

Appendix 2

Guam

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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 usually the 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. Bottomfish activity increases significantly during the summer when sea conditions are generally calmer, although calm sea conditions can occur every month of the year. Fishing activity over the past decade has increased on the east side of the island, a more productive fishing area, during periods of calm weather. At Ylig Bay, a paved parking area and maintenance of the brush along the highway has helped increased the number of boats accessing the east side of the island.

The majority of people in this fishery are either subsistence or part-time commercial, operate boats less than 25 feet in length, target primarily the shallow water bottomfish complex, and combine some trolling to supplement their overall fish catch. In recent years, the consumption of reef fish has increased, making it profitable to sell locally caught bottomfish. This demand, however, appears to be stressing bottomfish stocks around Guam, especially since bottomfish and BMUS species are also caught by other methods such as gillnets, castnets, and spearing.

The Agana Boat Basin (ABB), centrally located on the western leeward coast, is the island's primary launch site for boats fishing areas off the central and northern leeward coasts and the northern banks. Most commercial fishing boats operate from here. The Merizo boat ramp, Seaplane Ramp in Apra Harbor, Umatac boat ramp, and Agat Marina are launch sites which provide access to the southern coast, Apra Harbor, Cocos Lagoon, and the southern banks. The Agat Marina, located between ABB 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. At present, Department of Agriculture's Fisheries Section conducts its offshore creel surveys at the Agana Boat Basin (ABB), the Agat Marina, and the Merizo boat ramp.

Charter bottomfishing boats still comprise a significant proportion of participation, effort, and bycatch. Charter boats operating out of the Agat marina have as many as two to three trips daily, although heavily dependent on Asian visitors. These boats, however, have been fishing in the same general area every year. A majority of their catch is made up primarily of juvenile goatfish, triggerfish, and groupers, most of which is discarded as bycatch. These boats rarely catch fish of different genera regularly. Large fish are rarely caught but are often kept by charters, with the small juveniles kept to serve as sashimi to their guests. These boats include non-fishing activities to attract a wider tourist clientele.

The testing of fish potentially contaminated by PCB around Orote Point is currently ongoing. Agriculture's Fisheries Section is represented in talks with the U.S. Navy and the Guam Environmental Protection Agency to determine which marine species should be tested for possible PCB contamination. It appears that bottomfishing and spearing has decreased in the areas around Orote Point. In 2002, the area adjacent to the Navy dump originally designated as a high risk for fish consumption was decreased after preliminary PCB testing, although testing of PCB contamination in the inner Apra Harbor may occur in 2004.

The demand for both deep and shallow-water bottomfish continues to exceed what is locally caught. The cultural value of the shallow and deep-water complex for various ethnic groups remains high due to the popularity of this assemblage of fish as food items, especially during the Lenten season, family gatherings, and large celebrations. This demand may be contributing to the overall decline in nearshore and reef-associated bottomfish populations. Some of the demand for bottomfish, however, is offset with imports from the Philippines and Micronesia. BMUS species are also harvested by other methods, boat-based and inshore, such as spearing, trolling, and the use of nets such as gillnets, castnets, and surround nets. Abandoned gillnets are a persistent problem on Guam and are known to catch BMUS species, although not in significant numbers.

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 shallow and deep bottomfish complexes, extracts average size data, and summarizes unexpanded bycatch data. This improvement, combined with recent revisions of expansion algorithms, crosschecking features, and size distribution analysis have contributed to the increased efficiency in the production and reliability of the Guam annual reports, both Plan Team and Federal Reporting. These types of data outputs have become important in recent years as overall fish stocks appear to be declining and management decisions are being made based on the voluntary fishery data that is collected. Although complementary statistics of confidence and analysis of biological and species composition data are not possible at this time, DAWR's Fisheries Section is continuing work with the WPacFIN program coordinator to further develop the expansion system to eventually include production of such analyses.

Guam's declining tourist visitor arrivals and government revenues may increase subsistence and commercial fishing in order to increase income to offset the potential loss of jobs or reduction in pay and the increased cost of living. Local Guam laws, other than those restricting fishing in Guam's marine preserves, are not pro-active in overall fishery conservation, since there are no size, number, gear, species, or seasonal restrictions. In addition, fires, farming, and clearing activities deposit vast amounts of silt on coral reefs every year during the rainy season, possibly reducing the amount of food and habitat for BMUS species. The establishment of five (5) marine preserves has increased fish biomass in the preserves, although two (2) of the five (5) preserves are truly no-take zones. Jacks or trevallys can be caught at three (3) marine preserves. Although there is a cultural component for seasonal harvests, including juvenile jacks, this may negatively impact the preserves intent to restore the stocks of jacks. The Tumon Bay preserve allows for the take of all sizes of jacks and trevallys, the Pati Point preserve allows the take of any species caught by rod and reel from shore, while the Achang Bay preserve allows for the take of seasonal schools of juvenile rabbitfish and atulai with a permit from the Department of Agriculture.

Summary

The total and BMUS bottomfish harvests increased in 2003. The inshore harvest, however, decreased significantly in 2003. Total bottomfish landings increased 33%, with total offshore and offshore non-charter harvests increasing 48% and 35% respectively. Total BMUS landings increased 57%, with the offshore and its non-charter and charter components increasing 71%, 75%, and 5% respectively. Offshore made up 94% of the total bottomfish catch and almost 100% of the total BMUS catch. The inshore harvest of bottomfish and BMUS species decreased 47% and 93% compared with 2002.

The CPUE for all bottomfish increased 57%, with the CPUE for shallow and deep bottomfishing increasing 79% and 20% respectively. The CPUE for non-charter boats increased 57% for all bottomfishing, 20% for

deep bottomfishing, and 79% for shallow bottomfishing.

Bottomfishing effort did not change significantly in 2003. Total hours and trips decreased 2% and <1% respectively. Charter hours and trips decreased 11% and 14% respectively due to the after effects of Supertyphoon Pongsona in December 2002. Non-charter hours and trips decreased <1% and increased 3% respectively. The number of unique boats in the fishery increased 37% in 2003.

The commercial landings and the adjusted revenue of BMUS species both decreased 36%. The after effects of Supertyphoon Pongsona in the first quarter of 2003 may have negatively impacted commercial sales. The average price for bottomfish remained virtually the same, increasing one cent, while revenue per bottomfishing trip increased 21%.

The offshore surveys at ABB were halved in 2002 due to the departure of fisheries staff and an increase in fisheries-related projects. In October 2003, the offshore surveys at ABB were restored to four surveys a month (twice each on weekdays and weekends) with the hiring of three technical staff. Hiring of additional fisheries biologists is expected to occur in 2004.

The 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. The local government improved the launching area at Ylig by paving the parking area, cementing the boat ramp, and cutting brush alongside the access road to the ramp. Surveying fishermen at the Ylig ramp during the summer has been previously proposed due to significant fishing activity there during the summer months. However, a lack of adequate lighting, no public phone for emergencies, and other safety issues make surveying this area challenging. Agriculture's Fisheries Section plans on doing opportunistic surveys of boats fishing out of Ylig in 2004. Trolling highliners, spearfishing highliners, and deep and shallow bottomfishermen have been observed at Ylig.

The commercial receipt program continues to provide data of the sale of BMUS and other bottomfish species. Currently, there are three vendors in the program, which includes the largest vendor of locally caught fish, the Guam Fishermen's Cooperative. However, restaurants and hotels occasionally purchase fish directly from fishermen, and local neighborhood stores regularly purchase and sell locally caught fish.

Summary of Historical Annual Statistics

Year	Landings* Total (Lbs)	CPUE (Lbs/Hour)	CPI	Adjusted Revenue (\$)	Adjusted Price (\$/Lb)	Number of Boats
1980			134.0	43,635	4.63	
1981			161.4	59,168	5.58	
1982	39,972	7.2	169.7	40,088	5.77	154
1983	46,957	6.3	175.6	193,534	5.23	106
1984	57,523	7.3	190.9	117,475	5.04	144
1985	104,526	5.7	198.3	133,812	4.77	161
1986	50,146	5.2	203.7	54,404	4.49	118
1987	57,601	5.8	212.7	56,170	4.44	139
1988	83,672	4.9	223.8	67,568	4.24	198
1989	91,097	5.6	248.2	96,815	4.93	223
1990	85,974	4.5	283.5	90,306	4.77	226
1991	82,704	4.8	312.5	51,454	4.56	246
1992	97,946	5.8	344.2	44,743	4.19	236
1993	106,541	4.2	372.9	40,156	3.94	360
1994	117,008	5.6	436.0	122,261	4.03	298
1995	118,449	2.5	459.2	49,576	3.59	402
1996	161,923	4.1	482.0	20,547	2.78	408
1997	112,925	3.7	489.7	32,619	3.07	332
1998	112,754	2.6	487.1	49,728	3.37	354
1999	148,603	3.2	496.0	112,598	3.66	411
2000	156,071	3.7	505.9	77,706	3.54	312
2001	137,065	3.9	499.4	86,359	3.28	337
2002	88,634	3.0	502.0	56,651	3.10	351
2003	118,206	4.7	507.2	36,528	3.11	481
Average	98,923	4.7	337.3	72,246	4.17	273
Standard Deviation	34,862	1.4	140.4	40,357	0.84	110

*Data after 1984 combines the harvest from the inshore and offshore creel surveys.

Recommendations

Status of 2002 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 analyses 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 2003 is still ongoing. The hiring of technical staff in 2003 with plans to hire additional staff should allow for the completion of this recommendation during 2004.
2. Completing the baseline biological survey of the redgill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. NMFS Honolulu Lab has hired on contract a former biologist from Agriculture's Fisheries Section to complete the baseline biological survey done previously on the redgill emperor.
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 2003, although the offshore expansion program is being fine-tuned and integration of the offshore and inshore creel survey data has begun. Guam's offshore coordinator and NMFS Honolulu lab staff continues to make progress towards completing this recommendation.

2003 Recommendations

1. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, should be completed during 2004. Analyzing the data from the Bank A trips has been contracted out in 2003 and should be completed in 2004.
2. DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes. Fine-tuning of this program should be completed in 2004.
3. Additional staff and resources should be sought after in order to do, at the least, opportunistic interviewing of fishermen utilizing Ylig Bay as a boat launching area. Periods of calm weather, especially during the summer months have increased the number of fishermen fishing off the east side of Guam. Spearing, bottomfishing, and trolling activity have been observed by Fisheries staff, methods that regularly catch BMUS species.

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**Table 1. Expanded Offshore Creel Survey Composition
Of Bottomfish Management Unit Species (BMUS) for 2003**

Management Unit Species	Harvest (Pounds)
BMUS	
Lehi (<i>A. rutilans</i>)	362
Uku (<i>A. virescens</i>)	1,498
Ehu (<i>E. carbunculus</i>)	2,279
Onaga (<i>E. coruscans</i>)	8,583
Yellowtail Kalekale (<i>P. auricilla</i>)	2,605
Opakapaka (<i>P. filamentosus</i>)	292
Yelloweye Opakapaka (<i>P. flavipinnis</i>)	196
Gindai (<i>P. zonatus</i>)	1,608
Ta'ape (<i>L. kasmira</i>)	1,270
Giant Trevally (<i>C. ignobilis</i>)	412
Black Jacks (<i>C. lugubris</i>)	163
Amberjack (<i>S. dumerili</i>)	0
Blacktip Grouper (<i>E. fasciatus</i>)	8,263
Lyretail Grouper (<i>V. louti</i>)	8,522
Redgill Emperor (<i>L. rubrioperculatus</i>)	3,131
BMUS Total	39,184
Non-BMUS Bottomfish	
Other Snappers	2,836
Other Jacks	5,258
Other Groupers	5,172
Other Emperors	17,803
Non-BMUS Bottomfish Total	31,069
BOTTOMFISH TOTAL	70,253

Table 2. Guam 2003 Commercial Bottomfish Average Prices

Species Name	Average Price (\$/Lb)
Amberjack	2.58
Black Jack	2.53
Jacks	2.62
Emperor (mafute)	2.76
Snapper	2.50
Uku (gray snapper)	2.64
Bottom Fish (Misc.)	2.97
Ehu (red snapper)	3.83
Gindai (flower snapper)	3.99
Grouper	2.78
Kalikali (pink snapper)	3.35
Lehi (silverjaw)	3.83
Onaga (red snapper)	4.95
Opakapaka (pink snapper)	3.96
All Bottomfish Species	3.11

Figure 1a. Harvest of All Bottomfish Species

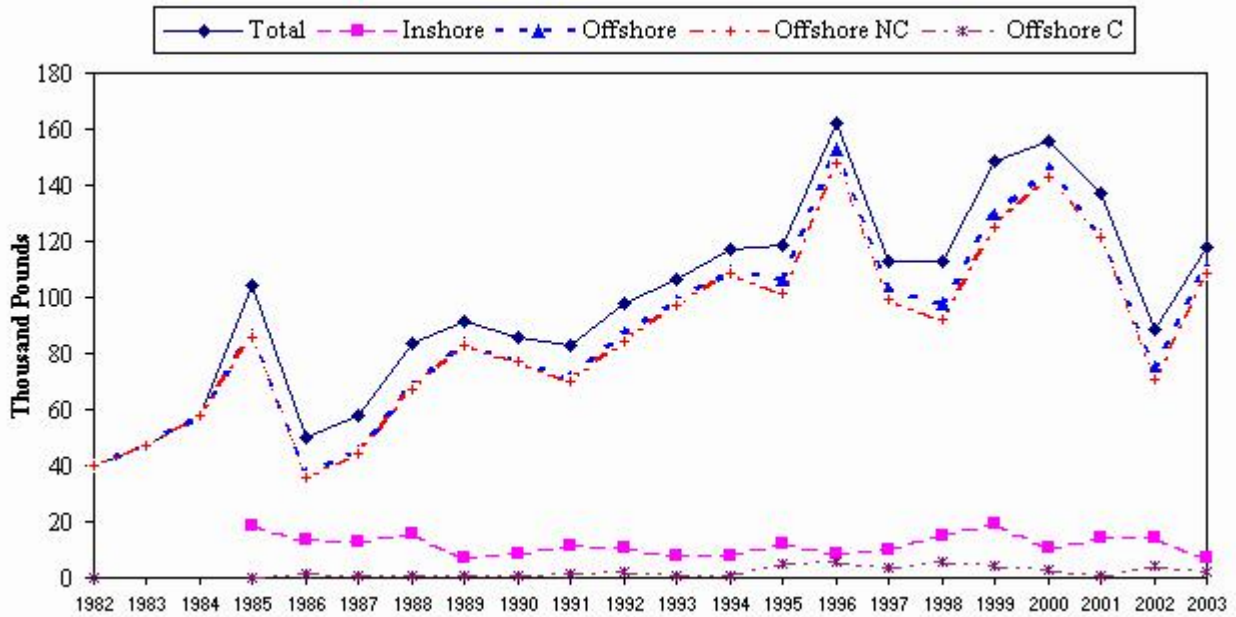
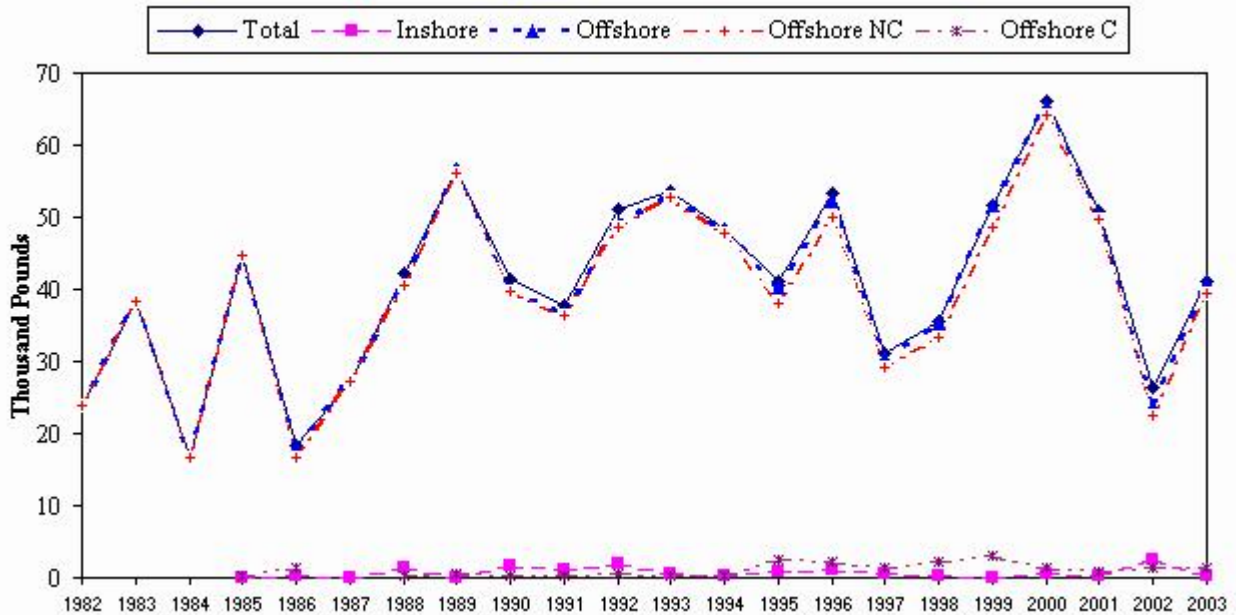


Figure 1b. Harvest of BMUS Species



Interpretations: A general increase in bottomfish and BMUS harvest was observed in 2003, except for the inshore harvests and offshore charter harvest. Total bottomfish increased 33%, with the overall offshore, offshore non-charter, and offshore charter sectors increasing 48%, increasing 35% and decreasing 39% respectively. Inshore harvest decreased 47%. Total BMUS harvest increased 56%, with the offshore, offshore non-charter, and offshore charter sectors increasing 71%, 75%, and 5% respectively. Inshore harvest decreased 93%. Offshore harvests made up 94% of the total bottomfish and 99% of the total BMUS catch.

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).

Harvest of All Bottomfish Species (Pounds)

Year	Total	Inshore	Offshore	Non-Charter	Charter
1982	39,972		39,972	39,953	20
1983	46,957		46,957	46,957	
1984	57,523		57,523	57,523	
1985	104,526	18,451	86,075	85,887	188
1986	50,146	13,307	36,839	35,363	1,475
1987	57,601	12,772	44,829	44,371	458
1988	83,672	15,895	67,777	66,846	931
1989	91,097	7,186	83,911	83,063	848
1990	85,974	8,616	77,358	76,974	384
1991	82,704	11,506	71,198	69,952	1,246
1992	97,946	11,035	86,911	84,577	2,334
1993	106,541	8,178	98,363	97,313	1,049
1994	117,008	7,966	109,042	108,287	755
1995	118,449	12,015	106,434	101,126	5,309
1996	161,923	8,801	153,122	147,721	5,402
1997	112,925	10,219	102,706	99,100	3,606
1998	112,754	14,994	97,760	92,319	5,441
1999	148,603	19,184	129,419	125,088	4,330
2000	156,071	10,372	145,699	143,001	2,697
2001	137,065	14,575	122,490	121,585	905
2002	88,634	13,979	74,655	70,724	3,931
2003	118,206	7,467	110,739	108,349	2,390
Average	98,923	11,922	88,626	86,640	2,185
Standard Deviation	34,862	3,601	32,798	31,706	1,854

Harvest of BMUS Species (Pounds)

Year	Total	Inshore	Offshore	Non-Charter	Charter
1982	23,756		23,756	23,756	
1983	38,470		38,470	38,470	
1984	16,602		16,602	16,602	
1985	44,843	34	44,809	44,666	143
1986	18,199	198	18,001	16,561	1,440
1987	27,160	64	27,096	27,096	
1988	42,253	1,368	40,885	40,516	369
1989	56,681	65	56,616	56,166	450
1990	41,463	1,541	39,922	39,774	148
1991	37,853	1,102	36,751	36,426	326
1992	51,112	1,860	49,252	48,733	519
1993	53,748	586	53,162	52,842	320
1994	48,249	245	48,004	47,702	302
1995	41,130	764	40,366	37,922	2,444
1996	53,331	1,154	52,177	49,916	2,261
1997	30,986	417	30,569	29,299	1,270
1998	35,595	187	35,408	33,250	2,158
1999	51,686	50	51,636	48,717	2,919
2000	66,227	576	65,651	64,219	1,432
2001	50,738	170	50,568	49,846	722
2002	26,292	2,445	23,847	22,577	1,270
2003	41,012	171	40,841	39,512	1,329
Average	40,790	684	40,200	39,299	1,101
Standard Deviation	12,988	706	12,950	12,802	875

Figure 2a. Total and Commercial BMUS Harvest Bottomfish

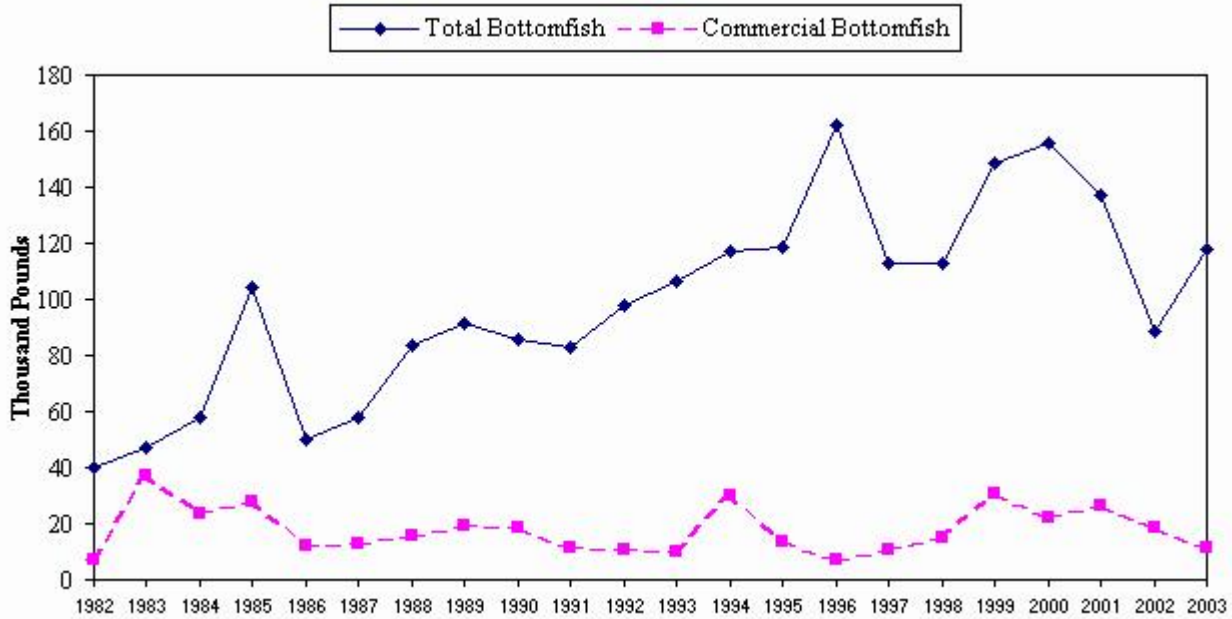
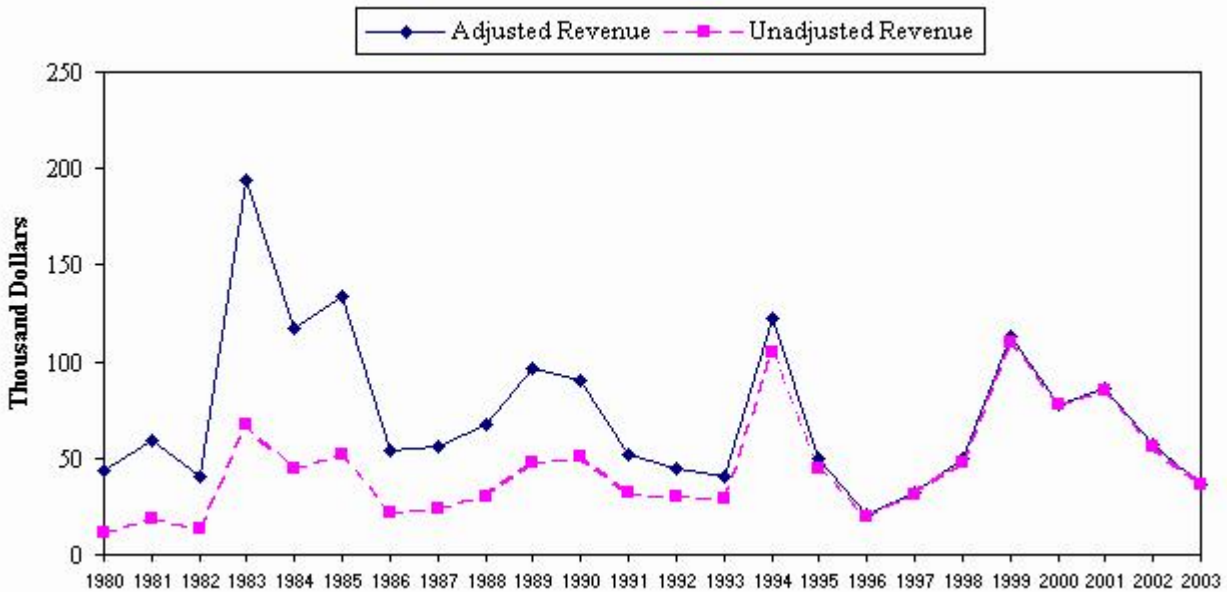


Figure 2b. Commercial BMUS Revenue Bottomfish



Interpretations: Highliners have been responsible for the peaks in the commercial BMUS landings in 1983, 1985, 1994, and 1999. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 is best explained by the absence or reduced effort of approximately six highliners who were responsible for 18% of the total BMUS harvests between 1992 and 1996. This decline in highliner landings accounts for about two-thirds of the 1995 reduction in commercial BMUS harvest.

A significant number of bad weather days occurred in 2003, although there were no direct hits by typhoons. Offshore creel surveys experienced a significant number of “no activity” days due to bad weather days. Commercial BMUS harvest decreased 36% in 2003, with adjusted revenues decreasing 36%. Commercial harvests falls below the 24-year average, with the adjusted revenue values almost 50% less than the 22-year average.

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.

Bottomfish Harvest (Pounds)

Year	Harvest (Pounds)		Revenue (\$)	
	Total	Commercial	Unadjusted	Adjusted
1980		9,434	11,528	43,635
1981		10,596	18,825	59,168
1982	39,972	6,947	13,412	40,088
1983	46,957	36,984	67,013	193,534
1984	57,523	23,291	44,213	117,475
1985	104,526	28,028	52,311	133,812
1986	50,146	12,110	21,849	54,404
1987	57,601	12,639	23,551	56,170
1988	83,672	15,933	29,818	67,568
1989	91,097	19,630	47,365	96,815
1990	85,974	18,916	50,479	90,306
1991	82,704	11,278	31,703	51,454
1992	97,946	10,668	30,355	44,743
1993	106,541	10,191	29,526	40,156
1994	117,008	30,356	105,126	122,261
1995	118,449	13,815	44,865	49,576
1996	161,923	7,389	19,531	20,547
1997	112,925	10,621	31,485	32,619
1998	112,754	14,737	47,770	49,728
1999	148,603	30,757	110,066	112,598
2000	156,071	21,924	77,474	77,706
2001	137,065	26,289	84,999	86,359
2002	88,634	18,297	56,090	56,651
2003	118,206	11,731	36,528	36,528
Average	98,923	17,190	45,245	72,246
Standard Deviation	34,862	8,311	27,003	40,357

*Includes harvest from the Inshore Creel Survey

Figure 3a. Estimated Bottomfish Boat Hours

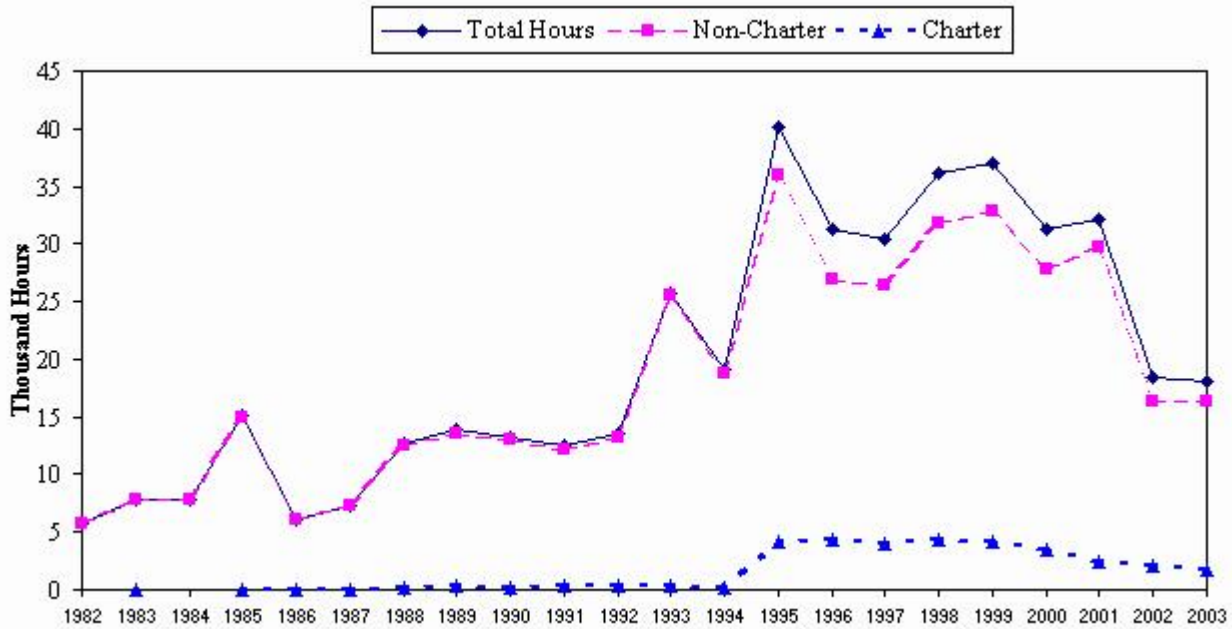
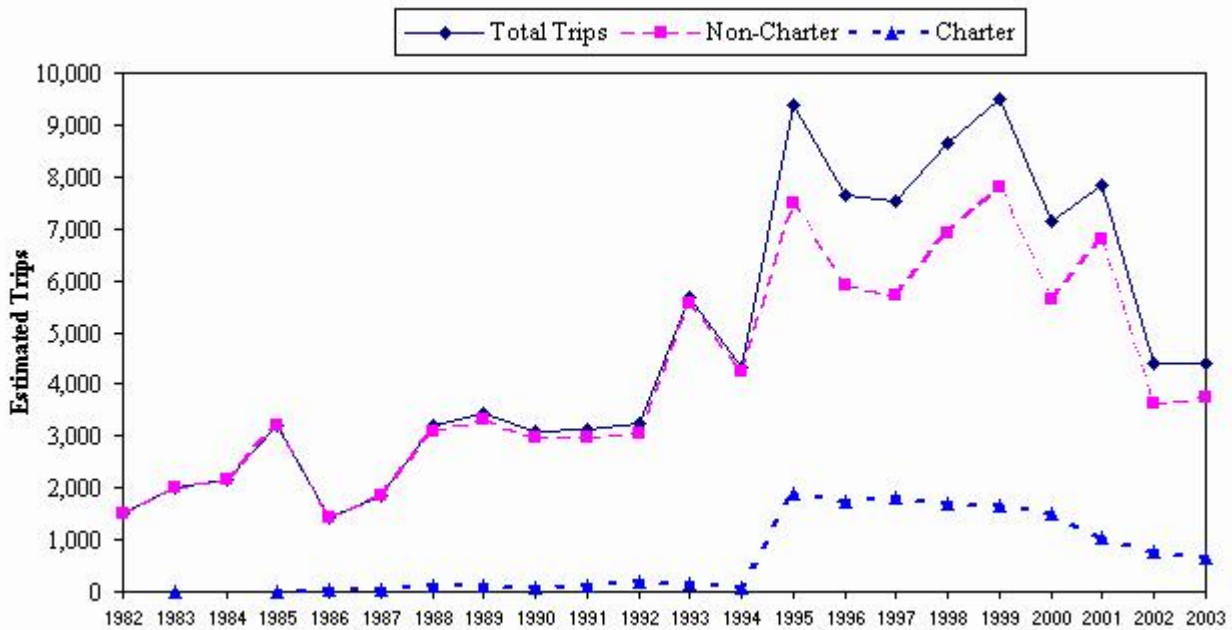


Figure 3b. Estimated Bottomfish Trips



Interpretations: The threefold increase in boating hours and doubling of bottomfish trips observed in 1995 may have been due to several factors: a 60% increase in the number of boats entering the fishery that year, the number of calm days compared with previous years, and the inclusion of the Agat Marina into the offshore survey in 1994. The charter boat component of the 1995 bottomfish fishery accounted for 23% of the total number of bottomfishing trips and 13% of the hours fished. This increase was due to bottomfish charter vessels at the Agat marina making up to three trips everyday. The number of charter trips shows a decreasing trend after 1995, due to a drop in the number of tourists, as well as tourists participating in less

expensive activities. Declines in effort observed in 1996, 1997, and 2002 were due to typhoons.

The total and non-charter hours decreased slightly (<2%) in 2003, with charter hours decreasing 11%. Total and non-charter trips increased slightly (<1% and 3%), while charter trips decreased 14%. Bottomfishing charter trips have been decreasing significantly after 1995.

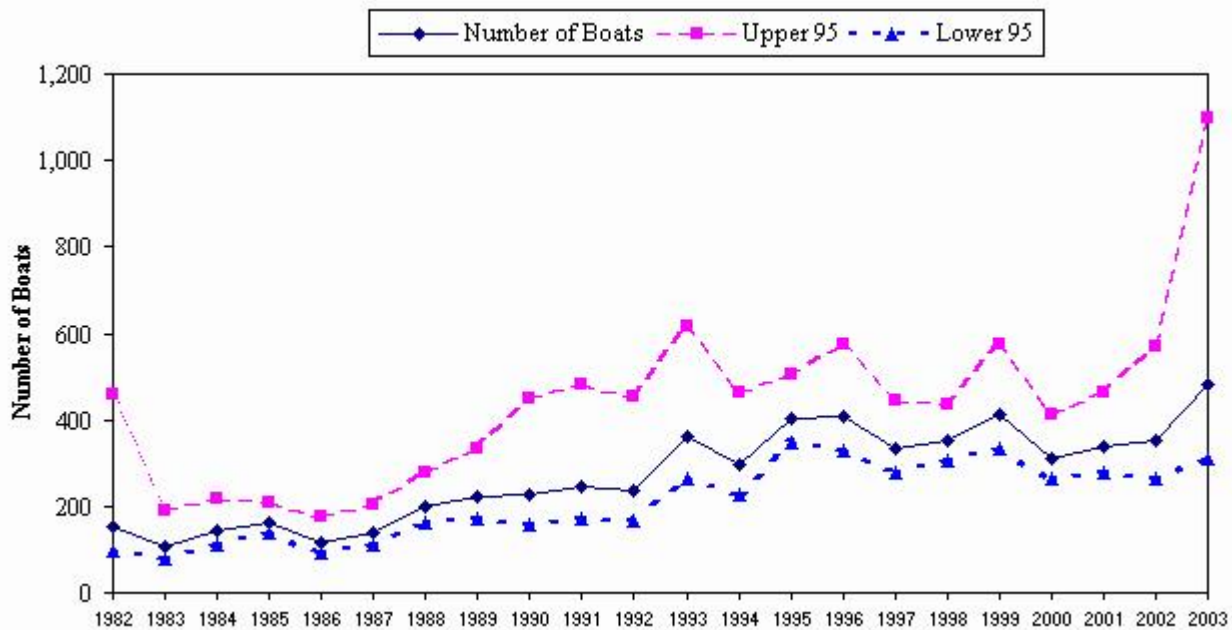
Source: The DAWR creel survey data for bottomfishing method.

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

Estimated Bottomfish Boat Hours and Trips

Year	Bottomfishing Hours			Bottomfishing Trips		
	Total	Non-Charter	Charter	Total	Non-Charter	Charter
1982	5,692	5,692	0	1,512	1,512	0
1983	7,894	7,849	45	2,017	2,006	11
1984	7,813	7,813	0	2,156	2,156	0
1985	15,037	14,989	48	3,212	3,201	11
1986	6,058	6,033	24	1,444	1,422	23
1987	7,313	7,264	48	1,857	1,835	22
1988	12,611	12,435	176	3,190	3,085	105
1989	13,910	13,615	295	3,452	3,338	114
1990	13,128	12,952	177	3,071	2,988	83
1991	12,527	12,217	310	3,109	2,986	123
1992	13,588	13,177	411	3,234	3,054	180
1993	25,733	25,458	275	5,692	5,551	141
1994	19,038	18,849	188	4,331	4,238	93
1995	40,153	35,927	4,226	9,376	7,498	1,878
1996	31,249	26,863	4,386	7,657	5,912	1,745
1997	30,370	26,360	4,010	7,527	5,724	1,803
1998	36,198	31,822	4,376	8,636	6,924	1,712
1999	37,019	32,860	4,159	9,479	7,804	1,675
2000	31,216	27,760	3,457	7,159	5,654	1,505
2001	32,138	29,710	2,428	7,822	6,795	1,027
2002	18,357	16,357	2,000	4,387	3,613	774
2003	18,048	16,300	1,748	4,395	3,729	665
Average	19,777	18,286	1,490	4,760	4,138	622
Standard Deviation	11,170	9,593	1,775	2,671	2,005	740

Figure 4. Bottomfish Fishery Participation



Interpretations: The number of unique boats in the fishery has leveled off in recent years, but increases during years with minimal adverse weather conditions and available marketing opportunities. The 53% increase in 1993 and 35% increase in 1995 could be due to the addition of the Merizo Pier and the Agat Marina as offshore creel survey sites. In 2003, the number of boats in the fishery increased 37% to approximately 481 boats, the highest number of bottomfishing boats in the 22-year time series.

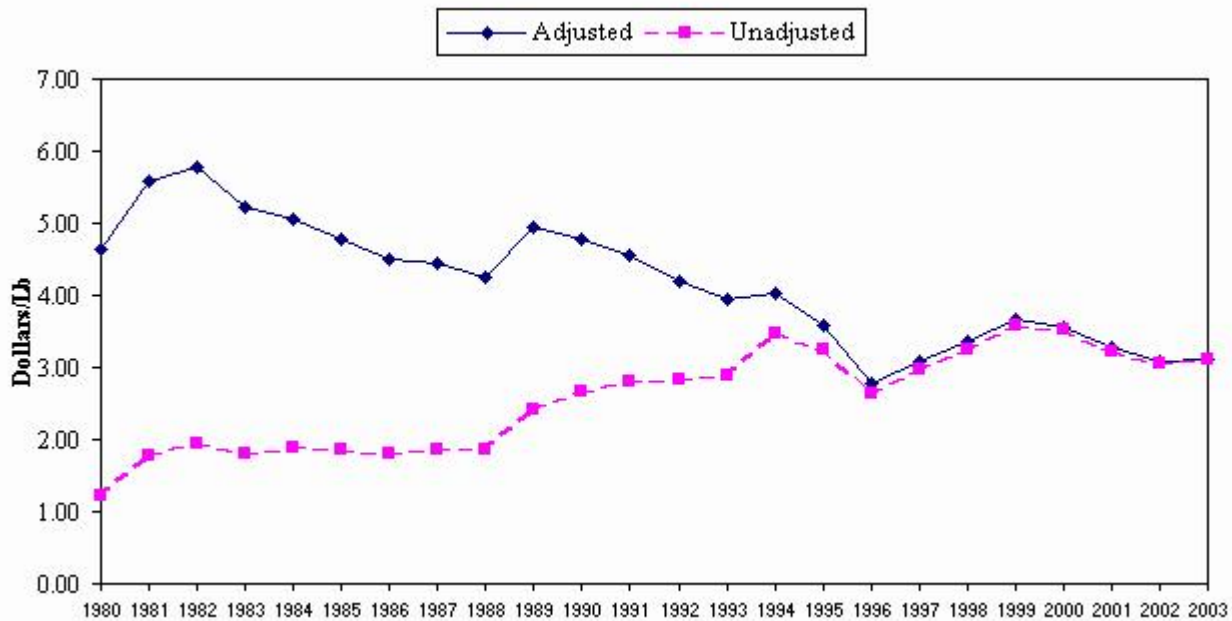
Source: Offshore creel survey boat log data from DAWR’s three sampled ports. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 2003 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.

Bottomfish Fishery Participation

Year	Number of Boats	Upper 95	Lower 95
1982	154	459	99
1983	106	190	80
1984	144	218	111
1985	161	207	138
1986	118	175	93
1987	139	202	112
1988	198	278	162
1989	223	333	172
1990	226	450	159
1991	246	482	170
1992	236	456	167
1993	360	615	266
1994	298	463	226
1995	402	507	346
1996	408	573	327
1997	332	447	276
1998	354	435	308
1999	411	573	333
2000	312	413	263
2001	337	463	276
2002	351	568	264
2003	481	1,096	310
Average	273	437	212
Standard Deviation	110	201	88

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 competed with vendors selling locally caught fish. This may have depressed 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 locally caught bottomfish. However, new fish shops have opened up in recent years, selling fish imported from the Philippines and Micronesia. These imports compete with locally caught bottomfish, with the imports being less expensive and consisting of large groupers, snappers, and emperors.

The adjusted average price for bottomfish has been showing a general decrease through the years, with unadjusted prices showing a general increase. The average adjusted price for bottomfish increased slightly (\$0.01) between 2002 and 2003.

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 values for 2002 and 2003 were 502.0 and 507.20 respectively.

Year	Unadjusted	Adjusted
1980	1.22	4.63
1981	1.78	5.58
1982	1.93	5.77
1983	1.81	5.23
1984	1.90	5.04
1985	1.87	4.77
1986	1.80	4.49
1987	1.86	4.44
1988	1.87	4.24
1989	2.41	4.93
1990	2.67	4.77
1991	2.81	4.56
1992	2.85	4.19
1993	2.90	3.94
1994	3.46	4.03
1995	3.25	3.59
1996	2.64	2.78
1997	2.96	3.07
1998	3.24	3.37
1999	3.58	3.66
2000	3.53	3.54
2001	3.23	3.28
2002	3.07	3.10
2003	3.11	3.11
Average	2.57	4.17
Standard Deviation	0.69	0.84

Figure 6a. CPUE: Overall, Charter, and Non-charter

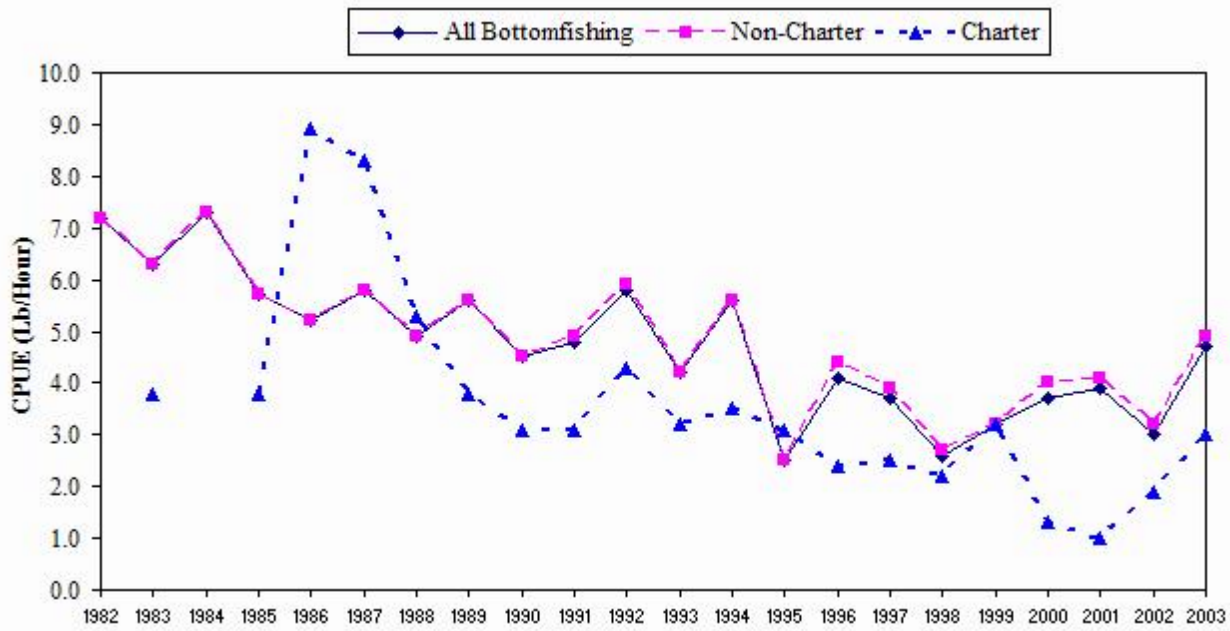


Figure 6b. Deepwater CPUE: Overall, Charter, and Non-charter

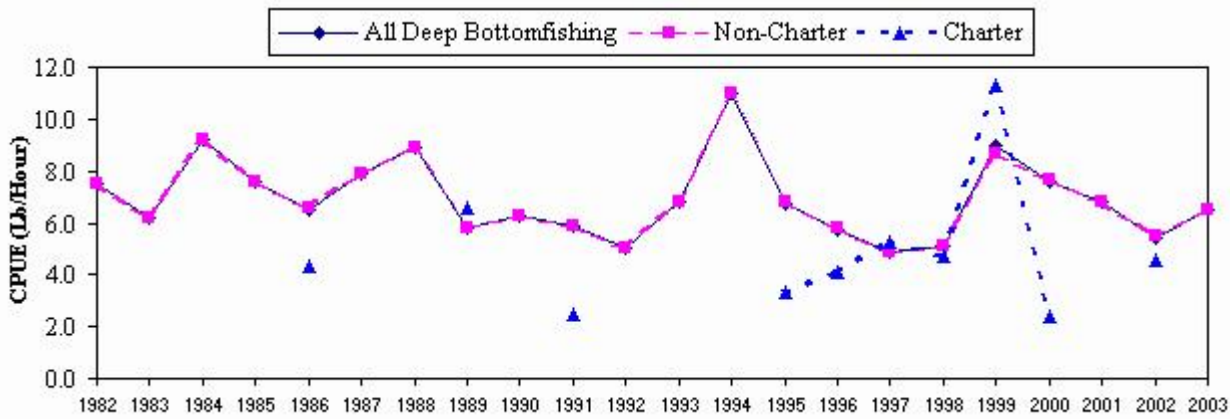
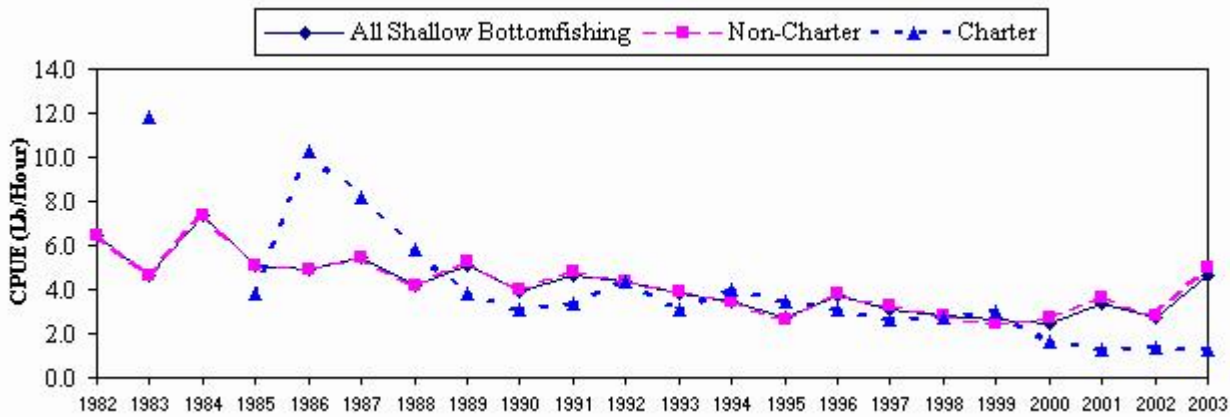


Figure 6c. Shallow Water CPUE: Overall, Charter, and Non-charter



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 to report a CPUE value more representative of bottomfishing activity and to separate out the activity of charter boats in Agat that had high effort and low catches, skewing the overall CPUE.

CPUE has generally fluctuated between 4-6 pounds per hour fished. The overall and non-charter CPUE in 1995 and 1998 fell below 2.8 pounds per hour, due to an increase in the number of recreational and subsistence-type vessels entering the fishery, targeting the shallow-water 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 expansion system during those years, placing the fishery in yellow light conditions.

In 2003, total, non-charter, and charter CPUE increased 57% (3.0 to 4.7 lbs/hr), increased 56% (3.2 to 5.0 lbs/hr), and decreased 32% (1.9 to 1.3 lbs/hr) respectively. The CPUE for total and non-charter deep bottomfishing increased 20% (5.4 to 6.5 lbs/hr) and 18% (5.5 to 6.5 lbs/hr) respectively. Charter deep bottomfishing was not encountered during creel survey days in 2003. The CPUE for total, non-charter, and charter shallow bottomfishing increased 70% (2.7 to 4.6 lbs/hr), increased 79% (2.8 to 5.0 lbs/hr), and increased 7% (1.4 to 1.3 lbs/hr). The CPUE values for total and shallow non-charter bottomfishing exceed the 22-year average.

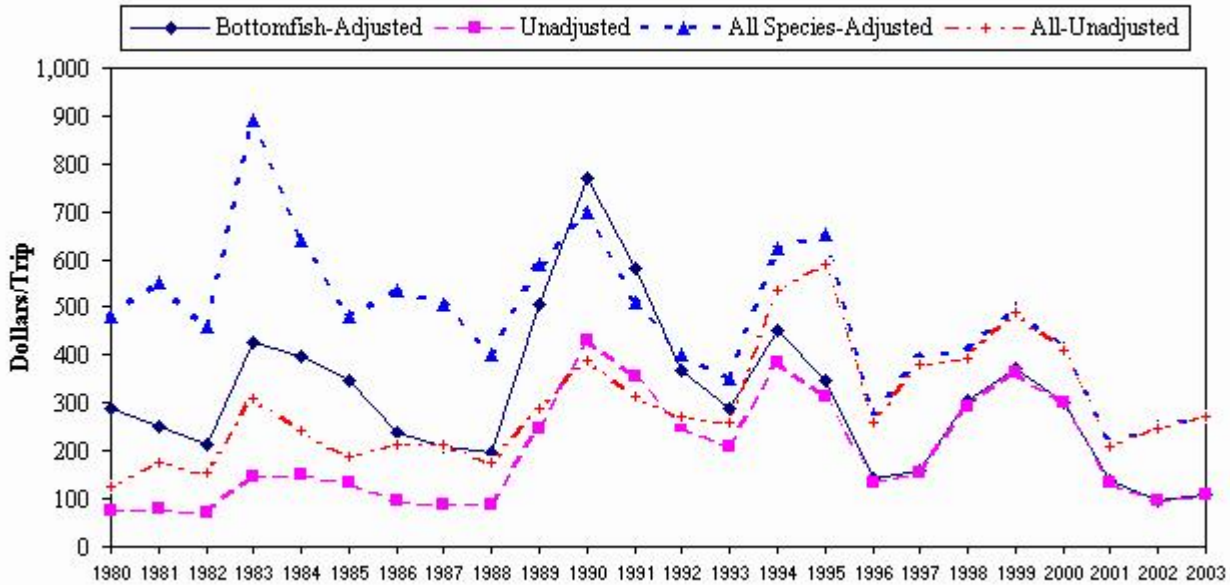
Source: The DAWR creel survey data for the bottomfishing method.

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 (Pounds/Hour)

Year	All Bottomfishing			Deep Bottomfishing			Shallow Bottomfishing		
	All	NC	C	All	NC	C	All	NC	C
1982	7.20	7.20	0.00	7.50	7.50	0.00	6.50	6.50	0.00
1983	6.30	6.30	3.80	6.20	6.20	0.00	4.60	4.60	11.80
1984	7.30	7.30	0.00	9.20	9.20	0.00	7.40	7.40	0.00
1985	5.70	5.70	3.80	7.60	7.60	0.00	5.10	5.10	3.80
1986	5.20	5.20	8.90	6.50	6.60	4.30	4.90	4.90	10.30
1987	5.80	5.80	8.30	7.90	7.90	0.00	5.50	5.50	8.20
1988	4.90	4.90	5.30	8.90	8.90	0.00	4.20	4.20	5.80
1989	5.60	5.60	3.80	5.80	5.80	6.60	5.10	5.30	3.80
1990	4.50	4.50	3.10	6.30	6.30	0.00	3.90	4.00	3.10
1991	4.80	4.90	3.10	5.90	5.90	2.50	4.60	4.80	3.40
1992	5.80	5.90	4.30	5.00	5.00	0.00	4.40	4.40	4.40
1993	4.20	4.20	3.20	6.80	6.80	0.00	3.80	3.90	3.10
1994	5.60	5.60	3.50	11.00	11.00	0.00	3.50	3.50	4.00
1995	2.50	2.50	3.10	6.70	6.80	3.30	2.70	2.60	3.50
1996	4.10	4.40	2.40	5.70	5.80	4.10	3.70	3.80	3.10
1997	3.70	3.90	2.50	4.90	4.90	5.30	3.10	3.30	2.60
1998	2.60	2.70	2.20	5.10	5.10	4.70	2.80	2.80	2.70
1999	3.20	3.20	3.20	9.00	8.70	11.30	2.60	2.50	3.00
2000	3.70	4.00	1.30	7.60	7.70	2.40	2.50	2.70	1.60
2001	3.90	4.10	1.00	6.80	6.80	0.00	3.40	3.60	1.30
2002	3.00	3.20	1.90	5.40	5.50	4.60	2.70	2.80	1.40
2003	4.70	5.00	1.30	6.50	6.50	0.00	4.60	5.00	1.30
Average	4.74	4.82	3.18	6.92	6.93	2.23	4.16	4.24	3.74
Standard Deviation	1.35	1.31	2.20	1.56	1.53	3.02	1.28	1.28	2.98

Figure 7. Average Revenue per Trip



Interpretations: The inflation-adjusted average revenue per trip for the “bottomfish” and “all species” categories increased 12% and 9% respectively in 2003. A decrease in revenue in previous years were due to a combination of occurrences: fishermen selling their catch to vendors not participating in DAWR’s commercial receipt book program, an increase in the amount of Philippine and Micronesian bottomfish imports, and significant numbers of bad weather days. A slight increase in revenue may have been due to better weather conditions than observed in 2002.

Locally caught bottomfish has had an advantage with marketing due to the closure of roadside vendors and a general preference to purchase locally caught fish. However, newly opened vendors selling imported fish consisting of large groupers, snappers, and emperors, are beginning to compete with locally caught fish.

Source: The commercial landings data from vendors participating in Fisheries’ commercial receipt book program.

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.

Average Revenue per Trip

Year	Bottomfish (\$/Trip)		All Species (\$/Trip)	
	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	76	287	127	479
1981	80	250	176	554
1982	72	214	153	458
1983	148	428	309	891
1984	149	396	241	639
1985	136	347	187	479
1986	96	239	215	535
1987	88	211	212	506
1988	88	199	178	402
1989	248	507	289	590
1990	430	770	390	697
1991	357	580	316	512
1992	250	369	272	402
1993	211	287	260	353
1994	387	450	534	621
1995	313	346	589	651
1996	135	142	261	275
1997	154	160	381	395
1998	293	304	394	410
1999	366	374	488	499
2000	302	303	412	413
2001	134	136	209	213
2002	97	98	247	249
2003	110	110	271	271
Average	197	313	296	479
Standard Deviation	114	159	121	157

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

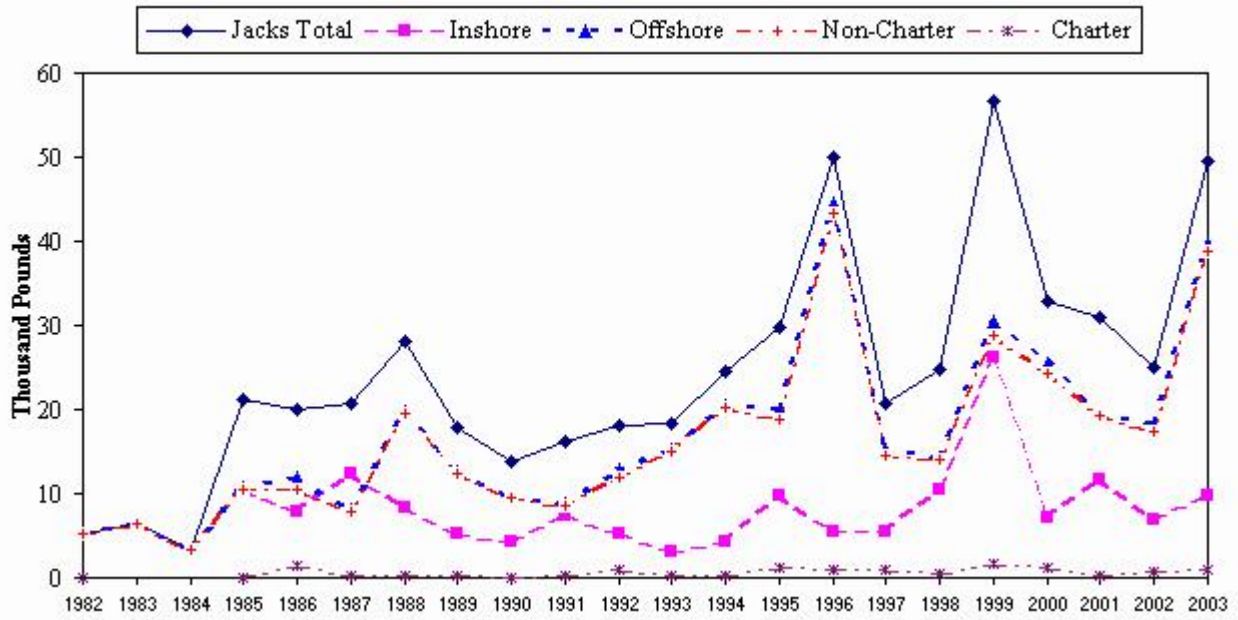


Figure 8b. Jacks/Trevallys (*Caranx, Carangoides*): CPUE

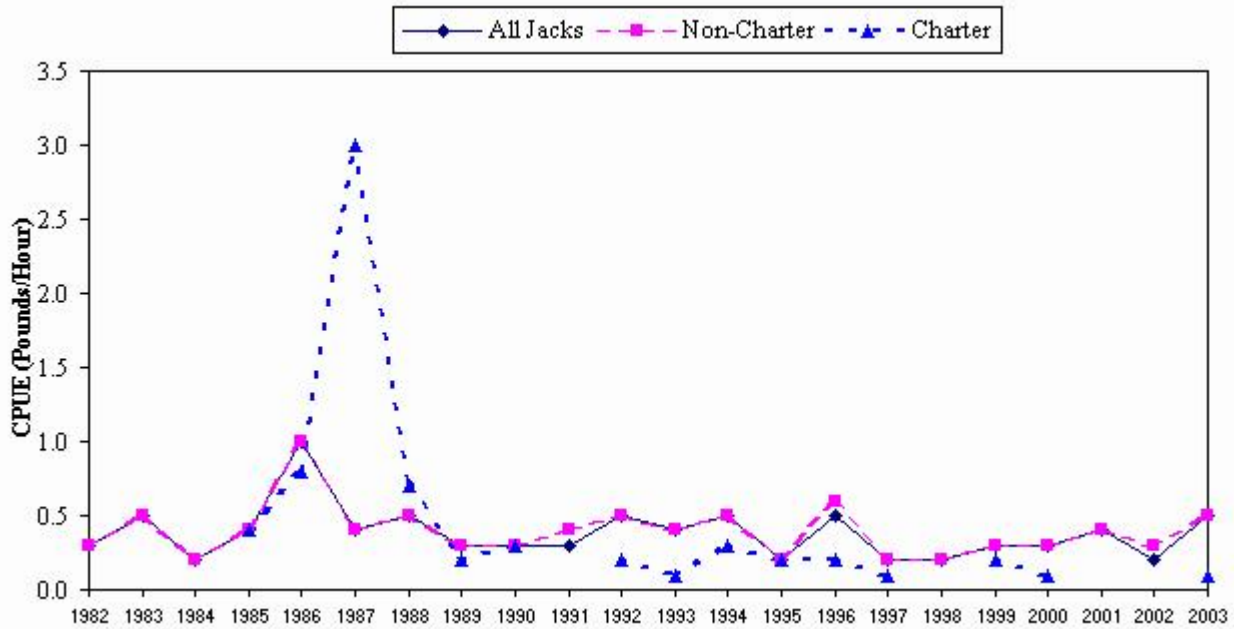


Figure 8c. Average Size Harvested: *Caranx melampygus*

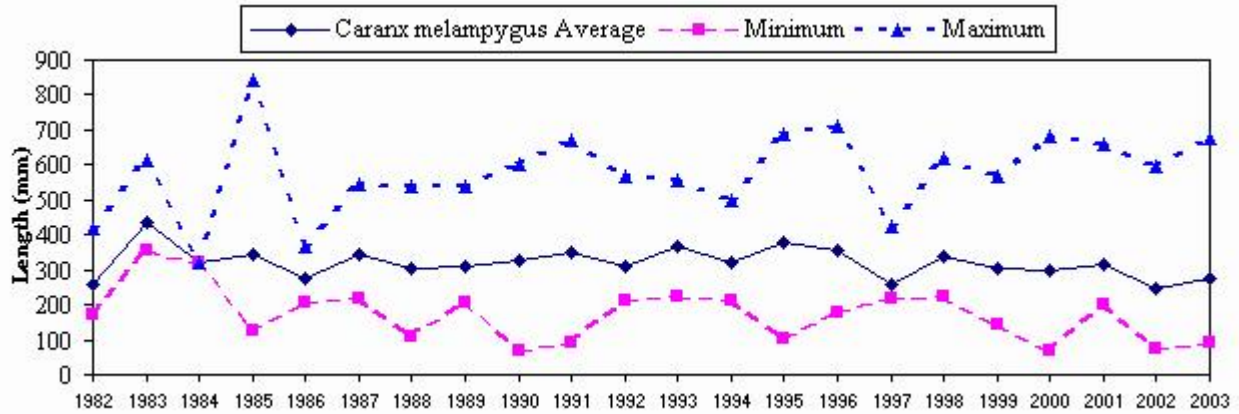


Figure 8d. Average Size Harvested: *Caranx ignobilis*

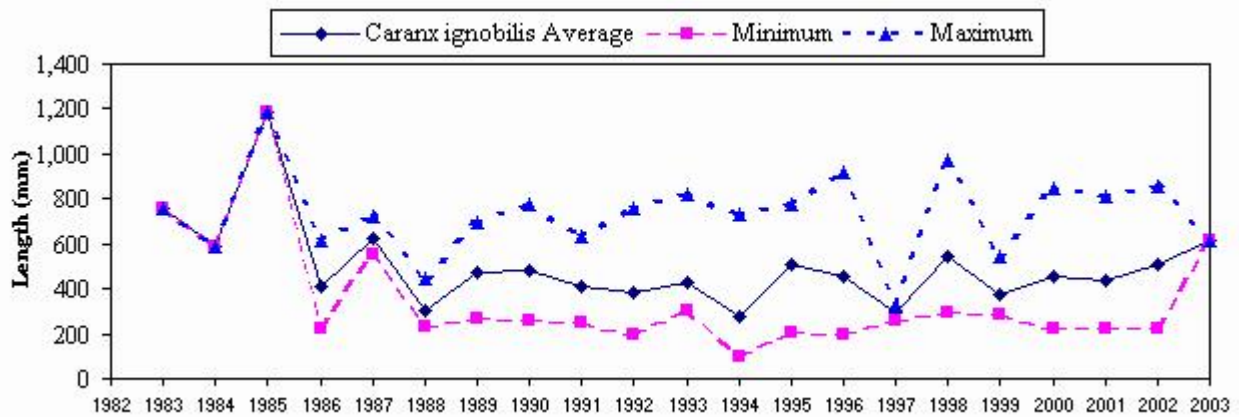
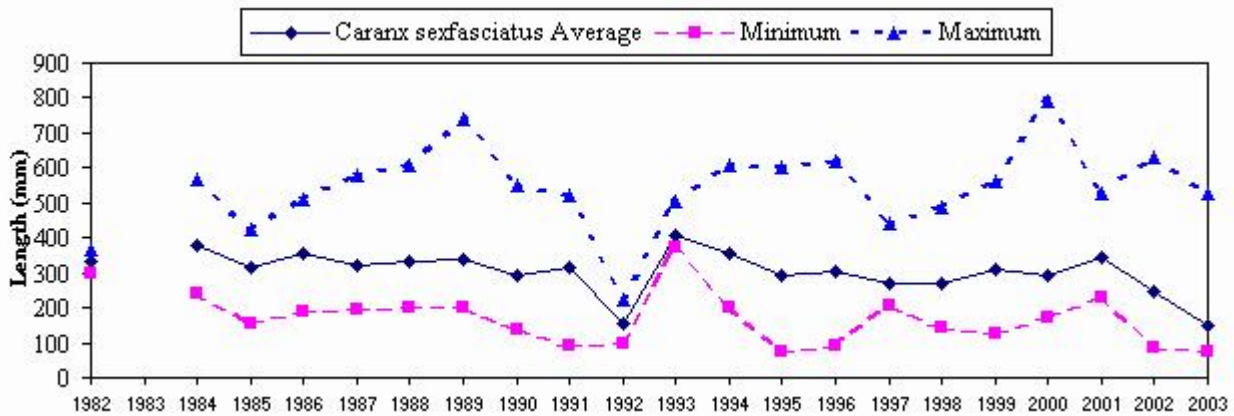


Figure 8e. Average Size Harvested: *Caranx sexfasciatus*



Interpretations: The total harvest, inshore harvest, and offshore harvest of jacks increased in 2003. The total harvest increased 97% to 49,469 pounds, the inshore harvest increased 43% to 9,700 pounds, and the offshore harvest increased 118% to 39,769 pounds. The offshore non-charter and charter harvests increased 122% (38,870 pounds from 17,463 pounds) and 14% (899 pounds from 788 pounds) respectively. Total and

non-charter offshore CPUE increased 150% (0.5 from 0.2 lbs/hr) and 67% (0.5 from 0.3 lbs/hr) respectively. The offshore charter CPUE for jacks is 0.1 lbs/hr., with the last charter CPUE in 2000 at 0.1 lbs/hr. The harvest of juvenile jacks is a seasonal fishery by several inshore methods, making this family of fish targeted for most of its lifespan island-wide. Guam established five marine preserves to limit or ban fishing to increase fish stocks such as jacks. Two preserves, however, allow the take of jacks year-round with certain restrictions, while the seasonal take of juvenile jacks is allowed in a third preserve with a permit beginning in 2002. In 2003, offshore fisheries accounted for 80% of the harvest of jacks.

The average sizes for the three most commonly caught jacks were compared, with the average sizes of *C. melampygus* and *C. ignobilis* increasing 10% and 21% in 2003. The average size for *C. ignobilis* in 2003, however, comes from a single fish. The average size for *C. sexfasciatus* decreased 40% to 149 mm. **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.

Jacks Harvest (Pounds) and CPUE (Pounds/Hour)

Jacks Year	Total Harvest	Inshore Harvest	Offshore Harvest			Offshore CPUE		
			All	Non-Cht	Charter	All	Non-Cht	Charter
1982	5,212		5,212	5,192	20	0.3	0.3	
1983	6,538		6,538	6,538		0.5	0.5	
1984	3,360		3,360	3,360		0.2	0.2	
1985	21,144	10,532	10,612	10,577	35	0.4	0.4	0.4
1986	19,901	7,965	11,936	10,532	1,404	1.0	1.0	0.8
1987	20,633	12,498	8,135	7,890	244	0.4	0.4	3.0
1988	28,162	8,394	19,768	19,448	321	0.5	0.5	0.7
1989	17,944	5,326	12,618	12,392	226	0.3	0.3	0.2
1990	13,722	4,207	9,515	9,452	62	0.3	0.3	0.3
1991	16,084	7,278	8,806	8,566	240	0.3	0.4	
1992	18,171	5,299	12,872	11,910	962	0.5	0.5	0.2
1993	18,315	3,085	15,230	14,903	327	0.4	0.4	0.1
1994	24,599	4,187	20,412	20,175	238	0.5	0.5	0.3
1995	29,722	9,656	20,066	18,842	1,224	0.2	0.2	0.2
1996	50,007	5,562	44,445	43,413	1,032	0.5	0.6	0.2
1997	20,730	5,480	15,250	14,414	836	0.2	0.2	0.1
1998	24,811	10,519	14,292	13,933	359	0.2	0.2	
1999	56,568	26,083	30,485	28,919	1,566	0.3	0.3	0.2
2000	32,745	7,252	25,493	24,257	1,235	0.3	0.3	0.1
2001	31,008	11,609	19,399	19,267	132	0.4	0.4	
2002	25,042	6,790	18,252	17,463	788	0.2	0.3	
2003	49,469	9,700	39,769	38,870	899	0.5	0.5	0.1
Average	24,268	8,496	16,930	16,378	608	0.4	0.4	0.5
Standard	13,739	5,036	10,497	10,197	501	0.2	0.2	0.7

Deviation												
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Average Size (mm)

Year	<i>Caranx melampygus</i>				<i>Caranx ignobilis</i>				<i>Caranx sexfasciatus</i>			
	Avg	Max	Min	n	Avg	Max	Min	n	Avg	Max	Min	n
1982	256	420	170	15					334	368	299	2
1983	437	615	355	6	760	760	760	1				
1984	320	320	320	1	590	590	590	1	377	570	240	3
1985	347	845	127	52	1,185	1,185	1,185	1	314	426	152	7
1986	274	365	209	15	411	615	225	4	353	510	191	13
1987	346	545	218	25	627	720	550	3	323	580	193	16
1988	303	540	110	40	305	445	234	4	330	610	203	20
1989	311	540	208	27	470	700	270	15	341	740	200	15
1990	325	600	70	36	480	780	260	12	290	550	140	6
1991	349	670	90	38	406	630	250	7	317	520	90	17
1992	309	570	210	27	381	760	200	18	153	225	100	4
1993	369	557	225	24	427	820	300	23	407	502	375	6
1994	319	500	212	24	281	730	97	16	356	610	200	16
1995	380	690	105	39	510	780	205	9	293	600	75	60
1996	357	710	180	54	451	915	200	13	303	620	89	34
1997	260	427	215	16	293	330	255	2	270	440	204	11
1998	340	620	225	46	541	975	290	5	269	490	145	20
1999	304	565	145	46	374	540	282	4	312	560	125	21
2000	296	680	70	70	453	845	221	10	294	790	170	25
2001	316	660	202	51	438	810	226	7	343	529	230	12
2002	248	596	76	40	507	858	227	12	247	630	88	16
2003	273	675	92	37	612	612	612	1	149	530	77	40
Average	320	578	174	33	500	733	354	8	304	543	171	17
Standard Deviation	45	122	77	17	196	185	253	6	63	121	77	14

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

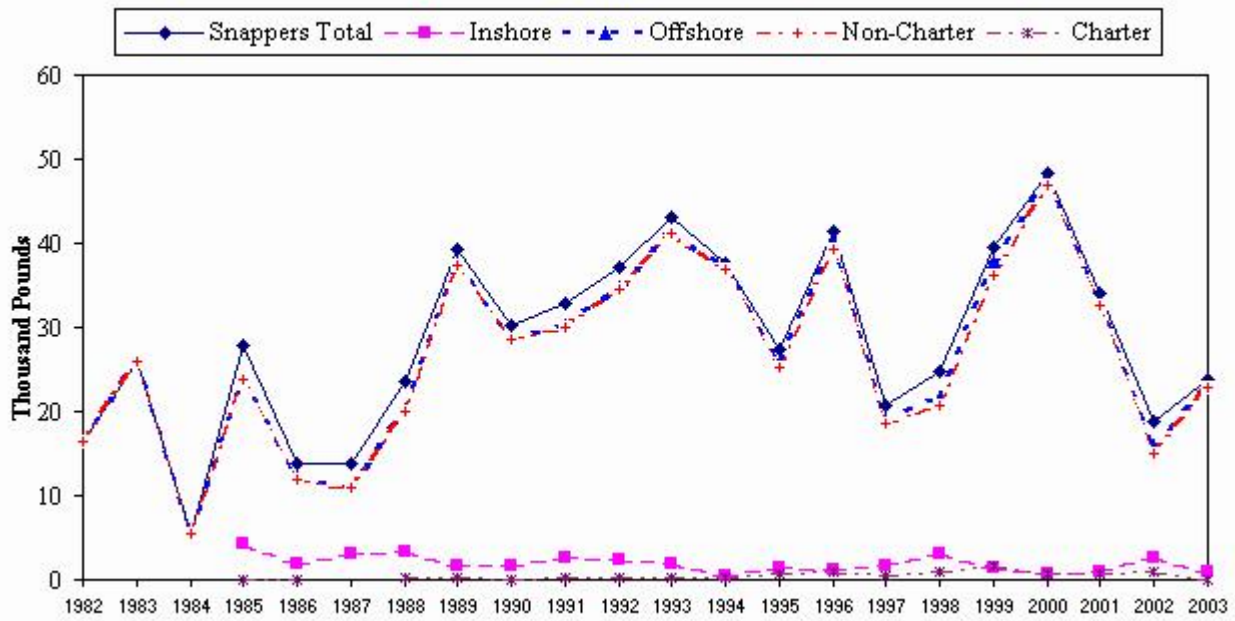


Figure 9b. Snappers (*Lutjanus*, *Pristipomoides*, *Aphareus*, *Etelis*): CPUE

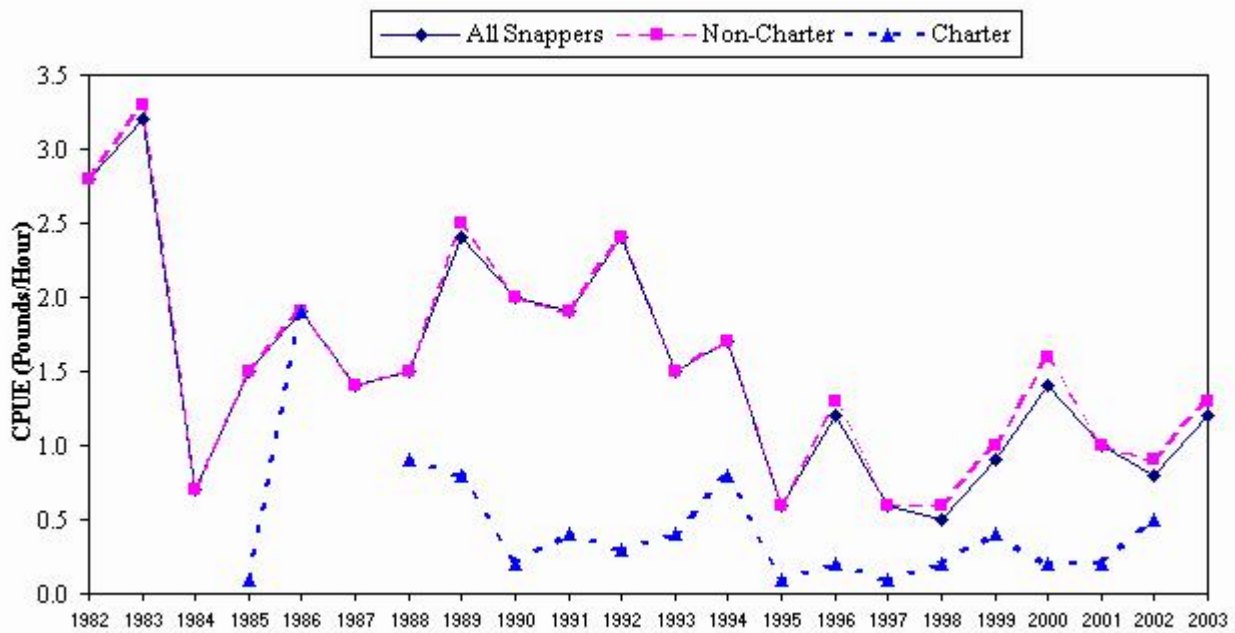


Figure 9c. Average Size Harvested: *Etelis carbunculus*

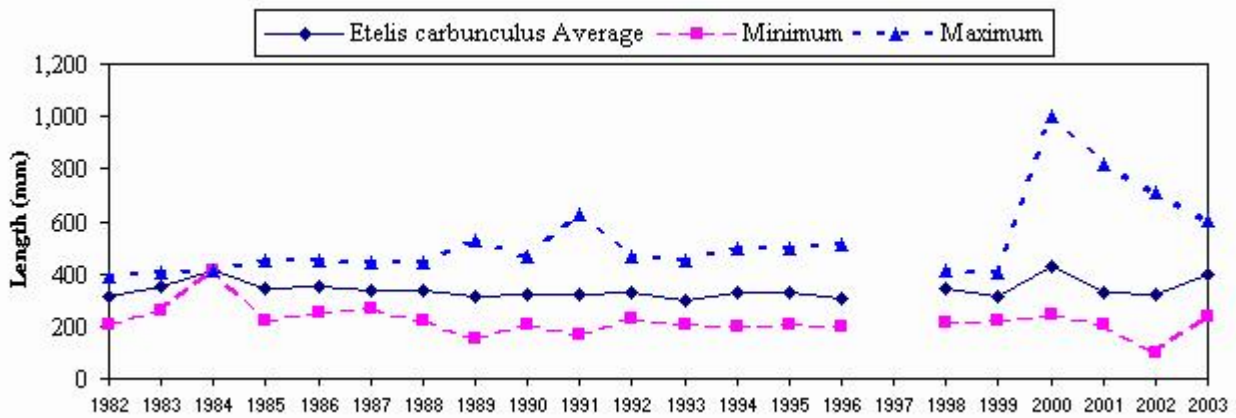


Figure 9d. Average Size Harvested: *Lutjanus kasmira*

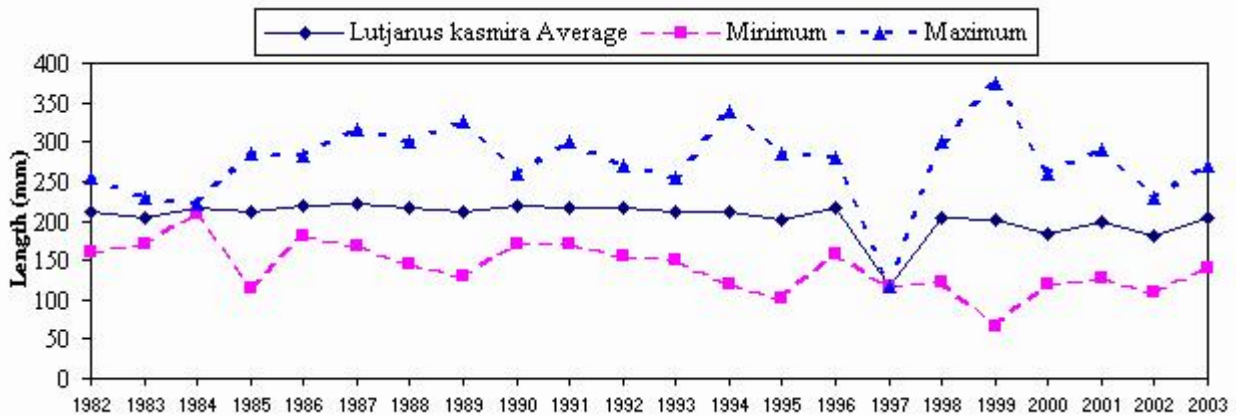
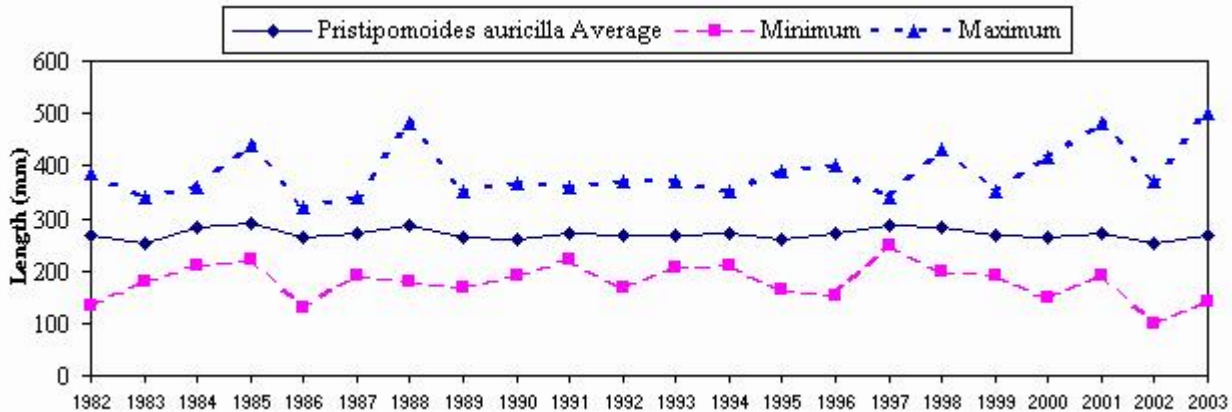


Figure 9e. Average Size Harvested: *Pristipomoides auricilla*



Interpretations: The 2003 total and offshore harvest of snappers increased 27% (23,733 pounds from 18,748 pounds) and 42% (22,872 pounds from 16,038 pounds) respectively. The inshore harvest of snappers decreased 67% (891 pounds from 2,710 pounds). Offshore non-charter harvest increased 53% (22,869 pounds from 14,981 pounds), while charter harvest of snappers decreased to almost zero.

The CPUE values for total and non-charter offshore increased 50% (1.2 lbs/hr from 0.8 lbs/hr) and 44% (1.3 lbs/hr from 0.9 lbs/hr) respectively. The CPUE for snappers fell from 0.5 lbs/hr to virtually zero, due to the near absence of snappers caught by charter boats. Offshore fisheries made up 96% of the total harvest.

The average sizes for the three representative snapper species increased in 2003. *E. carbunculus*, increased 23%, *L. kasmira* increased 13%, and *P. auricilla* increased 6% to 396 mm, 205 mm, and 269 mm respectively.

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.

Snappers Harvest (Pounds) and CPUE (Pounds/Hour)

Snappers Year	Total Harvest	Inshore Harvest	Offshore Harvest			Offshore CPUE		
			All	Non-Cht	Charter	All	Non-Cht	Charter
1982	16,453		16,453	16,453		2.8	2.8	
1983	25,945		25,945	25,945		3.2	3.3	
1984	5,475		5,475	5,475		0.7	0.7	
1985	27,971	4,236	23,735	23,732	4	1.5	1.5	0.1
1986	13,845	1,816	12,029	11,983	46	1.9	1.9	1.9
1987	13,911	3,058	10,853	10,853		1.4	1.4	
1988	23,657	3,443	20,214	20,054	161	1.5	1.5	0.9
1989	39,318	1,711	37,607	37,370	237	2.4	2.5	0.8
1990	30,287	1,785	28,502	28,458	44	2.0	2.0	0.2
1991	32,782	2,527	30,255	30,016	239	1.9	1.9	0.4
1992	37,079	2,315	34,764	34,594	170	2.4	2.4	0.3
1993	43,016	1,798	41,218	41,098	120	1.5	1.5	0.4
1994	37,673	551	37,122	36,970	153	1.7	1.7	0.8
1995	27,363	1,523	25,840	25,237	602	0.6	0.6	0.1
1996	41,376	1,203	40,173	39,293	880	1.2	1.3	0.2
1997	20,759	1,769	18,990	18,604	386	0.6	0.6	0.1
1998	24,707	3,138	21,569	20,694	875	0.5	0.6	0.2
1999	39,430	1,537	37,893	36,128	1,765	0.9	1.0	0.4
2000	48,229	792	47,437	46,786	652	1.4	1.6	0.2
2001	33,994	845	33,149	32,545	604	1.0	1.0	0.2
2002	18,748	2,710	16,038	14,980	1,057	0.8	0.9	0.5
2003	23,763	891	22,872	22,869	3	1.2	1.3	
Average	28,445	1,981	26,733	26,370	444	1.5	1.5	0.5
Standard Deviation	10,993	995	11,097	10,951	468	0.7	0.7	0.5

Average Size (mm)

Year	<i>Etelis carbunculus</i>				<i>Lutjanus kasmira</i>				<i>Pristipomoides auricilla</i>			
	Avg	Max	Min	n	Avg	Max	Min	n	Avg	Max	Min	n
1982	312	390	206	17	213	254	160	34	268	385	135	54
1983	351	404	262	10	203	230	171	13	252	340	179	89
1984	410	410	410	1	217	222	208	3	283	360	210	6
1985	342	450	220	38	212	285	115	67	291	440	220	51
1986	349	450	255	16	218	284	180	17	264	320	130	19
1987	335	440	265	17	222	315	168	45	273	340	190	27
1988	336	440	220	32	216	300	145	120	287	480	180	28
1989	313	530	155	41	211	325	130	92	264	350	170	151
1990	324	465	209	42	218	260	170	50	261	365	190	105
1991	317	630	170	47	216	300	170	53	272	360	220	97
1992	326	470	230	12	217	270	155	53	267	372	170	57
1993	299	450	210	32	211	255	150	38	267	370	205	86
1994	332	500	200	44	212	340	119	76	273	350	210	87
1995	329	494	210	18	202	285	102	85	260	390	165	57
1996	308	510	200	28	216	280	158	53	270	401	152	76
1997					118	118	118	1	287	340	250	3
1998	342	411	217	9	204	300	122	91	285	430	200	64
1999	314	405	222	11	200	375	65	78	267	350	190	65
2000	432	1,000	246	18	182	260	120	29	264	416	150	47
2001	328	818	207	28	197	290	127	39	270	481	190	46
2002	322	710	100	31	181	230	110	24	253	370	100	42
2003	396	606	240	23	205	270	139	33	269	501	140	40
Average	339	523	222	25	204	275	141	50	270	387	179	59
Standard Deviation	34	154	57	13	22	51	32	31	10	51	35	35

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

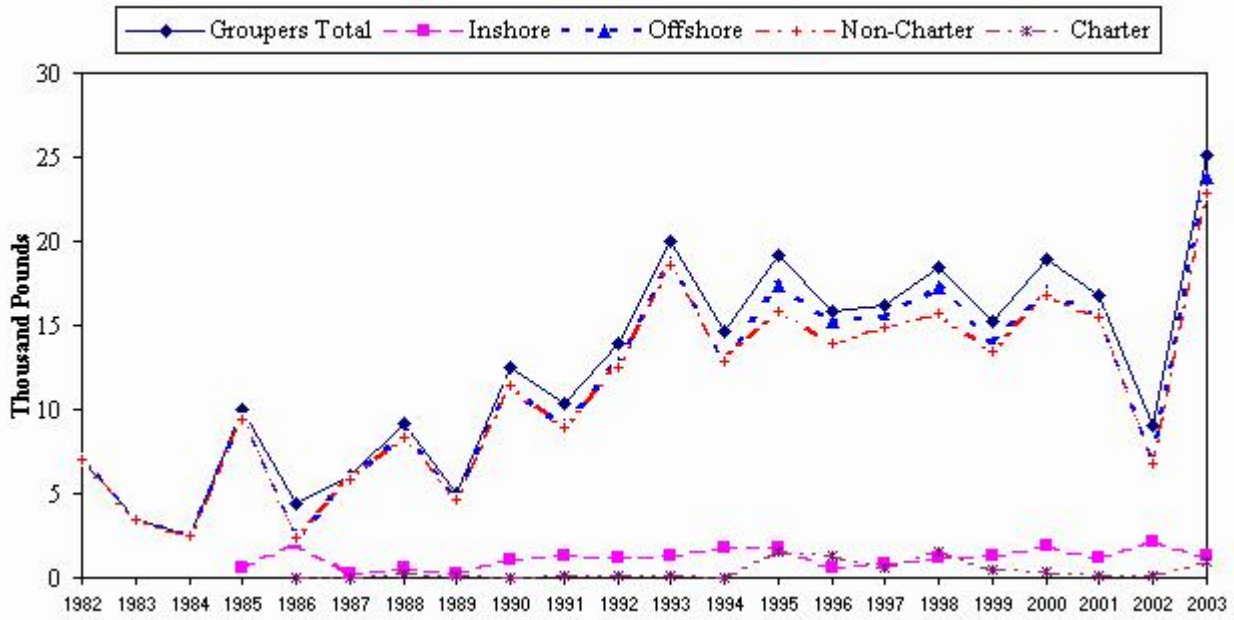


Figure 10b. Groupers (Epinephelus, Cephalopholis, Variola): CPUE

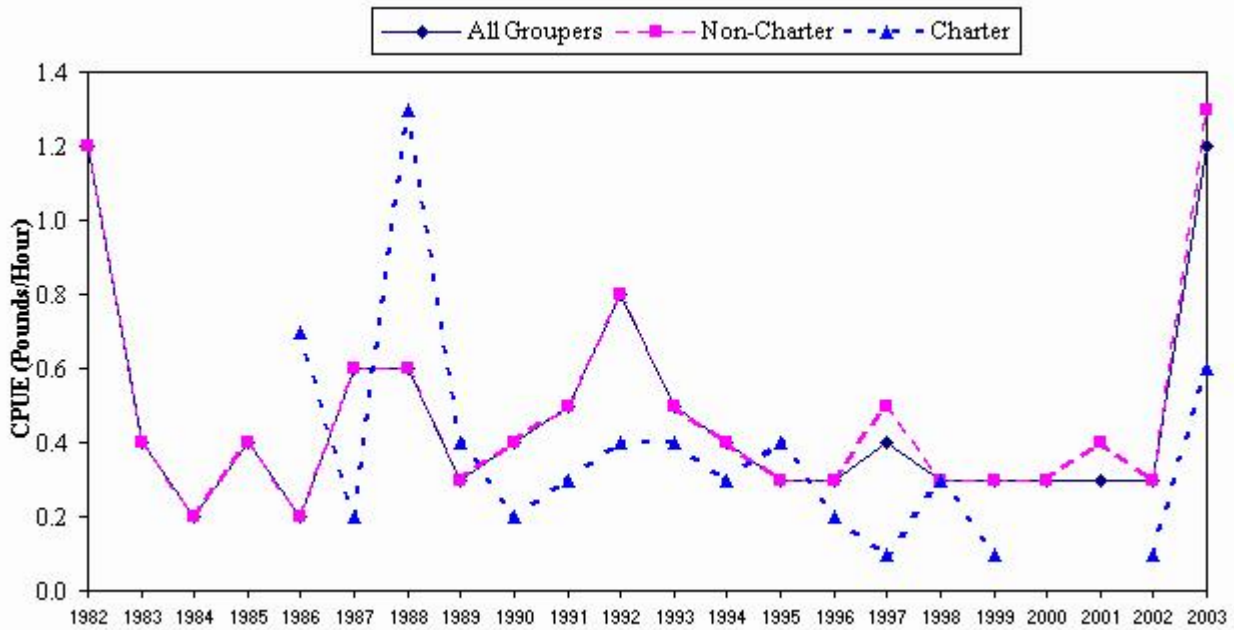


Figure 10c. Average Size Harvested: *Epinephelus fasciatus*

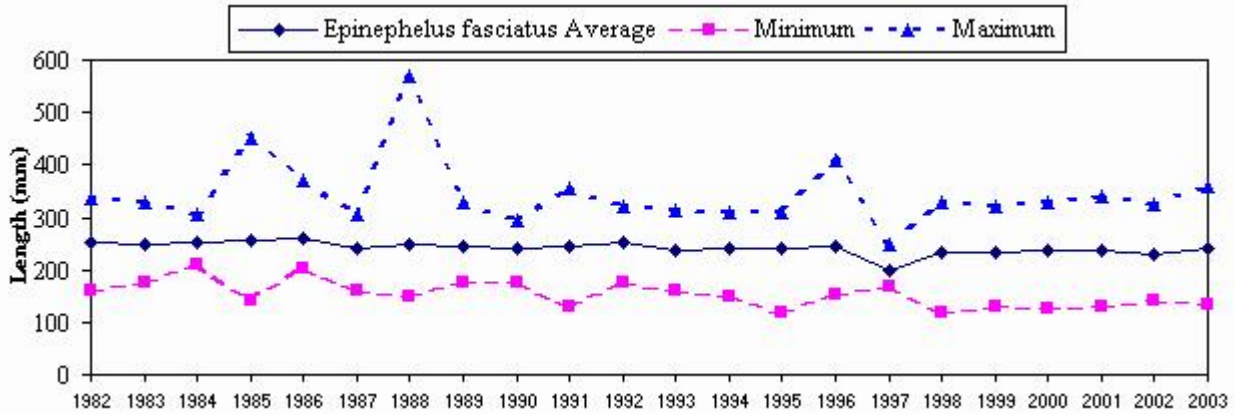


Figure 10d. Average Size Harvested: *Epinephelus merra*

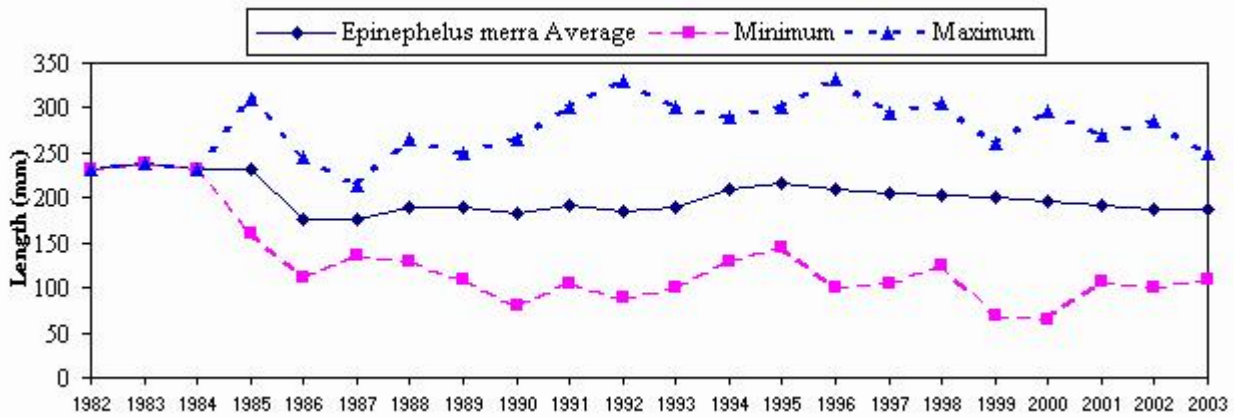
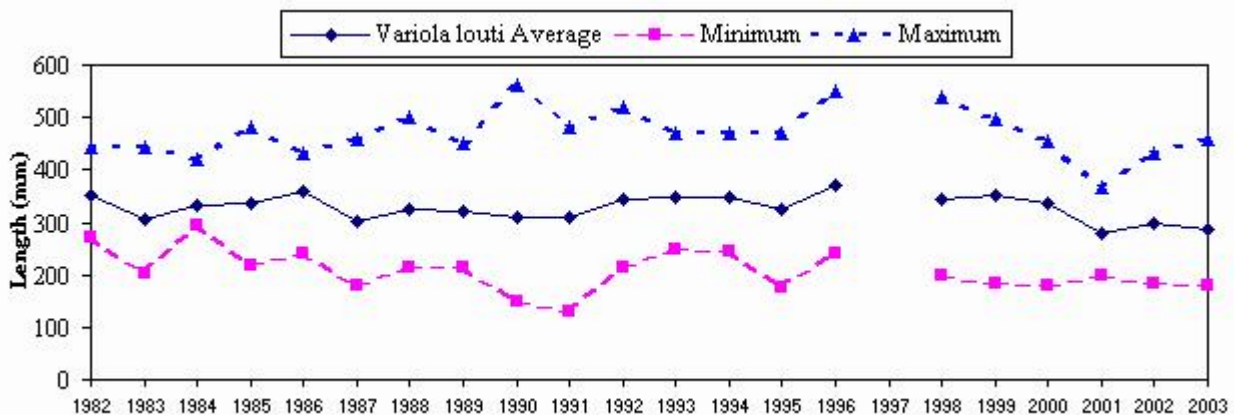


Figure 10e. Average Size Harvested: *Variola louti*



Interpretations: The total and offshore harvests for groupers increased in 2003, while the inshore harvest decreased. Total harvest increased 175% (9,093 lbs to 25,092 lbs), offshore harvest increased 243% (6,925

lbs to 23,808 lbs), while inshore harvest decreased 41% (1,284 lbs from 2,168 lbs). The CPUE for total offshore harvest, and non-charter, and charter harvests all increased significantly: 300% (0.3 lb/hr to 1.2 lb/hr), 333% (0.3 lb/hr to 1.3 lb/hr), and 500% (0.1 lb/hr to 0.5 lb/hr). Offshore fisheries harvested 95% of the total grouper harvest.

The average sizes for the three representative groupers remained virtually the same in 2003. *E. fasciatus* increased 5%, *E. merra* remained the same, and *V. louti* decreased 4%. The average sizes for these groupers are below averages for the 22-year time series.

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.

Groupers Harvest (Pounds) and CPUE (Pounds/Hour)

Groupers Year	Total Harvest	Inshore Harvest	Offshore Harvest			Offshore CPUE		
			All	Non-Cht	Charter	All	Non-Cht	Charter
1982	7,000		7,000	7,000		1.2	1.2	
1983	3,471		3,471	3,471		0.4	0.4	
1984	2,463		2,463	2,463		0.2	0.2	
1985	10,012	562	9,450	9,450		0.4	0.4	
1986	4,425	1,983	2,442	2,425	17	0.2	0.2	0.7
1987	6,066	243	5,823	5,814	9	0.6	0.6	0.2
1988	9,215	621	8,594	8,359	236	0.6	0.6	1.3
1989	5,012	221	4,791	4,664	127	0.3	0.3	0.4
1990	12,463	1,058	11,405	11,377	28	0.4	0.4	0.2
1991	10,332	1,256	9,076	8,918	158	0.5	0.5	0.3
1992	13,909	1,203	12,706	12,532	175	0.8	0.8	0.4
1993	20,013	1,333	18,680	18,582	97	0.5	0.5	0.4
1994	14,628	1,727	12,901	12,844	57	0.4	0.4	0.3
1995	19,183	1,815	17,368	15,825	1,543	0.3	0.3	0.4
1996	15,861	653	15,208	13,919	1,289	0.3	0.3	0.2
1997	16,222	802	15,420	14,847	573	0.4	0.5	0.1
1998	18,436	1,186	17,250	15,757	1,493	0.3	0.3	0.3
1999	15,179	1,258	13,921	13,437	484	0.3	0.3	0.1
2000	18,947	1,875	17,072	16,758	315	0.3	0.3	
2001	16,816	1,233	15,583	15,516	67	0.3	0.4	
2002	9,093	2,168	6,925	6,810	115	0.3	0.3	0.1
2003	25,092	1,284	23,808	22,816	991	1.2	1.3	0.6
Average	12,447	1,183	11,425	11,072	432	0.5	0.5	0.4
Standard Deviation	6,181	567	5,862	5,559	527	0.3	0.3	0.3

Average Size (mm)

Year	<i>Epinephelus fasciatus</i>				<i>Epinephelus merra</i>				<i>Variola louti</i>			
	Avg	Max	Min	n	Avg	Max	Min	n	Avg	Max	Min	n
1982	251	335	161	47	231	231	231	1	351	443	270	33
1983	250	330	175	48	239	239	239	1	307	445	203	33
1984	253	305	210	27	232	232	232	1	334	420	295	6
1985	255	450	141	143	232	309	161	13	338	480	218	41
1986	262	370	202	27	177	246	112	7	358	430	240	6
1987	242	307	160	62	177	215	137	14	303	460	180	35
1988	248	570	150	208	188	265	130	29	325	500	215	53
1989	245	330	175	95	189	250	110	22	321	450	215	42
1990	241	295	175	103	184	265	80	86	311	560	150	65
1991	245	355	130	101	193	301	105	80	310	480	130	32
1992	250	320	175	104	185	329	90	78	344	520	215	39
1993	238	312	160	114	190	300	100	98	347	470	250	29
1994	239	310	150	153	209	290	130	128	346	470	245	28
1995	242	310	120	235	216	300	146	184	325	470	175	21
1996	246	410	153	146	209	333	100	113	372	550	240	34
1997	198	250	170	7	205	295	105	47				
1998	233	330	120	197	203	305	125	132	344	540	200	19
1999	231	320	130	172	202	260	70	107	351	495	185	16
2000	239	330	128	80	196	297	65	127	336	455	180	24
2001	235	340	130	107	192	270	108	136	281	365	200	20
2002	229	325	140	96	187	285	100	100	297	433	185	20
2003	240	360	134	72	187	249	110	89	286	460	180	18
Average	241	344	154	107	201	276	127	72	328	471	208	29
Standard Deviation	13	65	25	61	19	33	49	55	24	46	39	14

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

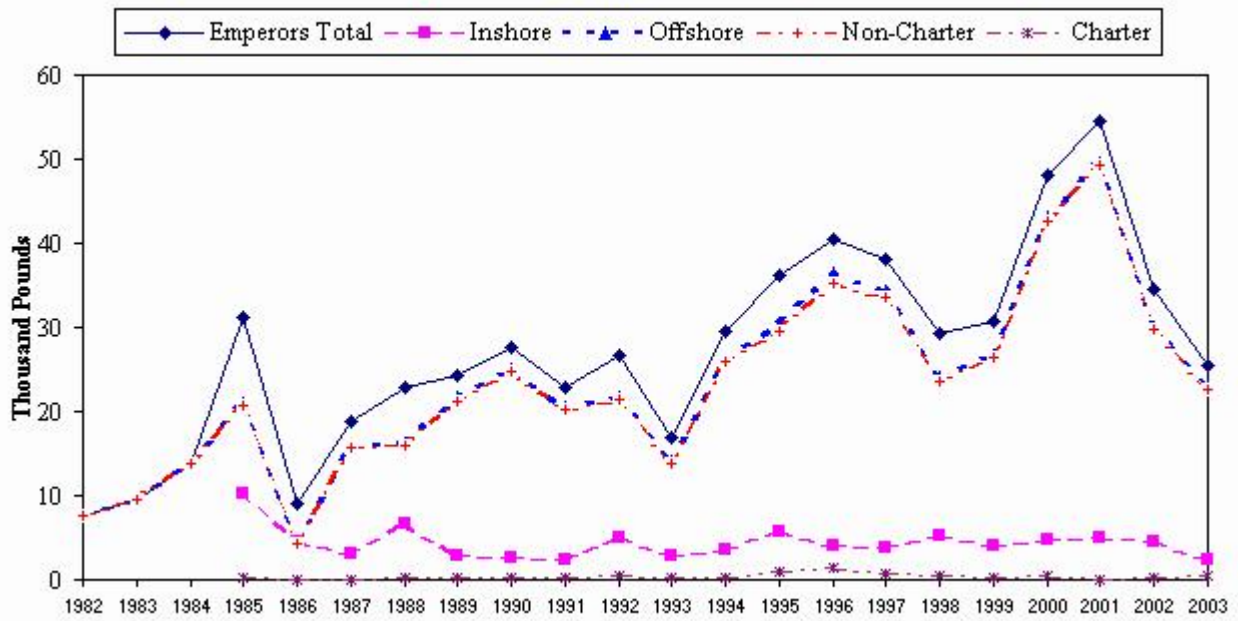


Figure 11b. Emperors (*Lethrinus*, *Gnathodentex*, *Gymnocranius*, *Monotaxis*): CPUE

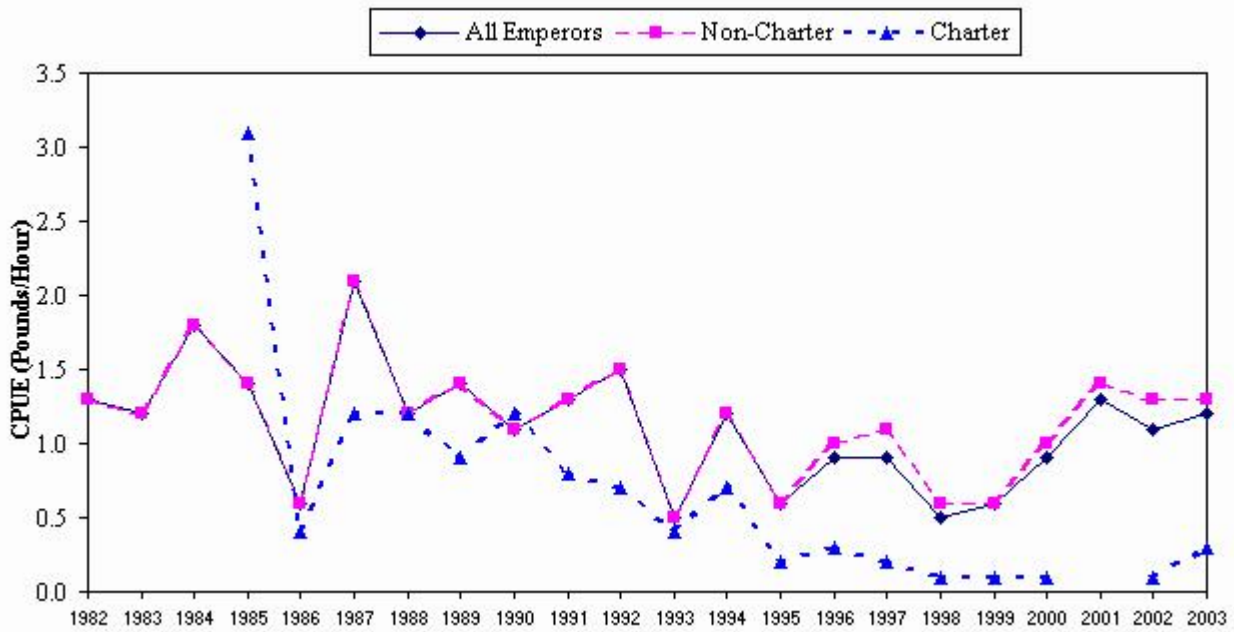


Figure 11c. Average Size Harvested: *Lethrinus olivaceus*

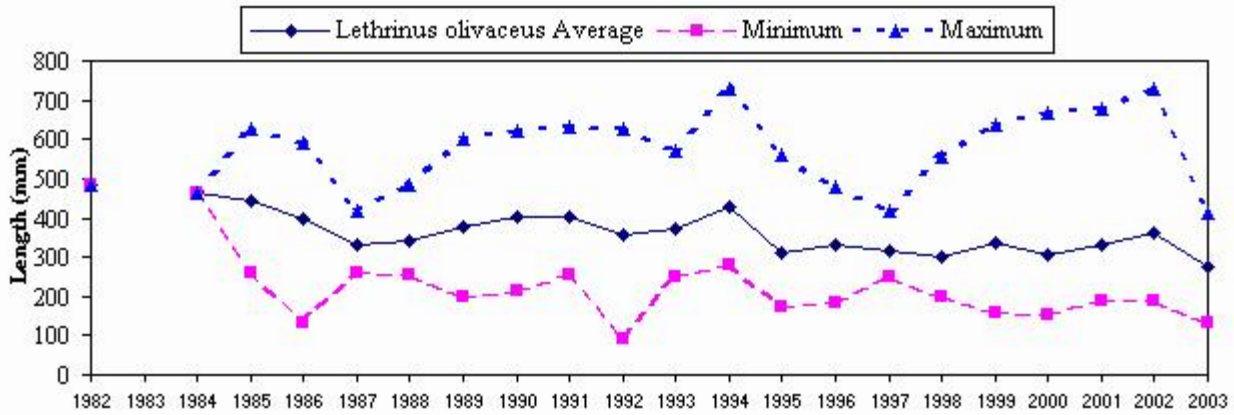


Figure 11d. Average Size Harvested: *Lethrinus obsoletus*

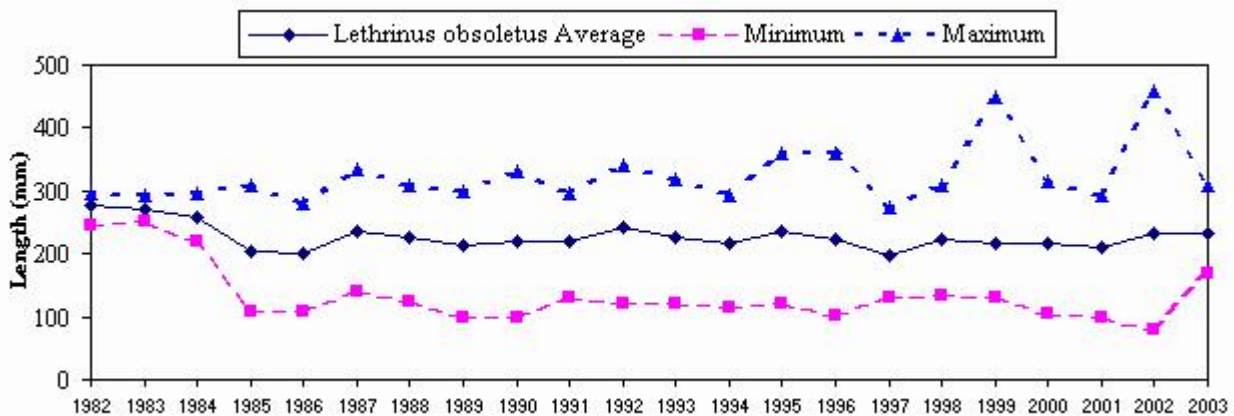
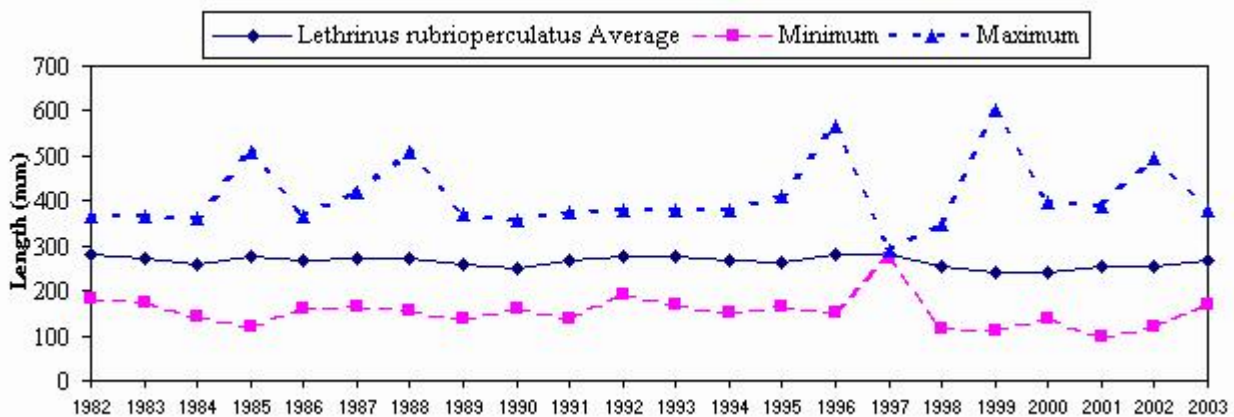


Figure 11e. Average Size Harvested: *Lethrinus harak*



Interpretations: The total, inshore, and offshore harvest of emperors decreased 26%, decreased 48%, and increased 23% in 2003, while charter harvest increased 171%. The CPUE for total harvest increased 9%, while the offshore non-charter harvest of emperors remained the same. Offshore fisheries made up 87% of the emperor harvest for 2002.

The average sizes of the *L. olivaceous*, *L. obsoletus*, and *L. harak* decreased 24%, increased 1%, and increased 7% respectively. *L. olivaceous*, a larger species of emperor, shows wider fluctuations in average size throughout the 22-year series, while the average sizes for the other two emperor species showing less fluctuation. The average size for *L. olivaceous* in 2003 is the smallest in the 22-year time series.

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.

Emperors Harvest (Pounds) and CPUE (Pounds/Hour)

Emperors Year	Total Harvest	Inshore Harvest	Offshore Harvest			Offshore CPUE		
			All	Non-Cht	Charter	All	Non-Cht	Charter
1982	7,677		7,677	7,677		1.3	1.3	
1983	9,635		9,635	9,635		1.2	1.2	
1984	13,843		13,843	13,843		1.8	1.8	
1985	31,182	10,341	20,841	20,691	149	1.4	1.4	3.1
1986	9,021	4,619	4,402	4,393	9	0.6	0.6	0.4
1987	18,910	3,204	15,706	15,648	58	2.1	2.1	1.2
1988	22,742	6,619	16,123	15,909	215	1.2	1.2	1.2
1989	24,337	2,780	21,557	21,300	257	1.4	1.4	0.9
1990	27,700	2,683	25,017	24,797	220	1.1	1.1	1.2
1991	22,911	2,478	20,433	20,177	256	1.3	1.3	0.8
1992	26,729	4,994	21,735	21,349	385	1.5	1.5	0.7
1993	16,799	2,857	13,942	13,821	121	0.5	0.5	0.4
1994	29,554	3,574	25,980	25,857	122	1.2	1.2	0.7
1995	36,161	5,687	30,474	29,634	840	0.6	0.6	0.2
1996	40,465	3,989	36,476	35,145	1,331	0.9	1.0	0.3
1997	38,202	3,916	34,286	33,516	770	0.9	1.1	0.2
1998	29,220	5,178	24,042	23,603	439	0.5	0.6	0.1
1999	30,783	4,135	26,648	26,327	321	0.6	0.6	0.1
2000	48,005	4,805	43,200	42,705	496	0.9	1.0	0.1
2001	54,484	4,982	49,502	49,401	101	1.3	1.4	
2002	34,463	4,485	29,978	29,795	183	1.1	1.3	0.1
2003	25,483	2,352	23,131	22,634	497	1.2	1.3	0.3
Average	27,196	4,404	23,392	23,084	356	1.1	1.2	0.7
Standard Deviation	12,093	1,853	11,102	10,927	327	0.4	0.4	0.7

Average Size (mm)

Year	<i>Lethrinus olivaceus</i>				<i>Lethrinus obsoletus</i>				<i>Lethrinus rubrioperculatus</i>			
	Avg	Max	Min	n	Avg	Max	Min	n	Avg	Max	Min	n
1982	485	485	485	1	276	295	245	10	281	365	185	242
1983					270	293	251	5	274	367	173	125
1984	462	462	462	1	258	295	220	2	260	360	142	56
1985	445	625	260	11	202	309	109	33	276	510	121	182
1986	398	590	134	10	201	280	109	21	268	365	160	46
1987	329	420	260	4	235	335	140	29	271	420	165	208
1988	343	483	256	11	225	310	125	47	271	510	155	352
1989	377	600	200	14	213	300	100	39	259	370	140	193
1990	404	620	215	18	220	330	100	68	250	355	160	306
1991	404	630	255	12	218	295	130	52	270	374	140	210
1992	356	625	94	18	241	340	121	63	278	380	190	173
1993	373	570	250	8	225	319	120	75	278	380	170	102
1994	427	731	280	24	217	294	115	125	270	379	150	157
1995	309	560	171	31	236	360	121	185	261	410	165	238
1996	332	480	185	21	224	360	103	156	282	565	150	116
1997	316	420	250	9	199	275	130	26	280	289	270	2
1998	301	555	200	26	224	310	135	98	254	350	115	114
1999	338	635	156	30	216	450	131	83	241	600	110	134
2000	305	665	153	61	216	315	105	135	242	396	140	85
2001	331	680	187	48	210	292	98	133	255	390	100	124
2002	360	731	189	40	231	460	80	104	252	496	120	133
2003	275	412	131	22	234	310	170	45	269	380	170	52
Average	365	570	227	20	227	324	134	70	266	410	154	152
Standard Deviation	57	99	96	15	20	48	46	52	12	77	35	86

12a. 2003 Bottomfish Bycatch: Non-charter and Charter

Species Name	Number Released			Total # of Species Caught	Bycatch (%)
	Alive	Dead/Injured	Both		
Non Charter					
<i>Epinephelus merra</i>	10		10	66	15.15
<i>Lethrinus harak</i>	2		2	103	1.94
<i>Lethrinus obsoletus</i>	6		6	59	10.17
<i>Lethrinus xanthurus</i>	11		11	80	13.75
<i>Thalassoma quinquevittatum</i>	3		3	3	100.00
<i>Odonus niger</i>	16		16	16	100.00
<i>Cephalopholis urodeta</i>	1		1	10	10.00
Non Charter Bycatch Total	49		49	337	14.54
Comparison with All Bottomfish				1,590	3.08
Charter					
<i>Aprion virescens</i>	1		1	1	100.00
<i>Saurida gracilis</i>	1		1	1	100.00
<i>Serranidae</i>	8		8	8	100.00
<i>Epinephelus merra</i>	2		2	2	100.00
<i>Rhinecanthus aculeatus</i>	6		6	6	100.00
<i>Lutjanus kasmira</i>	20		20	21	95.24
<i>Mullidae</i>	20		20	20	100.00
<i>Parupeneus bifasciatus</i>	15		15	16	93.75
<i>Parupeneus multifasciatus</i>	2		2	8	25.00
<i>Gymnosarda unicolor</i>	10		10	11	90.91
<i>Balistidae</i>	16		16	25	64.00
<i>Melichthys vidua</i>	13		13	16	81.25
<i>Odonus niger</i>	4		4	9	44.44
<i>Epinephelus fasciatus</i>	24		24	105	22.86
Charter Bycatch Total	142		142	249	57.03
Comparison with All Bottomfish				298	47.65
Total Bycatch	191		191	586	32.59
Comparison with All Bottomfish				1,888	10.12

12b. Bottomfish Bycatch: Summary

Year	Released alive	Released dead/injured	Total Number Released	Total Number Landed	Percent Bycatch	Interviews with Bycatch	Total Number of Interviews	Percent of Interviews with Bycatch
2001	620	3	623	3,896	16.0	58	183	31.7
2002	356	0	356	2,504	14.2	33	137	24.1
2003	191	0	191	1,888	10.1	14	100	14.0

Interpretation: Bycatch information was collected beginning in 2000 as a requirement of the Bottomfish FMP. Historically, most fish that is landed by fishermen is kept, regardless of size and species. This may

indicate a decrease of the stocks of more desirable bottomfish species, resulting in the harvest of juveniles, smaller individuals, and less desirable species. In 2003, the number fish discarded as bycatch decreased 46% from 356 pieces to 191 pieces. Charter boats discarded a majority of the bycatch, approximately 74%.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: Bycatch is obtained from the interviews with bottomfishing where bycatch was voluntarily reported. The numbers recorded are not expanded numbers, only from the bottomfish interviews obtained during 2002. Information obtained about bycatch includes the number of each individual fish species, an estimated length, and a computer generated calculated weight based on the estimated length. While fishermen know most fish species, fisheries staff will ask additional questions on the appearance of a fish in an attempt to identify the fish to the species level.