Appendix 2

Guam

CONTENTS

Summary

The new offshore creel survey expansion system utilizes a database format to expand the offshore survey data. The new format separates the charter and non-charter components, allows for the distinction between the shallow and deep bottomfish complexes, and provides for the collection of bycatch data. This improvement, combined with the addition of the Merizo boat ramp in 1991 and the Agat Marina in 1994 as offshore sampling ports, and recent revisions of expansion algorithms have contributed to the increased efficiency in the production and reliability of the Guam annual reports. This has become important in recent years as overall fish stocks appear to be declining and management decisions are being made based on data that is collected. Although complemental statistics of confidence and analysis of biological and species composition data are not possible at this time, Guam's Department of Agriculture's Fisheries Section is continuing work with the WPacFIN program coordinator to further develop the expansion system to eventually include production of such analyses. Work is currently being done to integrate the inshore creel census data with the offshore creel census data in order to obtain a better idea of BMUS species recorded by both data collection entities of DAWR's Fisheries section.

The bottomfish fishery data in 1998 indicated that Guam's aggregate CPUE for all bottomfishing may have been in a "yellow light" condition, an indicator of fishery stress. However, the charter and non-charter components were expanded separately in 1999 and a "yellow light" condition was not observed with the non-charter component. The bottomfish charters, primarily the Agat Marina bottomfish charters, may have skewed the overall CPUE toward a "yellow light" condition due to the high effort and low catch of this component of bottomfishing. Nonetheless, anecdotal evidence from local fishermen and creel census data do show that the bottomfish fishery is stressed. The sizes of bottomfish are decreasing, especially those of the shallow water complex. Unfortunately, these fish are usually not released despite their small size, although more fishermen are practicing release of small fish and less desirable species.

Total and BMUS bottomfish harvest decreased in 2001, except for the charter component of the total bottomfish harvest. Total bottomfish landings decreased 17%, with the non-charter and charter components decreasing 18% and increasing 45% respectively. Total BMUS landings decreased 13%, with the non-charter and charter components decreasing 15% and 8% respectively. The non-charter component makes up 98% of the total bottomfish and BMUS harvest. The CPUE for all bottomfish increased slightly, 3%, while the non-charter CPUE remaining the same. The charter CPUE increased 23%.

The commercial sale of BMUS species increased 16% in 2001, with the adjusted revenue increased 10%. The number of boats bottomfishing, the number of bottomfish trips, and the number of hours spent bottomfishing in 2001 increased 8%, 9%, and 3% respectively.

Historical Annual Statistics

Year	Total Bottomfish Landings (lbs)	CPUE (lbs/hour)	CPI	Adjusted Revenue ($)	Adjusted Price/lb ($)	Number of Boats
80			134.0	42,966	4.55	
81			161.4	58,245	5.50	
82	40,080	7.2	169.7	39,471	5.68	154
83	46,976	6.3	175.6	190,585	5.15	106
84	57,197	7.3	190.9	189,265	4.97	144
85	86,134	5.7	198.3	184,917	4.70	161
86	36,441	5.2	203.7	64,288	4.42	118
87	45,034	5.8	212.7	55,298	4.38	139
88	67,773	4.9	223.8	66,524	4.18	198
89	84,016	5.6	248.2	95,299	4.85	223
90	74,718	4.5	283.5	88,944	4.70	226
91	69,985	4.8	312.5	50,662	4.49	246
92	85,657	5.8	344.2	44,045	4.13	236
93	95,887	4.2	372.9	39,536	3.88	360
94	107,512	5.6	436.0	120,369	3.97	298
95	106,561	2.5	459.2	48,813	3.53	402
96	151,444	4.1	482.0	18,885	2.74	408
97	103,707	3.7	489.7	32,115	3.02	332
98	97,187	2.6	487.1	48,964	3.32	354
99	128,008	3.2	496.0	110,837	3.60	411
00	146,481	3.7	505.9	81,246	3.49	312
01	**121,427**	**3.8**	**499.4**	**89,844**	**3.28**	**337**
Average		4.5	322.12	80,051	4.26	258
Std. dev.		1.1	136.38	50,920	0.81	102

Introduction

There are two distinct bottomfish fisheries on Guam that can be separated by depth and species composition. The shallow water complex (<500 feet) makes up a larger portion of the total bottomfish effort and harvest, comprised primarily of reef-dwelling snappers, groupers, and jacks of the genera *Lutjanus*, *Lethrinus*, *Aprion*, *Epinephelus*, *Variola*, *Cephalopholis* and *Caranx*. The deepwater complex (>500 feet) consists primarily of groupers and snappers of the genera *Pristipomoides*, *Etelis*, *Aphareus*, *Epinephelus*, and *Cephalopholis*.

Bottomfishing on Guam is a combination of recreational, subsistence, and small-scale commercial fishing. This fishery can be highly seasonal in that effort significantly increases when sea conditions are generally calmer during the summer months, although calm sea conditions can occur every month of the year. During these periods, fishing activity increases dramatically on the east side of the island, a more productive fishing area. The majority of people in this fishery are either subsistence or part-time recreational fishermen that operate vessels less than 25 feet in length, target primarily the shallow water bottomfish complex and combine some trolling effort to supplement their bottomfishing effort.

The Agana Boat Basin is centrally located on the western leeward coast and serves as the island's primary launch site for boats fishing areas off the central and northern leeward coasts and the northern banks. Most commercial trolling activity operates out of this site. The Merizo boat ramp, Seaplane Ramp in Apra Harbor, Umatac boat ramp, and Agat Marina are boat launch sites which provide access to the southern coast, Apra Harbor, Cocos Lagoon, and the southern banks. The Agat Marina, located between the Agana Boat Basin and the Merizo boat ramp, provides trailered boats from the northern and central areas of the island a closer and more convenient launch site to the southern fishing grounds. A makeshift ramp at Ylig Bay provides access to fishing areas on the eastern side of the island, and is heavily used during periods of calm weather. Surveying this part of the island, specifically the Ylig makeshift ramp, during the summer months has been proposed since this area may harvest significant quantities of BMUS species, either by Bottomfishing or spearfishing. However, a lack of adequate lighting and other safety issues make surveying this area challenging. At present, Department of Agriculture's Fisheries Section conducts its offshore creel surveys at the Agana Boat Basin, the Agat Marina, and the Merizo boat ramp.

A significant addition to bottomfishing activity effort in recent years is the charter fishing boats that can make several two to four hour trips daily. These charter vessels range from typical trolling charter boat with patrons who opt to Bottomfish, to larger bottomfishing-only vessels that can accommodate as many as 35 patrons per trip. The larger vessels tend to fish in the same general area and release most of their catch, which have become primarily small triggerfish, groupers, and goatfish. These boats will have been known to keep larger fish and use a portion of the smaller catch to serve as sashimi for their guests. This sector, primarily the Agat charters, has been experiencing a decline in the number of trips and guests as a result of declining tourists from Asia. Fishing continuously in the same area has brought about a virtual absence of large fish that their guests can catch. The practice of other fishing methods in the same area in Agat, such as gillnetting and spearfishing, also occur in the same area. This may also contribute to the types and sizes of fish caught.

In 2001, the U.S. Navy began testing for PCBs around the Orote peninsula, located south of Apra Harbor. Preliminary testing of several fish species showed that a few fish had high levels of PCB. A warning about PCB contaminated fish has been issued for all marine foodfish and invertebrates caught from Orote to Agat. A decline in

fishing around Orote may have decreased fishing activity in that area, but may have also increased fishing in other areas. The final results of the PCB testing should be completed in 2002.

Agriculture's Fisheries Section began collecting information on bycatch as part of its offshore creel census at the beginning of 2000 as a requirement of the bottomfish FMP. This will provide information on the effect bottomfishing may have on fish species that are caught but discarded, a practice observed quite frequently with the charter sector, and beginning to be observed with the non-charter sector. The release of small fish back into the marine environment is a small but significant action taken by some fishermen as a response to declining numbers and smaller sizes of preferred food fish.

The demand for both deep and shallow-water bottomfish continues to exceed the locally-caught supply. Although Guam's deepwater bottomfish fishery has limited economic importance, especially in the absence of highliner vessels, the cultural value of the shallow water complex remains high due to the popularity of this assemblage of fish as food items. Some of the demand for bottomfish is offset with imports from the Philippines and Micronesia. This demand, however, may be contributing to the overall decline in nearshore and reef-associated bottomfish populations.

In 2000, Guam began enforcing fishing activity in five marine preserves that were established in 1997. These preserves were established due to an overall decline in the numbers and sizes of nearshore fisheries surveyed by DAWR's inshore fishery program. While three preserves are strictly no-take areas, two preserves, the Pati Point and Tumon Bay preserves, allow limited fishing. These preserves also include no fishing up to 200 meters beyond the reef, restricting shallow water bottomfishing. These preserves appear to be working, as information from fishermen fishing in adjacent areas and from divers have observed more fish and larger fish. However, a lack of consistent enforcement has not eliminated fishing in these areas, especially boat-based fishing methods that include bottomfishing. Effective enforcement, which relies heavily on local funding, is necessary in order to allow near shore and reef-associated bottomfishing stocks to recover. BMUS species such as the larger groupers and snappers, which have been heavily impacted by fishing, may have a difficult time recovering as a result of a lack of effective enforcement and an increase in boat-based fishing activity.

Recommendations

Status of 2000 recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, and analysis of mean fish size, and separation between the shallow and deepwater bottomfish complexes. Inputting the remaining historical offshore data that should have been completed in 2001 is still ongoing. The loss of three fisheries staff during 2001 and an increase in other fisheries projects has delayed this recommendation from being completed during 2001.

2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. The loss of fisheries staff during 2000 and an increase in other fisheries projects have prevented the Ataloa bottomfishing data from being analyzed.

3. The establishment of mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes has not been completed during 2001, although the offshore expansion program is being fine-tuned and integration of the offshore and inshore creel survey data has began. Guam's offshore coordinator and NMFS Honolulu lab staff continues to make progress towards completing this recommendation.

2001 Recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, mean fish size, and separating the shallow and deepwater complexes. Inputting the remaining five years of offshore data should be completed in 2002, although the loss of staff and an increase in fisheries projects have made completion of this recommendation slow.

2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. DAWR's fisheries staff has discussed making progress towards completing this study during 2002.

3. With additional funding from the WPacFIN program and technical assistance from NMFS, Guam's DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes.

Tables

Figures and Tables

Table 1. Guam 2001 Expanded Offshore Creel Survey Composition Of Bottomfish Management Unit Species (BMUS)

Management Unit Species	Total Harvest*(lbs)
Lehi (*A. rutilans*)	1,311
Uku (*A. virescens*)	2,182
Ehu (*E. carbunculus*)	5,450
Onaga (*E. coruscans*)	2,905
Yellowtail Kalekale (*P. auricilla*)	4,209
Opakapaka (*P. filamentosus*)	1,838
Yelloweye Opakapaka (*P. flavipinnis*)	354
Gindai (*P. zonatus)*	6,491
Ta'ape (*L. kasmira*)	2,169
Other Snappers	5,987
Jacks (*C. ignobilis, C. lugubris*)	2,757
Amberjack (*S. dumerili)*	849
Other Jacks	15,671
Groupers (*C. urodeta, E. fasciatus, V. louti*)	5,238
Other Groupers	10,014
Emperors (*L. rubrioperculatus*)	13,690
Other Emperors	35,271
Total	**116,386**

*Bottomfishing method only

Table 2. Guam 2001 Commercial Bottomfish Average Prices

Species	Average $/lb
Amberjack	2.70
Ehu	3.99
Kalekale	3.39
Lehi	4.00
Onaga	4.29
Opakapaka	4.00
Uku	3.27
Gindai	3.99
Black Jack	2.57
Misc. Jacks	2.47
Groupers	2.41
Emperors	3.10
Snappers	2.63
Misc. Deep Bottomfish	3.71

Misc. Bottomfish	2.96
All Bottomfish Species	**3.53**

Figure 1a. Guam Harvest of All Bottomfish Species

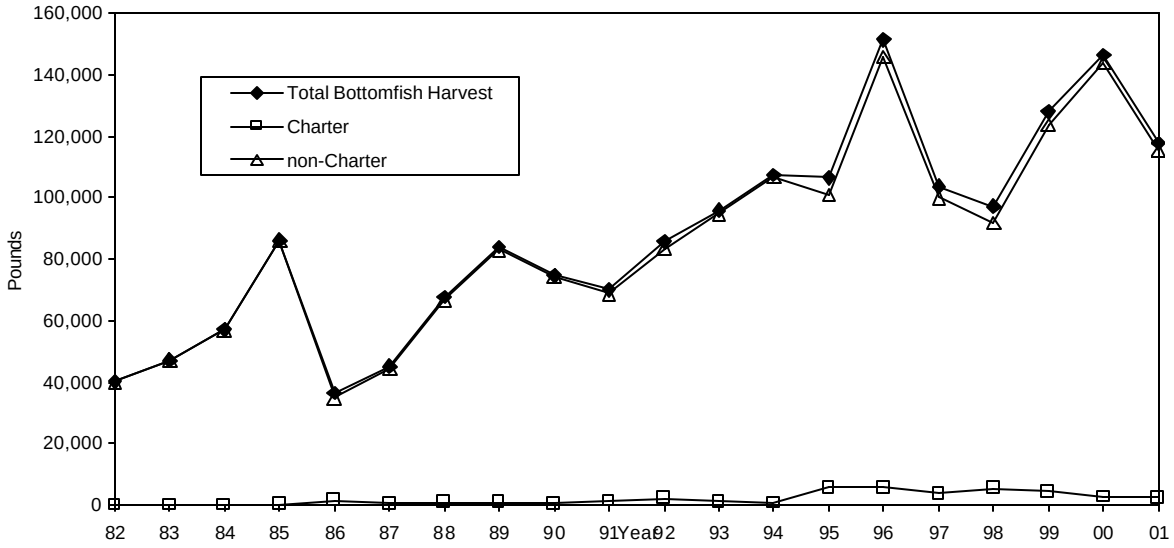
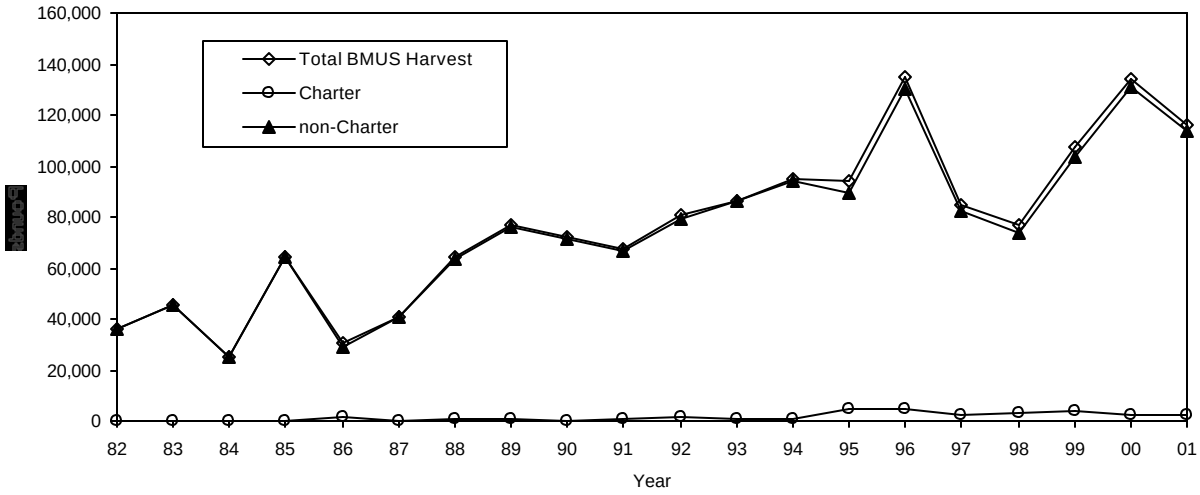


Figure 1b. Guam Harvest of BMUS Species



Interpretations: Historically, annual fluctuations of BMUS landings were usually due to highliners entering or leaving the fishery during a given year. The peak in 1985 of BMUS species harvested was the result of a number of

highliner fishermen who fished in 1985 and then left the fishery the following year. The decrease in the "all bottomfish" category observed in 1997 may have been caused by the elimination of the bigeye scad or atulai, *Selar crumenopthalmus*, as part of the bottomfish catch in the 1997 expansion. The inclusion of this fish in previous bottomfish expansions, especially during a bumper harvest year such as 1996, likely had the effect of inflating bottomfish catch totals. Distinguishing the difference between methods used to catch the bigeye scad continues to be an ongoing challenge, since some fishermen have reported that bottomfishing is the method used to capture these fish. Training DAWR's offshore survey staff is ongoing in order to collect accurate data from fishermen to distinguish between the two methods.

In 2001, a decrease in bottomfish and BMUS harvest was observed. Total bottomfish decreased 17%, with the non-charter and charter sectors decreasing 18% and increased 45% respectively. BMUS harvest decreased 13%, with non-charter and charter sectors decreasing 15% and 8% respectively.

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings of the bottomfish species are selected from the expanded creel survey species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. assorted/shallow/deep bottomfish) also include some non-BMUS bottomfish according to the FMP definition (e.g. triggerfish, wrasses, goatfish).

Year	Total Bottomfish Harvest (lbs)	Non-charter Harvest (lbs)	Charter Harvest (lbs)
82	40,008	40,060	20
83	46,976	46,976	0
84	57,197	57,197	0
85	86,134	85,946	188
86	36,441	34,966	1,475
87	45,034	44,576	458
88	67,773	66,842	931
89	84,016	83,168	848
90	74,718	74,334	384
91	69,985	68,739	1,246
92	85,657	83,476	2,181
93	95,887	94,838	1,049
94	107,512	106,757	755
95	106,561	100,980	5,581
96	151,444	145,769	5,674
97	103,707	100,099	3,607
98	97,187	91,745	5,442
99	128,008	123,678	4,330
00	146,481	143,808	2,673
01	**121,427**	**117,557**	**3,870**
Average	94,369	92,057	2,312
Std. deviation	31,423	30,277	1,925

Year	Total BMUS Harvest (lbs)	Non-charter BMUS Harvest (lbs)	Charter BMUS Harvest (lbs)
82	36,449	36,429	20
83	45,609	45,609	0
84	24,884	24,884	0
85	64,696	64,508	188
86	30,411	28,936	1,475
87	40,722	40,410	311
88	64,696	63,764	931
89	76,678	75,831	848
90	71,791	71,437	354
91	67,358	64,464	894
92	80,826	79,287	1,539
93	86,595	85,930	665
94	94,886	94,316	570
95	93,875	89,392	4,483
96	134,624	129,819	4,805
97	84,946	82,381	2,565
98	76,580	73,412	3,168
99	107,537	103,400	4,137
00	133,984	131,311	2,673
01	**116,386**	**113,904**	**2,482**
Average	76,677	75,071	1,600
Std. deviation	31,689	30,587	1,570

Figure 2a. Total and Commercial BMUS Harvest

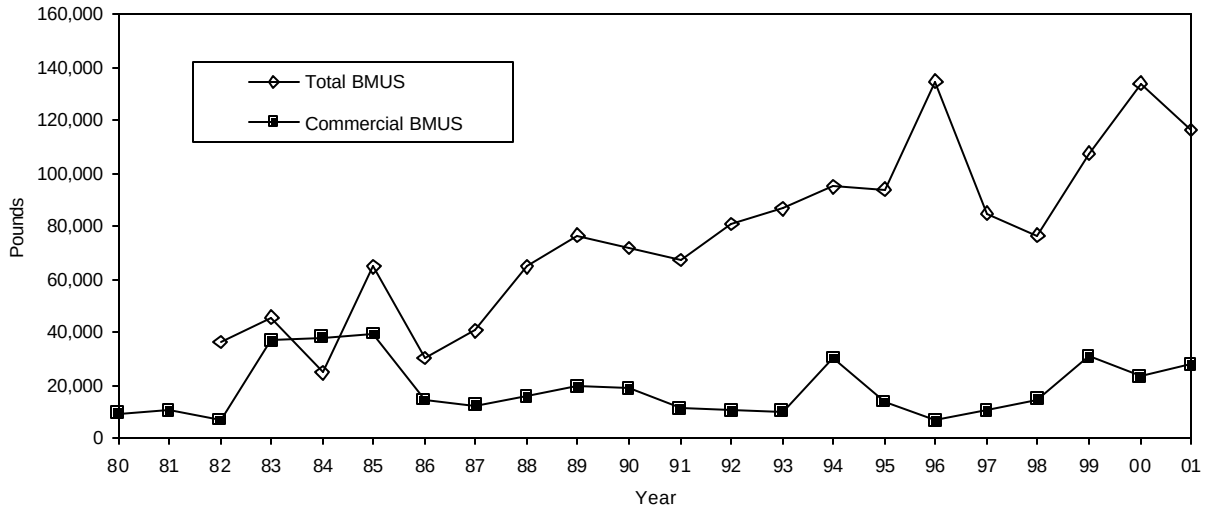
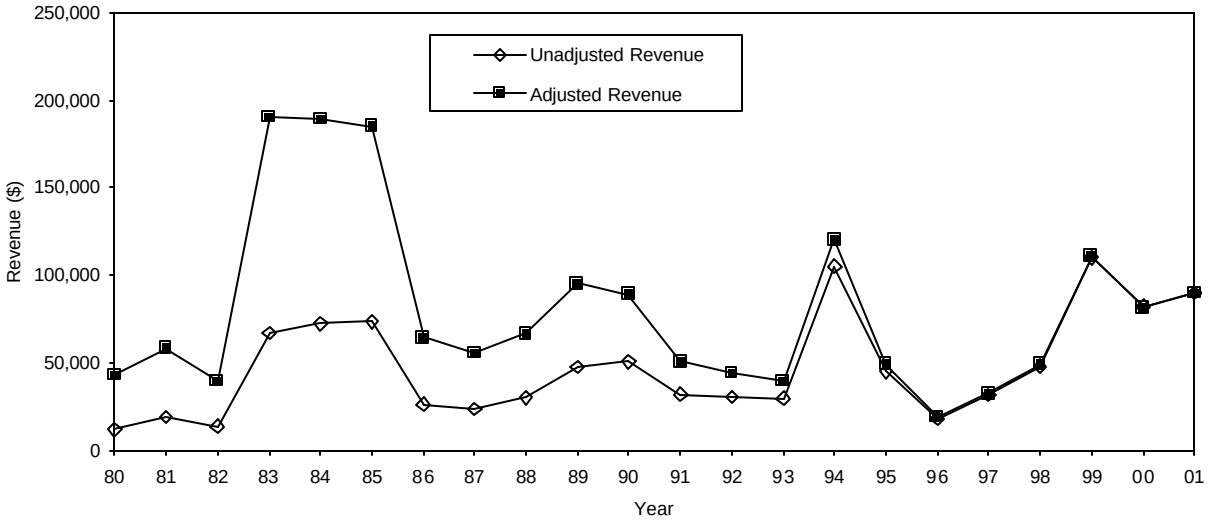


Figure 2b. Commercial BMUS Revenue



Interpretations: Highliners have generally been responsible for the peaks in the commercial BMUS landings, as was the case in 1983, 1985, 1994, 1998, and 1999. The threefold increase in 1994 of the commercial BMUS harvest and revenue was the result of highliner vessels entering into the fishery that year. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 are best explained by the absence or reduced effort of about six highliners who combined, have landed an average of 18% of the total BMUS harvests between 1992 and 1996, and 68% of the unexpanded commercial landings for the same period. Harvest records for these six highliners indicate a 45% reduction in 1995 of their total bottomfish harvest, dropping from 13,349 pounds in 1994, down to 6,023 pounds in 1995. This decline in highliner landings accounts for about two-thirds of the 1995

reduction in commercial BMUS harvest.

The peak in 1996 followed by a 46% decline the following year in total BMUS harvest is believed to have been influenced more by weather conditions than any other factor. In 1997, storms decreased the number of calm fishing days. Favorable weather conditions were also observed during 2001.

In 1996, the commercial BMUS harvest and adjusted revenue dropped to its lowest point ever, partially due to almost a complete absence of highliner activity that year. The slight increase in 1997 is attributed to a single highliner making several recorded trips to "Bank A," a rarely fished bank located 117 miles west of Guam. The increase in 1999 is likely the result of several highliners in the fishery, as well as an overall increase in participation and effort. A 10% increase in revenue was observed in 2001.

Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPacFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings database and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry and exit patterns, general dockside knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of best educated guesses.

Year	Total BMUS Harvest (lbs)	Commercial BMUS Harvest (lbs)	Unadjusted Revenue ($)	Adjusted Revenue ($)
80		9,434	11,528	42,966
81		10,596	18,825	58,245
82	36,449	6,947	13,412	39,471
83	45,609	36,984	67,013	190,585
84	24,884	38,113	72,349	189,265
85	64,696	39,327	73,438	184,917
86	30,411	14,532	26,219	64,288
87	40,722	12,639	23,551	55,298
88	64,696	15,933	29,818	66,524
89	76,678	19,630	47,365	95,299
90	71,791	18,916	50,479	88,944
91	67,358	11,278	31,703	50,662
92	80,826	10,668	30,355	44,045
93	86,595	10,191	29,526	39,536
94	94,886	30,356	105,126	120,369
95	93,875	13,815	44,865	48,813
96	134,624	6,896	18,229	18,885
97	84,946	10,621	31,485	32,115
98	76,580	14,737	47,770	48,964
99	107,537	30,757	110,066	110,837
00	133,984	23,294	82,316	81,246
01	**116,386**	**27,731**	**89,844**	**89,844**
Average	76,677	18,791	47,967	80,051
Std. deviation	31,689	10,486	29,697	50,920

Figure 3a. Estimated Bottomfish Boat Hours

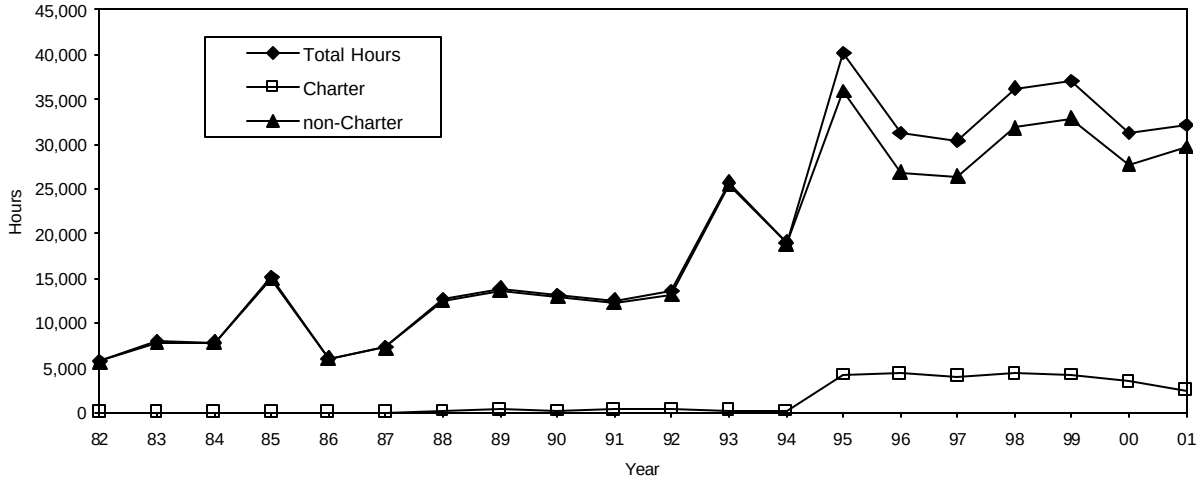
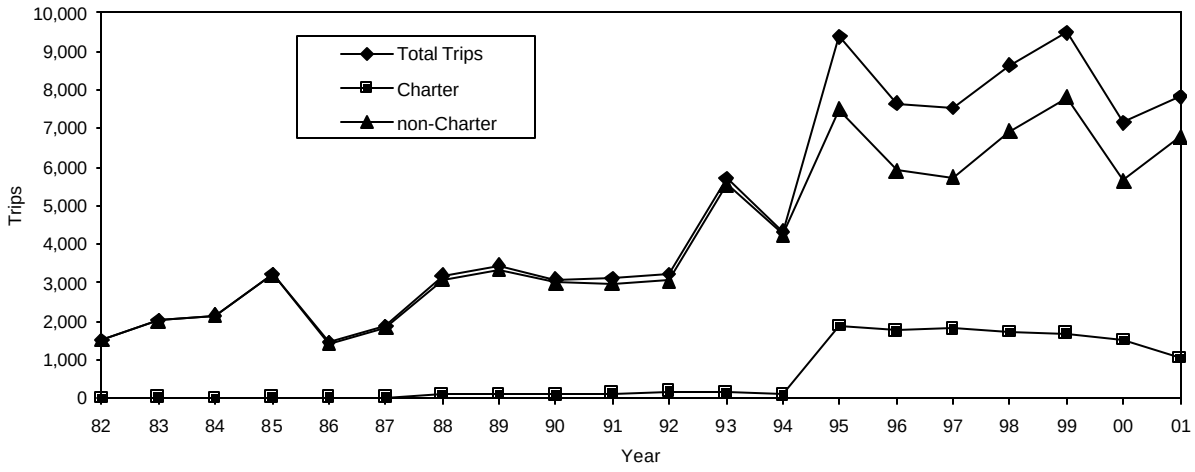


Figure 3b. Estimated Bottomfish Trips



Interpretations: The threefold increase in boating hours and doubling of bottomfish trips in 1995 may have been due to the 60% increase in the number of boats entering the fishery that year. Also, the number of calm days that year may have encouraged more bottomfishing activity than previous years. The increase in boat trips and hours may have also been due to adding the Agat Marina into the offshore survey in 1994. That year, the charter boat

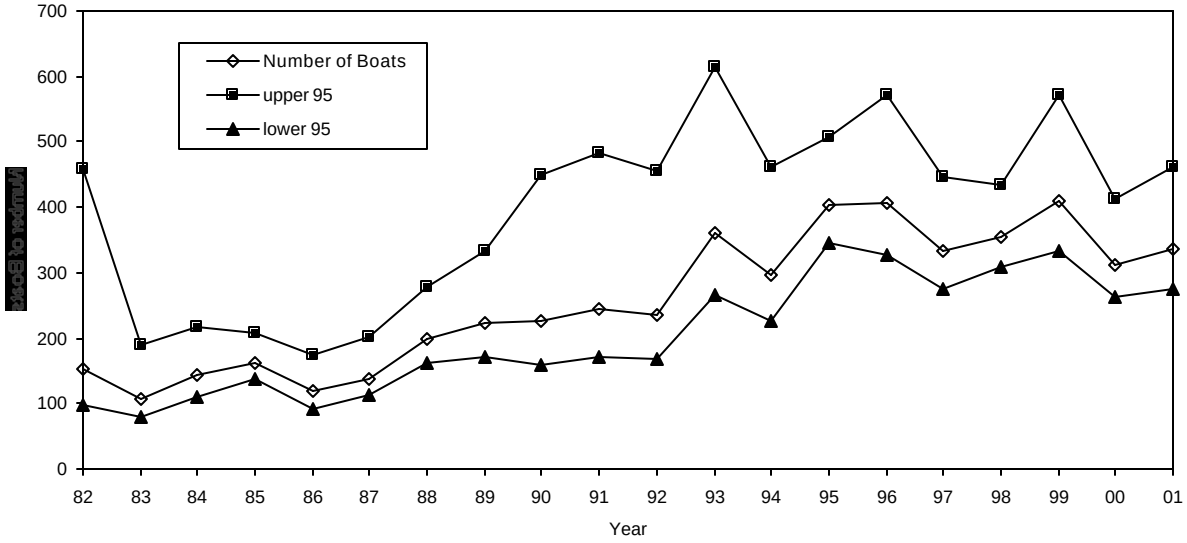
component of the bottomfish fishery accounted for 23% of the total number of bottomfishing trips and 13% of the hours fished. This increase may have been due to the inclusion of the Agat Marina, which had several charter bottomfishing vessels that made multiple trips on each survey day. The number of charter trips decreased after 1997, possibly due to tourists participating in less expensive types of recreation. The slight declines in bottomfishing trips and hours in 1996 and 1997 were due to a number of typhoons that hit Guam those years. A return to more normal weather patterns in 1999 best explains the increases that year. The decreases in boating hours and trips observed in 2000 could be due to fishermen dropping out of the fishery due to poor catches in the shallow bottom complex. In 2001, overall hours and trips increased slightly, 3% and 9% respectively, with non-charter hours and trips increasing 7% and 20% respectively. The charter hours and trips, however, decreased 28% and 31% respectively. This sector, which is tourist dependent, continues to decrease due to a decrease in tourist numbers and a shift to less expensive activities by tourists.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Year	Total Hours	Non-charter hours	Charter hours	Total Trips	Non-charter trips	Charter trips
85	15,037	14,989	48	3,212	3,201	11
86	6,058	6,033	25	1,444	1,422	23
87	7,313	7,264	49	1,857	1,835	22
88	12,611	12,435	176	3,190	3,085	105
89	13,910	13,615	295	3,452	3,338	114
90	13,143	12,967	176	3,071	2,988	83
91	12,527	12,217	310	3,109	2,986	123
92	13,550	13,138	412	3,234	3,054	180
93	25,733	25,458	275	5,692	5,551	141
94	19,038	18,849	189	4,331	4,238	93
95	40,153	35,927	4,226	9,376	7,498	1,878
96	31,249	26,863	4,386	7,657	5,912	1,745
97	30,370	26,360	4,010	7,527	5,724	1,803
98	36,198	31,822	4,376	8,636	6,924	1,712
99	37,019	32,860	4,159	9,479	7,804	1,675
00	31,216	27,760	3,457	7,159	5,654	1,505
01	**32,140**	**29,665**	**2,475**	**7,820**	**6,783**	**1,038**
Average	19,933	18,479	1,454	4,796	4,183	613
Std. deviation	11,732	10,061	1,863	2,806	2,102	778

Figure 4. Guam bottomfish fishery participation



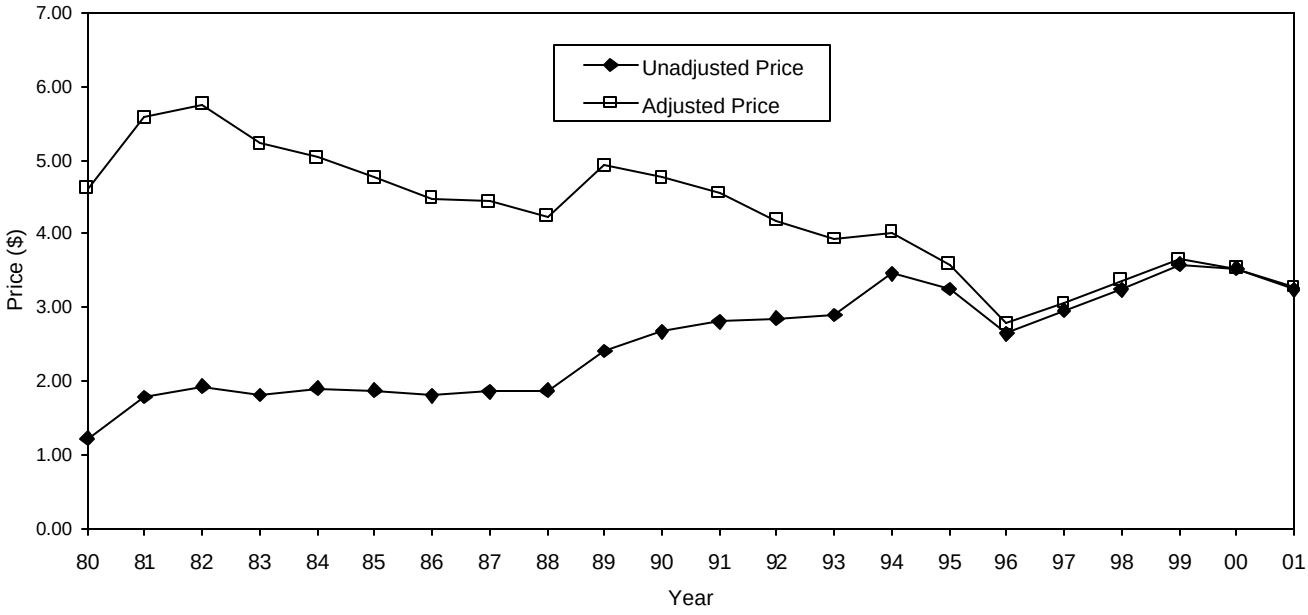
Interpretations: The number of boats participating in this fishery has leveled off in recent years, but generally increases during periods of better weather conditions and available marketing opportunities. The 57% increase in participation from 1992 and 1993 could be due to the inclusion of the Merizo Pier as a survey site in 1991, as well as a healthy economy that made it possible for more residents to afford boats. Another 57% increase occurred in 1995, due to the inclusion of the Agat Marina as an offshore creel survey site in October 1994. In general, most of the new boaters in the last six years are usually recreational vessels that bottomfish only part-time and primarily target the shallow-water bottomfish complex. A slight increase in the numbers of boats participating in bottomfishing occurred in 2001, increasing 8%.

Source: Offshore creel survey boat log data from DAWR's three sampled ports. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 2001 figure was obtained by first running the above-mentioned model 1,000 times using a randomly selected order of the days sampled at all three ports combined, then eliminating the upper and lower 25 estimates to rid the model of occasional outlier estimates; and finally calculating the mean and standard deviation for the remaining 950 estimates. The removal of the outliers conducted in the second step lowered the original estimated number of boats after the model was run 1,000 times by about 1%, but more important, reduced the standard deviation by approximately 20%.

Year	Lower95	Number of boats	Upper 95
82	99	154	459
83	80	106	190
84	111	144	218
85	138	161	207
86	93	118	175
87	112	139	202
88	162	198	278
89	172	223	333
90	159	226	450
91	170	246	482
92	167	236	456
93	266	360	615
94	226	298	463
95	346	402	507
96	327	408	573
97	276	332	447
98	308	354	435
99	333	411	573
00	263	312	413
01	**276**	**337**	**463**
Average	204	258	397
Std. Deviation	88	102	139

Figure 5. Average bottomfish prices



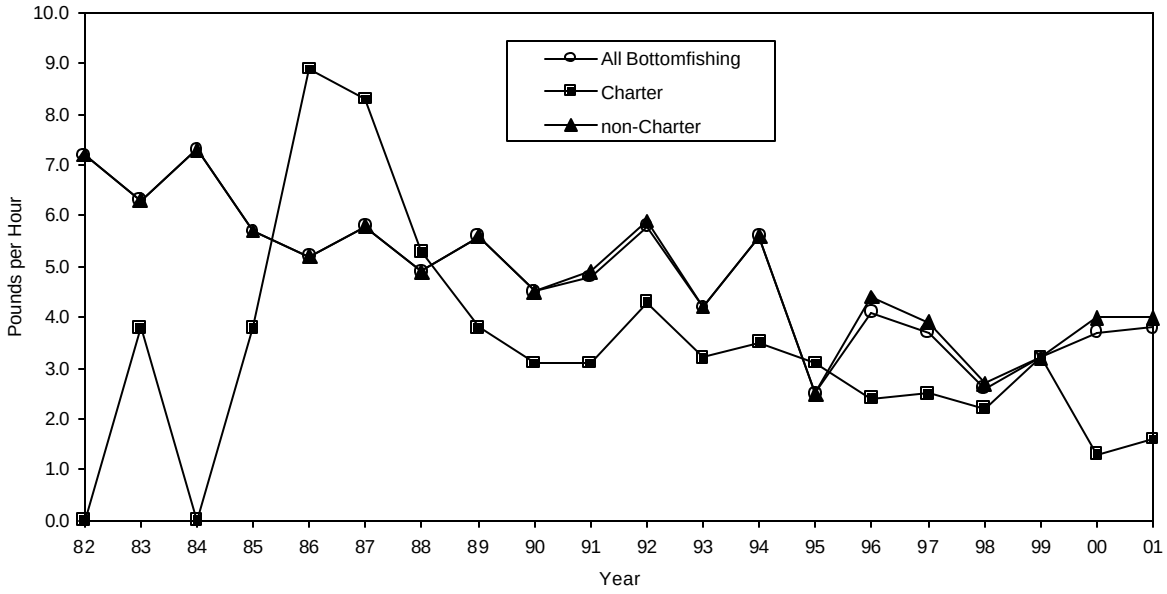
Interpretations: The decreases in adjusted fish prices observed prior to 1996 may have been the result of a consistent supply of reasonably priced fish and competition among vendors during those years. Roadside vendors importing fish from other islands did compete with and may have discouraged local vendors from increasing the price of locally caught bottomfish. These roadside vendors were shut down by the Department of Public Health due to health concerns, which resulted in the rise of bottomfish prices since less expensive fish from Micronesia could not be easily purchased. The adjusted average price for bottomfish has been increasing slightly from 1996 to 1999, and could likely have been the result of increased demand for a dwindling supply of locally caught fish. A slight decrease in fish prices occurred in 2001, decreasing 7%.

Source: The commercial landings data from the major wholesalers.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1998 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1998 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year. A new "market basket" was created by the Department of Commerce in 1998, which resulted in the CPI figure being reset in 1999. The CPI for Guam did not change for 2000.

Year	Unadjusted Price $/lb	Adjusted Price $/lb
80	1.22	4.61
81	1.78	5.57
82	1.93	5.76
83	1.81	5.22
84	1.90	5.03
85	1.87	4.76
86	1.80	4.48
87	1.86	4.43
88	1.87	4.23
89	2.41	4.92
90	2.67	4.76
91	2.81	4.55
92	2.85	4.18
93	2.90	3.93
94	3.46	4.02
95	3.25	3.58
96	2.64	2.78
97	2.96	3.06
98	3.24	3.37
99	3.58	3.65
00	3.53	3.53
01	**3.24**	**3.28**
Average	2.53	4.26
Std.deviation	0.71	0.81

Figure 6. Guam Bottomfish CPUE



Interpretations: Prior to 1999, the CPUE for bottomfishing was reported as a single value. Because of yellow light situations in 1995 and 1998, the fishery was divided into charter and non charter components, since the charter boats in Agat were observed to have high effort and low catches which may have skewed the overall CPUE.

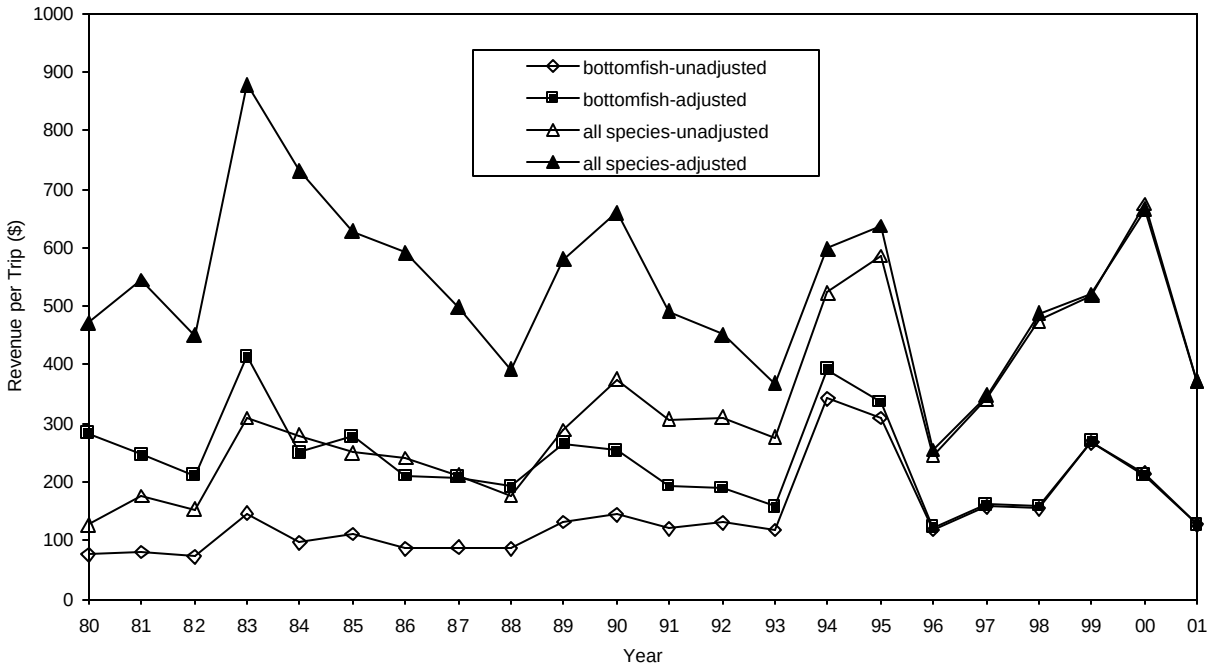
Historically, the CPUE has fluctuated around 4-6 pounds per hour and has, up until the last five years, remained fairly stable. In 1995 and 1998, the overall and non-charter CPUE fell below 2.8 pounds per hour, owing in large part to an increasing number of recreational and subsistence-type vessels continuing to enter into the fishery; most of which target the less-productive shallow-water bottomfish complex. Both 1995 and 1998 CPUE figures were less than a half of the aggregate CPUE average of 5.6 pounds per hour for the first three years reported using the new expansion system, placing the fishery in yellow light conditions those years. This indicates stress on the fishery, despite the rise in CPUE since 1999. The slight increase in overall CPUE was observed in 2001, 3%. The charter CPUE increased 23% in 2001, while the CPUE for non-charter boats remained the same. The 2001 CPUE values are still well below the 20-year average.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

	Catch per Unit Effort (lbs/hr)		
Year	**All Bottomfishing**	**Non-charter**	**Charter**
82	7.2	7.2	0
83	6.3	6.3	3.8
84	7.3	7.3	0
85	5.7	5.7	3.8
86	5.2	5.2	8.9
87	5.8	5.8	8.3
88	4.9	4.9	5.3
89	5.6	5.6	3.8
90	4.5	4.5	3.1
91	4.8	4.9	3.1
92	5.8	5.9	4.3
93	4.2	4.2	3.2
94	5.6	5.6	3.5
95	2.5	2.5	3.1
96	4.1	4.4	2.4
97	3.7	3.9	2.5
98	2.6	2.7	2.2
99	3.2	3.2	3.2
00	3.7	4.0	1.3
01	**3.8**	**4.0**	**1.6**
Average	4.8	4.9	3.4
Std.deviation	1.4	1.3	2.2

Figure 7. Guam average revenue per trip



Interpretations: The inflation-adjusted average revenue per trip for both the "bottomfish" and the "all species" categories decreased in 2001, 40% and 44% respectively. Previous drops in revenue were due to some of the more experienced fishermen not selling their catch to vendors participating in the DAWR commercial receipt book program. The increase in the amount of imported bottomfish from around Micronesia (Belau, Chuuk, Pohnpei, Kosrae, etc.) that began around 1991 with the addition of frequent airline routes to Guam, may explain the slight decrease in revenues between 1991 and 1993. Roadside vendors have, for the most part, been shut down, and most local vendors prefer purchasing locally caught fish. The substantial increases in the inflation-adjusted average revenue per trip in 1994 are best explained by the success of a few highliner vessels during that year. The decrease observed in 2001 may be partially due to commercial vendors not accepting bottomfish they consider too small for sale.

Source: The commercial landings data from major wholesalers.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip that landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Year	$/Trip, Unadjusted Bottomfish	$/Trip, Adjusted Bottomfish	$/Trip, Unadjusted All Species	$/Trip, Adjusted All Species
80	76	283	127	472
81	80	247	176	545
82	72	211	153	451
83	146	414	309	879
84	96	250	280	732
85	111	278	250	628
86	86	210	241	592
87	88	208	212	498
88	86	192	176	392
89	132	266	289	581
90	144	254	375	661
91	121	193	307	491
92	131	190	311	452
93	118	158	276	369
94	343	393	523	599
95	309	337	586	637
96	118	122	246	255
97	158	162	342	348
98	155	159	476	488
99	267	269	518	521
00	215	212	675	666
01	**127**	**127**	**372**	**372**
Average	145	233	328	529
Std. deviation	75	77	146	143

Figure 8a. Jacks/Trevallys (*Caranx, Carangoides*): Harvest

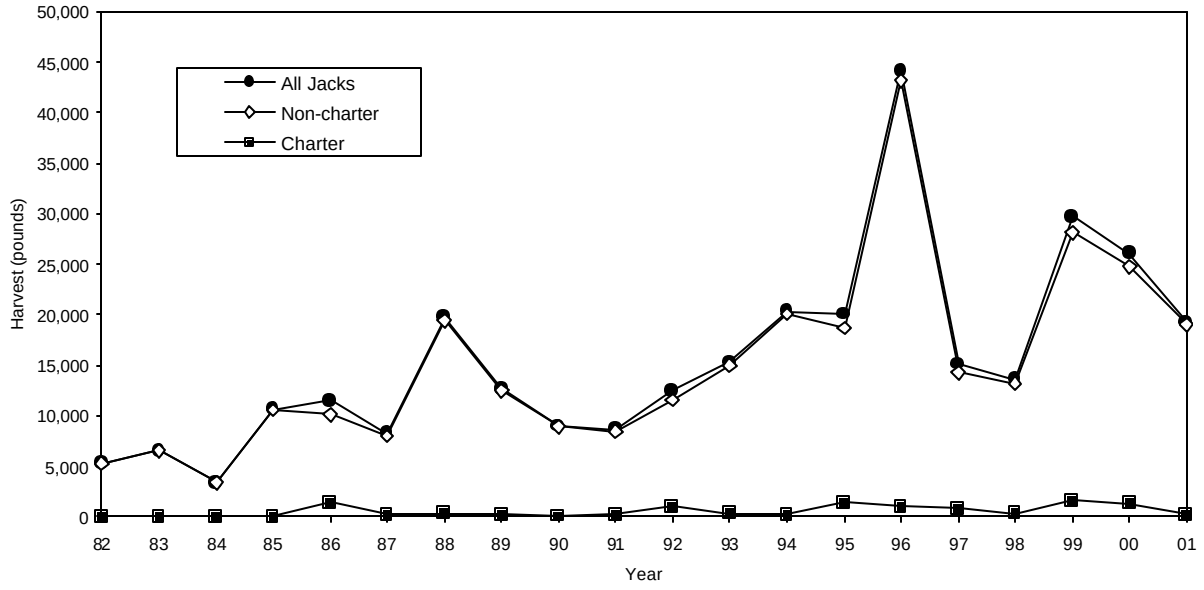
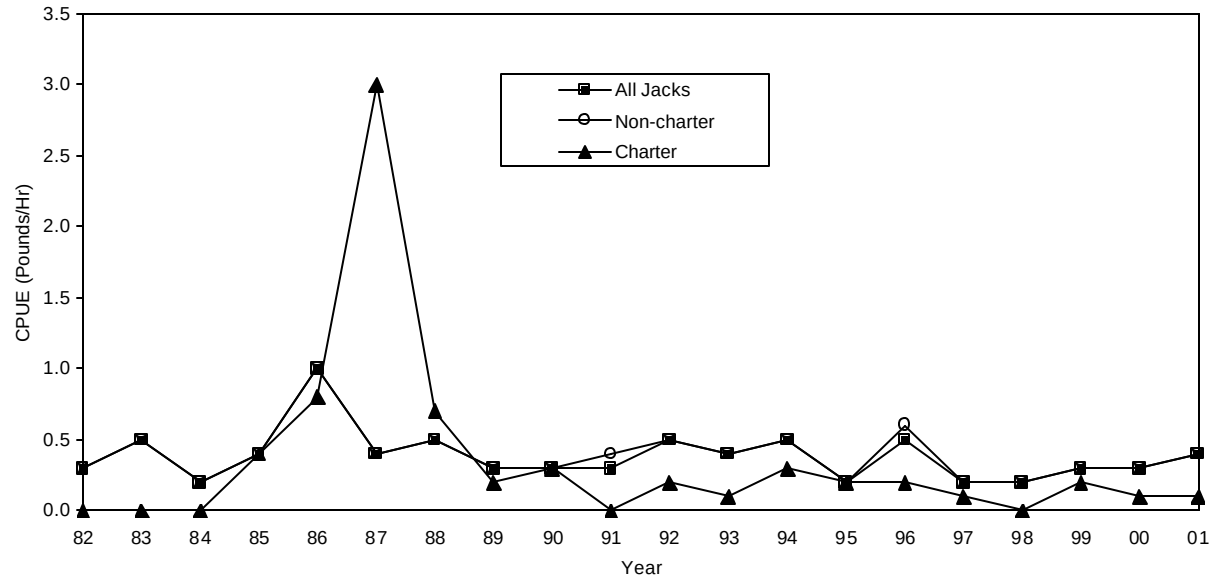


Figure 8b. Jacks/Trevallys *(Caranx, Carangoides*): CPUE



Interpretations: The total, non-charter, and charter harvest of jacks decreased 26%, 23%, and 82% respectively between 2000 and 2001. Total and non-charter CPUE increased slightly in 2001, with charter CPUE remaining unchanged. It is hoped that the establishment of the marine preserves on Guam can lead to the increase in number and size of jacks harvested. Juvenile jacks are harvested as a seasonal fishery, making this species of fish targeted during most of its lifespan.

The charter harvest shows extreme fluctuations prior to 1995, then increased fivefold in 1995 with the inclusion of the Agat Marina bottomfish charter boats. Extreme fluctuations in charter harvest and charter CPUE is a reflection of the charter activity in Agat, which account for over 80% of the bottomfish charter activity. These charter boats have high effort, low catches, and fish primarily in the same area over the years, and their low CPUE values in recent years may be an indication of overfishing.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of jacks landed by the total number of hours spent bottomfishing.

Year	Harvest All Jacks	Harvest Non-charter	Harvest Charter	CPUE All Jacks	CPUE Non-charter	CPUE Charter
82	5,300	5,280	20	0.3	0.3	0
83	6,557	6,557	0	0.5	0.5	0
84	3,387	3,387	0	0.2	0.2	0
85	10,612	10,577	35	0.4	0.4	0.4
86	11,529	10,126	1,404	1.0	1.0	0.8
87	8,241	7,997	244	0.4	0.4	3.0
88	19,764	19,443	321	0.5	0.5	0.7
89	12,680	12,454	226	0.3	0.3	0.2
90	9,006	8,944	62	0.3	0.3	0.3
91	8,660	8,420	240	0.3	0.4	0
92	12,508	11,546	962	0.5	0.5	0.2
93	15,311	14,984	327	0.4	0.4	0.1
94	20,304	20,067	238	0.5	0.5	0.3
95	20,082	18,700	1,382	0.2	0.2	0.2
96	44,186	43,153	1,032	0.5	0.6	0.2
97	15,130	14,301	828	0.2	0.2	0.1
98	13,592	13,233	359	0.2	0.2	0
99	29,732	28,166	1,566	0.3	0.3	0.2
00	26,095	24,753	1,342	0.3	0.3	0.1
01	**19,277**	**19,039**	**238**	**0.4**	**0.4**	**0.1**
Average	15,598	15,056	541	0.4	0.4	0.3
Std. deviation	9.588	9,266	542	0.2	0.2	0.7

Figure 9a. Snappers (*Lutjanus, Pristipomoides, Aphareus, Etelis*): Harvest

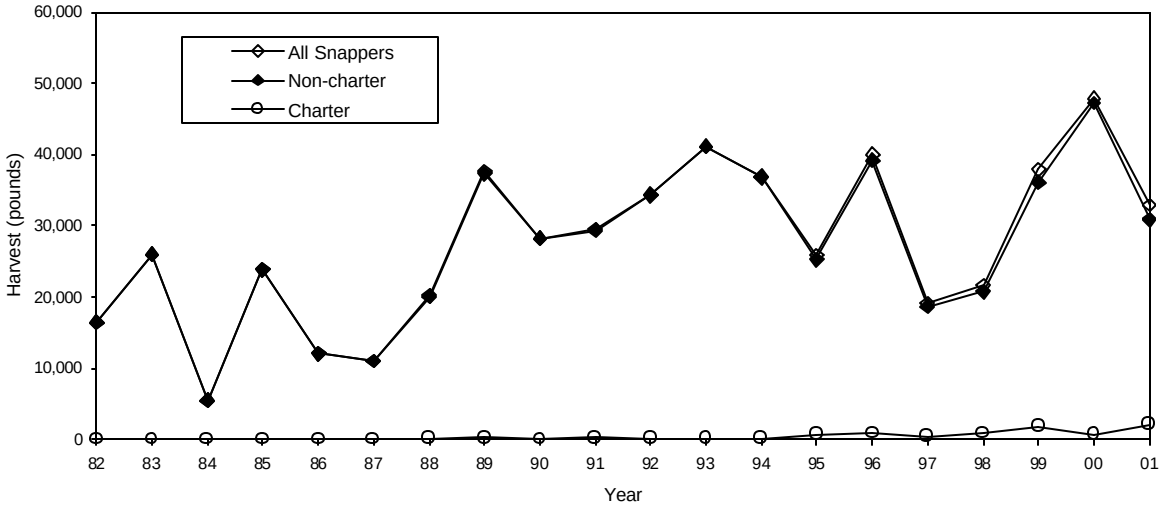
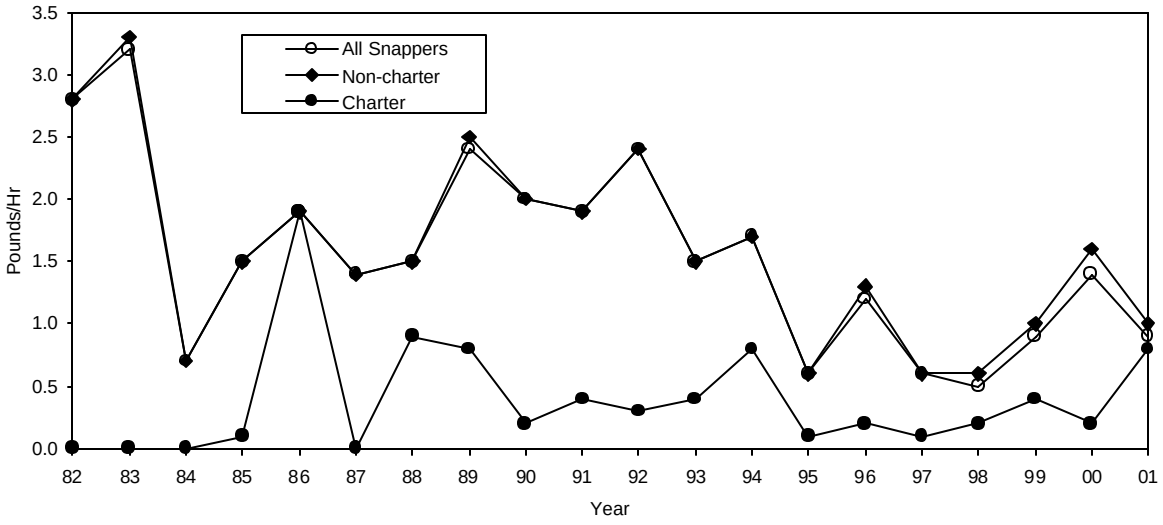


Figure 9b. Snappers *(Lutjanus, Pristipomoides, Aphareus, Etelis*): CPUE



Interpretations: The total and non-charter harvest of snappers decreased 31% and 35% respectively in 2001, while the charter harvest tripled. The total and non-charter CPUE decreased 36% and 38% respectively, while the charter CPUE quadrupled. The overall harvest of snappers appears to be increasing over time, while CPUE appears to show a decreasing trend. Since the harvest of snappers also includes deepwater species, the fluctuations in harvest could be due to targeting deepwater snapper species.

A significant increase in the charter harvest of snappers is observed in 1995 when the Agat Marina was included as

an offshore sampling port. Low catches and high effort, however, have resulted in low CPUE values after 1994. This may be skewed primarily by the Agat bottomfish charter boats, which account for approximately 85% of the yearly annual charter bottomfish trips.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of snappers landed by the total number of hours spent bottomfishing.

Year	Harvest All Snappers	Harvest Non-charter	Harvest Charter	CPUE All Snappers	CPUE Non-charter	CPUE Charter
82	16,472	16,472	0	2.8	2.8	0.0
83	25,945	25,945	0	3.2	3.3	0.0
84	5,475	5,475	0	0.7	0.7	0.0
85	23,833	23,830	4	1.5	1.5	0.1
86	12,029	11,983	46	1.9	1.9	1.9
87	10,951	10,951	0	1.4	1.4	0.0
88	20,214	20,054	161	1.5	1.5	0.9
89	37,604	37,367	237	2.4	2.5	0.8
90	28,242	28,198	44	2.0	2.0	0.2
91	29,591	29,352	239	1.9	1.9	0.4
92	34,377	34,257	119	2.4	2.4	0.3
93	41,214	41,094	120	1.5	1.5	0.4
94	36,955	36,802	153	1.7	1.7	0.8
95	25,884	25,209	675	0.6	0.6	0.1
96	40,059	39,182	877	1.2	1.3	0.2
97	19,014	18,624	391	0.6	0.6	0.1
98	21,597	20,720	877	0.5	0.6	0.2
99	37,895	36,130	1,765	0.9	1.0	0.4
00	47,940	47,289	652	1.4	1.6	0.2
01	**32,896**	**30,843**	**2,053**	**0.9**	**1.0**	**0.8**
Average	27,409	26,989	421	1.6	1.6	0.4
Std. deviation	11,338	11,120	588	0.8	0.8	0.5

Figure 10a. Groupers (*Epinephelus, Cephalopholis, Variola*): Harvest

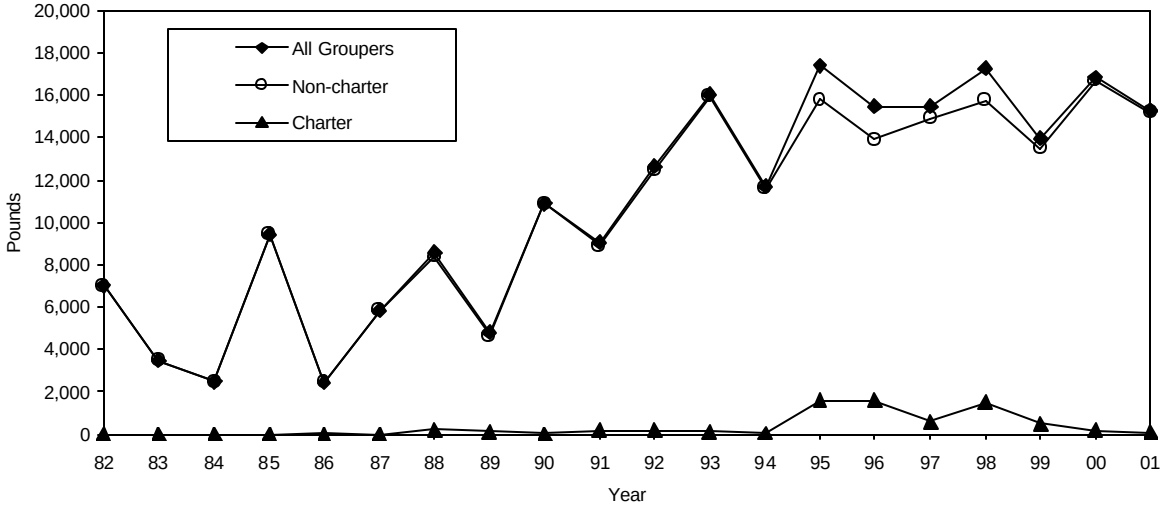
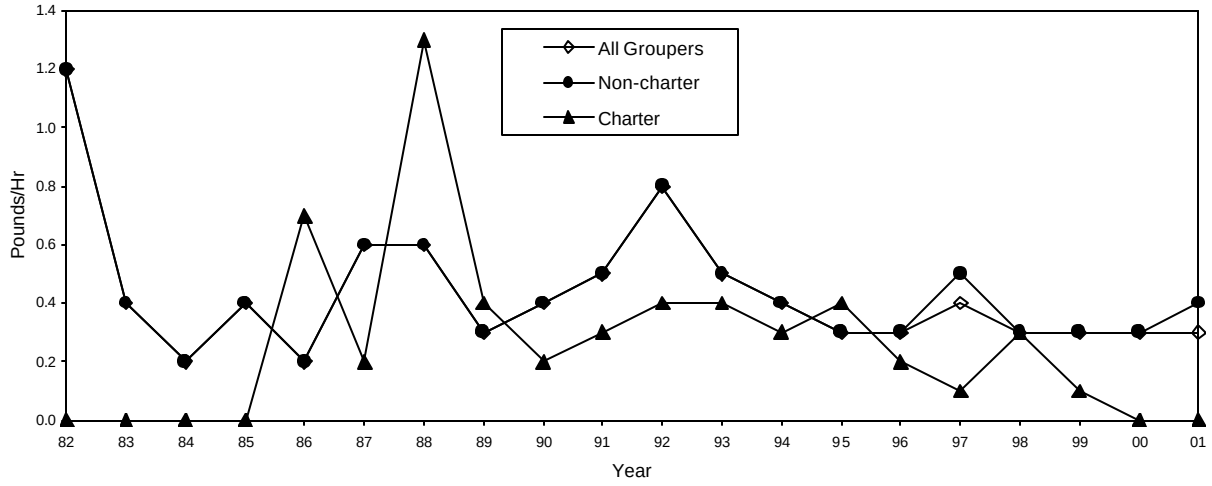


Figure 10b. Groupers *(Epinephelus, Cephalopholis, Variola*): CPUE



Interpretations: The total and non-charter harvest of groupers both decreased 9% in 2001. The CPUE for total and charter harvest of snappers remained the same for 2001, while non-charter CPUE increased slightly from 0.3 to 0.4 pounds per hour. The overall harvest of groupers appears to be leveling off since 1992, while CPUE appears to show a decreasing trend. This could be due to the harvest of smaller groupers, since large groupers are not commonly caught by bottomfishing. In recent years, the number of large groupers have been observed to be harvested more by spearfishing than bottomfishing by Fisheries staff.

The harvest of groupers by charter boats increased significantly with the inclusion of the Agat Marina as an offshore

sampling port. The CPUE for charter boats, however, is decreasing. In 2001, the charter harvest of groupers decreased 59%, with the CPUE remaining near zero. This trend is a reflection of the Agat charters, which account for over 85% of charter activity on Guam. These charter boats have low catches, high effort, and fish in the same general area. High effort by charter boats in relatively the same fishing areas has resulted in the harvest of large numbers of juveniles.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of groupers landed by the total number of hours spent bottomfishing.

Year	Harvest All Groupers	Harvest Non-charter	Harvest Charter	CPUE All Groupers	CPUE Non-charter	CPUE Charter
82	7,000	7,000	0	1.2	1.2	0.0
83	3,471	3,471	0	0.4	0.4	0.0
84	2,463	2,463	0	0.2	0.2	0.0
85	9,410	9,410	0	0.4	0.4	0.0
86	2,442	2,425	17	0.2	0.2	0.7
87	5,823	5,814	9	0.6	0.6	0.2
88	8,594	8,359	236	0.6	0.6	1.3
89	4,795	4,668	127	0.3	0.3	0.4
90	10,907	10,879	28	0.4	0.4	0.2
91	9,076	8,918	158	0.5	0.5	0.3
92	12,609	12,435	175	0.8	0.8	0.4
93	16,037	15,939	97	0.5	0.5	0.4
94	11,677	11,620	57	0.4	0.4	0.3
95	17,411	15,826	1,585	0.3	0.3	0.4
96	15,500	13,906	1,594	0.3	0.3	0.2
97	15,480	14,906	573	0.4	0.5	0.1
98	17,252	15,759	1,493	0.3	0.3	0.3
99	13,969	13,484	484	0.3	0.3	0.1
00	16,846	16,663	183	0.3	0.3	0.0
01	**15,252**	**15,177**	**75**	**0.3**	**0.4**	**0.0**
Average	10,801	10,456	345	0.4	0.4	0.3
Std. deviation	5,157	4,846	545	0.2	0.2	0.3

Figure 11a. Emperors (*Lethrinus, Gnathodentex, Gymnocranius, Montaxis*): Harvest

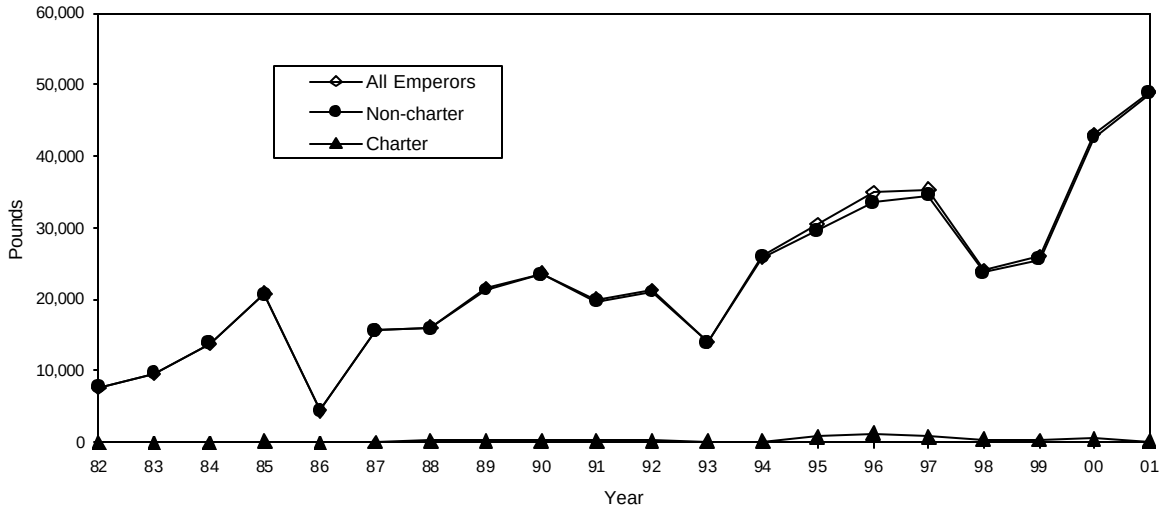
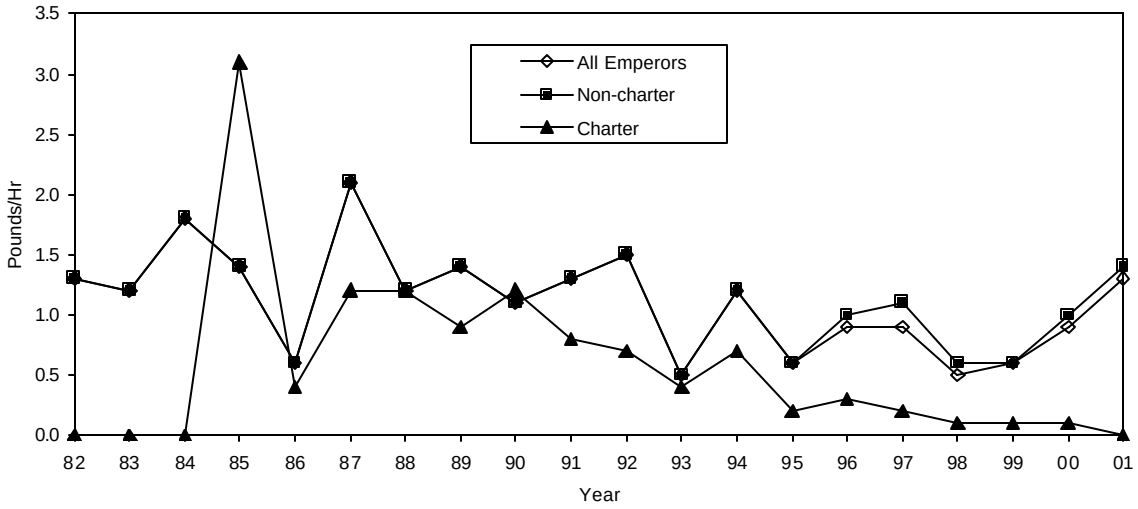


Figure 11b. Emperors *(Lethrinus, Gnathodentex, Gymnocranius, Monotaxis*): CPUE



Interpretations: The total and non-charter harvest of emperors increased 14% and 15% in 2001. The CPUE for total and non-charter harvest of snappers also increased, increasing 44% and 40% respectively in 2001. The increased in the harvest of emperors in both the charter and non-charter sectors in 1995 and 1996 may have be due to the addition of the Agat Marina as an offshore sampling port. The CPUE for emperors, however, decreased 50% between 1994 and 1995. The overall harvest of emperors appears to be increasing, while CPUE shows a decreasing trend. Total and non-charter CPUE, however, has been increasing since 1999.

The harvest of emperors by the charter sector increased significantly with the inclusion of the Agat charters in 1995. However, harvest by charter boats appear to be decreasing after an initial increase. Since the Agat charters make up to 80% of bottomfish charter activity, their low catches, high effort, and tendency to fish in the same general area may have resulted in low emperor catches. Currently, emperors are rarely observed with charter boats. The harvest of emperors by charter boats decreased 76% in 2001, with the CPUE decreasing to nearly zero. Both the harvest and CPUE for the charter sectors fall below the 20-year average.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	Harvest All Emperors	Harvest Non-charter	Harvest Charter	CPUE All Emperors	CPUE Non-charter	CPUE Charter
82	7,677	7,677	0	1.3	1.3	0.0
83	9,635	9,635	0	1.2	1.2	0.0
84	13,843	13,843	0	1.8	1.8	0.0
85	20,841	20,691	149	1.4	1.4	3.1
86	4,411	4,402	9	0.6	0.6	0.4
87	15,706	15,648	58	2.1	2.1	1.2
88	16,123	15,909	215	1.2	1.2	1.2
89	21,599	21,341	257	1.4	1.4	0.9
90	23,637	23,417	220	1.1	1.1	1.2
91	20,030	19,774	256	1.3	1.3	0.8
92	21,333	21,049	283	1.5	1.5	0.7
93	14,033	13,913	121	0.5	0.5	0.4
94	25,949	25,827	122	1.2	1.2	0.7
95	30,498	29,657	840	0.6	0.6	0.2
96	34,879	33,578	1,301	0.9	1.0	0.3
97	35,323	34,550	773	0.9	1.1	0.2
98	24,139	23,700	439	0.5	0.6	0.1
99	25,941	25,620	321	0.6	0.6	0.1
00	43,103	42,607	496	0.9	1.0	0.1
01	**48,961**	**48,844**	**117**	**1.3**	**1.4**	**0.0**
Average	22,883	22,584	299	1.1	1.1	0.6
Std. deviation	11,443	11,254	335	0.4	0.4	0.7

12a. Guam 2001 Bottomfish Bycatch: Charter

Species	Released alive	Released dead/injured	Total # Released	Total Number Landed	% Bycatch
C. longimanus		2	2	2	100.0
Triaenodon obesus	1		1	1	100.0
Holocentridae	6		6	6	100.0
S. tieroides	3		3	4	75.0
M. berndti	12		12	28	24.9
Serranidae	14		14	37	37.8
Serranidae	14		14	37	37.8
E. fasciatus	9		9	214	4.21
E. hexagonatus	5		5	7	71.4
E. merra	51		51	303	16.8
Snappers (Deep)	2	1	1	1	100.0
Lutjanus kasmira	2		2	91	2.2
Lethrinidae	111		111	197	56.4
L. rubrioperculatus	11		11	444	2.5
Siganus argenteus	3		3	5	60.0
Balistidae	14		14	14	100.0
B. undulates	6		6	10	60.0
B. viridescens	1		1	2	50.0
M. niger	2		2	3	66.7
O. niger	5		5	13	38.5
R. aculeatus	3		3	50	6.0
S. freanatus	3		3	21	14.3
TOTAL	**262**	**3**	**265**	**1,453**	**18.2**
Compared with All Species				**3,454**	**7.7**

12b. Guam 2001 Bottomfish Bycatch: Non-Charter

Species	Released alive	Released dead/injured	Total # Released	Total # Landed	% Bycatch
Holocentridae	13		13	13	100.0
Serranidae	12		12	18	66.7
C. urodeta	1		1	2	50.0
E. fasciatus	8		8	10	80.0
Lutjanidae	4		4	4	100.0
L. rubrioperculatus	3		3	9	33.3
Mullidae	44		44	44	100.0
M. pflugeri	7		7	9	77.8
P. ciliatus	1		1	1	100.0
P.multifasciatus	39		39	41	95.1
X. aneitensis	3		3	3	100.0
Balistidae	53		53	53	100.0
B. undulates	4		4	8	50.0
M. niger	97		97	110	88.2
M. vidua	97		97	110	88.2
O. niger	51		51	57	89.5
S. bursa	10		10	10	100.0
S. freanatus	4		4	4	100.0
A. scriptus	1		1	1	100.0
TOTAL	**338**	**0**	**338**	**402**	**89.1**

Compared with All Species		**442**	**81.0**

12c. Guam 2001 Bottomfish Bycatch: Summary

Year	Released alive	Released dead/injured	Total # Released	Total # Landed	% Bycatch	Bycatch Interviews	Total # of Interviews	% interviews with Bycatch
2001	620	3	623	1,855	89.1	58	183	31.7

Interpretation: A description of bycatch was done for for 2001 based solely on interviews obtained, and not from expanded data. A total of 183 bottomfish interviews were taken during 2001, with 58 of those interviews (32%) indicating that bycatch was obtained. Comparing between non-charter and charter interviews, 20 interviews out of 24 charter interviews (83%) and 38 out of 159 non-charter interviews (24%) indicated bycatch. The majority of the charter interviews were obtained from the Agat Marina, since bottomfish charters at the Agana Boat Basin, which usually have a greater variety of species, are not commonly interviewed. The Agana Boat Basin bottomfish charter boats generally do trolling, and those doing bottomfish charters generally return outside of the survey time period. However, the sizes of fishes caught at the Agana Boat Basin are not . Generally, most bycatch caught by charter and non-charter boats are released alive and generally undersized and juveniles. Exceptions to these during 2001 were sharks. Unfortunately, fish not considered preferable eating fish, such as filefish (*A. scriptus*), triggerfish, porcupine puffers, angelfishes, and cornetfishes have been caught in the past several years.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: The total bycatch is obtained from the interviews obtained from bottomfishing interviews. The numbers recorded is not an expanded data, but obtained directly from the bottomfish interviews obtained during 2001. Each bycatch has an associated number of each individual fish species, an estimated length, and a calculated weight based on the estimated length.