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Past and present data collection systems of the bottom fishery in Tonga : a comparison

by

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PAST AND PRESENT DATA COLLECTION SYSTEMS OF THE BOTTOM FISHERY IN TONGA: A COMPARISON.

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ABSTRACT

The past and present data collection systems of the bottom fishery in Tonga are described. For the purpose of stock assessment of this fishery, the past system was found to be inadequate. A new system was devised to rectify this situation. However, in using fishermen as the main source of data, sources of error still exist.

1. INTRODUCTION

Following the S.P.C. Stock Assessment workshop in Noumea, 1986, Fisheries Tonga wished to implement a full stock assessment programme on the bottom fishery in Tonga.

The existing data collection scheme was reviewed, found inadequate for the proposed programme, and a new system was established.

Also in 1986, a visit was made by Dr. Polachek, at that time a statistician with S.P.C's Tuna and Billfish Assessment Program. This was requested by the government of Tonga in order to improve all existing fisheries statistics.

This paper describes the past system, lists the main problems of using this for stock assessment, including those advised by Polachek (1986), and gives the main details of the new system.

2. BACKGROUND

The commercial development of the bottom fishery in Tonga, with its target species of snappers and groupers (Ref. App. 1), began in 1980 after S.P.C.'s Deep Water Fishing Projects in 1978 and 1979, F.S.P.'s Demonstration Boat Project and the UNCDF/UNDP Boatbuilding Scheme.

Fishermen were trained on the demonstration boats in techniques required to fish the extensive seamounts in Tonga, using the FAO design Western Samoan handreels. For a description of this technique ref. Mead (1979). Bottom fishing is in depths of 50 to 400 metres.

In addition to bottom fishing, many boats troll for pelagic species whilst travelling to and from the fishing grounds. During the skipjack season some boats cease bottom fishing entirely.

The UNCDF scheme was to build 40 wooden, inboard diesel fishing vessels, the majority 28ft in length.

Fisheries Division helps select suitable fishermen to apply for a loan for a new boat, and then conducts a 6 month practical training programme using the new boat.

In addition to the UNCDF boats which will number 40 by early 1988, there are 9 private boats engaged in bottom fishing.

3. THE PAST DATA COLLECTION SYSTEM.

This was implemented as part of the UNCDF Project and therefore only UNCDF boats were monitored.

3.1. AIMS

1. To assess the profitability of individual vessels.

2. To ensure loan repayments are made to the bank.

3. To gather fisheries catch statistics.

3.2. METHODS.

Each boat owner was required to fill out and submit a logsheet for each fishing trip. (Ref. App. 2).

Logsheets were collected in the main fisheries centres; Tongatapu, Vava'u, Ha'apai and Eua. (Ref. Fig.1).

Data from these was transferred to a big ledger book with a separate page for each vessel.

Monthly summaries on each vessel and monthly totals for all vessels were transferred to a monthly summary report.

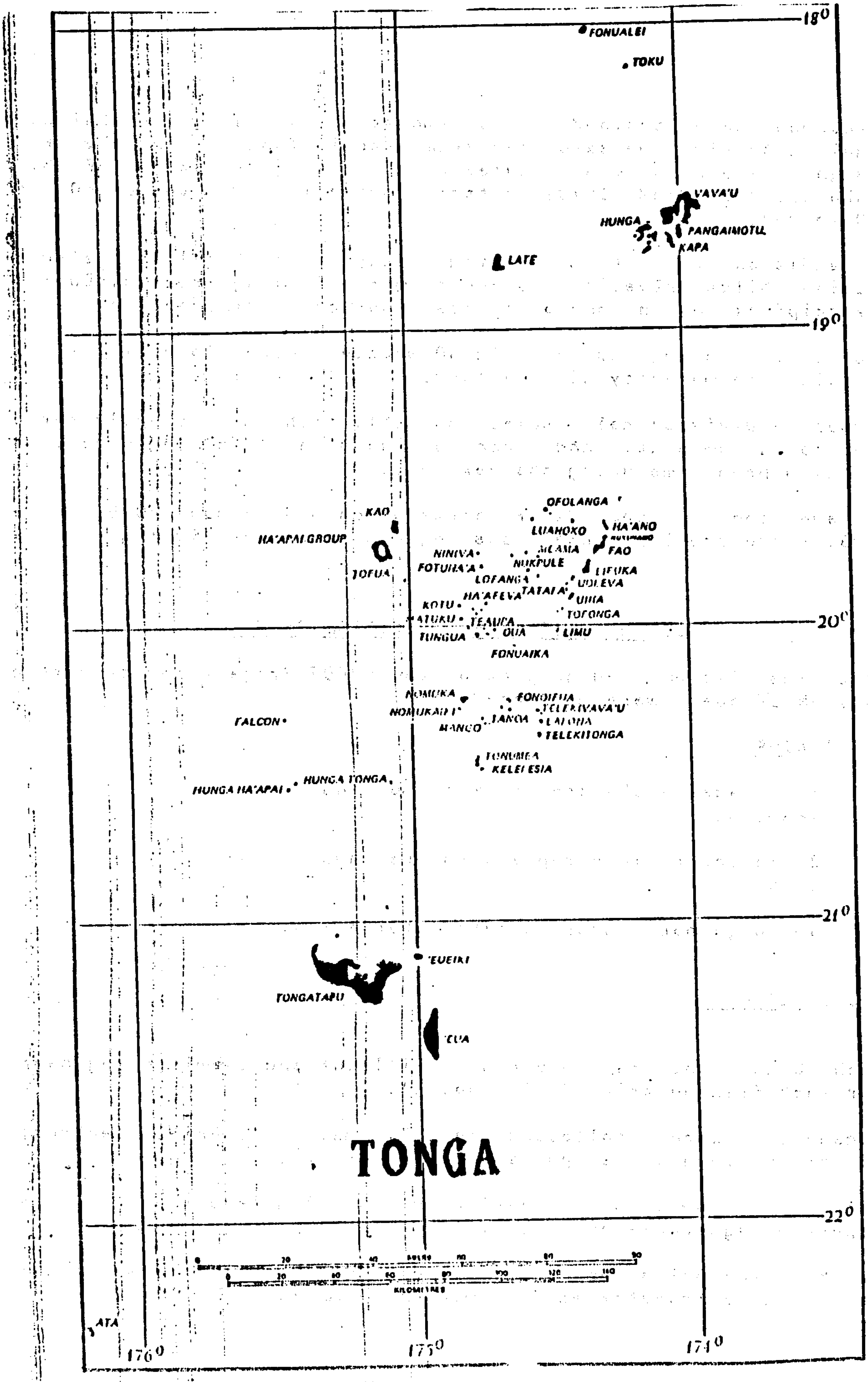

18°
FONUALEI
TOKU
VAVA'U
HUNGA
PANGAIMOTU
KAPA
LATE
19°
OFOLANGA
KAO
HA'ANO
LUAHOKO
HA'APAI GROUP
FAO
NINIVA
NUKPULE
TOFUA
FOTUHA'A
LIFUKA
LOFANGA
UOLEVA
HA'AFEVA
TATAFA
KOTU
UIHA
TOFONGA
TEAUPA
OUA
LIMU
TUNGUA
20°
FONUAIKA
FONOIFUA
NOMUKA
TELEKIVAVA'U
FALCON
MANGO
TANOA
TELEKITONGA
TONUMEA
KELEFESIA
HUNGA TONGA
HUNGA HA'APAI
21°
'EUEIKI
TONGATAPU
'EUA
TONGA
22°
KILOMETRES
ATA
176°
175°
174°

Figure 1

3.3. RESULTS

Monthly summaries were used to compile annual reports, estimating total landings of fish from UNCDF boats.

Individual fishermens' performances were monitored from the data on economic performance.

In Vava'u, summaries of each boats performance were graphically displayed in the fisheries office to provide feedback to fishermen.

3.4. PROBLEMS

Polachek (1986) lists many problems with the system, including;

> Procedures for and consistency of collecting the forms varied between fisheries centres. In Vava'u, this was very good, while in Tongatapu, the Division relied on fishermen bringing in the forms to the office. In Ha'apai and Eua the reporting system had lapsed by the time of Polachek's visit.
>
> Many forms were incompletely filled out. The number of fish, size range, location of catch and hours of effort were often not recorded.
>
> The filing system in Tongatapu was disorganised and logsheets missing.

Additional problems for stock assessment were;

> Since the fishermen themselves filled out the forms, the information was sometimes fabricated.
>
> No individual length or weight measurements were made.
>
> The species list was inadequate for monitoring individual species, eg. the 2 main species were lumped together with others under the umbrella term "palu" ("snapper").
>
> The bottom fishes were put together with pelagics in summary reports.
>
> Boats other than UNCDF boats were not monitored.

4. THE PRESENT DATA COLLECTION SYSTEM

The design of the present collection system is based on ideas learnt at the S.P.C. workshop. (Walters and Hilborn (1986).

4.1. AIMS

The final aims of the stock assessment programme are to answer the questions

1. How big is the resource?

2. How best to manage the resource in order to sustain the fishery?

The present system aims to collect the following data; (Ref. Fig.2 for the rationale behind the choice of data to be collected.)

Catch and effort statistics so that catch curves, mortality and surplus production may be calculated.

Location so that spatial distribution may be estimated, also size distribution and catch and effort by area.

Length / weight measurements to estimate growth, age, mortality and recruitment rates.

Otolith samples to give age, growth and mortality.

Depletion Experiments to estimate initial stock size.

4.2. METHODS

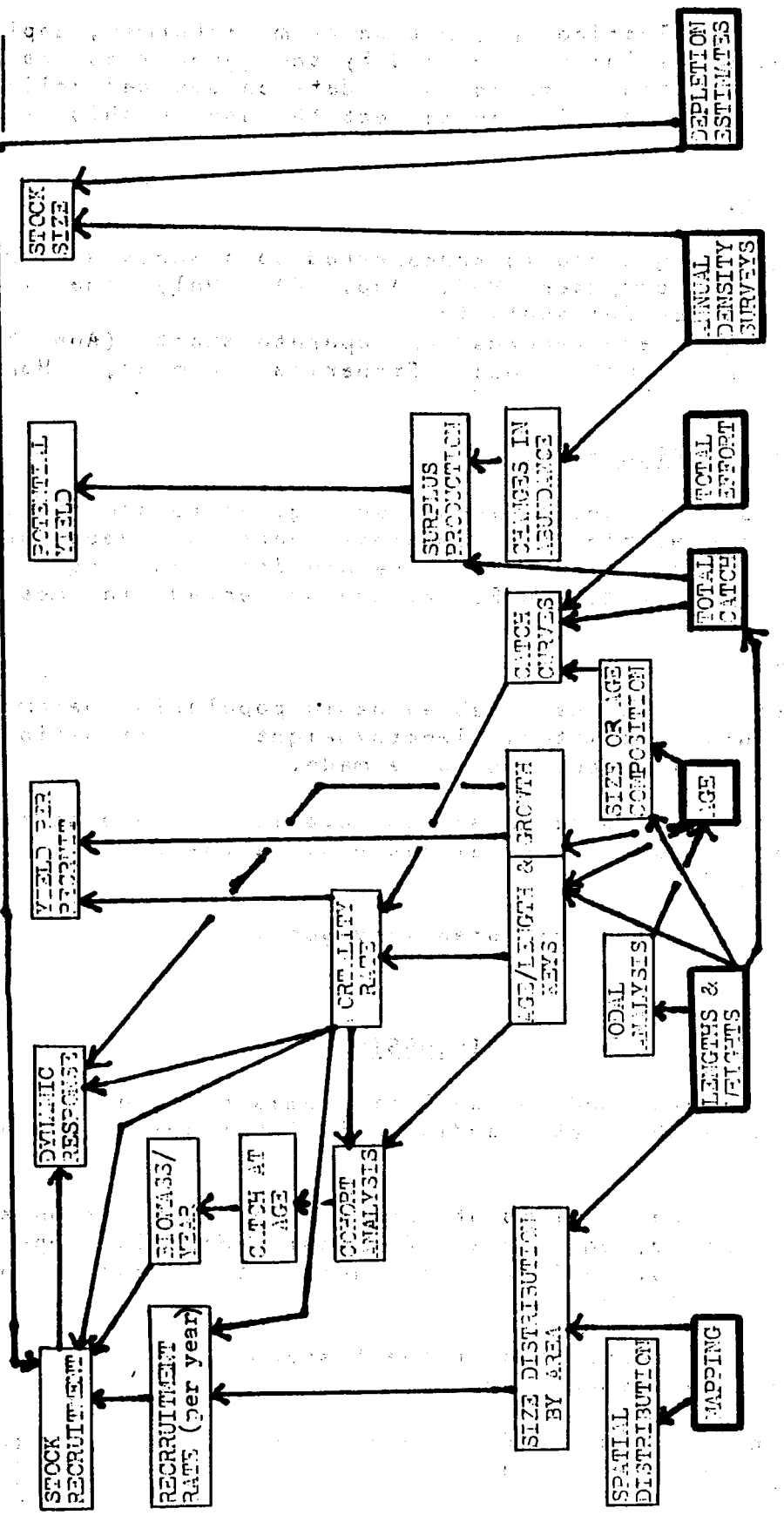
Catch and effort statistics

In Tongatapu, fisheries officers try to meet every boat returning from bottom fishing. The fishermen are interviewed and a logsheet (Ref. App.3) filled out. A count of every fish by species is done.

Length/Weight statistics

In addition to the above, in 4 months each year, 2 trips from each boat are recorded for lengths and weights of every fish by species. After 1 year, when length/weight relationships were established, only lengths were recorded.
This quarterly sampling is done in Vava'u and Tongatapu.

FIG. 2.



PROPOSED FLOW OF INFORMATION IN STOCK ASSESSMENT PROGRAMME

Depletion experiments and Otolith sampling.

In addition to collecting information from fishermen, depletion experiments were initially conducted by the government research vessel. Also otolith samples and data on sex was collected. However, after 2 months, fisheries lost the use of this vessel, and this work ceased.

Data processing.

Data from the logsheets is transferred to a sheet used as the header file on the computer (Ref. App. 4). Only the 7 main species are recorded for analysis.
Lengths and weights are recorded on separate sheets (App. 5) for analysis at the South West Fisheries Center, Honolulu Laboratory.

Encouragement for fishermen.

Initially, charts of the seamounts were given to the fishermen, with compass courses plotted from their port of departure. 2 free bags of ice are issued in return for measuring a catch. Maps showing areas of good C.P.U.E. are presented in meetings.

4.3. RESULTS

Data analysed so far has enabled basic population parameters, yield per recruit estimates, length/weight relationships and length frequency distributions to be made.

Absence of sufficient data on sex and otoliths is a problem, but cannot be gained from commercial catches, as the fish are sold whole, not gutted.

Cooperation by fishermen has been very good.

5. DISCUSSION

At present, all data used for analysis comes from the fishermen. Without a research boat, additional information cannot be gained.

Although some of the problems of the past data collection system have been eliminated, eg. lack of consistency in reporting, length measurements, effort data and catch location, others still remain as follows;

Despite the cooperation of the fishermen, sources of error exist in data gained from them.

For example, hours of fishing are not accurate; many fishermen do not have watches.

Location of catch may be falsified.

Data on pelagic fish is no longer recorded, nor economic data, as the latter is no longer required.

However, maximum accuracy has been obtained in species identification and fish measurement by having the sampling done by fisheries officers. Also so far the amount of fishing effort captured by the present system represents 25% of the total for Tonga and has continued at this level for the first 18 months of the 5 year programme.

6. ACKNOWLEDGEMENTS

Many thanks to the fishermen for their cooperation, to all the research team, especially Tevita Latu, to Carl Walters, Ray Hilborn, Tom Polachek who started the whole programme, and to J. Polovina for his advice and encouragement.

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APPENDIX 1. SPECIES LIST (BOTTOMFISH TONGA)

FAMILY: SERRANIDAE (GROUPERS)

Epinephelus septemfasciatus
Epinephelus morrhua
Epinephelus fasciatus
Epinephelus truncatus
Epinephelus fuscus
Epinephelus areolatus
Epinephelus maculatus
Epinephelus microdon
Epinephelus merra
Epinephelus hoedtii
Epinephelus salmonoides
Epinephelus fario
Epinephelus poecilonotus
Epinephelus chlorostigma
Epinephelus tauvina
Epinephelus mystacinus

Cephalopholis igarashiensis
Cephalopholis sonnerati
Cephalopholis aurantius
Cephalopholis sexmaculatus

Saloptia powelli
Variola louti
Variola albimarginata
Plectropomus leopardus
Plectropomus melanoleucus

FAMILY: POMADASYIDAE (GRUNTS\ SWEETLIPS)
SUBFAMILY: PLECTRORHYNCHUS

Plectrorhynchus chaetodontoides
Plectrorhynchus orientalis (picus)

FAMILY: LETHRINIDAE (EMPERORS & LARGE-EYE BREAMS)

Gnathodentex (Wattsia) mossambica

Gymnocranius japonicus
Gymnocranius rivulatus
Gymnocranius griseus (?)
Gymnocranius robinsoni (?)

Lethrinus chrysostomus
Lethrinus lentjan
Lethrinus rubrioperculatus
Lethrinus miniatus
Lethrinus xanthocheilus
Lethrinus nebulosus
Lethrinus microdon
Lethrinus ornatus (?)

APP. 1.

FAMILY: LUTJANIDAE (SNAPPERS)
Pristipomoides filamentosus
Pristipomoides flavipinnis
Pristipomoides multidens
Pristipomoides sieboldii
Pristipomoides auricilla
Pristipomoides (Tropidinius) zonatus
Pristipomoides (Tropidinius) amoenus (argyrogrammicus)

Etelis coruscans
Etelis carbunculus
Etelis radiosus

Aphareus rutilans
Aphareus furcatus

Aprion virescens

Paracaesio kusakarii
Paracaesio xanthurus
Paracaesio sordidus

Lutjanus bohar
Lutjanus gibbus
Lutjanus fulviflamma
Lutjanus sebae
Lutjanus rufolineatus
Lutjanus fulvus
Lutjanus kasmira
Lutjanus quinquelineatus (spilurus)
Lutjanus boutton

FAMILY: ANOMALOPIDAE (LANTERNEYE FISH)
Anomalops sp.

FAMILY: POLYMIXIIDAE (BEARDFISH)
Polymixia sp.

FAMILY: HOLOCENTRIDAE
SUBFAMILY: MYRIPRISTINAE (SOLDIERFISH)
Myripristis chryseres

Ostichthys hypsipterygion
Ostichthys japonicus

FAMILY: EMMELICHTHYIDAE (ROVERS)
Erythrocles schlegelii

FAMILY: GEMPYLIDAE (SNAKE MACKERELS)
Promethichthys prometheus

Ruvettus pretiosus

APP.1.

FAMILY: CARANGIDAE (JACKS & POMPANOS)
Seriola rivoliana
Seriola quinqueradiatus (?)
Seriola lalandi (*aureovittata*) (?)

Caranx lugubris
Caranx ignobilis
Caranx melampygus

Carangoides compressus

Alectis indicus

Decapturus tabl

FAMILY: SPHYRAENIDAE (BARRACUDAS)
Sphyraena barricuda
Sphyraena forsteri

FAMILY: TRIODONTIDAE (THREE-TOOTHED PUFFERS)
Triodon macropterus (*bursarius*)

FAMILY: TRICHIURIDAE (CUTLASSFISH)
Trichiurus lepturus

FAMILY: LABRIDAE (WRASSES)
SUBFAMILY: BODIANINAE
Bodianus perditio
Bodianus trilineatus
FAMILY: PRIACANTHIDAE (BIG-EYES)
Priacanthus sp.

FAMILY: MURAENESOCIDAE (PIKE CONGER EELS)
Muraenesox cinereus

FAMILY: MURAENIDAE (MORAY EELS)
Gymnothorax sp.

FAMILY: MULLIDAE (GOATFISH)
Mulloidichthys pfluqeri (?)

FAMILY: PERCICHTHYIDAE (TEMPERATE BASSES)
Neoscombrops pacificus

FAMILY: BRAMIDAE (POMFRETS)
Tractichthys steindachneri

FAMILY: GRAMMISTIDAE (SOAPFISHES)
Pogonoperca punctata

APPENDIX 2.

Fishing Trip Report

Fakamatala Folau Toutai

Fisherman Name/Boat
Hingoa Tangata Toutai/Vaka: _____

Fishing grounds
Feitu'u toutai'anga _____

Weather condition
'Ea mo e tahi _____

Departure - time/Date
Tukufolau-Taimi/'Aho _____

Return-Time/Date
Tau mai-Taimi/'Aho _____

Number of Crew
To'olahi kau toutai _____

Fishing Method
Founga Toutai _____

Fish Market
Maketi 'oe ika _____

Total Catch
Fakakatoa toutai _____

FINANCIAL REPORT
FAKAMATALA PA'ANGA

EXPENSES FAKAMOLE	AMOUNT TAHI	PRICE TUTUNGI	TOTAL FAKAKATOA
Diesel Tisolo			
Ice 'Aisi			
Bait Mounu			
Engine parts Kongakonga Misimi			
Fishing Gear Naunau Toutai			
Other Sales Fakakatoa Pa'anga Fakatau'aki			
Total Expenses Fakamole Fakakatoa			
Money Remaining after Expenses Toenga Pa'anga hili hono to'o fkamole			
Money Deposited to Bank of Tonga Pa'anga fakahu ki he Pangike Tonga			
Money Deposited to Development Bank Pa'anga fkahu ki he Pangike Fakalakalaka			
Crew Share per man Vahenga kau Toutai tokotaha		Total Fakakatoa	

TYPES OF FISH CAUGHT FA'AHINGA IKA NA'U 'I HE TOUTAI	Amount Lahi	Weight Mamafa	Value Mahu'inga
Billfish (Makula)			
Dolphinfish (Mahimahi)			
Wahoo (Valu louniu)			
Rainbow Runner ('Utumo'a)			
Yellowfin Tuna (Takuo/Kahikahi)			
Dog Tooth Tuna (Valu Tonga)			
Skipjack ('Atu)			
Mackerel ('Otule)			
Barracuda ('Ono/Hapatū)			
Trevally (Kupo)			
Grouper (Ngatala)			
Snapper (Palu)			
Long Tail Snapper (Palu tavake)			
Emperor (Mangā)			
Variegated Emperor (Ngutuloa)			
Longnose Emperor (Ngutuloa)			
Red Bass (Pungamea)			
Oil Fish (Palutalatala/Valu maka)			
Shark ('Anga)			
Sea Perch (Koango)			
Green Jobfish ('Utu)			
Other (Ika kehe)			
Total (Fakakatoa)			

Please fill this out and return the completed form to the Fisheries Office in Sopu, 'Ohonua, Pangai, Neiafu or Niuatoputapu after your fishong trip. We need this report to maintain our recoeds and help the deveveloement of Tonga's Fisheries.

'Oku ou kole atu kemi ki he kau toutai kemou kataki 'o fakafonu 'a e foomu ko'eni pea fakafoki ki he 'ofisa Toutai 'i Sopu, 'Ohonua, Pangai Neiafu, Niuatoputapu, hili pe kakato ho'o folau toutai kotoa pe. 'Oku fu'u fiema'u 'a e fakamatala ni ko e 'uhi koe tauhi ho'o leekooti pea moe ngaahi ngaue fakalakalaka ki he toutai 'i he kaha'u.

APPENDIX 3.

AOBA PU

SEAMOUNT SURVEY

Date: _____

Boat Number _____

Number of Fishermen _____

Number of Days Fishing This trip _____

Number of Hours Actual Bottom Fishing _____

Number of Reels _____

Number of Hooks Per Line _____

Location of Fishing _____

Total Number of Fish _____

Reel Hours _____

Total No. Species _____

Hook Hours _____

Depth of Fishing _____

Bait Type _____

SPECIES NAME	LENGTH	TOTAL NUMBER

APPENDIX 4.

TOTAL NO. FISH

LOCATION	BOAT NO.	DATE	DEPTH	TOTAL NO FISH	HOOK HOURS	REEL HOURS	SPECIES 1	2	3	4	5	6	7	8	TOTAL NO SPECIES	BAIT TYPE

APPENDIX. 5.

CONTROL No. 59

NATIONAL MARINE FISHERIES SERVICE SOUTHWEST
FISHERIES CENTER HONOLULU LABORATORY
SIZE - FREQUENCY LOG

Vessel_____ Cruise_____ Station_____ Date_____

Position_____ Species_____ Ratio Measured____ Reminder____

No.	Length (mm) Total or fork	Length (mm) Standard	Weight (kg)	Sex	No.	Length (mm) Total or fork	Length (mm) Standard	Weight (kg)	Sex
1					1				
2.					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
0					0				
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
0					0				
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
0					0				