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TUVALU FISHERIES STATISTICAL SYSTEM

Report of Follow-up Visit  
12 July - 14 August 1985

by  
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## TUVALU FISHERIES STATISTICAL SYSTEM

This report covers work performed on the Tuvalu Fisheries Statistical System (TFSS) during a follow-up visit to Funafuti between 12 July and 14 August, 1985. The primary objectives of this visit were identified from two sources: a) the initial request from Tuvalu for assistance in developing the TFSS, and b) the accomplishments and recommendations which resulted from the first SPC-funded visit relative to this project made earlier in the year. The primary objectives outlined for the follow-up visit included those listed below:

- 1) Design long-term data collection procedures for artisanal and subsistence fishing activities which occur from boats and canoes, and along the shoreline, at the inhabited islets of Funafuti.
- 2) Design final set of field data collection forms for use in surveying artisanal and subsistence fishing activities.
- 3) Document step-by-step instructions for conducting fisheries surveys.
- 4) Design long-term data processing procedures for the local analysis of fisheries survey data.
- 5) Document step-by-step instructions for processing fisheries survey data in Tuvalu.
- 6) Train Tuvalu Fisheries Division staff in conducting surveys of artisanal and subsistence fishing activities, and in processing the data that are collected.

In addition, the following secondary objectives were identified:

- 1) Observe existing length frequency data collection methods and correct deficiencies.
- 2) Improve data collection procedures for the Fisheries Division's commercial fishing activities.
- 3) Summarize recommended equipment and supply needs related to the TFSS.
- 4) Visit the outer islands in Tuvalu in order to provide

first-hand advice to the Fisheries Division on how best to implement the TFSS in areas outside of Funafuti.

A summary of the major work activities accomplished during the visit is provided in Appendix I. Initial discussions with Tuvalu's Chief Fisheries Officer, Mr. Elisala Pita, and Fisheries Advisor, Mr. Michael Batty, resulted in the identification of factors around which the TFSS had to be designed. Among the most significant of these was the commitment of staff time equalling two full-time positions to the implementation of the TFSS. As identified, this time would be provided by Mr. Sikela Ullumutu (half-time), Mr. Malaki Tihala (half-time), and a Fisheries Statistician (full-time) yet to be hired. I was asked to interview applicants for the job and make a recommendation for selection. Ms. Helen Patiale was selected and began work on 22 July 1985.

In identifying the the most important results to be obtained from the TFSS, both Mr. Pita and Mr. Batty placed emphasis on the following:

- 1) Estimated kilograms of fish harvested by boat and canoe fishing on an annual basis. Total estimate to be broken down into three component method categories which are trolling, handlining, and other methods combined.
- 2) Estimated number of boat-hours of effort expended by boat and canoe fishers on an annual basis. Total estimate to be broken down into the above fishing method categories.
- 3) Estimated kilograms of fish harvested by shoreline fishing on an annual basis. Total estimate to be broken down into four component method categories which are hook and line fishing, net fishing, spearing, and other methods combined.
- 4) Estimated number of gear-hours of effort expended by shoreline fishers on an annual basis. Total estimate to be broken down into the above fishing method categories.
- 5) Species-specific data only in the form of length frequency measurements of six designated indicator species. These species comprised two pelagics: Thunnus albacares (Takua), Katsuwonus pelamis (Atu); two deep bottom species: Pristipomoides zonatus (Palu savane), Etelis carbunculus (Palu malau); and two shallow reef species: Epinephelus microdon (Catala), Lethrinus (Taca).

During the visit, I found the Fisheries Division staff to be not only very helpful, but also very eager to implement the TFSS, despite obvious limitations such as being seriously understaffed. It was unfortunate whenever someone closely associated with the TFSS had to cancel out of a training session or field work in order to fulfill other Division responsibilities of a higher priority or of a more immediate necessity. However, not even that nor the relatively intense social calendar related to the departure of Mr. Batty, the marriages of other Division and Ministry staff members, and the annual Division and Ministry parties; nor the usual end-of-the-year vacations and personnel juggling, upcoming government election, and potential administration change; coupled with such unforeseen occurrences as six straight days of torrential downpour, and the injury and absence of Mr. Tihala during the days intended for developing and practicing the shoreline survey, resulted in diminishing anyone's enthusiasm in the least.

Although my original work plan had to be near-totally abandoned after the first week, the primary and most of the secondary objectives of the project were basically achieved. What was not achieved was the refinement of all of the various field survey and data processing procedures with the Fisheries Division staff. Realistically, however, this is a relatively slow process that will only come in time as experience in implementing the TFSS is gained, and this was discussed with the staff members involved. The instructions that were developed for implementing the data collection and data analysis phases of the TFSS are provided in Appendices II and III, respectively. These instructions represent a sound first step in establishing a reliable fisheries statistical system, and should be modified with time and experience in an effort to streamline the efficiency of their implementation, and to more adequately accommodate the changing needs of the Tuvalu Government.

At this point in time, the boat and canoe fishing survey is the most well developed part of the TFSS. It includes all motorized and nonmotorized boats and canoes, and covers both day and night fishing activities at the main island of Funafuti. The islet fishing survey is also in fairly good shape as it covers all fishing method categories during both day and night periods. However, the estimates derived will be somewhat less precise than those of the boat and canoe survey due to the limited amount of sampling that can be done at the islets each month. Typically, it is the shoreline survey that is the most complex part of the system in field survey methods and data analysis, which is why it was originally anticipated that several days would be spent in the field practicing the surveys. Although the instructions for conducting the shore line fishing surveys and for processing its data were

documented and discussed with Mr. Pita, Ms. Patiale, and Mr. Ulumutu, only one day of training in conducting the shoreline survey was accomplished with Mr. Tihala, who is to be responsible for shoreline fishing data collection. Nevertheless, as long as Mr. Tihala remembers most of what was covered on that day as he carefully follows the instructions in Appendix II, there is no doubt that in a short time he will be collecting reliable data on which sound estimates may be based.

It should also be noted that, as designed, the shoreline survey incorporates the use of a motorbike. This was done since Mr. Tihala preferred to use his personal motorbike for surveying as long as fuel could be reimbursed by the Fisheries Division. Obviously, the use of a motorbike in conducting the shoreline survey is of great benefit and well worth the cost of fuel involved. Ultimately, the Division should consider acquiring a small motorbike to be used within the TFSS.

In addition to the collection of the various types of artisanal and subsistence fishing data, the TFSS will include the compilation of data on the commercial fishing activities of the Fisheries Division. The data compilation method is very straightforward and is totally under the control of the Division. While it is the responsibility of the fishing vessel captain to fill in an activity log for each day's fishing, it is the responsibility of the Fisheries Statistician to ensure that the logs are completed properly and submitted in a timely manner. A copy of this log as well as the other data collection forms designed during the follow-up visit may be found at the back of Appendix II. Approximately one year's worth of copies of these forms were printed and stored at the Fisheries Division along with the original stencils.

Unfortunately, it was not possible to train the Fisheries Statistician in the analysis of length frequency data due to time constraints and other factors. However, Ms. Patiale and Mr. Ulumutu were instructed in the proper way to measure fish, and how to segregate the data by species. It became apparent from conversations with Mr. Ulumutu that the measurements of Gatala and Palu savane (and possibly Palu malau) taken since February 1985 involved more than one species in each case. It was also revealed that the length data compiled since then had been taken from fishes that were representative of the catch after the most desirable fishes had been sold. Based on what was discussed these deficiencies should now be corrected.

It was also not possible to visit any of the outer islands during the follow-up visit. The Fisheries Division staff was very helpful in setting up the transportation for such a visit,

but the amount of work to be accomplished at Funafuti and other constraints, did not, in my opinion, allow the nine-day trip to be justified. It was recommended to Mr. Pita that before trying to extend the TFSS to the outer islands, he be sure that it is functioning smoothly and correctly at Funafuti.

A summary of the major equipment and supply items required by the TFSS as implemented at Funafuti is shown in Appendix IV; and a summary of the major activities recommended for maintaining the TFSS is given in Appendix V. After considering the information contained in these two appendices, it becomes apparent that the use of common sense in planning ahead, and the development of a strong commitment to collecting high quality data are the keys to a successful fisheries statistical system. These facts were discussed with the Fisheries Division staff, and everyone was well aware that progress is made in increments, and that complete success will not come overnight. The survey and analysis methods outlined for the Division during this visit should be practiced as diligently and as faithfully as possible, and always allowed to be improved with time. I further recommended that any staff member involved with the TFSS, particularly Ms. Patiale, feel free to communicate any problems or questions that might arise to me directly, so that I may be of further help during the early stages of implementing the system.

As a final remark, it should be stated that much of my time in Funafuti was spent with Ms. Patiale in going over the steps and calculations outlined for data processing. While none of the individual calculations are very complex, there are numerous steps involved; and considering the different types of fishing activities to be surveyed and the different fishing method categories to be analyzed, I feel that it is inevitable that confusion will arise at some point early on. After the time I spent with Ms. Patiale, I am convinced that she is very capable of performing the required mathematics as outlined in Appendix III. However, since Ms. Patiale's statistical background is not very broad, it is going to take some time and practice for her confidence to build. With support from the Fisheries Division, the SPC, and myself, I am confident that this should not take long. In addition to being responsible for all of the data analysis within the TFSS, Ms. Patiale will be the primary surveyor of boat and canoe fishing activities, and for islet fishing activities, with limited assistance required from Mr. Ulumutu. As stated earlier, Mr. Tihala will be responsible for the collection of shoreline fishing data. These divisions of labor were decided toward the end of the follow-up visit, although Mr. Pita made it clear that activities with higher priorities may modify this plan without much notice and for unpredictable lengths of time.

APPENDIX I  
TUVALU FISHERIES STATISTICAL SYSTEM  
MAJOR WORK ACTIVITIES

02 JULY - 04 JULY:

- Travel to Noumea from Guam

05 JULY - 09 JULY:

- Project briefing with SPC Tuna Programme staff

10 JULY - 12 JULY:

- Travel to Funafuti from Noumea

15 JULY - 20 JULY:

- Discussions with Tuvalu's Chief Fisheries Officer and Fisheries Advisor re: project objectives, allocated staff time, survey priorities, logistical constraints, and other topics related to the statistical system project.
- Field orientation with Fisheries Division staff re: current Funafuti fishing activities, and current motorboat survey techniques.
- Verification and update of existing motorboat numbers and motorboat location map.
- Survey of nonmotorized canoes and creation of a canoe location map.
- Interview and selection of applicants for the new Fisheries Statistician position.
- Discussions with Fisheries Division staff re: fisheries surveys conducted to date, collection of length frequency data to date, indicator species chosen for measuring, fishing method categories chosen for surveying, refinements to existing survey methods, and other related topics.

22 JULY - 27 JULY:

- Orientation of new Fisheries Statistician re: job objectives and priorities, field survey methods, data analyses methods, selection of survey dates, proper maintenance for the statistical system, etc.
- Training of the new Fisheries Statistician in the use of a hand calculator and in the interpretation of simple mathematical formulae.

- Modification of existing motorboat survey methods to include nonmotorized canoes:
- Development of procedures, formulae, and worksheets for processing boat and canoe fishing data.
- Development of boat and canoe fishing data collection forms.
- Reconnaissance to Funafuti islets to survey islet fishing activities.
- Instruction of Fisheries Division staff in the collection of length frequency data.

29 JULY - 03 AUGUST:

- Painting of numbers on nonmotorized canoes on the main island of Funafuti.
- Refinement of field survey methods for boat and canoe fishing.
- Development of procedures, formulae, and worksheets for processing islet fishing data.
- Development of islet fishing data collection form.
- Development of shoreline fishing survey methods.
- Development of procedures, formulae, and worksheets for processing shoreline fishing data.
- Development of shoreline fishing data collection forms.

05 AUGUST - 10 AUGUST:

- Verification and update of list of current boat and canoe owners at Funafuti, and their points of contact for survey purposes.
- Painting of numbers on boats and canoes missed previously.
- Refinement of field survey methods for boat and canoe fishing.
- Refinement of field survey methods for islet fishing activities.



- Development of commercial fishing vessel data collection form.
- Documentation of instructions for conducting fisheries surveys in the field, and for processing fisheries data.
- Finalization and printing of all survey data collection forms.

12 AUGUST - 14 AUGUST:

- Documentation of major equipment and supply needs for maintaining the fisheries statistical system.
- Documentation of major guideline activities for maintaining the fisheries statistical system.
- Final discussion with the Chief Fisheries Officer and Fisheries Statistician re: all aspects of the system, including its strengths and weaknesses; the primary responsibilities of the Fisheries Statistician and other fisheries personnel involved in the system; the schedule for sending data to the SPC; and the maintenance of the statistical system
- Drafting of a radio news announcement re: training of Fisheries Division staff in the implementation and operation of the fisheries statistical system, the major objectives of the system, and the need for all members of the community to continue to cooperate with the Fisheries Division.
- Drafting of general job description for the Fisheries Statistician position.

APPENDIX II  
TUVALU FISHERIES STATISTICAL SYSTEM  
INSTRUCTIONS FOR CONDUCTING FISHERIES SURVEYS

1. ARTISANAL AND SUBSISTENCE FISHING

A. Boat and Canoe Fishing - Funafuti

1. Since boat and canoe fishing participation on weekend days is over 2 times greater than it is on weekdays, surveys should be conducted on each type of day during each month.
  - a. Weekdays = Monday through Thursday  
Weekend days = Friday and Saturday
  - b. Select dates for 4 weekdays and 2 weekend days per month by picking numbers from 1 to 31 from a container without looking.
  - c. Surveys will be conducted on each day of the week (excluding Sundays) once during each month. No surveys will be conducted on holidays. No two survey dates shall be consecutive. Once a number is picked it is to be set aside and selection continues until the above criteria are satisfied.
2. On the morning of each survey day, the surveyor should gather together the following items:
  - a. 1 clipboard with pencil and pen
  - b. 1 copy of two-page Boat and Canoe Fishing Participation Form
  - c. 2 copies of Boat and Canoe Fishing Effort and Catch Form
  - d. 1 copy of map showing approximate locations of boats and canoes
  - e. 1 copy of list of boat and canoe numbers with owners' names
  - f. 1 spring scale and bag for weighing fish
  - g. 1 torch for writing in dark and for a bike light
  - h. 1 plastic bag for carrying the above items
  - i. 1 raincoat
3. At 10:00 am on each survey day, the surveyor will begin counting the number of boats and canoes that are out fishing. This will be done by traveling an established survey route through the main part of Funafuti Island between the southern end of the airfield and the Fisheries Division Office.
  - a. Along the survey route the surveyor will identify which prenumbered boats and canoes are present in port (P), absent for an unknown reason (A), absent or out for nonfishing activities (N), or definitely out fishing (F).
  - b. Only boats and canoes that are actually seen and known to be present in port should receive a P. However, if a boat or canoe is either in the process of getting ready to depart, or just returning, it should appropriately receive an N or F. These letters (P, A, N or F) should be placed next to the corresponding boat or canoe number listed on the Boat and Canoe Fishing Participation Form.

- c. Whenever a boat or canoe is encountered, returning to port during the survey, an effort and catch interview should be completed for it.
  - d. Normally, a boat and canoe participation survey should take approximately 2.0 hours to complete.
  - e. After completing the morning survey, the surveyor should try to locate or verify the whereabouts of any boat or canoe which was assigned an A in order to determine whether or not it is out fishing.
4. At 4:00 pm on each survey day, the surveyor will repeat the boat and canoe participation survey by following the same procedure that was used during the morning count.
    - a. The same Participation Form that was used during the morning count should also be used for the afternoon count.
    - b. The letters (P, A, N or F) assigned during the afternoon should be written immediately to the right of those which were assigned during the morning for corresponding boat or canoe numbers.
  5. After completion of the afternoon participation survey, the surveyor should remain at a central location with a relatively good view of the lagoon in order to watch for returning boats and canoes.
    - a. While waiting, the surveyor should circle the boat numbers on the Participation Form to which either an A or an F was assigned during the day.
    - b. The surveyor should then list the circled boat numbers on the Boat and Canoe Fishing Effort and Catch Form.
  6. When a boat or canoe is observed returning to shore the surveyor should meet it when it lands, and as soon as possible conduct an effort and catch interview.
    - a. If the purpose of the boat or canoe trip is in question, the surveyor should first ask if any fishing was done on that day's trip. If no fishing was done the interview should be terminated; those on board should be thanked; and the boat or canoe number should be crossed off the Effort and Catch Form. The surveyor should also make sure that an N is assigned to that boat or canoe number on the Participation Form.
    - b. If the purpose of the trip was for fishing, the surveyor should complete the interview by filling in the answers to all questions on the Effort and Catch Form.
    - c. If certain information cannot be obtained leave the space blank.
    - d. If more than one boat or canoe comes in at the same time, the surveyor should go to the closest one first. After the interview for that one is completed, the surveyor should then go to the next closest boat or canoe.

- e. During periods when no boats are coming in, especially just before dark, the surveyor should watch for boats or canoes which may be leaving for night fishing trips. The surveyor should attempt to keep an accurate count of such vessels and obtain their boat numbers whenever possible.
- 7. After dark the surveyor should periodically check the landing locations of boats and canoes that are known to be out fishing. The Vaiaku Wharf should also be checked periodically for returning boats.
  - a. The surveyor should end the survey day at 8:00 pm. During the early morning of the following day, the owners of all boats that were recorded as having gone out fishing on the survey day, but for which no interview was obtained, should be contacted. A complete interview should be conducted at that time.
  - b. The surveyor should always try to make all interviews as brief as possible, and not delay fishers any longer than what is necessary to obtain the required information. Courtesy and respect should be shown at all times; and all data that is collected should be kept confidential. If the fishers do not wish to be interviewed, don't force it. The information that is provided is done so voluntarily, and the surveyor will find that the job will be much easier if a positive relationship is developed with members of the fishing community.

### 8. Shoreline Fishing - Funafuti

- 1. Since shoreline fishing participation is also greater on weekend days (Friday and Saturday) than it is on weekdays (Monday through Thursday), surveys should be conducted on each type day during each month.
  - a. The same dates selected for surveying boat and canoe fishing may also be used for surveying shoreline fishing.
- 2. On the morning of each survey day, the surveyor should gather together the following items:
  - a. 1 clipboard with pencil and pen
  - b. 1 copy of Shoreline Fishing Participation Form
  - c. 2 copies of Shoreline Fishing Effort and Catch Form
  - d. 1 copy of map showing approximate locations of survey vantage points
  - e. 1 pair of binoculars
  - f. 1 spring scale and bag for weighing fish
  - g. 1 plastic bag for carrying the above items
  - h. 1 raincoat
- 3. Since shoreline fishers often target different tidal periods for employing certain fishing methods, the times of the surveys should be adjusted accordingly.

- a. Shoreline spearfishing and mollusk collecting are strongly associated with low-tide periods.
  - b. Shoreline gill netting and cast netting are typically associated with periods when more water covers the reef, centered especially around flooding mid-tide conditions.
  - c. Shoreline hook and line fishing occurs at all tide levels.
  - d. The participation survey route to be used should extend between the north or south extremities of the main road on Funafuti Island, and run the entire length of the island and back again.
  - e. The following alternating pattern of surveys should provide the coverage required to adequately monitor shoreline fishing activities:
    - Weekday surveys
      - 1) begin at north end at peak lowtide
      - 2) begin at south end at peak hightide
      - 3) begin at south end at peak lowtide
      - 4) begin at north end at peak hightide
    - Weekend day surveys
      - 1) begin at north end at peak lowtide
      - 2) begin at south end at peak hightide
4. Regardless of which end of the road (north or south) the shoreline survey begins, the surveyor should stop at all of the following vantage point locations in order to identify fishing activities by scanning the coastline in both directions with binoculars:
- North end of the road (to view north end of the island on both the ocean side and the lagoon side)
  - Noa's house (to view lagoon side)
  - Causeway (to view both the ocean side and the lagoon side)
  - Peagaiga's house (to view the ocean side)
  - Emily & Rolf's house (to view the ocean side)
  - Chicken Farm (to view the lagoon side)
  - Marine Resources Pier (to view the lagoon side)
  - Fisheries Office (to view both the ocean side and the lagoon side)
  - Cemetery/Tofaga Bar area (to view both the ocean side and the lagoon side)
  - North end of the Runway (to view the ocean side)
  - Radio Tuvalu Transmitter area (to view the ocean side)
  - Vaitu Wharf (to view the lagoon side)
  - South end of the Runway (to view the ocean side)
  - Tony's black house (to view the lagoon side)

- Goat House (to view both the ocean side and the lagoon side)
  - Nearest point south of Goat House (to view the south end of the island on the lagoon side)
5. Normally, a shoreline fishing participation survey should take approximately 6.0 hours to complete.
- a. Along the survey route the surveyor will identify all observed shoreline fishing activities by logging down information on the Shoreline Fishing Participation Form.
  - b. Whenever a shoreline fishing activity is observed to be ended or ending, an effort and catch interview should be completed for it.
6. In addition to the participation surveys, shoreline effort and catch interviews should be conducted for as many completed or near-completed trips as possible.
- a. Shoreline fishing effort and catch interviews should be conducted in the field on different days. The times and locations for these interviews should be targeted for the specific fishing methods involved, and should assure the collection of enough data to calculate a reliable catch rate for each fishing method.
  - b. The surveyor should complete all shoreline fishing interviews by filling in the answers to all questions on the Shoreline Fishing Effort and Catch Form.
  - c. The same comments relative to the conduct of the surveyor as stated in A. Boat and Canoe Fishing.7.b. also apply here.

monthly average

#### 4. Islet Fishing Activities - Funafuti

1. Select 2 weekdays per month to visit the inhabited islets of Funafuti. Since fishing participation is so low on these islets, there is no need to survey both weekdays and weekend days; but selected dates should be at least one week apart.
  - a. Selection of these dates can be based on surveyor convenience and on the availability of boat transportation; but, an effort should be made to select days on which there is a good chance of encountering the greatest number of resident fishers on the islets at the same time.
2. Information on average fishing participation, effort and catch may be obtained by interviewing as many fishers as possible.
  - a. The surveyor should complete all interviews by filling in the answers to all questions on the Islet Fishing Activity Form.
  - b. The same comments relative to the conduct of the surveyor as stated in A. Boat and Canoe Fishing.7.b. also apply here.

## II. COMMERCIAL FISHING

### A. Fisheries Division Vessels

1. Since the vessels operated by the Fisheries Division are currently responsible for the only domestic commercial fishing activities in Tuvalu, it should be a relatively simple matter to gather statistics in this area.
2. It should be the responsibility of the captains of each vessel to document the fishing activities that occur on each fishing trip.
  - a. Information on daily fishing activities should be recorded on the Commercial Fisheries Vessel Effort and Catch Log.
  - b. These logs should be completed at the end of each fishing trip on a daily basis.
  - c. Completed logs should be turned in to the Fisheries Division's primary statistician.
3. While it is the responsibility of the fishing vessel captains to fill in the logs, it is the responsibility of the fisheries statistician to ensure that the logs are completed properly and submitted in a timely manner.

FISHERIES DIVISION  
MINISTRY OF COMMERCE AND NATURAL RESOURCES  
TUVALU GOVERNMENT

BOAT AND CANOE FISHING PARTICIPATION

Date: \_\_\_\_\_ 1st Survey Start: \_\_\_\_\_ Stop: \_\_\_\_\_

Surveyor: \_\_\_\_\_ 2nd Survey Start: \_\_\_\_\_ Stop: \_\_\_\_\_

1)	21)	41)	61)	81)	101)
2)	22)	42)	62)	82)	102)
3)	23)	43)	63)	83)	103)
4)	24)	44)	64)	84)	104)
5)	25)	45)	65)	85)	105)
6)	26)	46)	66)	86)	106)
7)	27)	47)	67)	87)	107)
8)	28)	48)	68)	88)	108)
9)	29)	49)	69)	89)	109)
10)	30)	50)	70)	90)	110)
11)	31)	51)	71)	91)	111)
12)	32)	52)	72)	92)	112)
13)	33)	53)	73)	93)	113)
14)	34)	54)	74)	94)	114)
15)	35)	55)	75)	95)	115)
16)	36)	56)	76)	96)	116)
17)	37)	57)	77)	97)	117)
18)	38)	58)	78)	98)	118)
19)	39)	59)	79)	99)	119)
20)	40)	60)	80)	100)	120)

P = present in port

A = absent for unknown reason

N = absent for nonfishing activity

F = out fishing



FISHERIES DIVISION  
MINISTRY OF COMMERCE AND NATURAL RESOURCES  
FEDERAL GOVERNMENT

BOAT AND CANOE FISHING PARTICIPATION

121) _____	141) _____	161) _____	181) _____	201) _____
122) _____	142) _____	162) _____	182) _____	202) _____
123) _____	143) _____	163) _____	183) _____	203) _____
124) _____	144) _____	164) _____	184) _____	204) _____
125) _____	145) _____	165) _____	185) _____	205) _____
126) _____	146) _____	166) _____	186) _____	206) _____
127) _____	147) _____	167) _____	187) _____	207) _____
128) _____	148) _____	168) _____	188) _____	208) _____
129) _____	149) _____	169) _____	189) _____	209) _____
130) _____	150) _____	170) _____	190) _____	210) _____
131) _____	151) _____	171) _____	191) _____	211) _____
132) _____	152) _____	172) _____	192) _____	212) _____
133) _____	153) _____	173) _____	193) _____	213) _____
134) _____	154) _____	174) _____	194) _____	214) _____
135) _____	155) _____	175) _____	195) _____	215) _____
136) _____	156) _____	176) _____	196) _____	216) _____
137) _____	157) _____	177) _____	197) _____	217) _____
138) _____	158) _____	178) _____	198) _____	218) _____
139) _____	159) _____	179) _____	199) _____	219) _____
140) _____	160) _____	180) _____	200) _____	220) _____

Remarks:

at fishing

### LEAD AND LAG: EFFORT, EFFORT AND GAIN

Surveyor: \_\_\_\_\_

[illegible]

SHORELINE FISHING PARTICIPATION

#	Time	Fishing Location	Fishing Method	# Pers	# Gear	Name of Fisher(s)

Remarks:

### JACQUELINE FIGHTING EFFORTS AND CATCH

[illegible]

FISHERIES DIVISION  
MINISTRY OF COMMERCE AND NATURAL RESOURCES  
TUVALU GOVERNMENT

### ISLET FISHING ACTIVITIES

Date: \_\_\_\_\_ Page: \_\_\_\_\_ Source of Weights: SS = surveyor scale SE = surveyor estimate  
FS = fisher scale FE = fisher estimate  
Surveyor: \_\_\_\_\_

[illegible]

FISHERIES DIVISION  
MINISTRY OF COMMERCE AND NATURAL RESOURCES  
TUVALU GOVERNMENT

COMMERCIAL FISHERIES  
VESSEL EFFORT AND CATCH LOG

Vessel: \_\_\_\_\_ Date: \_\_\_\_\_ Depart: \_\_\_\_\_  
Captain: \_\_\_\_\_ Landing: \_\_\_\_\_ Return: \_\_\_\_\_

<u>Fishing Method</u>	<u>Fishing Areas</u>	<u>Hours</u>	<u>Kg.</u>
Trolling:	_____	_____	_____
Scoop Netting:	_____	_____	_____
Deep Bottomfishing: Depth _____	_____	_____	_____
Shallow Handlining: Depth _____	_____	_____	_____
Other Method:	_____	_____	_____

Total Effort (Hours) and Catch (Kg.) for this trip: \_\_\_\_\_

<u>Species</u>	<u>No.</u>	<u>Kg.</u>		<u>No.</u>	<u>Kg.</u>
Trolling: Atu	_____	_____	Deep Bottom: Palu savane	_____	_____
Takua	_____	_____	Palu malau	_____	_____
Others	_____	_____	Others	_____	_____
Scoop Netting:			Shallow Handlining: Taea	_____	_____
Flying Fish	_____	_____	Gatala	_____	_____
Others	_____	_____	Others	_____	_____

FAD Fishing:

FAD \_\_\_\_\_ Start time \_\_\_\_\_ Hours \_\_\_\_\_ Passes \_\_\_\_\_

<u>Species</u>	<u>No.</u>	<u>Kg.</u>	<u>Species</u>	<u>No.</u>	<u>Kg.</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Remarks:

APPENDIX III  
TUVALU FISHERIES STATISTICAL SYSTEM  
INSTRUCTIONS FOR PROCESSING FISHERIES SURVEY DATA

I. ARTISANAL AND SUBSISTENCE FISHING

A. Boat and Canoe Fishing

1. At the beginning of each month the fisheries statistician should create a separate worksheet for each of the 3 fishing method categories chosen by the Fisheries Division for analysis (handlining, trolling, and others\*).

\*This category includes other fishing methods as well as multiple - method trips when effort and catch cannot be segregated by individual fishing method.

- a. A standard data analysis pad with at least 13 columns should be used for creating the worksheets.
2. As soon as possible after every survey day the following information for each individual fishing method category should be taken from the participation, and effort and catch forms, and listed on its own worksheet:

- a. The date of the survey day.
- b. The total # of boats and canoes that were out fishing [from the participation form] (A)
- c. The total # of boats and canoes that were interviewed for all fishing methods [from the effort and catch form] (B)
- d. The # of boats and canoes that utilized the individual fishing method [from the effort and catch form] (C)
- e. The # of boat-hours spent fishing\* by those boats which utilized the individual fishing method [from the effort and catch form] (D)

\*Remember to subtract Lost Time from Trip Time to obtain actual boat-hours spent fishing.

- f. The # of kg of fish caught by those boats which utilized the individual fishing method [from the effort and catch form] (E)
3. The results of the following calculations should also be listed on each worksheet:
  - a. The % of the total # of survey-day boat trips attributed to the individual fishing method (F)  
$$(C \div B) \times 100 = F$$
  - b. The average # of boat-hours per survey-day boat trip for the individual fishing method (G)  
$$D \div C = G$$
  - c. The estimated # of survey-day boat trips attributed to the individual fishing method (H)  
$$A \times (F \div 100) = H$$
  - d. The estimated # of survey-day boat-hours attributed to the individual fishing method (I)  
$$G \times H = I$$
  - e. The survey-day catch rate (kg/boat-hour) attributed to the individual fishing method (J)  
$$E \div I = J$$

- f. The estimated survey-day fish catch (kg) attributed to the individual fishing method (K)  

$$I \times J = K$$

4. After the results of the above calculations have been entered onto all 3 worksheets for all survey days, the estimated monthly fishing effort (boat-hours) for each fishing method may be calculated.

- To perform these calculations a hand calculator which employs a Standard Deviation Mode (such as the one provided to the Fisheries Division at the SPC Fisheries Statistics Workshop) should be used.
- After placing the calculator into the Standard Deviation Mode, enter the four estimates of survey-day boat-hours (I) attributed to the individual fishing method on weekdays.
- Push n to check the number of entries.
- Push  $\bar{x}$  to obtain the average # of boat-hours per survey-day (L) for weekdays.
- Push  $\sigma$  n-1 to obtain the standard deviation (s) of the four estimates.
- Calculate the estimated # of weekday boat-hours for the month (M)

$$L \times N = M$$
, where N = the number weekdays in the month, excluding holidays.

NOTE: Insert I. A. 4. g. - i. here (see attachment)

- j. Calculate the 95% Confidence Limits (95% C.L.) of the estimated # of boat-hours for the month

$$2 \times Se = 95\% \text{ C.L.}$$

5. The estimated monthly fish catch (kg) for each individual fishing method may be calculated by performing steps 4.a.- j., but substituting the estimates of survey-day fish catch (K) in place of boat-hours.

*for all fishing methods combined*

6. The estimated total monthly fishing effort or total monthly fish catch may be calculated by performing steps 4.a.- j., but using the sums of the estimates for all 3 fishing method categories for the survey days.
7. Similar quarterly and annual figures for each fishing method or for all 3 methods combined may be calculated by entering the estimates for 3 and 12 months, respectively.

#### B. Shoreline Fishing

- At the beginning of each month the fisheries statistician should create a separate worksheet for each of the 4 fishing method categories chosen by the Fisheries Division for analysis (net fishing, spearfishing, hook and line fishing and others\*).

\*This category includes other fishing methods as well as multiple-method trips when effort and catch cannot be segregated by individual fishing method.

- A standard data analysis pad with at least 13 columns should be used for creating the worksheets.



INSERT THE FOLLOWING INTO THE APPROPRIATE PLACES WITHIN THE INSTRUCTIONS  
FOR PROCESSING FISHERIES SURVEY DATA:

1. A. 4. g. Repeat steps 4.b.-f. using weekend day survey data.

h. Sum the estimated weekday and weekend day boat-hours for the month to get the estimated total # of boat-hours for the month

i. Calculate the Standard Error (Se) of the estimated # of boat-hours for the month by:

- clearing the calculator's Standard Deviation Mode memory,
- entering L for weekdays and L for weekend days, and obtaining the standard deviation (s) of these two estimates,
- and, inserting (s) into the following equation:

$$N \times (s \div \sqrt{n}) \times \sqrt{1 - (n \div N)} = Se$$

where n = 2, and N = the total # of fishing days in the month (remember to exclude Sundays)

- b. Each worksheet should be used to summarize the data for an individual fishing method category that is collected on each survey day during a one month period.
2. As soon as possible after every survey day the following information for each individual fishing method category should be taken from the participation forms and listed on its own worksheet:
  - a. The date of the survey day.
  - b. The tidal period during which the survey was conducted (flood or ebb).
  - c. The # of gear units counted for the individual fishing method [from the participation form] (A)
3. As soon as possible after the last day in the month the following information should also be listed on each worksheet:
  - a. The total # of gear units counted for the individual fishing method during all flood period surveys [from the participation forms] (B)
  - b. The total # of gear units counted for the individual fishing method during all ebb period surveys [from the participation forms] (C)
  - c. An average daily adjustment factor for each tidal period survey (D)
 
$$1 \div [B \div (B + C)] = D \text{ [for flood period survey days]}$$

$$1 \div [C \div (B + C)] = D \text{ [for ebb period survey days]}$$
  - d. The estimated # of survey-day gear units for an individual fishing method (E)  $A \times D = E$
  - e. The total # of gear units from all interviews for an individual fishing method [from the effort and catch forms] (E)
  - f. The total # of gear - hours\* from all interviews for an individual fishing method [from the effort and catch forms] (G)

\*Remember to subtract Lost Time from Trip Time to obtain actual fishing time.

- g. The total # of kg of fish caught from all interviews for an individual fishing method [from the effort and catch forms] (H)
4. The results of the following calculations should also be listed on each worksheet:
  - a. The average # of gear-hours per gear unit for an individual fishing method (I)
 
$$G \div F = I$$
  - b. The estimated # of survey-day gear-hours for an individual fishing method (J)
 
$$E \times I = J$$
  - c. The average catch rate (kg/gear-hour) attributed to the individual fishing method (K)
 
$$H \div G = K$$

- d. The estimated survey-day fish catch (kg) attributed to the individual fishing method (L)

$$J \times K = L$$

5. After the results of the above calculations have been entered onto all 4 worksheets for all participation survey days, the estimated monthly fishing effort (gear-hours) for each fishing method may be calculated.
  - a. Follow the same procedure as outlined on steps 4.a.-j under I. Boat and Canoe Fishing.
6. The estimated monthly fish catch (kg) for each fishing method may be calculated by following the same procedure as outlined in steps 4.a.-j. under I. Boat and Canoe Fishing, but substituting the estimates of survey-day fish catch (L) in place of gear-hours.
7. The estimated total monthly fishing effort or total monthly fish catch may be calculated by performing the same procedure outlined in steps 4.a.-j. under I. Boat and Canoe Fishing, but using the sums of the estimates for all 4 fishing method categories for the survey days.
8. Similar quarterly and annual figures for each fishing method or for all 4 methods combined may be calculated by entering the estimates for 3 and 12 months, respectively.

#### C. Islet Fishing Activities

1. At the end of each month the fisheries statistician should create a worksheet to summarize the data collected on islet fishing activities during the month.
  - a. The worksheets should summarize the data collected for handlining, trolling, other boat and canoe fishing methods, shoreline net fishing, spearfishing, shoreline hook and line fishing, and other shoreline fishing methods.
2. The following information regarding the last fishing period employed should be taken from the Islet Fishing Activity forms and listed on the worksheet:
  - a. The fishing method category.
  - b. The total # of hours spent fishing for the fishing method (A)
  - c. Remember to subtract Lost Time from Trip Time to obtain actual boat-hours or gear-hours spent fishing.
  - d. The total # of kg of fish caught for the fishing method (B)
  - e. The total # of last trip interviews for the fishing method (C)
  - f. The total # of trips made during the previous week for the fishing method employed during the last fishing trip (p)

3. Also listed should be the number of times during previous week other fishing methods were employed (E).
4. After listing the above information, the following calculations should be performed on the last fishing method data:

- a. Calculate the catch rate (kg/boat-hour or kg/gear-hour) for the fishing method (G)

$$B \div A = G$$

- b. Calculate the average # of boat-hours or gear-hours per trip for the fishing method (H)

$$A \div C = H$$

- c. Calculate the average fish catch (kg) per trip for the fishing method (I)

$$H \times G = I$$

- d. Calculate the estimated # of boat-hours or gear hours for the fishing method the two-week survey period (J)

$$H \times D = J$$

during

- e. Calculate the estimated fish catch (kg) for the fishing method during the two-week survey period (K)

$$I \times D = K$$

5. The following calculations should be performed on the other fishing method data separately for each fishing method category.

- a. Calculate the estimated # of boat-hours or gear hours for each fishing method during the two-week survey period (L)

$$H \times F = L$$

- b. Calculate the estimated fish catch (kg) for each fishing method during the two-week survey period (M)

$$I \times E = M$$

6. A general estimate of total boat-hours or gear-hours of fishing effort for the 2 survey weeks (N) may be obtained by summing the estimates for the last fishing method employed plus those for the other fishing methods.

$$J + L = N$$

7. A general estimate of total fish catch for the 2 survey weeks (O) may be obtained similarly

$$K + M = O$$

8. A general monthly estimate for islet fishing effort (P) and fish catch (Q) may be obtained by the following calculation:

$$(N \div 12) \times R = P \quad , \text{ where } R = \text{the number of days in the month, excluding Sundays}$$

$$(O \div 12) \times R = Q$$

APPENDIX IV  
TUVALU FISHERIES STATISTICAL SYSTEM  
SUMMARY OF RECOMMENDED EQUIPMENT AND SUPPLIES

The items listed below are recommended for use in implementing the fisheries statistical system in Funafuti. While this list is by no means complete, it does contain the items that are considered necessary for the basic functioning of the system. These items include:

1. Transport (bicycle, motorbike, small boat, & fuel) ;
2. Cylindrical spring scales\*\*
3. Clipboards\*
4. Flashlight/Torch\*
5. Binoculars\*
6. Net bag for weighing fish
7. Data analysis pads, file folders, pens, pencils, etc.
8. Calculator\*\*
9. Black and white spray paint\*
10. Stencils for the numbers 0 - 9
11. Spare batteries for calculator and flashlight/torch\*
12. Fish measuring board\*\*
13. Container with numbered cards (for selecting dates)\*
14. Extra blank forms for each type of survey

\* indicates items provided by the SPC during the follow-up visit

\*\* indicates items provided previously by the SPC