

**JOB PROJECT REPORT
RESEARCH PROJECT SEGMENT**

STATE: Territory of Guam

PROJECT NO: F-1R-7
SUB-PROJECT NO.: F-1
STUDY NO.: 1
JOB NO.: 1

STUDY 1: Fisheries Participation, Effort, and Harvest Surveys

JOB 1: Offshore Fisheries Survey

PERIOD COVERED: October 1, 1998 to September 30, 1999

SUMMARY

Monthly offshore fisheries surveys were conducted at the Agana Boat Basin, Agat Marina, and the Merizo boat-ramp facility from October 1998 through September 1999. The FY99 islandwide offshore catch (see Table 1), from primarily small recreational-type vessels, is estimated to be 549.9 metric tons (m.t.). The bulk of the catch, 329.7 m.t., was landed by the trolling method, consists primarily of five pelagic species. Bottomfishing produced an estimated 63.2 m.t., both snorkel spearfishing and SCUBA spearfishing produced a total of 61.4 m.t., while night-light jigging produced an estimated 21.6 m.t. Other methods such as surround net, gillnet, castnet, jigging, spincasting, and other methods encountered during offshore surveys account for 74.0 m.t. Compared with FY98, the total FY99 offshore catch increased slightly, 4%. Comparing only the trolling, bottomfishing, spearfishing, and night light jigging activity, total offshore catch decreased slightly, 6%. Trolling and nightlight jigging showed decreases in catch compared with FY98, 13% and 31% respectively, while bottomfishing and spearfishing catches increased 57% and 11% respectively. The offshore catch from other methods more than doubled compared with FY98, due primarily to boat-based gillnet and surround net catches of bigeye scad (*Selar crumenophthalmus*) that were encountered during offshore creel surveys.

TABLE 1: Composition of the Guam Offshore catch during FY99. Weights are in metric tons (m.t.).

Offshore Fishing Method	FY99 Catch
Trolling	329.7
Bottomfishing	63.2
Spearfishing	61.4
Atulai night-light jigging	21.6
Other Methods	74.0
Total FY97 Offshore Catch	549.9

BACKGROUND

Effective management of the island's offshore fishery resources requires the collection and analysis of data on fishing effort, methods used, and harvest. In order to identify trends in fishing participation, effort, and catch, the Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR) has been monitoring offshore fishing activities for the

past 22 years. Over this period of time, survey and analysis methodologies have changed in response to fluctuations in budget and staff, as well as changes in the fishery. Since FY97, the National Marine Fisheries Service (NMFS) and DAWR have been developing and are completing a computerized database program to collect, input, and analyze the offshore fisheries data. The expansion program's algorithms are currently being reviewed, verified, and improved and should be completed this next fiscal year. The data in the FY99 report should still be considered preliminary data. During FY99, historical offshore data since 1984 was entered into the new database system. The statistical basis for the expansion can be found in NOAA SWFC Admin. Reports H-83-21C and H-92-08.

OBJECTIVES

1. To quantify fishing participation, effort, and catch of fishing methods which generally occurs outside the reef margin and are boat-based.
2. To collect biological data from the specimens examined during interviews.
3. To continue and complete the review and verification of the Guam Offshore Expansion System.

PROCEDURES

Interviews of returning fishing parties utilizing the three major boat ramps on island were conducted four days each month at the Agana Boat Basin (two weekends and two weekdays), two days each month at the Agat Marina (one weekend and one weekday), and two days each month at the Merizo boat ramp facility (one weekend and one weekday). Each of these days were randomly selected within weekdays (WD) and weekend/holiday days (WE/H) fields. Agana Boat Basin surveys consist of two periods, from 0500 to 1200 hours and from 1600 to 2400. The Agat Marina and Merizo boat ramp facility survey times differ slightly in the morning survey hours, 0530 to 1200 and 0600 to 1100 hours respectively. During FY99, the Merizo boat ramp facility was undergoing construction, and was unavailable from January 1999 until May 1999. Surveys at the Agat Marina were doubled during this period. Islandwide offshore participation was determined by means of a morning and evening survey, two weekdays and two weekends a month, of all public boat launching areas and accessible makeshift launching sites where trailers attached to vehicles were counted, but no interviews were taken. The expansion program assumes that a percentage of boats operating out of the Agana Boat Basin, Agat Marina, and the Merizo boat ramp facility that are fishing is proportional to the types of fishing occurring around the island as a whole.

Important changes in the data expansion process were incorporated into the offshore survey since FY97. These changes include using quarterly rather than monthly expansions in order to account for seasonal fisheries, using the boat log data to calculate participation in the expansion process, expanding data from the three surveyed ports rather than just the Agana Boat Basin, separating charter and non-charter fishing activity, and separating bottomfishing into shallow and deepwater strata.

All complete interviews had catch, participation, and effort data collected for each method encountered. For most interviews, the catch was identified to the species level. However, if a species breakdown is not possible due to time constraints imposed by the fishermen, a total weight, either estimated or actual, is recorded.

RESULTS

Trolling

Five major pelagic species account for 90% of the total troll catch by weight (Table 2). Yellowfin tuna (*Thunnus albacares*) made up 25% of the troll catch, followed by mahimahi (*Coryphaena hippurus*, 24%), bonita (*Katsuwonus pelamis*, 16%), wahoo (*Acanthocybium solandri*, 13%), and Pacific blue marlin (*Makaira mazara*, 12%). The remainder of the troll catch was composed of rainbow runner (*Elagatis bipinnulatus*, 4%), kawakawa (*Euthynnus affinis*, <2%), great barracuda (*Sphyraena barracuda*, <2%), and other species.

TABLE 2: Composition of the Guam troll catch during FY99 by most common species. Weights are in kilograms.

Troll Species	Total Catch	% of Troll Catch
<i>Thunnus albacares</i>	83,387	25
<i>Coryphaena hippurus</i>	79,260	24
<i>Katsuwonus pelamis</i>	52,015	16
<i>Acanthocybium solandri</i>	42,091	13
<i>Makaira mazara</i>	40,397	12
<i>Elagatis bipinnulatus</i>	11,952	4
“Assorted Troll Catch”	5,919	<2
<i>Euthynnus affinis</i>	4,829	<2
<i>Sphyraena barracuda</i>	4,465	<2
<i>Gymnosarda unicolor</i>	2,493	<1
<i>Carcharhinidae</i>	1,454	<1
<i>Istiophorus platypterus</i>	1,049	<1
Other species	437	<1
Total	329,748	100

Comparing trolling participation between FY99 and FY98, the number of trolling trips increased 15%, 15,883 trips up from 13,836 trips, while the number of people trolling increased 8%, 49,747 people compared with 46,296 in FY98. Weekdays had an average of 9.47 trolling trips per day, while weekends and holidays averaged 22.76 trips a day for an overall average of 16.11 troll trips per day. Approximately 49% of all boats interviewed on offshore surveys were trolling trips, 15,883 out of 32,505 offshore trips. Non-charter boats made up 81% of the trolling trips, with each trolling trip averaging 3.8 hours with an average of 4.2 fishermen. Comparing between ports, 46% of all trolling trips originated from the Agana Boat Basin.

Comparing effort, the number of hours spent trolling increased slightly in FY99 (6%), 60,958 hours compared with 57,716 hours in FY98. There were 234,717 gear hours and 18,105 person hours of trolling effort during FY99. Troll catch decreased 13%, 329.7 m.t. down from 377.7 m.t. in FY98. Landings increased 90% for Pacific blue marlin (40.4 m.t. compared with 21.3 m.t.) and increased 19% for yellowfin tuna (83.4 m.t. compared with 69.9 m.t.), while decreased 43% for wahoo (42.1 m.t. down from 73.9 m.t.), decreased 40% for bonita (52.0 m.t. down from 86.7 m.t.), and decreased 27% for mahimahi (79.3 m.t. down from 108.8 m.t.). Yellowfin tuna replaced mahimahi as the top pelagic species caught in FY99.

Trolling catch rates decreased from the harvests in FY98. Catch per hour fished decreased 17%, 5.41 kg/hr compared with 6.54 kg/hr in FY98, while catch per gear hour decreased

14%, 1.40 kg/gr-hr compared with 1.63 kg/gr-hr in FY98. Charter boat activity made up a significant portion of the trolling activity on Guam. Charter boats made up approximately 5% of the trolling fleet, yet account for 11% of the troll catch, 15% of trolling hours, 19% of all trolling trips, and 36% of people trolling in FY99. Charter boats account for 25% of the total blue marlin catch and 20% of mahimahi caught. During FY99, however, charter boats experienced a decrease in total catch, CPUE, and participation. Troll trips decreased 15%, 3068 trips down from 3,625 trips in FY98, while total charter troll catch decreased 34%, 36.9 m.t. down from 56.1 m.t. Charter boat catch per hour fished decreased 20%, 3.93 kg/hr down from 4.91 kg/hr in FY98, while catch per gear hour also decreased 16%, 1.52 kg/gr-hr down from 1.80 kg/gr-hr.

Bottomfishing

An estimated 63.2 m.t. of bottomfish were landed during FY99, a increase of 57% from FY98. The bottomfish catch (Table 3) was dominated by four major families: Lutjanidae or snappers (16.4 m.t., 26% of the total bottomfish catch), *Lethrinidae* or emperors (13.0 m.t., 21), *Serranidae* or groupers (5.8 m.t., 9%), and *Carangidae* or trevallys and jacks (4.1 m.t., 6%). Compared with FY98, *Lethrinidae* catches increased 80%, *Lutjanidae* catches increased 106%, *Carangidae* catches increased 8%, and *Serranidae* catches decreased 19%.

TABLE 3: Composition of the Guam bottomfish catch during FY99 by Family* and most common species. Estimated weights are in kilograms.

Family/Species	Total Catch	% Total Catch
<i>Lutjanidae</i>	16,411	30
<i>E. coruscans</i>	6,742	41+
<i>L. kasmira</i>	2,926	18+
<i>P. auricilla</i>	1,874	11+
<i>A. rutilans</i>	1,198	7+
<i>A. virescens</i>	933	6+
<i>P. zonatus</i>	889	5+
<i>Lethrinidae</i>	13,061	21
<i>L. rubrioperculatus</i>	5,079	39+
<i>L. harak</i>	2,114	16+
<i>L. xanthochilus</i>	1,839	14+
<i>L. obsoletus</i>	1,615	12+
<i>L. olivaceus</i>	745	6+
<i>Serranidae</i>	5,800	9
<i>E. fasciatus</i>	3,636	63+
<i>C. igarashiensis</i>	619	11+
<i>Carangidae</i> *	4,135	7
<i>Seriola dumerili</i>	1,286	31+
<i>C. sexfasciatus</i>	787	19+
<i>C. lugubris</i>	725	18+
<i>Holocentridae</i>	2,640	4
<i>Balistidae</i>	2,469	4
<i>Mullidae</i>	2,197	3
"Assorted bottomfish"***	13,795	22
Total	63,154	

*over 1000 kg. +% in respective Family **unable to obtain species breakdown

The dominant bottomfish species caught during FY99 were onaga (*Etelis coruscans*, 6.7 m.t.), the redgill emperor (*Lethrinus rubrioperculatus*, 5.1 m.t.), the black-tipped grouper (*Epinephelus fasciatus*, 3.6 m.t.), the bluelined snapper (*Lutjanus kasmira*, 2.9 m.t.), the

blackspot emperor (*L. harak*, 2.1 m.t.), the yellowtail kalikali (*Pristipomoides auricilla*, 1.9 m.t.), and the yellowlip emperor (*Lethrinus xanthochilus*, 1.8 m.t.), the yellowstripe emperor (*Lethrinus obsoletus*, 1.6 m.t.), the greater amberjack, (*Seriola dumerili*, 1.3 m.t.), and the silvermouth or lehi (*Aphareus rutilans*, 1.2 m.t.). The greatest increases were observed with onaga (6.7 m.t. from 19 kg), the yellowlip emperor (1.8 m.t. from 0.2 m.t.), the greater amberjack (1.3 m.t. from 0.3 m.t.), the blackspot emperor (2.1 m.t. from 0.7 m.t.), the bluelined snapper (2.9 m.t. from 1.3 m.t.), and the redgill emperor (5.1 m.t. from 2.1 m.t.). Decreases were observed with the honeycomb grouper (*Epinephelus merra*, 0.3 m.t. from 1.5 m.t.), the bigeye emperor (*Monotaxis grandoculus*, 0.3 m.t. from 1.4 m.t.), opakapaka (*Pristipomoides flavipinnis*, 0.3 m.t. from 1.0 m.t.), and the yellow spotted trevally (*Carangoides orthogrammus*, 0.4 m.t. from 1.1 m.t.). Other important bottomfish families encountered during FY99 include soldierfishes and squirrelfishes (*Holocentridae*, 2.6 m.t.), triggerfishes (*Balistidae*, 2.5 m.t.), goatfishes (*Mullidae*, 2.2 m.t.), tunas and mackerels (*Scombridae*, 0.7 m.t.), barracudas (*Sphyraenidae*, 0.5 m.t.), and wrasses, (*Labridae*, 0.4 m.t.). For 22% of the bottomfish catch, a species breakdown was not obtained due to time constraints imposed by the fishermen. Bottomfish trips that were interviewed were partitioned between shallow water and deepwater trips.

Comparing bottomfish participation with FY98, the number of bottomfish trips increased 18%, 10,365 trips up from 8,810. Approximately 83% of these trips were from non-charter boats. The number of persons participating in bottomfishing increased 38%, 49,747 compared with 36,263 in FY98, approximately 57% from non-charter fishing trips. There was an average of 4.89 trips on weekdays and 9.57 on weekends and holidays, with an overall average of 7.23 bottomfish trips per day. Bottomfish trips made up 32% total offshore trips, each trip averaging 4.0 hours and having 5.4 fishermen.

Comparing FY99 bottomfish effort with FY98, the number of boat hours increased slightly, 5%, 41,547 boating hours up from 39,538 hours. Approximately 90% of this effort were from non-charter boats. There were 145,812 bottomfish person-hours and 147,144 bottomfish gear-hours during FY99. Overall bottomfishing catch rates increased, compared with FY98. Catch per gear hour increased 34%, 0.43 kg/gr-hr compared with 0.32 kg/gr-hr in FY98.

Charter bottomfishing trips showed an overall increase in participation, effort, and CPUE compared with FY98. The number of charter bottomfish trips increased 8%, total catch increased 26%, 4.8 m.t. compared with 3.8 m.t., and the number of gear hours increased 7%, 36,518 compared with 34,230. CPUE increased 18%, 0.13 kg/gr-hr compared with 0.11 kg/gr-hr. The low CPUE value probably reflects the charter bottomfishing activity at the Agat Marina, which accounts for 80% of the total charter bottomfishing activity on Guam. The two main bottomfishing charter boats at Agat have up to three trips daily, fish in the same general area, and have up to 25 gear units per trip. These boats catch primarily goatfish and triggerfish which are generally released. However, they usually do not release large fish, and keep a part of the catch for sashimi.

Similar increases were observed with non-charter bottomfishing trips. The number of non-charter bottomfish trips increased 20%, 8,586 trips in FY99 compared with 7,168 trips in FY98, catch increased 57% 63.2 m.t. compared with 403 m.t. In FY98, and the number of gear hours increased 16%, 147,144 gear hours compared with 126,790 gear hours in FY98. CPUE increased 34%, 0.43 kg/gr-hr compared with 0.32 kg/gr-hr in FY98.

Deep water species comprised 23% of the total bottomfish catch (Table 4). Deep bottomfish more than tripled, 14.4 m.t. compared with 4.6 m.t. in FY98. Deep bottomfish was dominated with onaga (6.7 m.t.), yellowtail kalikali (*P. auricilla*, 1.9 m.t.), silvermouth or lehi (*Aphareus rutilans*, 1.2 m.t.), the greater amberjack (*S. dumerili*, 1.3 m.t.), gindai (*P.*

zonatus, 0.9 m.t.). Approximately 0.9 m.t. of deep bottomfish was not identified to the species level due to time constraints imposed by the fishermen.

TABLE 4: Composition of the Guam deep bottomfish catch during FY99. Estimated weights are in kilograms.

Species	Total Catch (kg)	% Total Deep Bottomfish Catch
<i>Etelis coruscans</i>	6,742	30.8
<i>Pristipomoides auricilla</i>	1,874	21.0
<i>Seriola dumerili</i>	1,286	13.2
<i>Aphareus rutilans</i>	1,198	8.3
<i>P. zonatus</i>	889	6.2
Misc. deep bottomfish*	867	6.0
<i>Cephalopholis igarashiensis</i>	619	4.3
<i>P. flavipinnis</i>	324	2.3
<i>P. filamentosus</i>	289	2.0
<i>E. carbunculus</i>	224	1.6
<i>P. argyrogrammicus</i>	67	<1
Total	14,379	100.0

*unable to obtain species breakdown

Atulai Night-Light Jigging

Atulai night-light jigging trips were encountered year round during FY99. This method experienced the most significant decrease in participation and catch compared with other offshore survey methods. An estimated 21.6 m.t. of fish were landed, a 31% decrease from the 31.3 m.t. landed in FY98 (Table 5). Atulai comprised 90% of the night-jigging catch, a 15% increase from FY98. The remainder of the night-jigging catch consisted of dogtooth tuna (*Gymnosarda unicolor*, 0.8 m.t.), the white-margined lyretail grouper (*V. albimarginata*, 0.6 m.t.), *Carangidae* species (0.2 m.t.), *Sphyraenidae* species (0.2 m.t.), and a species of *Dasyatididae* (0.2 m.t.).

TABLE 5: Composition of the Guam atulai or bigeye scad (*Selar crumenophthalmus*) night jigging catch during FY99. Weights are in metric tons.

Species	Total Catch (kg)
<i>Selar crumenophthalmus</i>	19.5
<i>Gymnosarda unicolor</i>	0.8
<i>Variola albimarginata</i>	0.6
<i>Carangidae</i>	0.2
<i>Sphyraenidae</i>	0.2
<i>Dasyatididae</i>	0.2
Other	0.1
Total Catch (kg)	21.6

The number of atulai trips decreased 45% in FY99, 917 trips compared with 1,655 trips in FY98. Effort comprised of 5,258 fishing hours, 12,575 person hours, and 14,674 gear hours. The number of gear hours decreased 61% compared with FY98, 14,674 gear hours compared with 37,976 in FY98. CPUE, however, increased. Catch per gear hour increased 52%, 1.47 kg/gr-hr compared with 0.82 kg/gr-hr, since the number of gear hours decreased proportionally more than the overall catch. Atulai night-jigging had an average of 0.97 trips

per day, 0.87 on the weekdays and 1.06 trips on weekends and holidays. Each trip had an average of 2.2 fishermen fishing an average of 6.1 hours. Average catch rates were 1.5 kg/gear-hr and 4.1 kg/hr.

Spearfishing

An estimated 61.4 m.t. of speared fish, crustaceans, and mollusks were landed during FY99 (Table 6), an increase of 11% from FY98. The finfish catch (Table 7) was dominated by surgeonfishes (*Acanthuridae*, 17.8 m.t.), parrotfishes (*Scaridae*, 11.5 m.t.), groupers (*Serranidae*, 2.8 m.t.), emperors (*Lethrinidae*, 1.8 m.t.), and mullets (*Mullidae*, 1.4 m.t.). The bluespine unicornfish (*Naso unicornis*) was the most important spearfish species taken, comprising 61% of the *Acanthuridae* catch and 19% of the total spearfish catch, followed by the Pacific longnose parrotfish (*Hipposcarus longiceps*, 2.7 m.t.), the yellowband parrotfish (*S. schlegeli*, 1.9 m.t.), and the bullethead parrotfish (*S. sordidus*, 1.4 m.t.). Marine invertebrates, *Trochus niloticus* (1.3 m.t.) and the spiny lobster (*Panilurus penicillatus*, 1.2 m.t.), followed in overall catch. For 19% of the spearfish catches, a species breakdown was not possible due to time constraints imposed by fishermen. For these interviews, an estimated catch weight, as well as participation and effort data, were taken.

TABLE 6: Composition of the Guam spearfish catch during FY99. Weights are in kilograms.

Family/Species	Total Catch (kg)	% Total Catch
<i>Acanthuridae</i>	21,415	35
<i>Naso unicornis</i>	12,511	58*
<i>N. lituratus</i>	4,391	21*
<i>A. caesius</i>	1,458	7*
<i>A. xanthopterus</i>	776	4*
<i>Scaridae</i>	8,335	14
<i>Hipposcarus longiceps</i>	2,869	34*
<i>S. altipinnis</i>	1,029	12*
<i>S. schelegeli</i>	967	12*
<i>S. sordidus</i>	903	11*
<i>Kyphosidae</i>	2,001	3
<i>K. cinerascens</i>	2,001	100*
<i>Labridae</i>	3,133	5
<i>Chelinus undulatus</i>	2,497	80*
<i>Chelinus trilobatus</i>	406	13*
<i>Lethrinidae</i>	2,211	4
<i>Monotaxis grandoculus</i>	707	32*
<i>L. olivaceus</i>	471	21*
<i>Palinurus penicillatus</i>	1,888	3
<i>Lutjanidae</i>	1,445	2
<i>L. bohar</i>	996	69*
<i>Mullidae</i>	1,421	2
<i>Parupeneus barberinus</i>	749	53*
<i>Serranidae</i>	1,209	2
<i>Epinephelus fasciatus</i>	303	25*
<i>Siganidae</i>	1,091	2
<i>S. punctatus</i>	437	40*
<i>S. argenteus</i>	392	36*
<i>Trochus niloticus</i>	854	1
Octopus	840	1

<i>Carangidae</i>	605	<1
<i>C. melampyus</i>	249	41*
<i>Balistidae</i>	468	<1
<i>B. viridescens</i>	272	58*
Assorted Reef Fish**	10,957	18
Total	61,350	100

*% in respective Family

**unable to obtain species breakdown

Comparing participation, the number of trips decreased 12%, 3,076 trips in FY99 compared with 3,515 trips in FY98, while the number of people spearfishing increased 6%, 10,702 people, compared with 10,054 people in FY98.

There were 1,919 snorkel spearfishing trips, 62% of all spearfishing trips in FY99 (See Table 7), a 26% decrease from FY98. Snorkel spearfishing harvest was 21.3 m.t., a slight decrease of 3% compared with 21.9 m.t. in FY98. Snorkel spearfishing averaged 1.37 trips a day, 0.75 trips on weekdays and 1.66 trips on weekends and holidays. Each trip averaged 3.3 hours and 3.2 fishermen, with an average CPUE of 1.31 kg/gr-hr. The change in CPUE is only a negligible 0.06 kg/gr-hr higher than with FY98. Hours spent snorkel spearfishing decreased 23%, 5,956 compared with 7,750 in FY98, the number of people fishing remained the same, while the number of gear hours decreased 7%, 16,295 compared with 17,455 in FY98. The most common species caught were the bluespine unicornfish, 3.2 m.t., the orangespine unicornfish (*N. lituratus*, 1.8 m.t.), and the gray unicornfish (*Naso caesius*, 1.3 m.t.), 15%, 8%, and 6% respectively of the total snorkel spearfishing catch. Approximately 3,799, or 18%, of the snorkel spearfish catch was estimated due to time constraints imposed by the fishermen.

TABLE 7: Comparison of Participation and Catch between snorkel spearfishing and SCUBA spearfishing during FY99.

Spearfishing Method	Number of Trips	Catch (mt)	Catch/Trip (kg/trip)	Catch/Gear Hr (kg/gh)
Snorkel Spear	1,919	21.3	11.1	1.31
SCUBA Spear	1,152	40.0	34.68	6.57
Total*	3,071	61.3		

*Excludes mixed spearfishing activity, which accounts for 5 trips and 129 kg during FY99.

SCUBA spearfishing had 1,152 trips during FY99, 37% of all spearfishing trips (Table 7). This is an increase of 27%, compared with 905 trips in FY98. SCUBA spearfishing account for 65% of the total spearfish catch, approximately 40.0 m.t., a 19% increase from the 33.7 m.t. caught in FY98. SCUBA spearfishing averaged 0.7 trips a day, 2.0 hours per fishing trip, 3.8 fishermen per trip, with an average catch rate of 6.57 kg/gear-hour and 34.68 kg/trip. The average catch rates of 6.6 kg/gear-hour and 34.7 kg/trip are slightly lower than FY98, 8% and 7% respectively. Hours spent SCUBA spearfishing increased 29%, 2,144 compared with 1,659 in FY98, the number of people engaged in SCUBA spearfishing increased 17%, 3,892 people compared with 3,317 people in FY98, while the number of gear hours increased 30%, 6,079 compared with 4,678 in FY98. The most common species caught by this method were the bluespine unicornfish, 9.3 m.t., the Pacific longnose parrotfish, 2.6 m.t., and the orangespine unicornfish, 2.6 m.t., the humphead wrasse or Napoleonfish (*Cheilinus undulatus*, 2.4 m.t.), the highfin rudderfish (*Kyphosus cinerascens*, 1.4 m.t.), and the spiny lobster, 1.2 m.t.

Other Methods

Boat-based fishing methods other than trolling, bottomfishing, spearfishing, and jigging are regularly encountered during the offshore surveys. These methods often use boats to access fishing areas that are not easily accessible from shore. The most important boat-based methods in this category encountered during FY99 were the surround net (39.8 m.t.), gillnet (29.2 m.t.), castnet (2.2 m.t.), jigging (1.7 m.t.), and spincasting (1.0 m.t.). Approximately 78% of the catch in this category were atulai that were caught using gillnets and surround nets. Other major species caught by these methods were the reef blacktip shark (*Carcharhinus melanopterus*, 4.3 m.t.) the fringelip mullet (*Crenimugil crenilabis*, 2.0 m.t.), the yellow-spotted trevally (*Carangoides orthogrammus*, 0.7 m.t.), the bluefin trevally (*Caranx melampygus*, 0.7 m.t.), and the yellowstripe goatfish (*Mulloidis flavolineatus*, 0.6 m.t.).

DISCUSSION

The total offshore catch for FY99 decreased slightly, 4%, compared with the total offshore harvest in FY98. Comparing only trolling, bottomfishing, atulai night-light jigging, and spearfishing, a 6% decrease in overall catch is observed.

Trolling showed an overall increase in participation, yet showed significant decreases in overall catch and CPUE. Comparing charter and non-charter trolling activity, the only increase was observed with the number of trips, persons, and hour spent fishing with non-charter boats. Bottomfishing, on the other hand, showed increases in participation, effort, and catch for both charter and non-charter bottomfishing. The CPUE for bottomfishing, especially for charter boats, is still considered significantly low. Snorkel spearfishing participation, effort, and catch, too, showed a general decrease compared with FY98. Despite the general decrease, a slight increase in CPUE (kg/gr-hr) was observed since the number of gear hours decreased proportionally less than the overall catch. SCUBA spearfishing participation, effort, and catch showed a general increase. However, the CPUE (kg/gr-hr) showed a decrease compared with FY98 since the number of gear hours increased proportionally more than the overall catch. On the other hand, atulai night-light jigging showed a significant decrease in catch, participation, and effort. The CPUE (kg/gr-hr), however, showed a significant increase since the gear hour decreased proportionally more than the overall catch decreased.

The increase in catch, participation, and effort of bottomfishing, combined with the continued unrestricted SCUBA spearfishing participation and effort could further negatively impact Guam's already over-utilized marine resources. A historic decrease in CPUE for bottomfishing and snorkel spearfishing is already observed, indicating a decrease in nearshore and reef-associated fish populations. Should an increase in bottomfishing, SCUBA spearfishing, and other boat-based fishing methods such as gillnetting continue, many important reef-associated species could be negatively impacted even further. SCUBA spearfishing presents a serious threat since a significant portion of the SCUBA spearfishing activity are commercial ventures that use state-of-the-art equipment, perform multi-tank dives as often as three times a week, and dive as deep as 50 meters. The FY99 SCUBA spearfishing catch could be underestimated since a significant portion of SCUBA spearfishing activity occurs at ports not surveyed, especially Ylig bay, which provides access to fishing resources on the east side of Guam. Individuals in these groups, too, possess bang sticks, using them to both fend off sharks and to take large individual fish. Unrestricted use of this method can become a serious threat to the fishery by removing the large individuals of parrotfishes, groupers, and wrasses such as the Napoleonfish. During FY99, SCUBA spearfishing catch of Napoleonfish increased from 580g to 2.4 metric tons. At this rate, the numbers of large individuals of this reef species, like the humphead parrotfish (*Bolbometapon muricatum*) and eight-banded grouper (*Epinephelus octofasciatus*), could be reduced significantly in a short period of time.

Charter boat activity is still suffering from the drastic drop in the number of tourists as a result of the Asian economic crisis and from present tourists seeking less expensive activities to do on Guam. Charter boats still account for a significant portion of the trolling activity, especially with blue marlin, which they target during the summer months.

During FY99, a significant increase was observed with deep bottomfishing. The estimated expanded catch for onaga, 6.7 metric tons, was due to a single highliner that did a significant amount of deep bottomfishing, reportedly in CNMI waters north of Guam.

RECOMMENDATIONS

The new survey design and computerized database analyzing the offshore data is still undergoing quality control and development. Although the inputting of all the historical offshore data is near completion, the data is currently undergoing several quality control tests to ensure that strata in the historical offshore data such as fishing method, deep versus shallow bottomfishing, and charter versus non charter fishing, are correctly inputted into the database. The new offshore expansion program will provide a standard methodology in order to obtain a more reliable history of the various offshore and reef-associated fisheries that are covered under the offshore fisheries project. It is recommended to continue working with NMFS on completing the offshore expansion program, entering historical data for re-expansion and analysis, and designing outputs that will be important in analyzing Guam's fisheries.

The interviews obtained in the offshore survey provide information including participation, effort, total catch, a species breakdown, sizes of individual fish, and area fished. Other important strata are charter activity and deep versus shallow bottomfishing. For mahimahi and species of *Scarus*, the historical and present data do, at times, record size and sex of individual fishes. The change in the size of pelagic fish and important reef-associated fishes such as groupers, parrotfishes, snappers, and wrasses should be analyzed to see if the effect of fishing pressure on particular species from the beginning of the offshore program. The historical data on size and sex of species of *Scarus* can be analyzed to see if fishing pressure has affected the size of reproducing individuals. The computer outputs to obtain this data should be completed with the assistance of NMFS during FY00.

PROGRAM COSTS

The estimated cost is approximately \$514,000.

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