GUAM BOAT-BASED CREEL SURVEY DOCUMENTATION

Compiled by

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1.0 INTRODUCTION

The purpose of this manual is to document the Guam Department of Agriculture Division of Aquatic and Wildlife Resources (DAWR) Boat-based Creel Survey Program and to provide standard guidelines for this program. This manual may be used by creel survey program managers, data collection technicians, data entry technicians, data managers, and programmers to guide their work and to train new staff. This manual can also be provided to users outside of DFW who want to learn more about the island creel survey programs. DAWR also has a Shore-based Creel Survey Program that monitors fishing activity that originates from shore. A similar manual is available for that program (see Oram, Risa. et al., 2010. "*Guam Shore-based Creel Survey Documentation*").

The objective of the Boat-based Creel Survey Program is to quantify fishing participation, effort, methods used, and catch from vessels to support effective management of Guam's marine fishery resources. This requires the collection and analysis of Boat-based fishery data. The Boat-based Creel Survey is one of the major data collection systems used by DAWR to monitor and manage fisheries resources. This survey was formerly known as the Guam Offshore Creel Survey (or sometimes erroneously as a creel census) and this is still reflected in the data collection forms. The preferred term is "boat-based" because it covers all the fishing done from a boat regardless of where the fishing occurred, for example, inside or outside the reef or lagoon. This is an important distinction because where the fishing is initiated (shore vs. boat) determines how that type of activity will be accounted for in the survey systems. For instance, very small boats launched from non-standard launching areas, e.g., from the back of a pickup truck on a beach, are not included in the Boat-based Creel Survey.

DAWR has been collecting information on boat-based fishing activities since the late 1970s to identify trends in fishing activities. During this period, survey and analysis methodologies have changed in response to fluctuations in budget and staff, changes in the fisheries and the development of computer hardware and software. In the early years of the program, the data were manually collected and analyzed on paper. In 1982 with the assistance of the Western Pacific Fisheries Information Network (WPacFIN) program at the Pacific Islands Fisheries Science Center (PIFSC), a computerized database system was created called the Guam Offshore Expansion System (GOES) on the Apple IIE. In 1998 WPacFIN implemented a data processing application, which standardized the data processing and the method of expanding the estimated landings. The current database used to enter, verify, process, expand, and analyze the data runs in Visual FoxPro 6.0 SP2.

This documentation covers data collection procedures, including survey methodology, survey sites, scheduling methodology, quality assurance and quality control procedures, and reports. Survey forms and maps used by the program are shown in the Appendices.

2.0 SURVEY METHODOLOGY

Guam's Boat-based Creel Survey Program uses a random scheduling protocol to survey around the island and at three major boat ramp/port areas: Agana Boat Basin, Agat Marina; and the Merizo Boat Ramp. This program collects two types of data to estimate catch and effort information and to monitor fishing activity of the boat-based fishery. The two types of data collection are: 1) an island-wide Boat-based Participation Count to collect participation data around the island, and 2) a Boat-based Access Point Survey to collect catch and effort data through Survey Maps, Boat Logs, and Interviews at the three major boat ramp areas. The data collected are then expanded at a stratum level; strata include: (expansion period [quarterly or annually], port, charter or non-charter, day type [weekday or weekend], and gear type) to create the estimated landings by gear type for Guam's boat-based fishery.

3.0 SURVEY SITES

The Boat-based Participation Count (also locally referred to as participation (PAR), vehicle trailer (VT), or island-wide trailer count (IWTC) estimates island-wide relative participation effort information by counting trailers that are attached to a vehicle at any of the following port areas: Agana Boat Basin (central area of Guam's west coast), Agat Marina, Umatac Bay (both southwest area of Guam), Merizo Pier (southern tip of Guam), Pago Bay (central area of Guam's east coast), Ylig River (central area of Guam's east coast), Seaplane Ramp, and other areas, if encountered, along that route.

The Boat-based Access Point survey currently covers the three most actively used ports: Agana Boat Basin, Merizo Pier; and Agat Marina. The Access Point survey was initially only conducted at Agana Boat Basin. In 1989 Merizo Pier was added and in 1994 the newly opened Agat Marina was added (see "Appendix 1 Boat-based Survey Sites Map").

4.0 DATA COLLECTION

The Boat-based Creel Survey Program uses two types of data collection methods to estimate the catch, effort, and fishing activity of the boat-based fishery: a Boat-based Participation Count that involves counting the number of trailers attached to a vehicle at all public boat launching areas; and an Access Point Survey, that includes boat log data and interview data. The Access Point Survey collects data on the fishing activities that occur on any given day at the sampled port. Boat Log data are used to determine the number of boat trips engaged in each fishing method per selected port. Interviews involve interviewing fishermen after they return from their fishing trip.

4.1 Participation Count

The Participation Count collects island-wide fishing effort information about the boat-based fishery. The Participation Count collects data about the relative number of boats out fishing on a particular day by counting trailers attached to a vehicle at all public boat launching areas. The data collected are used to determine a ratio of fishing effort at the three creel surveyed ports versus the non-surveyed areas (or the rest of the island).

The Boat-based Participation Count is conducted jointly with the Shore-based Participation Count. Consequently, staff conduct the Shore-based Participation Counts along the route until they encounter one of the public boat launching ramps at which time the Boat-based Participation Count is conducted.

The route that is followed is the main road that lines the perimeter of Guam's accessible shoreline access points (see "Appendix 1 Boat-based Survey Sites Map"). It is assumed that VT's that are encountered are associated with boats that are out fishing. Staff stop at each of the boat launching areas for about 10 minutes, or however long it takes to record the number of vehicle trailers on the Participation Count Survey Form (see "Appendix 2 Boat-based Participation Count Survey Form").

The Participation Count Survey Form includes:

- Date of survey.
- Type of day – weekday (WD) or weekend/holiday (WE/H).
- Staff name.
- Port number.
- Port name.
- Number of vehicled trailers.
- Time of observation.

Participation data are collected on a minimum of four surveys per month — two weekend/holidays and two weekdays. Participation counts are collected during two separate shifts per scheduled day. AM shifts start at 06:30 and continue until finished; PM shifts start at 19:00 and continue until finished (see Table 1).

The Boat-based Participation Count's starting location follows the same as the Shore-based Participation Count (whatever number was selected from #1-71 – see "5.0 Survey Scheduling" for more information). The direction for the Participation run is alternated clock-wise and counter-clockwise each survey day. The direction used for the AM shift is repeated for the PM shift.

Table 1. Boat-based Participation Survey Schedule

Location	Minimum Survey Days per Month	Morning (AM) Shift	Evening (PM) Shift
Agana Boat Basin, Agat Marina, Merizo Pier, Pago Bay, Ylig Bay, Umatac Bay, Seaplane Ramp and along that route	(2 weekday and 2 weekend/holidays) – 4 surveys per month	06:30 - until finished	19:00 – until finished

4.2 Access-Point

The Boat-based Access Point Survey (also locally referred to as Port Survey) collects two types of data during a scheduled survey day: Boat Log data and Interview data. These data are used to measure the fishing activity occurring on any given day at the sampled port. The surveys are conducted on two separate shifts per sampling day. The starting time of the morning shifts varies slightly depending on the port being surveyed (see Table 2). The schedule for shifts and starting times has been determined by logistical limitations and not necessarily statistical needs. Boat-based surveys are conducted on eight randomly-chosen days per month, excluding holidays.

Table 2. Boat-based Access Point (Boat Log & Interview) Survey Schedule

Location	Minimum Survey Days per Month	Morning (AM)	Evening (PM)
Agana Boat Basin	2 weekdays and 2 weekends/holidays	05:00 - 12:00	16:00 - 24:00
Agat Harbor	1 weekday and 1 weekend/holiday	05:30 - 12:00	16:00 - 24:00
Merizo Pier	1 weekday and 1 weekend/holiday	06:00 - 11:00	16:00 - 24:00

4.2.1 Boat Log

The Boat Log Data survey is intended to be a census count of fishing activity on each survey day and is conducted at the three main ports/boat launch locations from which most fishing activities occur: Agana Boat Basin, Agat Marina, and Merizo boat ramp. The Boat Log data are collected for each scheduled survey day and are used to determine the number of boat trips engaged in each fishing method per selected port at the stratum level (expansion period [quarterly or annually], port, charter or non-charter, day type [weekday or weekend], and gear type). To assist in this data collection, staff use Boat Presence/Absence Maps and Boat Log Forms.

Boat Presence/Absence Maps -- If staff are surveying at the Agana Boat Basin or Agat Marina, where some vessels are stored in slips at the marinas, they first fill out Boat Presence/Absence Maps (locally referred to as survey maps) to assist with data collection. Staff record the presence or absence of boats at these locations by filling out these forms (see "Appendix 3 Boat-based Agana Boat Presence/Absence Map" and "Appendix 4 Boat-based Agat Presence/Absence Map").

The Agana Boat Basin and the Agat Marina Survey Maps collect essentially the same information:

- Date of survey.
- Type of day (weekday or weekend/holiday).
- Interviewer's name for AM and PM shifts.
- Start and end times for AM and PM shifts.

- Number of hitched and unhitched trailers and location of berthed boats in port at the end of the AM shift to cross check that all boats encountered are on the Boat Log form.
- Number of hitched and unhitched trailers and number and location of berthed boats in port at the start of the PM shift to cross check that all boats encountered are on the Boat Log form.
- A list of trailered vehicles at the end of the AM shift.
- A list of trailered vehicles at the start of the PM shift.

Boat Log Form -- A Boat Log form is completed for each scheduled survey day and is used to determine the number of boat trips engaged in each fishing method per selected port. Fisheries staff record Boat Log data starting at the beginning of each shift. The staff log all boats going out and coming back in, even if they are not fishing. When boaters are going out, staff ask questions such as, "How did you do today?" or "What types of fishing did you do?"

The Boat Log form includes:

- Date of survey.
- Location.
- Type of day – weekday (WD) or weekend/holiday (WE/H).
- Interviewer's name, start time, and end time (for AM and PM shifts).
- Interview number (if interview is obtained).
- Departure time for each logged boat.
- Return time.
- Boat registration number and/or name.
- Whether the boat is fishing or not.
- Whether or not it is a charter boat.
- The type of activity.
- Remarks.

Fisheries staff use the boat number for identification purposes. This is done to ensure that a boat is not recorded twice in the Boat-based database. Both boat number and boat name can be recorded if there is uncertainty. The Boat-based Program also allows cross-checking a particular vehicle license plate with all boats recorded for that vehicle. This helps to decrease interview errors in recording boat numbers (e.g., mixing up "0" and "6" or "1" and "7").

Since the boat log form is designed to be a census of all boat-based fishing activity during the sample day, staff are instructed that it is most important to obtain boat log information over sample interview information. This helps prevent the situation where staff spend all their time interviewing boats and miss recording boats that are departing. If a boat arrives that is not on the boat log, staff give that boat priority for obtaining information.

4.2.2 Interview

The Guam Boat-based Interview (also locally referred to as Creel) collects data on fishing effort and catch by interviewing fishermen after they return from a fishing trip. Data collected with the Boat-based Interview are used to calculate catch per unit (trip) effort (CPUE) at the stratum level (expansion period [quarterly or annually], port, charter or non-charter day type [weekday or weekend], and gear type). Detailed species composition and length-weight information are collected and used to calculate length-weight regression analyses, and to create the estimated landings for individual species.

Interview data are collected on a minimum of four surveys per month (two weekend/holidays and two weekdays). Boats are chosen on a first-come-first served basis for interviews. For returning boats, staff may ask "How did you do today?" or "What types of fishing did you do?" and "Did you do any other types of fishing?"

Participating in the interviews is voluntary. If fisheries staff sense that a fisher does not want to provide data (e.g., fisher ignores staff, fisher states that he is in a rush, etc.), they cease the interview and thank the fisher for his/her time. Most fishers are cooperative and support Guam's overall fishery management program. However, a small percentage of fishers decline interviews.

After conducting an interview, staff make sure the interview number on the Boat Log form matches the interview number on the Interview form. The survey locations and times should also match. If the fishermen changed their fishing method from what they originally stated on the Boat Log, fished additional methods, or did not fish as recorded by AM staff, then staff update the Boat Log to reflect the fishing method that was actually used. Common information on the Boat Log and Interview forms should match. Corrections are made by crossing out erroneous data and explaining it in the remarks section.

Interview data collection is conducted at the same time as the Boat Logs and is recorded on the Boat-based Interview Survey Form (see "Appendix 6 Boat-based Interview Survey Form" and "Appendix 7 Guam Boat-based Fishing Areas Map".)

The Interview Survey Form includes:

- Date of interview.
- Type of day – weekday (WD) or weekend/holiday (WE/H).
- Landing location.
- Interview number, interviewer's name, and the time of the interview.
- Boat registration number.
- Charter (yes, no, unknown).
- Berthed (yes, no, unknown).
- Towing vehicle's license number.
- Fishing method used.
- Number of gear units.
- Number of hours fished.

- Area fished, including reef zone.
- Number of people on board.
- Number of guests (charter only).
- Weather (including cloud cover, wind direction, wind speed, tropical storm/typhoon condition, and warnings (small craft, high surf).
- Fish species/code.
- Fish length in millimeters and fish weight in kilograms.
- Total number of pieces of fish.
- Total weight of fish.
- Disposition of fish landed including method, percent sold, percent unsold, and buyer.
- Bycatch – Staff ask if there was any fish thrown back (bycatch), and if there was, staff ask the species name; method used; disposition (live, or dead/injured); species length and weight; and number of pieces.

Each fishing trip may have multiple fishing methods conducted by a fisherman, however each interview should be broken down to the method level (including catch information) when the information is collected. If the catch cannot be separated by method, that information is recorded as a "multi-gear" type fishing method. When too many boats return at the same time and cannot all be interviewed, staff prioritize interviews so that boats fishing with the least-encountered methods for the past month are interviewed first and most thoroughly. The fishing methods that are often needed include: a) all types of spearfishing, b) deep bottomfishing, and c) shallow bottomfishing.

Fish Identification, Measure, and Weight -- During the interview, staff ask if they can examine the catch to identify, measure, and weigh the fish caught. For smaller catches, staff attempt to identify, measure, and weigh all fish, time permitting. At times, fishers will allow staff to obtain both length and weight information, especially for rarely seen specimens. This is important for improving length-weight regressions. For large catches, staff attempt to quickly identify and enumerate all the different fish species and measure at least three individual fish per species. Each individual specimen of a particular species is randomly selected with no preference for size. For fish species having 2 or more distinct size categories (e.g., 3-5 lbs of tuna vs. 15-20 lbs of tuna), at least 3 individual fish per size category are measured. When an interview is difficult to obtain (e.g., the fisherman is a rush), staff attempt to estimate the fish catch by species level or by family level (e.g., miscellaneous reef fish, miscellaneous bottomfish).

Several standard units of measurement are used. For instance, all fish are measured with measuring tapes and recorded in millimeters/centimeters and grams/kilograms. For finfish with forked tails, fork length (FL) is the standard unit of measurement. For billfish, this is taken from measuring the tip of the lower jaw to the notch of the tail. For all other fish, whichever jaw extends the furthest is used and measured to the notch of the tail. For species with rounded or truncated tails, FL equals total length (TL) (see "Appendix 8 Invertebrate Measurement Diagrams").

A Complete Interview -- A complete interview accounts for all of the catch and ensures that there are no missing or erroneous data. It is important to have a complete measure of all the catch per fishing trip since these data are used to determine the average catch per unit effort (CPUE) calculation. If all catch cannot be counted and measured during the interview (e.g., fisher was in a rush, uncooperative), staff should attempt to: 1) estimate the total number of fish per species, or if they cannot do that, then 2) estimate the total weight of the entire catch per species. If not all fish are measured, and an estimate of species composition and weight per species cannot be made, this entails an incomplete interview and will not be used for CPUE or species composition calculations during the data expansion process.

5.0 SURVEY SCHEDULING

Guam's Boat-based Creel Survey uses a stratified, randomized scheduling regime for data collection. The stratification consists of ports and day type: weekday or weekend/holiday. A weekday is normally defined as Monday through Friday with no holidays. A weekend/holiday is normally defined as Saturday, Sunday, and holidays. These strata are selected randomly without replacement.

Staff that work on the Boat-based Creel Survey Program also work on the Shore-based Creel Survey Program. To make more efficient use of staff time, scheduling for these two programs (Boat-based and Shore-based) is conducted at the same time. Before the mid-1980's the Participation Count for each of these programs was scheduled separately. Scheduling for the Boat-based Program was set up with the limited logistical resources in mind. It has been designed and implemented to get the best representative sample as possible with the resources that are available. Consequently, the minimum scheduling times are not statistically ideal samples, but rather constrained by available resources.

To begin scheduling for the Boat-based Participation Count, the numbers 1 – 31 are each written on small pieces of paper to represent the dates in a month. These papers are placed in a small container. The dates selected for the Boat-based Participation Count are also used for the Shore-based Participation Count and the Aerial Survey (see Oram, Risa. et al., 2010. "Survey Scheduling" in *"Guam Shore-based Creel Survey Documentation."*).

Selection involves choosing a piece of paper from the tin. The chosen date is marked down on a blank calendar, and it is noted whether it falls on a weekend day or a weekday day. This paper is removed from the tin, and additional papers are chosen one by one until two weekend days and two weekday days are selected.

The next step is to determine where the participation run will begin by choosing a number marked 1-71 from a container representing access points for each selected participation date (see Oram, Risa. et al., 2010. "Shore Based Survey Sites Map" in "*Guam Shore-based Creel Survey Documentation.*"). After an access point number is selected, this paper is removed from the container and the starting location number is written on the corresponding date on the calendar. For each shore-based participation sampling date, the direction driven alternates from clockwise to counter-clockwise. The direction used during the AM shift is repeated for the PM shift.

After the Boat-based Participation is scheduled, the Boat-based Access Point Survey (also locally referred to as Boat-based Port Survey) is scheduled by selecting dates from the remaining papers labeled 1-31 in the tin. The dates selected for the Boat-based Access Point Survey will be used for both the Boat Log and Interview, since these are done at the same time). Scheduling is done per month, for three months at a time.

Randomized selection of the dates is based on the ports first. For example, for the first month of scheduling, Agana Boat Basin is selected first, until two weekdays and two weekend days are selected. After dates are selected, they are removed from the tin. Next, the dates for Agat Marina are selected from the remaining papers until one weekday and one weekend are selected. After dates are selected, they are removed from the tin. Last, the dates for the Merizo Pier are selected from the remaining papers until one weekend and one weekday are selected. After dates are selected, they are removed from the tin. The dates are then marked on a calendar along with "Boat-based" and "Port Area". This process is repeated in its entirety two more times, for a total of three months (with the exception that the port location chosen first is rotated based on which port was selected first in the prior month). Following the preceding example of scheduling, the first port selected was Agana, then Agat, and then Merizo. For the second month, the first port would be Agat, then Merizo, and then Agana. For the third month, the first port would be Merizo, then Agana, and then Agat.

If a holiday is selected during scheduling, the paper is removed and the survey date is discarded because the government does not allow its staff to work on holidays. A new paper is selected instead. For data expansion purposes, holidays are treated as weekend days for levels of participation, and so on.

6.0 DATA QUALITY CONTROL

The Boat-based Creel Survey Program employs several methods to ensure data quality assurance and control of the data that are collected.

6.1 Fish Identification Training

DAWR developed a comprehensive fish identification training program that all new Fisheries Section staff are required to participate in before they are allowed to collect data unaccompanied by senior staff. Staff members are trained to identify fish to the species level with the use of identification aids, including two fish posters (Oceanic Fishes of the Mariana Islands and Reef Fishes of the Mariana Islands), fish reference books, fish ID flash cards, and visiting fish markets to identify fish that are caught. All survey staff members undergo in-house testing using picture slides and answer sheets. After a boat-based creel survey biologist or project leader determines that new staff can successfully identify fish species about 95% of the time, then the staff are trained in field survey methodology. Mini refresher training sessions are also provided for experienced staff to review reef and deep bottomfish species before the summer months when bottomfishing and spearing activity increase.

6.2 Data Collection Protocols Training

Next, staff are allowed to participate in field surveys. All new DAWR staff are accompanied on all surveys by experienced staff and a boat-based creel survey biologist or project leader. These senior staff members supervise new employees while they conduct interviews and observe their ability to accurately identify, measure, and weigh a fisher's catch. They make sure that all species have been identified accurately and that all data forms are correctly completed.

The data collection technicians are required to come back to the office and review the survey forms to check for mistakes or missing data. If there were any unknown species, staff identify these in the office using fish identification reference materials. If missing data are easily recalled, then they can be filled in at that time. Staff write "log" and their initials on the forms and put them in binders labeled "log" and "date" in the file cabinet for the data manager to review.

6.3 Data Entry, Editing, Storage and Backup

The data manager reviews the forms for missing data and legibility. If information is missing or unclear, the data manager asks the data collection technicians to clarify it. All remarks and edits are written in red pencil and the data manager writes "edit" and their initials on the form. When the data manager approves the forms, then s/he will write "coded" and their initials and place these forms into the binders in the filing cabinet labeled "coded" and the "month ".

Next, the data are entered into the system either by a technician or a data manager. The data entry person retrieves the forms from the binder marked "coded" and enters the data into the central database. If the data manager is entering the data, they may need to apportion the right fish species to the correct fishing method used and make adjustments where necessary if this was not recorded on the Interview Form. The data entry staff or data manager then writes "entered" and their initials on the forms. The forms are placed into a binder in the file cabinet marked "entered" with the corresponding month. After the data are entered, the system is backed up on Fridays (first backup) onto an external hard drive. Paper data forms in the binder marked "entered" are kept in the file cabinets for one year. After that, the paper forms are scanned and archived using the Document Imaging Archival System (DIAS), developed by WPacFIN.

After data are entered, the data manager compares the data entry to the paper forms. If there is any need for changes, the manager crosses out the wrong information and writes the correct information next to it. The data manager also writes "edit" and their initials in red pencil on the form. All edits made to the data forms must also be made to the database. The edited data are backed up again (second backup, preferably on Fridays) to overwrite changes made to the data. Backups are done using an external hard drive and backup copies are placed on two additional computers. Data entry and edits are made only on the central database to ensure that everyone is working from the correct version of the database. Copies of the master database are transferred to other computers for local access.

7.0 REPORTS

The WPacFIN data processing application generates data-entry validation reports, maintenance reports, and various data summary reports, including expanded catch and effort (see "7.1 Boat-based Expanded Catch and Effort Report"), and expanded species composition (see "7.2 Boat-based Expanded Species Composition").

7.1 Boat-based Expanded Catch and Effort Report

The following is an annual creel survey expansion report of estimated total catch by method and type of day:

November 12, 2009
12:42 PM

Division of Aquatic & Wildlife Resources
Department of Agriculture
Government of Guam

Page: 1
Weight Unit: lb

Boat-Based Creel Survey Expansion Summary
For January to December, 2008
Based on Expanding Full Time-Period Data

Method	Type of Day	Num of Int	Expanded Data (CV %) lb/hr	lb/gr-hr	lb/trip	Trip	Catch(lb)	Hour	Person	Prsn-hr	Gear-hr
	Weekday										
TROLLING		96	22.78	6.14	108.66	3,055 (9.3)	331,941 (14.5)	14,574	9,558	38,387	54,049
BOTTOM		23	2.66	1.09	9.57	1,670 (9.5)	15,983 (22.4)	5,999	3,631	11,944	14,711
ATULAI NIGHT LIGHT		1	5.33	3.24	21.77 (59.0)	78 (47.9)	1,689 (57.7)	317	116	464	521
SPEAR/SNORKEL		7	9.75	3.12	36.65 (83.6)	300 (17.4)	10,985 (37.9)	1,127	929	3,560	3,515
SPEAR/SCUBA		3	20.50	5.81	60.29	329 (13.4)	19,831 (62.2)	967	1,013	3,118	3,414
JIGGING		2	12.23	4.03	57.72 (62.6)	39 (65.0)	2,245 (74.5)	184	106	550	558
GILLNET		2	30.98	18.81	86.58 (88.5)	111 (39.8)	9,572 (66.2)	309	294	806	509
CASTNET		1	11.57	6.61	32.41	66 (55.5)	2,146 (55.5)	185	199	583	325
SPINCASTING			5.42	1.95	20.06	33 (81.9)	664 (81.9)	123	99	457	341
	Weekend/Holiday										
TROLLING		309	11.87	3.28	55.04 (48.2)	3,892 (11.8)	214,250 (9.2)	18,050	13,700	56,914	65,246
BOTTOM		80	4.93	1.87	26.87 (57.6)	1,637 (11.0)	43,987 (3.0)	8,917	4,322	22,028	23,546
ATULAI NIGHT LIGHT		2	5.42	3.05	22.55 (56.9)	54 (39.7)	1,208 (50.1)	223	88	354	396
SPEAR/SNORKEL		18	12.60	4.16	46.62 (67.1)	442 (6.6)	20,586 (19.8)	1,634	1,478	5,396	4,954
SPEAR/SCUBA		3	16.34	5.76	49.09	114 (20.8)	5,618 (52.6)	344	383	1,187	976
JIGGING		12	10.32	3.23	50.85 (82.4)	130 (21.0)	6,622 (28.1)	641	409	2,122	2,048
GILLNET		6	17.57	8.78	43.92 (62.4)	104 (20.9)	4,554 (42.8)	259	277	709	518
CASTNET			11.57	6.61	32.41	5 (98.6)	158 (98.6)	14	15	43	24
	Combined Day-Type										
TROLLING		405	16.74	4.58	78.62	6,947 (7.8)	546,191 (8.1)	32,624	23,258	95,300	119,294
BOTTOM		103	4.02	1.57	18.13	3,307 (7.3)	59,970 (6.4)	14,916	7,954	33,972	38,256
ATULAI NIGHT LIGHT		3	5.37	3.16	22.09 (82.2)	131 (32.7)	2,897 (39.6)	540	203	818	918
SPEAR/SNORKEL		25	11.44	3.73	42.59	741 (5.8)	31,572 (18.4)	2,760	2,406	8,955	8,469
SPEAR/SCUBA		6	19.41	5.80	57.40	443 (11.3)	25,449 (49.9)	1,311	1,395	4,305	4,390
JIGGING		14	10.75	3.40	52.43	169 (22.0)	8,867 (28.2)	825	515	2,673	2,606
GILLNET		8	24.86	13.75	65.93	214 (22.9)	14,126 (46.9)	568	571	1,515	1,027
CASTNET		1	11.57	6.61	32.41	71 (52.1)	2,304 (52.1)	199	213	626	348
SPINCASTING			5.42	1.95	20.06	33 (81.9)	664 (81.9)	123	99	457	341
TOTAL:		565	12.85	3.94	57.39	12,058 (4.8)	692,040 (6.8)	53,866	36,614	148,621	175,650

7.2 Boat-based Expanded Species Composition

The following is an annual expanded species composition report by method:

Division of Aquatic & Wildlife Resources
Department of Agriculture
Government of Guam

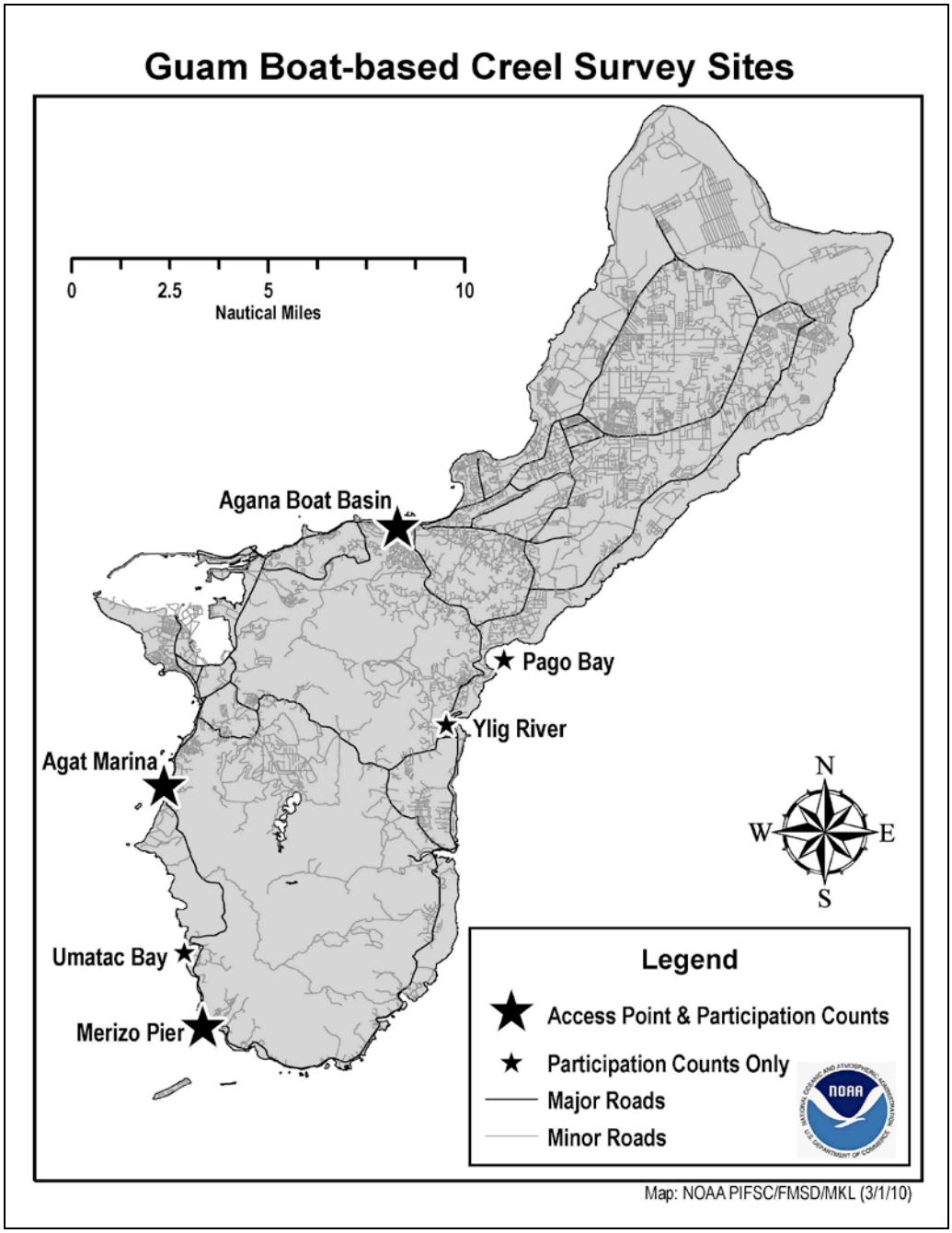
November 12, 2009
12:45 PM

Page: 1
Weight Unit: lb

Boat-Based Creel Survey Species Composition
For January to December, 2008
Based on Expanding Full Time-Period Data

All Species	TOTAL	Trolling	Bottom	Atulai	Mix Spear	Snorkel	Scuba	Others
Katsuwonus pelamis	295,250	295,250						
Coryphaena hippurus	111,811	111,208						603
Acanthocybium solandri	98,345	98,345						
Thunnus albacares	19,888	19,882						6
Naso unicornis	11,020					3,848	7,172	
Selar crumenophthalmus	10,335			2,362				7,973
Makaira mazara	9,704	9,704						
Naso lituratus	7,540					1,503	5,835	202
Etelis carbunculus	6,580		6,580					
Mulloidichthys flavolineatus	6,053							6,053
Pristipomoides zonatus	5,708		5,708					
Caranx melampygus	5,373		2,403			2,195		775
Pristipomoides auricilla	4,903		4,903					
ASSORTED REEF FISH	4,891					3,998		893
Tridacna maxima	4,850					4,850		
Etelis coruscans	4,815		4,815					
Euthynnus affinis	4,313	4,074						239
Lutjanus bohar	3,814		826				2,988	
Epinephelus merra	3,559		84			128	3,346	
Lethrinus rubrioperculatus	3,198		3,198					
Acanthurus lineatus	2,724					2,724		
Tarachtichthys steindachneri	2,620		2,620					
Gymnosarda unicolor	2,602	82	2,521					
Elagatis bipinnulatus	2,455	2,455						
Epinephelus polyphekadion	2,390						2,390	
SHALLOW BOTTOMFISH	2,246		2,246					
Sphyraena barracuda	2,166	2,024	143					
Aprion virescens	2,002		1,169			833		
Tylosurus crocodilis crocodi	1,985	1,650	335					
Chlorurus frontalis	1,915					323	1,591	
Epinephelus fasciatus	1,887		1,887					
Seriola dumerili	1,885		1,885					
Kyphosus vaigiensis	1,768					63		1,705
Chlorurus sordidus	1,734					1,545	190	
Lethrinus xanthochilus	1,733		1,556			176		
Lethrinus obsoletus	1,653		1,653					
Acanthurus triostegus triost	1,498					286		1,211
Siganus spinus	1,341					100		1,241
Hipposcarus longiceps	1,206					352		854
Caranx ignobilis	1,157	107	1,050					
Myripristis berndti	1,074		630			439		5
Gnathodentex aurolineatus	1,050		768			283		
Lethrinus harak	1,010		830					180
Carcharhinus limbatus	950	950						
Lutjanus kasmira	906		903					3
Aphareus rutilans	903		903					
Lethrinidae	900		900					
Pristipomoides seiboldii	873		873					
Sargocentron spiniferum	846		775			60	11	

APPENDIX 1 BOAT-BASED SURVEY SITES MAP



APPENDIX 2 BOAT-BASED PARTICIPATION COUNT SURVEY FORM

DEPARTMENT OF AGRICULTURE
FISHERIES SECTION, DIVISION OF AQUATIC AND WILDLIFE RESOURCES
OFFSHORE VEHICLE-TRAILER PARTICIPATION CENSUS

DATE_____ WD WE/H

DAY SURVEY: STAFF_____

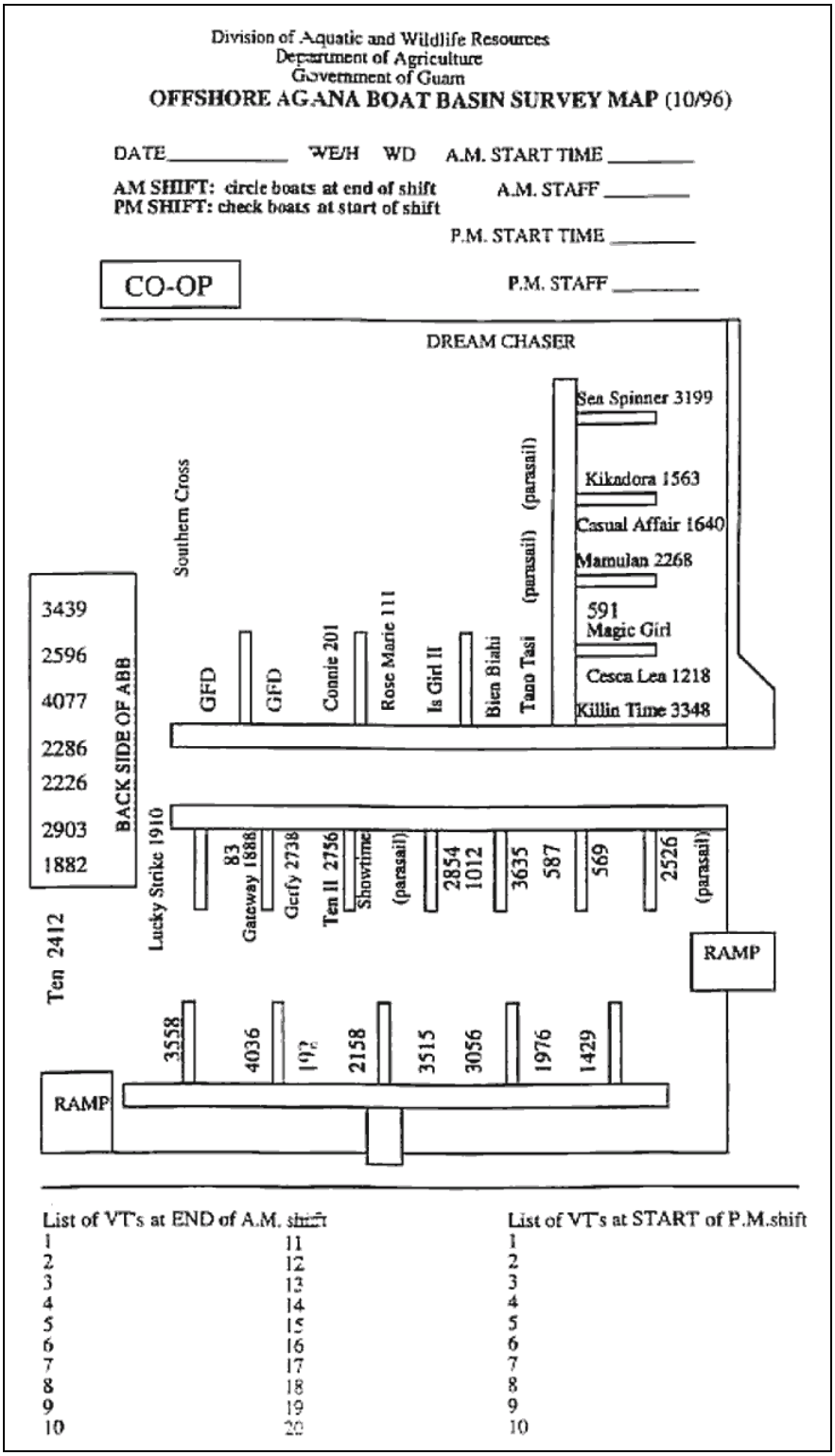
Port Number	Port	No. Vehicle-Trailers	Time
1	AGANA BOAT BASIN		
2	AGAT MARINA		
3	MERIZO PIER		
4	PAGO BAY		
5	YLIG BAY		
6	UMATAC BAY		
7	AGAT BAY		
8	SEAPLANE RAMP		
9 (Other)			
9 (Other)			
9 (Other)			

NIGHT SURVEY: STAFF_____

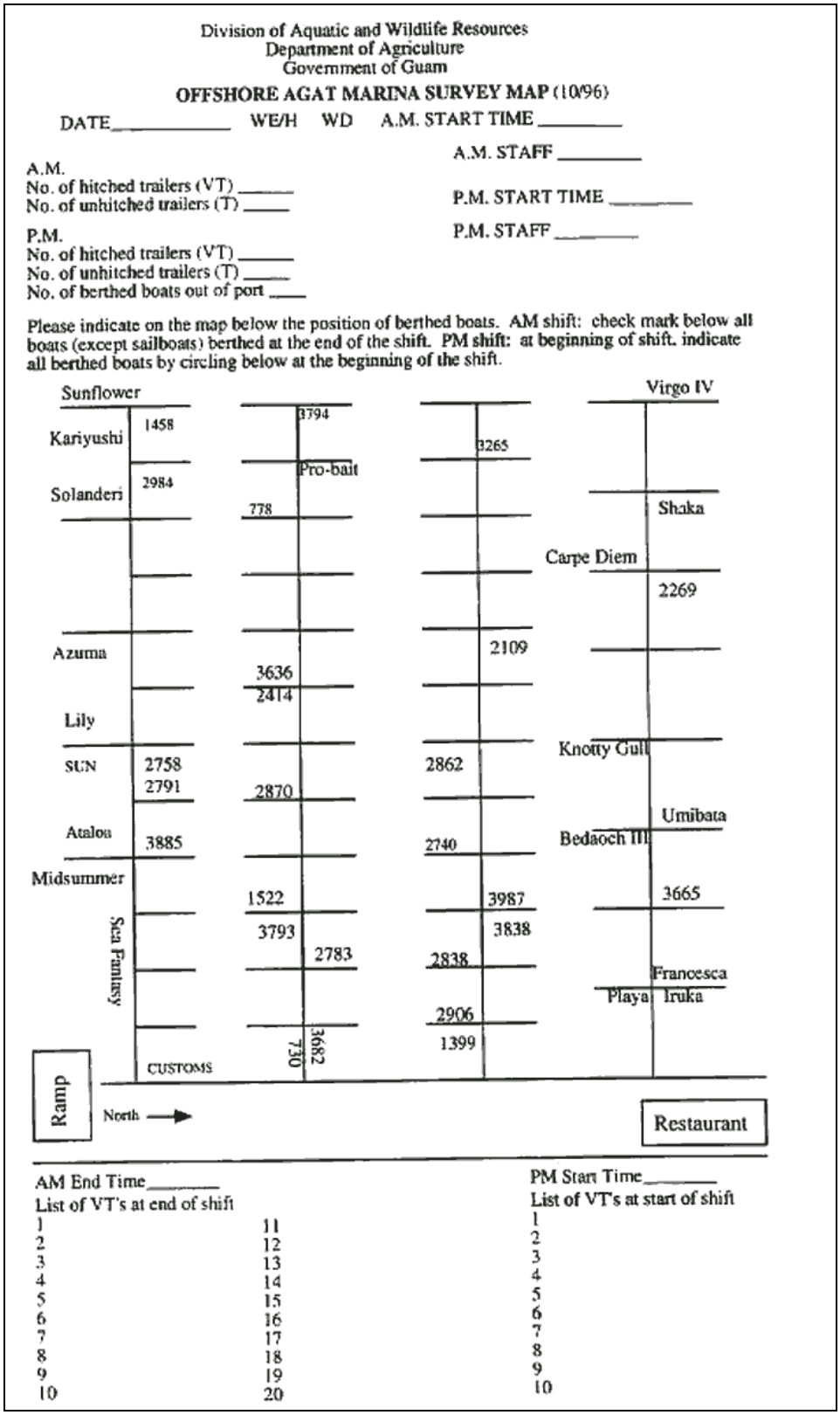
Port Number	Port	No. Vehicle-Trailers	Time
1	AGANA BOAT BASIN		
2	AGAT MARINA		
3	MERIZO PIER		
4	PAGO BAY		
5	YLIG BAY		
6	UMATAC BAY		
7	AGAT BAY		
8	SEAPLANE RAMP		
9 (Other)			
9 (Other)			
9 (Other)			

Revised 4/03

APPENDIX 3 BOAT-BASED AGANA BOAT PRESENCE/ABSENCE MAP



APPENDIX 4 BOAT-BASED AGAT PRESENCE/ABSENCE MAP



APPENDIX 5 BOAT-BASED SURVEY BOAT LOG FORM

Fisheries Section, DAWR
Department of Agriculture, Guam
Offshore Survey Boat Log

Interviewer Start Time End Time
AM: \ \
PM: \ \

Date \ \
Location
TypeDay (1:WD, 2WE)

Log No	Int. No.	Depart Time	Return Time	Boat No. (or Name)	Fish? (Y/N/U)	Charter (Y/N/U)	Type of Activity	Vehicle License No.	Remarks
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
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34									
35									

APPENDIX 6 BOAT-BASED INTERVIEW SURVEY FORM

Fisheries Section
Division of Aquatic and Wildlife Resources
Department of Agriculture, Guam
OFFSHORE CREEL CENSUS FORM

Date _____ 1 WD/2 WE
Landing_____
Interview #_____
Interviewer _____
Interview Time _____

Boat #_____ Charter? (y/n/u)_____ Berthed (y/n/u) _____ Towing Vehicle's License #_____

Method	Gear Units	Hours fished	Area Fished
1. Trolling			
2. Bottom (s,d,m)			
3. Atulai night jgging			
4. Snorkel Spearfishing			
5. Scuba Spearfishing			
6. Other_____			
7. Other_____			

No. of people on board _____
No. of guests (charter only)_____

Weather _____ Cloud cover_____
Wind Direction _____ Speed _____
Tropical Storm/Typhoon condition_____
Warnings: Small craft _____ (y,n,u)
High Surf _____ (y,n,u)

Species/Code	Length (mm)	Wt. (kg)	Length (mm)	Wt. (kg	Length (mm)	Wt. (kg)	Total Actual	No. Est.	Total Actual	Weight Calc.	Est.

Disposition of Fish Landed

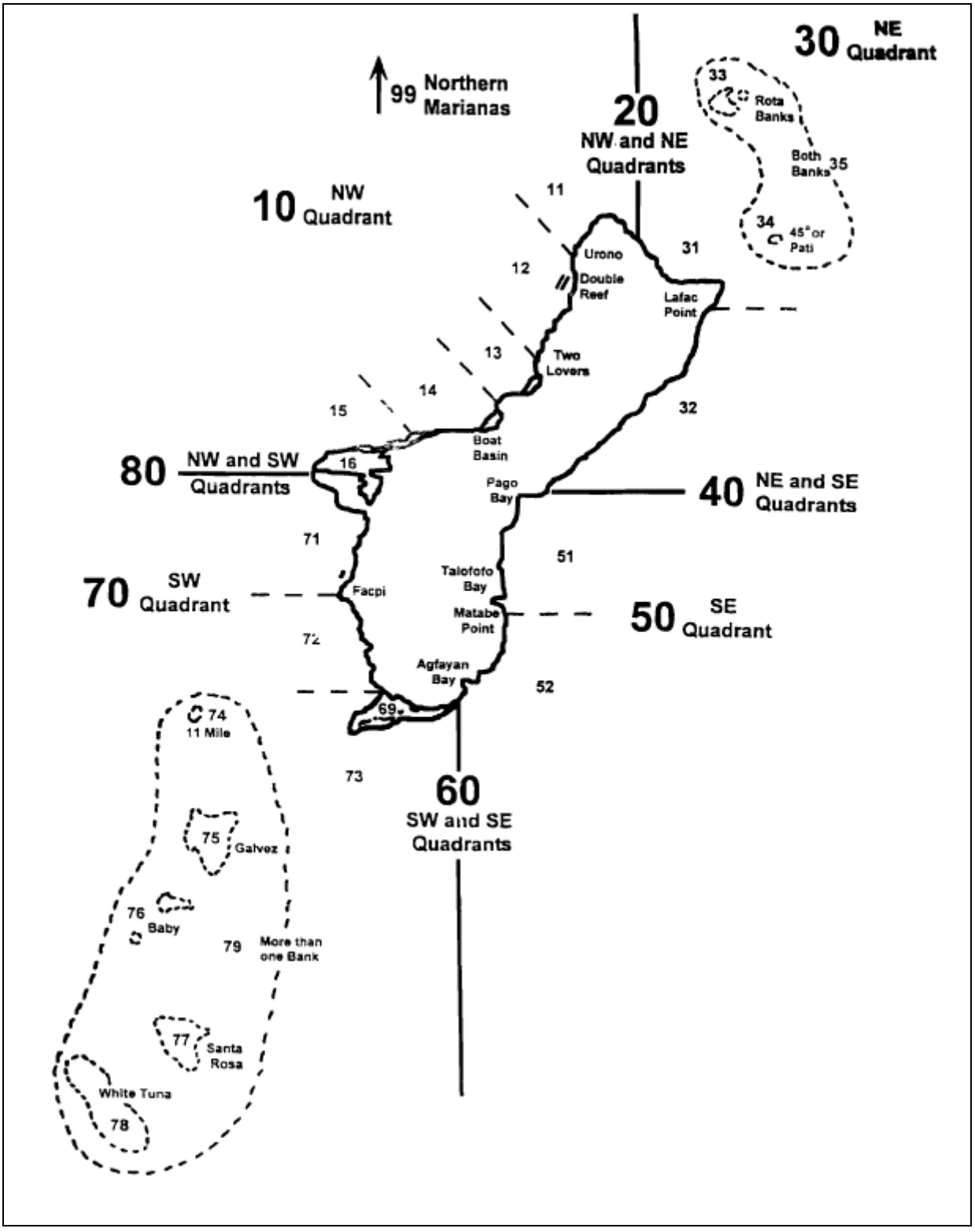
Method	% not sold	% sold	Buyer

REMARKS:

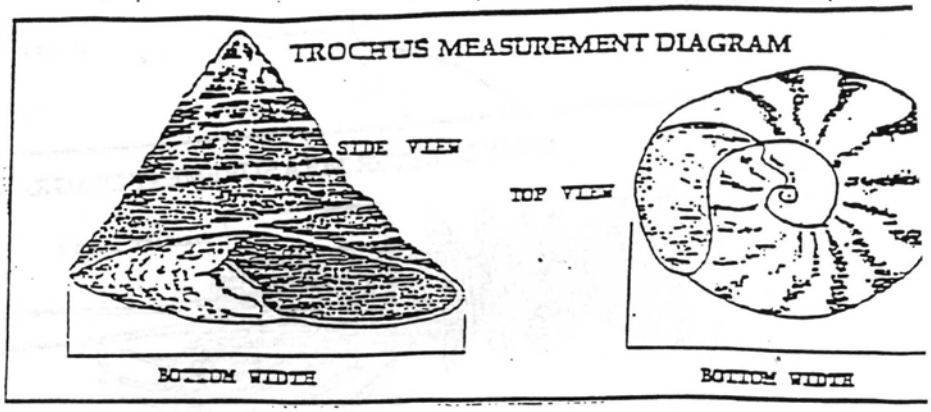
Bycatch: Did you release or throw back any fish? ( ) NO ( ) Yes (if yes, list below)

Species/Code	Method	Bycatch Alive (10)	Type Dead (20)	Length (mm)	Wt. (kg)	Length (mm)	Wt. (kg)	Total Act.	Number Est.	Total Actual	Weight Calc.	Est.

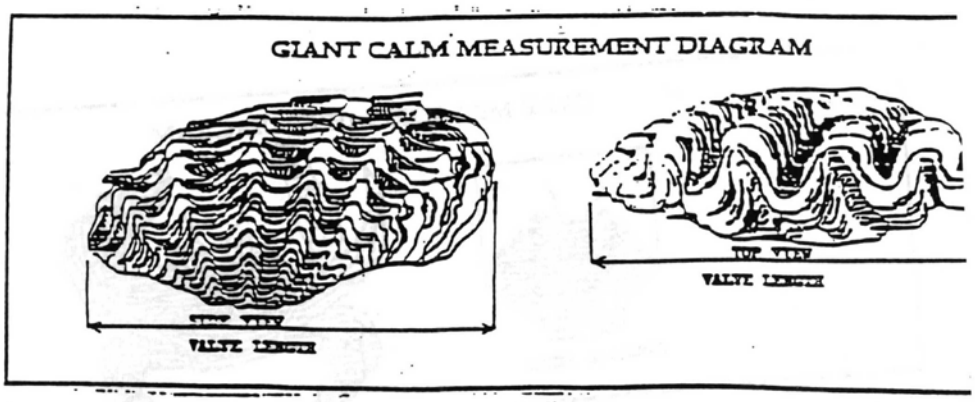
APPENDIX 7 GUAM BOAT-BASED FISHING AREAS MAP



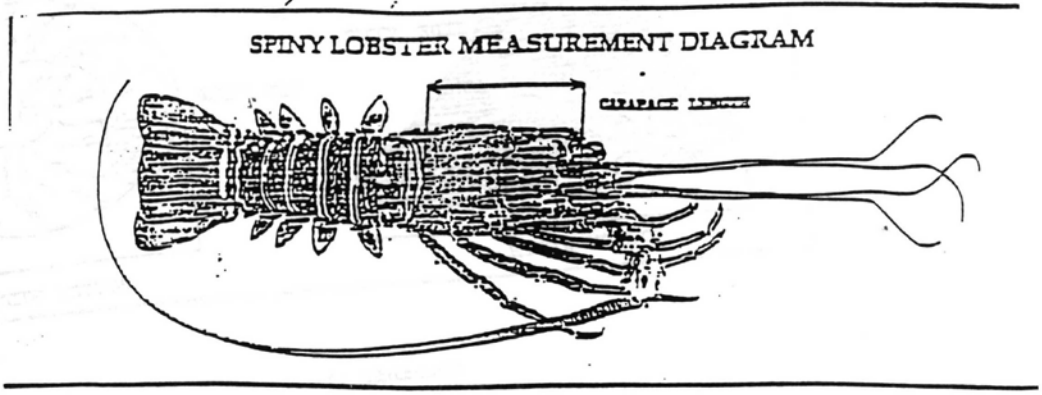
APPENDIX 8 INVERTEBRATE MEASUREMENT DIAGRAMS



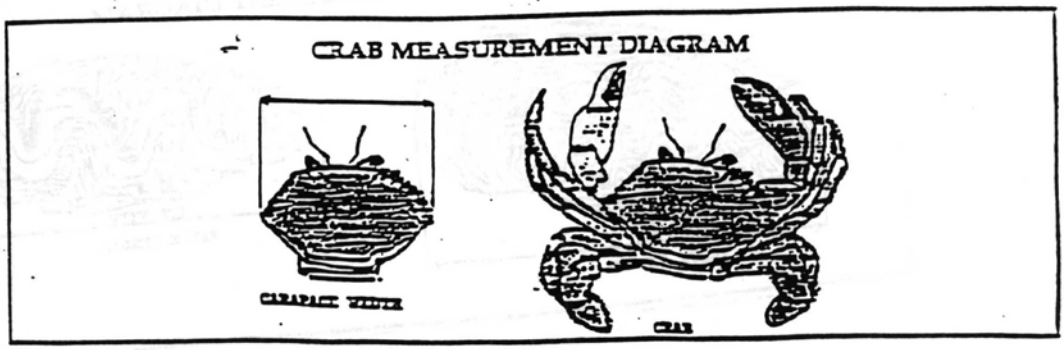
(Exhibit 1)



(Exhibit 2)



(Exhibit 3)



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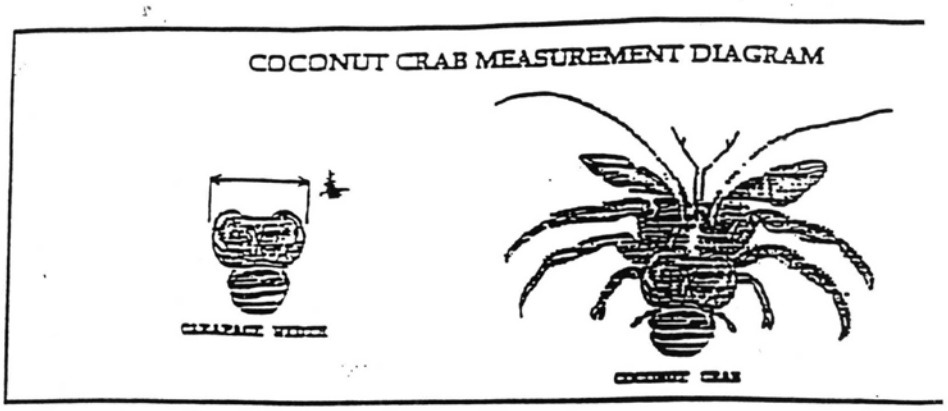

(Exhibit 5)