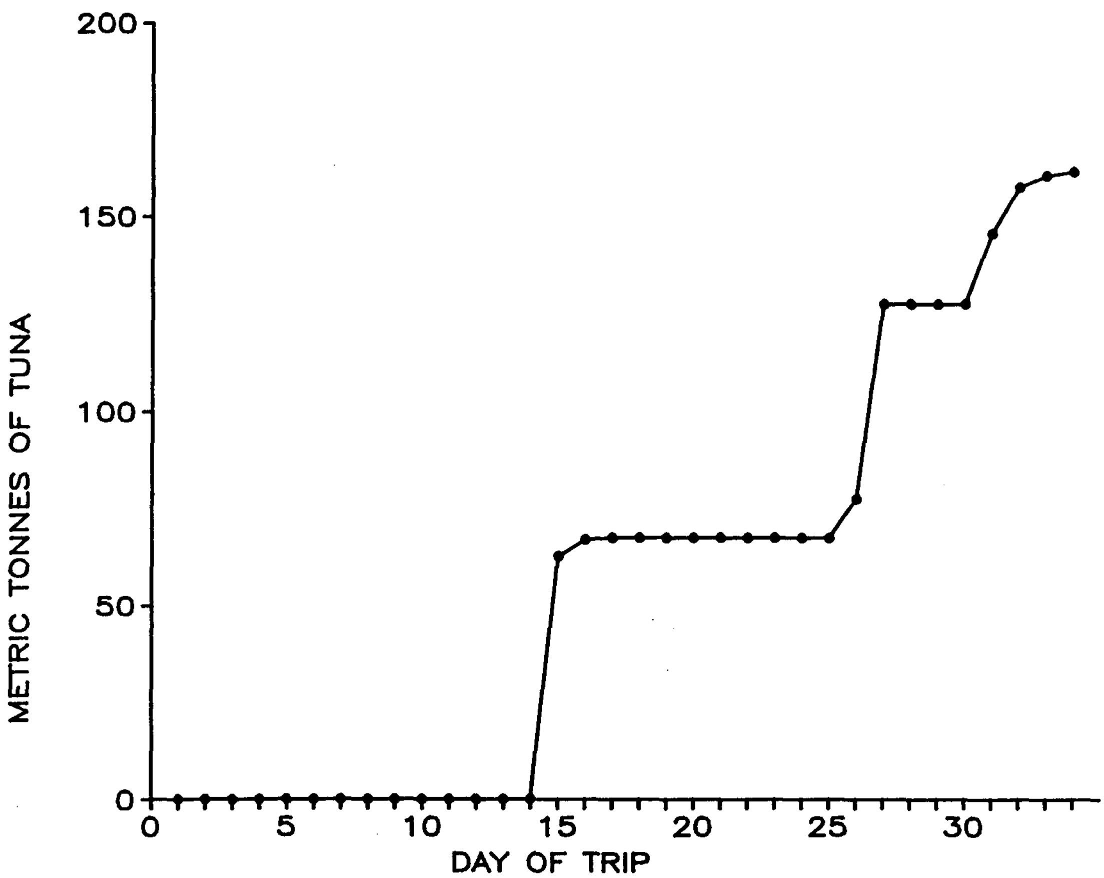
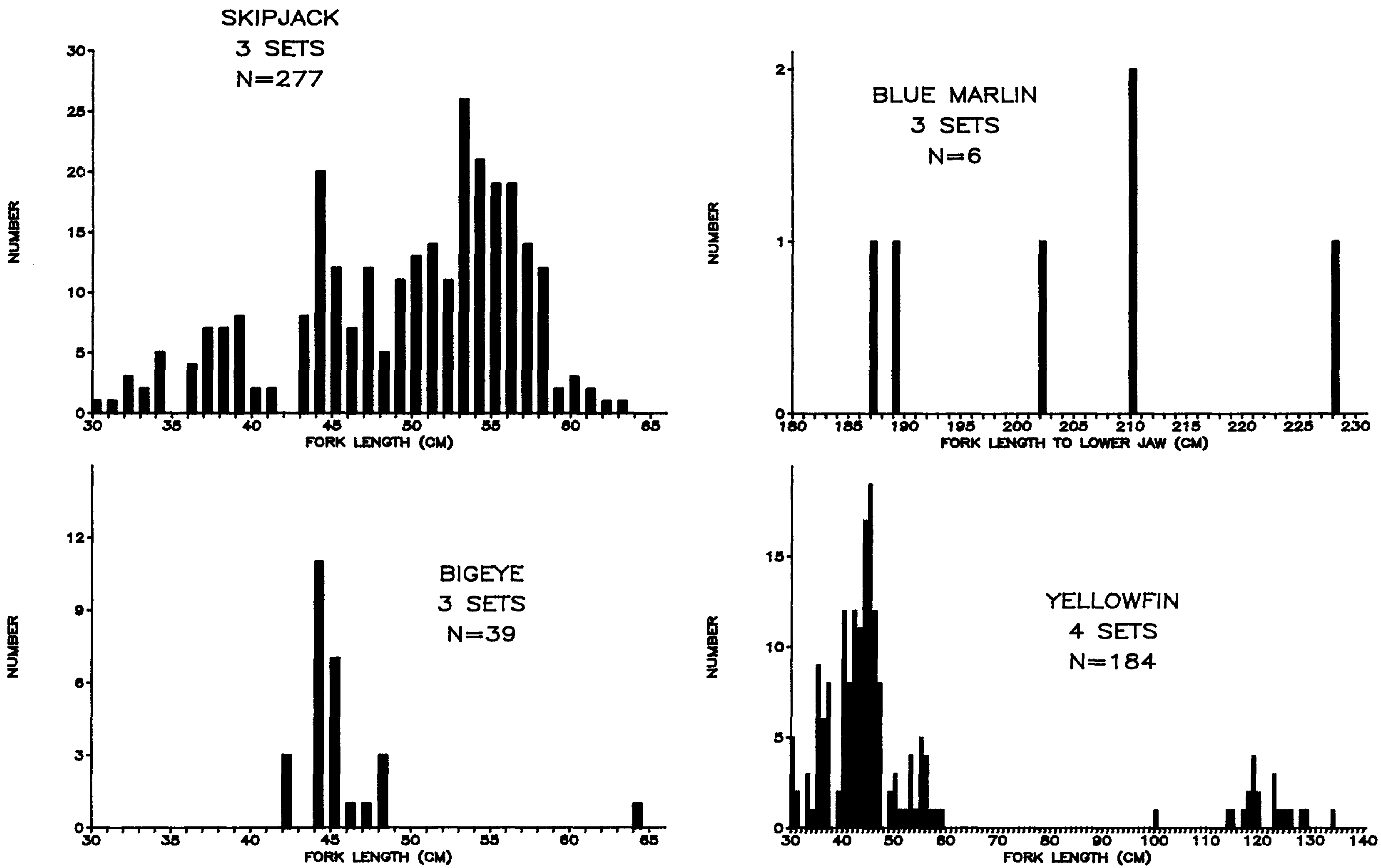


FIGURE 9. TUNA CATCH DETAILS BY TYPE OF SET


Note: Area of circle proportional to average catch.

FIGURE 10. LENGTH FREQUENCY INFORMATION



on the work deck where thorough sampling could be done. Fish that were brailed on board were rapidly sorted by the crew on the hopper (Figure 11a) and quickly disappeared below. Any alteration to this procedure to allow for rigorous sampling would have interfered with the fishing operation and would have been unfair to the crew, especially considering that the invitation for the observer trip was extended voluntarily.

Sampling of the catch in port likewise has problems. The major difficulty is that any fish discarded while at sea would not be available for sampling.

In Table 1 some of the strengths and weaknesses of shipboard and port sampling are compared.

In summary, port sampling for species composition and length frequency information appears more practical than shipboard sampling. Considering the limitations of port sampling, when the opportunity arises to do shipboard sampling, it should definitely be done as it can provide information useful for estimating what is not available from port sampling. The need to establish and maintain a good working relationship with vessel operators is critically important for the success of a port sampling programme.

## 5.0 BLUE MARLIN

Blue marlin was the only species of billfish caught and these were captured only in log sets. Catch details are summarised in Table 2.

The number of marlin eliminated from the population owing to fishing mortality is not always clear as these fish thrash considerably in the confined area of the net just prior to sacking up, and frequently escape over the corks. The condition of these liberated fish ranges from unharmed to almost dead.

From Table 2 it can be seen that at least one marlin was associated with each log set on. The average number of marlin taken (defined as the combination of columns 3 and 4 of Table 2) per any type of set was 0.57 and 1.14 per log set. It should be noted that this data should be used with caution as it includes only a small number of sets in a limited geographical area. An extrapolation of these catches to all seiners operating in the area would not be realistic and should not be attempted at this time.

The taxonomic nomenclature for marlins causes some confusion for American fishermen. Because blue marlin are black and have stripes, they are frequently thought of as being black marlin or striped marlin. It is interesting to note that the Japanese name for black marlin actually translates literally as white marlin and that of blue marlin as black marlin. As some guide to marlin taxonomy for fishermen appears to be needed, a simplified guide to the identification is attached as Appendix A.

FIGURE 11A. SORTING FISH ON THE HOPPER

FIGURE 11B. BIGEYE (left) AND YELLOWFIN

FIGURE 11C. BIGEYE GAS BLADDER

TABLE 1. COMPARISON OF STRENGTHS AND WEAKNESSES BETWEEN SHIPBOARD AND PORT SAMPLING

| | Shipboard Sampling | Port Sampling |
|---|---|---|
| Accurate species composition sampling of what is available for sampling | Possible with experience* | Can be quite accurate |
| Accurate sampling of what is available for sampling | Very difficult | Can be quite accurate; some size change in freezing process reported |
| Interruption of activities | Considerable for accurate sampling | Slight |
| Undersized tuna in catch available for sampling | Yes | No |
| Incidental species available for sampling | Yes | No |
| Location of capture available | Yes | Only with co-operation of vessel operators |
| Yellowfin - bigeye discrimination possible | Somewhat difficult, especially for very small fish | ? |
| Expense | Large | Relatively small |

* Comparison of estimate by crew in ship´s log to cannery receipts shows considerable accuracy.

TABLE 2. CATCH DETAILS OF BLUE MARLIN

| Log | Set no. | Number landed on vessel | Number captured but not brailed on vessel; probably dead | Number captured but escaped; probably alive | Total number per set | Total number per log |
|---|---|---|---|---|---|---|
| A | 1 | 0 | 1 | 1 | 2 | 2 |
| A | 2 | 0 | 0 | 0 | 0 | |
| B | 3 | 1 | 0 | 0 | 1 | 1 |
| C | 11 | 3 | 0 | 0 | 3 | 3 |
| D | 12 | 0 | 0 | 0 | 0 | 1 |
| D | 13 | 0 | 0 | 1 | 1 | |
| E | 14 | 2 | 1 | 0 | 3 | 3 |

## 6.0 BIGEYE

During the time in which I was on board the Jeannine, a total of about two tonnes of bigeye tuna were captured and retained on board. Normally, on the Jeannine and presumably on most of the vessels in the fleet, small and medium size bigeye are not discriminated from yellowfin when they are captured or at the cannery.

Small bigeye are very easily confused with small yellowfin. Characteristics used for discrimination in the FAO species identification sheets have not proven completely reliable. During the trip an attempt was made to judge the accuracy of the FAO criteria for separating the two species. Quoting from the FAO species sheet: "White stripes on side of the body usually curve backwards toward the ventral side in yellowfin, while in bigeye they normally run straight down. Stripes appear alternately in an unbroken line and in a chain of dots in yellowfin, but appear only as an unbroken line in bigeye. Yellowfin has more than 10 stripes, bigeye less than 8. In the yellowfin liver, the right lobe is longer than central lobe, and all lobes are rather pointed, while in bigeye the central lobe is the longest, with all lobes being less pointed. Liver striated in bigeye but not in yellowfin".

On the Jeannine, 48 bigeye and 50 yellowfin in the 40-50 cm size range from two sets (Figure 11b) were closely examined about half an hour after brailing for the above characteristics. For bigeye, and to a lesser extent for yellowfin, the stripes can be very indistinct and difficult to count. When it was possible to count them, from 4 to 11 were present on bigeye, with the average number being 8. Three bigeye had at least one stripe made up of dots. Most of the livers on bigeye were not fully striated; the left and right lobes had patches on the margins which were smooth. The need to fully cut open the fish and properly identify the liver also limits the usefulness of liver examinations for species segregation.

Considering these limitations, an attempt was made to determine more suitable criteria. The following characteristics appeared to be the most appropriate for distinguishing between the 98 fish examined (Table 3).

TABLE 3. DISTINGUISHING CHARACTERISTICS BETWEEN BIGEYE AND YELLOWFIN TUNA

| Character | Bigeye | Yellowfin |
|---|---|---|
| Body outline | Dorsal outline from tip of snout to base of caudal peduncle almost a smooth arc; ventral outline from tip of snout to base of caudal peduncle almost a smooth arc. | Dorsal outline from secondary dorsal fin to base of caudal peduncle somewhat flat; ventral outline from anal fin to base of caudal peduncle somewhat flat. |
| Pectoral fin | Pectoral fin extends to the posterior end (insertion) of anal fin. | Pectoral fin extends to the anterior end (origin) of the anal fin. |
| Gas bladder | Distended; extends along the roof of body cavity to within 2 cm of anal pore; highly visible. | Deflated or slightly inflated; extends along roof of body cavity to a point more than 6 cm from anal pore; not obvious. |

For the fish examined (and at the time they were examined) inspection of the gas bladder appears more practical than that of the liver. A small incision from the anus to the tips of the pelvic fins will allow for inspection of the roof of the body cavity (Figure 11c). Furthermore, the gas bladder is not easily confused with other internal organs (Figure 11c).

It appears that the enlarged gas bladder results in a slight positive buoyancy of the fish during sacking up and brailing. The presence of many "floaters" in the net at this time is a useful clue that the catch that is about to come aboard probably comprises at least some bigeye.

## 7.0 COMPARISONS OF FLEETS, AREAS, AND TYPE OF FISHING

The present observer trip, in conjunction with previous trips on Japanese vessels, provides an opportunity to compare different types of fishing. In Tables 4, 5 and 6 American purse seining in the western Pacific is compared to Japanese purse seining in the same area; eastern Pacific purse seining is compared to western Pacific purse seining; and log fishing is compared to school fishing. Information contained in the tables was compiled primarily by direct observation on the vessels and by discussions with the crews. It is assumed that the information is applicable to the operation of most purse seiners, but some of the items have yet to be confirmed.

# TABLE 4. COMPARISON OF AMERICAN AND JAPANESE PURSE SEINE FLEETS IN THE WESTERN PACIFIC IN 1984

| | American | Japanese |
|---|---|---|
| Number of vessels in purse seine fleet operating in SPC area | Approximately 50 | 40 |
| Size of purse seine vessels operating in SPC area | 315 to 1558 gross tons mostly between 1000 to 1500 gross tons | 33 seiners of approx. 500 gross registered tonnes; 7 seiners of approx. 116 gross tonnes operating seasonally |
| Primary area of fishing | 10 degrees north and south of the Equator from 135°E to 180°E | 10 degrees north of the Equator to 5 degrees south, 135°E to 165°E |
| Port where catch discharged | Pago Pago, Tinian, Honolulu | Yaizu, Tinian |
| Nationality of crew | US, Pacific Islander, Latin American, Korean, Portuguese, New Zealand, Yugoslav | Japanese |
| Spotting aircraft | Most have helicopter; one vessel with ultra-light fixed wing | None |
| Electronics | Much less advanced than Japanese except for voice communication | Very sophisticated except for voice communication; video position plotter and current meter |
| Code group | 3 code groups | Entire fleet in one "code group" |
| Fishing experience in region | Commercial operations since 1979 | Commercial operations since late 1960s |
| Government restrictions (other than those for all vessels including non-fishing vessels) | None | Size of vessels, number of vessels, area of operation, season of operation (116 GT) |
| Net size* (cork line x depth) | (Jeannine) 1500 x 240 m | (Takuryo Maru, 500 GT): 1500 x 280 m (Matsuo Maru, 116 GT): 1100 x 230 m |
| Net mesh | Braided, knotted | 2 to 3 strand knotless |
| Average trip length* | 68 days (Jeannine, 1984) | 38 days (Takuryo Maru, 1981 to 1982) |
| Direction of set | Counter-clockwise | 500 GT - mostly counter-clockwise; 116 GT - clockwise |
| Specialised crew | Helicopter pilot, helicopter mechanic | Radio operator/ electronic technician |
| Number of crew | 18 - 20 | 22 - 25 (500 GT); about 55, including 4 captains (116 GT) |
| Catch reported to | ATA (if member); some cases to PNG | Japan Fishery Agency; country in which catch made |
| Catch form used | IATTC, in some cases SPC | Japan Fishery Agency, SPC |
| Special problems | Unloading delays, less knowledge of area, less exchange of information based outside country, crew turnover, helicopter problems | Small vessels: (1) capacity, (2) stability, (3) comfort, less experience with seining, less innovative, less mechanised vessels, competition with U.S. vessels |

* Large variation expected.

Note: When vessel name given, information supplied refers to that vessel and applicability to other vessels not verified.

TABLE 5. COMPARISON OF EASTERN AND WESTERN PACIFIC PURSE SEINE FISHING

| | Eastern Pacific | Western Pacific |
|---|---|---|
| Types of schools fished | Foamer, log, porpoise, sometimes breezer | Foamer, log, rarely breezer |
| Length of trip | Average for all purse seiners over 400 tons was 82.3 days (1982) and 88.9 days (1983) | Jeannine's first 3 trips of 1984 averaged 68 days |
| Trips per year | Most large seiners do 3 trips | Usually 4 |
| Government restriction (other than those for all vessels including non-fishing vessels) | Some years yellowfin quota, regulation dealing with porpoise issue | None |
| Catch data given to | IATTC | ATA (if member); PNG in some cases |
| Catch form used | IATTC | IATTC, SPC in some cases |
| Catch composition | Average yearly catch composition for 1980 to 1984 varied between 42% and 50% yellowfin | About 75 per cent of total fleet catch is skipjack |
| Number of crew | 14 - 16 | 18-20; larger crew owing to size of net and less experienced crewmen |
| Net depth | About 165 m (15 strips) | About 40 per cent deeper |
| Porpoise | Usually associated with tuna | Very rarely associated with tuna |
| Vessel size | Various | Mostly over 1000 tons of carrying capacity |
| Use of aircraft | Helicopters on larger vessels; some airplane spotting near coast off Baja, California | Almost all vessels use helicopters; some airplane spotting from Guam |
| Oceanographic factors | | Water usually clearer; deeper thermocline; sea surface temperature warmer |
| Recent "El Nino" effect | Resulted in poor catches | Could have been responsible for the excellent catches |
| 1983 fishery success | 3 of 50 most productive seiners in world fished in the eastern Pacific in 1983 | 44 of 50 most productive seiners in world fished in the western Pacific in 1983 |
| Sharks | Very aggressive; many fishermen injured | Relatively benevolent |
| Net construction | Porpoise panels installed | Lighter webbing |
| Special problems | Intense competition; "El Nino effect"; yellowfin quota; porpoise-related regulations | Based outside country; unloading delays; new area; crew transportation costs; crew turnover; vessel repairs; cost of supplies; repair work |
| Weather | | Usually better; more ideal fishing days |

TABLE 6. COMPARISON OF LOG AND SCHOOL FISHING BY UNITED STATES FLEET IN THE WESTERN PACIFIC

| | Log Fishing | School Fishing |
|---|---|---|
| Setting time | Almost always just before dawn; close to nautical twilight | All daylight hours |
| Number of sets possible per day | One | Four |
| Use of aircraft | Useful for spotting logs; not used for setting | Very useful for spotting foaming schools; very useful for directing vessel movements just prior and during setting |
| Desirable characteristics of school | Seasoned log, which has an abundance of smaller fish species associated with it; good tracing on sonar and depth sounder | Foaming school required; the more stationary the better |
| Fishing area | Areas where logs are common; near large islands at the extreme west of SPC area and in the counter-current flowing from this area | Anyplace, especially those areas where large concentrations of Stolephorus buccaneeri are found |
| Success rate | Usually successful | 10 to 25 per cent |
| Species composition (average) | 75 per cent skipjack; 25 per cent yellowfin and bigeye | 80 per cent skipjack; 20 per cent yellowfin and bigeye |
| Incidental catch | Often considerable; rainbow runner, triggerfish, sharks, blue marlin wahoo, dolphinfish, decapterus | Usually very little; blue marlin at certain times; sharks |
| Portion of total number of sets by US fleet | About 60 per cent | About 40 per cent |
| Portion of total tonnage by US fleet | About 75 per cent | About 25 per cent |
| Special fishing techniques | Electronic monitoring of fish movement to gauge necessary pursing speed | Fast set; fast pursing; can use skiff, speedboat, helicopter, hammer noise, dye, bombs, and crew thrashing in water to manoeuvre fish; towline used more often, powerful purse winch useful |
| Other considerations | Good logs may be marked with radio beacons and vessel can easily return; "ownership" is clear; sorting out the incidental catch can be time consuming; most very large catches (over 200 tonnes) on logs; successful log sets sometimes reported as school fish sets to avoid competition from vessels attracted to the area | Considerable skill involved; competition between vessels can be considerable; skipjack easier to catch than yellowfin |
| Lunar effect | Less successful fishing when set is during full moon | Foamer school thought to be more common before and during full moon |

## 8.0 PURSE SEINE TERMINOLOGY

For observers to be fully effective aboard purse seiners, they must be conversant with the specialised terms frequently used on these vessels. Fisheries personnel in general might also benefit from a knowledge of the vocabulary used in the US fleet. During the trip a glossary of 88 such terms was compiled and appears in Appendix B.

## 9.0 TRAINING

Several countries and agencies have made informal requests to the South Pacific Commission Tuna and Billfish Assessment Programme for training of local fishermen for employment on purse seiners. Although not strictly within the established priorities of the Programme, the present trip provided an opportunity to collect material which could be used for training purposes in the future.

As six Pacific Islanders are employed on the *Jeannine*, lengthy discussions were carried out with the crew members on their initial difficulties and what training would be possible. The ship's officers' opinions were also solicited on these topics. During the course of my trip several hundred colour slides were taken, the aforementioned glossary of US purse seiner terms was completed, an explanation of net stacking was written (Appendix C), a vertical cross-section of a purse seine was drawn (Appendix D), and a notebook of useful information for novice purse seine fishermen was prepared.

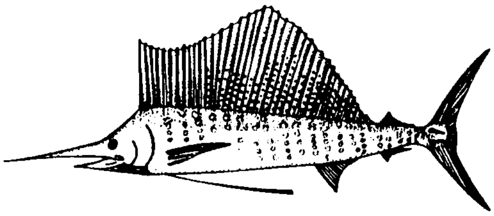
APPENDIX A. MARLIN CHARACTERISTICS. From A brief guide to the tunas and billfish of Papua New Guinea by A.D. Lewis and B.R. Smith.

| Character | BLACK | BLUE | STRIPED |
|---|---|---|---|
| Lateral line | straight, but not usually visible | two or more large loops; very clear in small fish | straight |
| Pectoral fin | rigid and not retractable, except in some small fish | retractable | retractable |
| 1st dorsal fin | short, less than half body depth | medium height; 1/2 - 3/4 body depth | high; equal to body depth |
| 2nd dorsal fin | begins in front of 2nd anal fin | begins slightly behind 2nd anal fin | begins slightly behind 2nd anal fin |
| 1st anal fin | short, half body depth | medium, two-thirds body depth | high, 3/4 to equal to body depth |
| Vertical bars | rarely present; occasionally seen in smaller fish | present; variable in clarity | present |

Note: No one character should be used to identify marlin; at least two, and preferably more, should be used together, as there is a certain amount of variation in all characters.

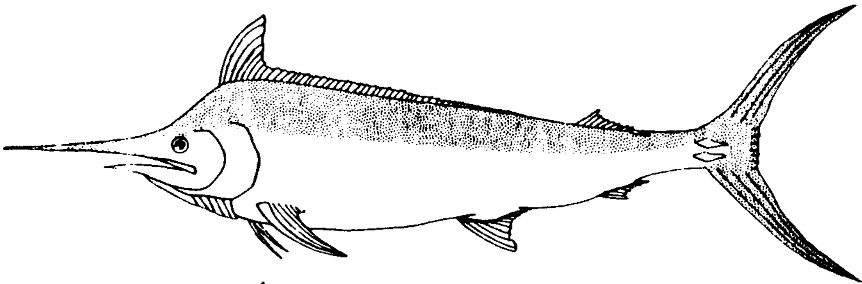
# BILLFISH OF PNG

## SAILFISH



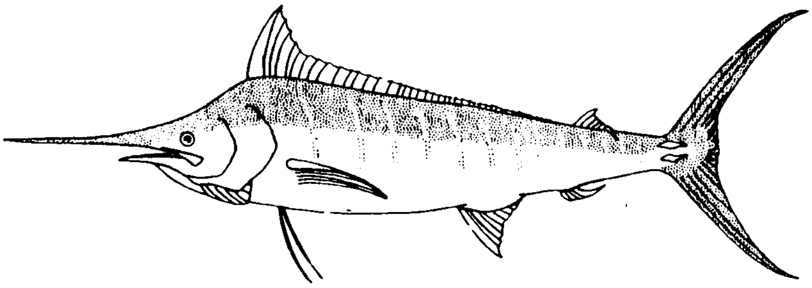
1. 1st dorsal fin very high along its whole length
2. Ventral fins very long, reaching past pectoral fin tip

## BLACK MARLIN



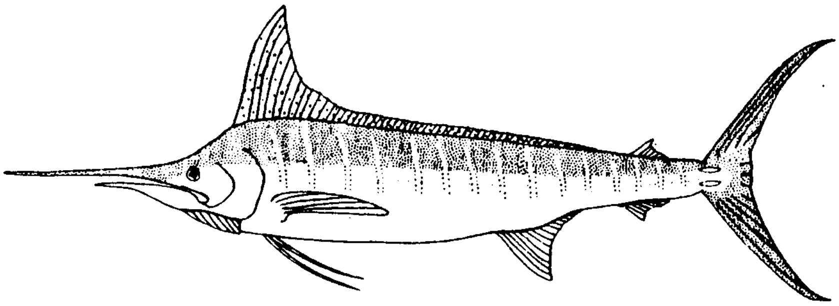
1. Pectoral fin rigid, non-retractable
2. 1st dorsal fin low, less than half body depth
3. 2nd dorsal fin begins in front of 2nd anal fin
4. Lateral line straight, usually hidden

## BLUE MARLIN



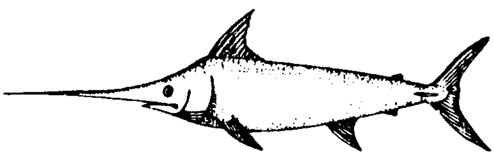
1. Pectoral fin retractable
2. 1st dorsal fin moderate, half to three-quarters body depth
3. 2nd dorsal fin begins slightly behind 2nd anal fin
4. Lateral line a series of loops, more distinct in smaller fish

## STRIPED MARLIN



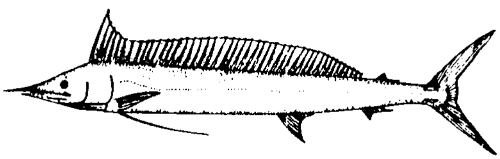
1. Pectoral fin retractable
2. 1st dorsal fin high, equal to body depth
3. 2nd dorsal fin begins slightly in behind 2nd anal fin.
4. Lateral line straight.

## BROADBILL



1. Bill flat in cross-section
2. No ventral fins
3. Only one keel at tail base.

## SPEARFISH



1. Bill very short
2. 1st dorsal fin generally the same height along its length, but lower than in sailfish
3. Very short pectoral fin

## Other billfish

### Sailfish
The billfish most frequently captured in Papua New Guinea, which is regarded as the centre of the most prolific sailfish area in the Pacific; essentially a near-shore species; grows to at least 200 lbs (approx. 90 kg).

### Broadbill swordfish
Taken on longlines, particularly in the Coral Sea; its characterisitic sickle-shaped dorsal fin and tail have yet to be seen at the surface in Papua New Guinea. Zane Grey reported the species spawning in the Gulf of Carpentaria. Its capture would be a boon to gamefishing here.

### Spearfish
Smallest and least known of the billfish, the spearfish is of curiosity rather than angling value. The long high dorsal fin, like that of a sailfish, is distinctive, as is the short bill. One specimen was taken on a research cruise during 1969.

# APPENDIX B. SPECIALISED TERMS USED ABOARD UNITED STATES PURSE SEINE VESSELS

## Rigging and Deck Machinery

Cherry picker. A reel-type hydraulic winch, cable and hook mounted on an arm which can be extended and rotated. Can be used to launch speedboats or load cargo. Frequently mounted on the bow deck and the starboard side of the speedboat deck.

Choker. Hydraulic reel-type winch and Sampson Braid line mounted on the starboard side of the work deck. The line from the winch is wrapped around a section of the net, and tension from the winch causes the line to draw tightly on the net. During sacking-up, one choker is used to prevent the net from slipping out over the power block, and another is used to prevent mesh of the sack from slipping overboard.

Double hydraulic. Reel type hydraulic winch and cable which is reeved through double blocks and attached to a hook. This winch is used for lifting the heaviest loads and for pulling the skiff onboard. Operation is controlled by a lever on the hydraulic console.

Gooseneck. A steel fitting used to attach a boom to the mast.

Gypsy, "Niggerhead". A revolving winch head around which cable or lines can be wrapped for pulling loads.

Hydraulic console. A control panel at the aft end of the speedboat deck from which the operation of the hydraulic winches is controlled.

Main boom. A large steel spar attached to the mast above the level of the work deck and extending upwards and aft.

Mast. The tall tower centrally located on a purse seine vessel.

Nesting winch-Inhaul winch. A winch and cable mounted on the main boom which is used to control the angle of the power block.

Power block. An hydraulic roller mounted on the upper end of the main boom. Used for retrieving the net from the water.

Purse davit. A davit located on the port side of the work deck, even with the purse winch. Heavy blocks are attached to these davits and guide the purse cables during net setting and pursing.

Purse winch. A large, powerful hydraulic winch mounted in the centre of the work deck aft of the mast. Used to haul in both ends of the purse cable to close the opening at the bottom of the net.

Ring stripper. Hydraulically operated arm located on the port rail just aft of the purse davits on the work deck. The arm of the stripper is raised and collects the rings of the net after they have been raised to the surface by the purse winch and to overhead level by the double hydraulic winch.

Single electric. Reel-type electric winch, cable and hook mounted on a boom over the work deck. Operation is controlled by a switch on a cord.

Single hydraulic. Reel-type hydraulic winch, cable, and hook mounted on a boom over the work deck. Operation is controlled by a lever on the hydraulic console.

Small booms. Two steel spars which are smaller than the main boom and which are attached to the mast to port and to starboard of the main boom attachment. These booms extend upwards; one towards port and aft, the other to starboard and aft.

Speedboat davits. Two sets of arms, usually hydraulically operated and located on the starboard side of the work deck. Used to support and launch speedboats.

Tire. Device resembling an automobile tire which is used to apply pressure on the net as it travels over the power block to ensure that the net does not slip.

Topping lift. A winch and cable used to raise or lower a boom.

Vang. A winch and cable used to move a boom to starboard or to port.

## Vessel Spaces

Bow deck. Area forward of the accommodation around the anchor windlass.

Control room. Semi-soundproof, semi-air-conditioned room at wet deck level from which the machinery of the engine room is monitored.

Crow´s nest. Observation platform at the top of the mast.

Half-mast platform. Observation platform half-way up the mast.

Helicopter deck-Flight deck. The uppermost deck. Area where helicopter lands and is stored.

Net pile-Pile. The mound formed by the entire net when it is onboard the vessel.

Ramp. Sloping deck extending aft from the net pile to the water. The skiff is pulled up onto this area.

Rig room. Room forward of the work deck, which is used for storage of the net-mending gear, deck hardware, and tools used on deck.

Shaft alley. Space extending aft of the lower engine room to the stern. The main engine shaft is located at the bottom of this space and fish wells are located to port and starboard.

Turntable-Table. Deck area on which the net pile rests. On early seiners this deck rotated, hence the name.

Upperdeck-Top deck-Speedboat deck. Second-highest deck. The pilot house is located at the forward end and the hydraulic console is at the after end of this deck.

Wet deck. Deck located below the work deck at approximately sea- surface level. Hatches for the fish wells are on this deck.

Work deck. Area aft of the accommodation and mast and forward of the net. Purse winch is mounted on this deck.

Net Terms (see net diagram, Appendix D)

Breast line. A line from the vessel to the cork line. It is used to prevent the net from going under the vessel.

Bridle. Sections of chain approximately 8 metres in length attached at each end to the chain. The spacing of the points of attachment is about 7 metres and the spacing between bridles is about 7 metres. From 100 to 150 bridles are attached to a net.

Bunch line. A line attached to the corkline of the net and threaded through several of the corks. When this line is pulled it draws together several corks giving extra flotation to an area of the net. This is done in anticipation of a very large catch.

Chain line. Chain attached to the selvedge at the bottom of the net and running the entire length of the net. In the western Pacific a chain line is typically 2000 metres long.

Cork line. Three-stranded line at the top of the net onto which the corks are threaded. This line is approximately 1500 metres in length.

Corks. Floats attached to the top of the net for buoyancy. Usually the corks are white or yellow and about 5000 are attached to the net.

Hung-in. The amount that a length of a section of webbing exceeds the length of corkline onto which it is attached. For example, 13 fathoms of webbing on 10 fathoms of cork line is "hung-in" three fathoms or 30%.

Lacing. The heavy twine used to join together net strips.

Ninety. A size of twine used in the webbing. Twine size can vary from 36 to 120. A part of the net is sometimes referred to by the size of the twine. For example, someone might say "Look for a hole in the 90".

Ortza. Either end of the net. Made of specially reinforced mesh. The bow ortza is attached to the skiff at the beginning of the set and the stern ortza is the first section of the net to be hauled.

Purse cable. Six-stranded wire rope which passes through all of the rings. This cable extends from the purse winch on the work deck through these rings and terminates on another spool on the the purse winch. By drawing on the purse cable after the net has been set, all of the rings are brought together.

Rings. Sturdy steel rings approximately 30 cm in diameter, one of which is attached to the mid-section of each bridle.

Ripper stopper. A strip of heavy webbing (90 or 120 twine) approximately 10 meshes wide sewn vertically into the net from the cork-line to the chain line. Its function is to stop rips in the the weaker adjoining webbing from becoming very large.

Sack-Bunt. Portion of the net close to the bow ortza where fish are concentrated for loading onto the vessel. Made of heavy webbing.

Selvedge-Chain selvedge-Chain panac. Section of selvedge running the entire length of the net at the bottom. This heavy webbing is approximately 125 cm wide.

Selvedge-Cork selvedge-Cork panel. Strong webbing attached to the cork line on top and to the regular mesh below. This mesh runs the entire length of the cork line and is approximately 125 cm in width. Its purpose is to distribute strains applied to the corkline over a large section of regular mesh.

Strip. A panel of webbing which runs parallel to the corkline. A strip is six fathoms (11 metres) wide and a western Pacific net is typically 18 to 28 strips deep.

Towline. Wire rope extending from the stern ortza to the vessel. If, in the process of encircling a school of fish, the circumference of the circle made by the vessel is longer than the length of the net, the stern ortza is released into the water and the vessel continues, paying out towline as it proceeds, until the circle is complete. The towline is then used to pull the stern ortza back to the vessel. A maximum of about 600 metres of towline is used in the western Pacific.

Triangle. A sturdy stainless steel fitting, equilateral triangle in shape (approximately 25 cm on a side), which is attached to each ortza.

Twenty-five fathom piece. A wire rope which connects the bow ortza to the skiff.

Procedures

Brailing. The transfer of fish from the sack of the net onto the work deck of the vessel. This is done by a large round brailing scoop suspended from a boom.

Letting go. Releasing the skiff into the water with the bow ortza attached. This begins a set.

Pulling a bunch. Pulling in a bunch line in anticipation of a large catch.

Pursing. Drawing in on the purse cable at both ends using the purse winch. This causes the rings to be brought together and closes the opening at the bottom of the net.

Ring stripping. Removing the rings from the purse cable. After the net has been pursed and rings brought to the surface, the rings are raised to an overhead position by the double hydraulic winch and manipulated so that they are collected on an aft-facing arm known as a ring stripper. From this position they can easily be dislodged, one at time, as the net is rolled over the power block.

Rolling. Passing the net through the power block at the end of the main boom. By doing this the net is retrieved from the water.

Roll up. An undesirable condition in which the webbing is wrapped around the chain. Sometimes refers to any tangling malfunction of the net.

Sacking up-Sacking. Raising the portion of the net in which the fish are concentrated to the surface. Usually done by one of the boom winches but can be done manually if the fish catch is small.

Setting. Surrounding a school of fish with a net.

Sorting. The removal of undesirable fish from the brailing scoop load after it has been placed on the work deck.

Stacking-Stacking net. Manually guiding the net onto the net pile. Consists of stacking cork (starboard side of the pile), stacking mesh (centre of the pile), and stacking chain. About half of the entire vessel crew is involved in this operation.

Miscellaneous Terms

Beeper. Radio beacon used to mark logs associated with concentrations of tuna. Consists of a central metal canister, a round float around the canister, and an antenna which sometimes has a flag.

Big glasses. Large binoculars (approximately 80 to 90 cm in length) which are used to search for signs of tuna. These may be mounted forward or to the side of the pilot house and in the crow's nest.

Big jag. The capture of a large amount of fish, usually over 100 tons.

Bow thruster. A propeller mounted in the bow perpendicular to the axis of the vessel. Used to move the bow to port or starboard.

Brailing scoop-Brailing net. A net used for transferring fish from the net to the work deck.

Cable. Six stranded wire rope of various sizes.

Cable clamps. Jaw-type fittings which can be attached securely to a cable so that the full strain of the cable can be temporarily transferred. Used during the process of ring stripping.

Chopper. Helicopter.

Christmas tree. A very large number of gillers in the net.

Chutes. Narrow chutes on the wet deck in which fish that have fallen through the hopper hatch travel to the selected fish well. The chutes are angled so that the fish move by gravity but the motion is assisted by water flow and by the crew.

Crew. Consists of captain, navigator, chief engineer, assistant engineer, deck boss, mast man, cook, skiff man, assistant skiff man, helicopter pilot, helicopter mechanic, and miscellaneous deck crew. May also include oiler, assistant deck boss, and galley boy.

Gillers. Fish stuck in the net usually by the gills.

Hopper. Shallow, wide chute on the work deck onto which the contents of the brailing scoop are dumped. On the hopper undesirable fish are removed and the remaining fish are pushed to the hopper hatch.

Hopper hatch. A hatch centrally located on the work deck through which fish pass from the work deck down to the wet deck.

Pelican hook. A fitting which attaches the skiff cable to the deck. On command of "Let go!" from the Captain, a man will pull the pin of the pelican hook causing the skiff to slide into the water and setting the net commences.

Skiff. The large open boat which rests on the stern ramp. It is used in conjunction with setting the net, manoeuvering the vessel when retrieving the net, and transferring fish from the net to the vessel.

Skiff cable. A wire rope attached at one end to the bow of the skiff as it rests on the ramp and at the other end to a fitting at the base of the purse winch. This cable prevents the skiff from sliding down into the water. At the beginning the cable is released and the skiff enters the water stern first dragging the end of the net with it.

Sling. A piece of line about two metres in length in which the two ends have been spliced together to form a circle. Used in conjunction with a winch for lifting or pulling heavy objects.

Speedboat. A small fast boat used for a variety of purposes such as marking logs, scaring fish, and carrying lights.

Split link. Oval-shaped steel fitting which is detachable into two components. Used for connecting two sections of cable each of which has an eye splice.

Trip. The length of time required to fill all of a vessel's fish wells. May include one or more port calls.

Tuna. Used by American purse seine fishermen to indicate yellowfin tuna, but also includes bigeye tuna as it is difficult to discriminate between the two species.

## APPENDIX C. NOTES ON STACKING NET ON UNITED STATES PURSE SEINE VESSELS

The purse seine vessel has set the net, the bottom of the net has been drawn together by the purse cables, and any fish that may be within the net will eventually see the inside of a can. The problem at this point is to get the net, that is, almost half a million square metres of webbing, 5000 corks, and 2 kilometres of heavy chain back onto the boat. Thanks to a clever fellow named Puretic who invented the power block, most of the pulling force required for this operation is performed hydraulically. The net is drawn from the water up to a huge block mounted on the main boom and then falls on the stern of the vessel below. The net being 240 metres wide, going onto a deck just 12 metres wide creates a problem which requires the attention of a large portion of the crew. The orderly placement of the net onto the stern is known as stacking and enables the net to function correctly on the following set. Although conceptually simple, the novice fisherman may find stacking net exhausting, confusing, terrifying, and perhaps the most difficult of his tasks to master.

Net stacking may be divided into cork stacking, chain stacking, and webbing stacking, all of which occur simultaneously. On US purse seiners the chains are placed to port, the corks to starboard, and the webbing obviously in the middle. Typically, two men will handle the corks, two men on the chain/rings, and about a half a dozen men on the webbing.

As the net comes over the roller of the power block it falls vertically to the deck about 12 metres below. One of the cork men will grab the selvedge next to the corks and pull it to starboard, unwrapping any webbing wound around the corks. The second cork man layers the corks back and forth (perpendicular to the axis of the boat) in lines about one quarter the width of the boat. On the other side of the deck the chain man is pulling the chains to port and assuring that the attached selvedge is not wrapped around the chain. He passes the chain bridles to another man who lays them over a rail so that the rings hang down from the outboard edge of the rail. A line is then passed through each ring as it is placed on the rail. Eventually the purse cable will replace this line.

Between the cork men to starboard and the chain men to port a half-dozen men will stack webbing. Novice crew will find that this is the area where they will work. About three men will be at the aft end of the pile and three on the forward end, alternating in a "W" formation. That is, going from starboard to port one man aft, then one forward, one aft, etc. Each man attempts to guide a bundle of net 10 to 30 cm in diameter to a growing pile in such a way that the net between him and the men on either side is not totally slack. The men lay the net on the pile evenly so that the edges of the pile are straight and so that there are no large cavities or mounds as the pile grows. In order to do this, the men must guide the net to either side with their hands, throw webbing behind them and also walk around distributing webbing. The net does not enter the power block in an especially orderly manner and gets a tremendous compression load while in the block, so when it comes out it can be somewhat jumbled. Also, the net itself tapers and uses various sizes of net twine and mesh sizes so that the section of net being stacked by a man can get larger or smaller and the amount of net between two men can vary a great deal. To counteract this problem the men "pass mesh" to men on either side simultaneously as the net is being stacked. By grabbing the moving net at slightly higher than head level (the net is less chaotic there), it is somewhat easier to sort out the side of the net which needs to be passed. Passing involves just releasing a controlled amount of mesh, as the man to whom net is being passed will take up the slack.

While stacking is in progress, small holes in the net are ignored but large rips are marked by a piece of brightly coloured material and the webbing surrounding the holes is dragged to the edge of the pile where it can be patched after stacking. The same is done for fish or flotsam that may be stuck in the net.

To this apparently simple situation complicating factors are added. The size of the bundle a man handles, the other crew, the side of the net pile, and the top of the pile must be watched simultaneously. This is done while the net is dropping rapidly. The boat rocking, webbing piling around one′s feet, and unsteadiness of newly piled webbing make balance difficult on top of the pile which may be over three metres off deck level. Mesh catching on clothing, wind blowing the net around, and the occasional unsympathetic fellow crewman do not help the situation. The biggest problem, however, is from falling objects. A tuna may be thought of as a nice pliable object, but one of these fish falling from the power block 12 metres up can do damage like a cannon ball. Being struck on the head by a 25 kg yellowfin could ruin one′s entire day. Jellyfish and sea water constantly rain down on the crew and the occasional dodging of steel rings on the chain line keeps the men from being lulled into tranquillity. The crew member operating the power block offers some degree of safety as he will do his best to warn of impending danger. Occasionally, however, the operator will reverse the direction of rolling the net to correct a problem. When this occurs, the men on the pile must be cautious that they are not jerked off their feet as the net on which they are standing becomes airborne.

Clothing is important in stacking net. Nothing should be worn on which the net can snag because, if the net can <u>possibly</u> snag, it definitely <u>will</u> snag. This includes shoe buckles, buttons, watches, and necklaces. A hard hat must always be worn while the net is being stacked, as well as during all fishing operations. Gloves are also a "must". Some crew prefer to wear a T-shirt or foul-weather jacket for protection from bits of jellyfish while others choose to wear no shirt because of the heat.

Anytime a group of people are participating in an activity directed towards a common goal which involves some degree of difficulty, danger, and physical exhaustion, a certain comradeship develops between the individuals. Working on the net pile is no exception. A novice fisherman after stacking net several times will see that the work is not quite as miserable as it appeared at first and a fair amount of work satisfaction can come from doing the job well.

APPENDIX D. PURSE SEINE VERTICAL SECTION