Appendix 4

Commonwealth of the Northern Mariana Islands

CONTENTS

Summary

Landings of bottomfish decreased (34.3% fewer pounds in 2002 than in 2001) from the highest total landings last year, to slightly higher than the 20-yr mean. Bottomfish landings in the CNMI have been higher than the 20-yr mean for the last 7 years. The number of trips during which bottomfishes were caught also decreased to near the 20-yr mean, and the average bottomfish catch per trip increased to just above the 20-yr mean. This fishery continues to show a high turnover with changes in the high liners participating in the fishery and an increased number of local fishermen focusing on reef fishes in preference to bottomfishes. Fishermen are moving towards an increasing number of multi-purpose trips that focus primarily on reef fishes and catch pelagic species while in transit. In doing so, the shallow-water bottomfish complex continues to be exploited, but as part of the exploitation of reefs near the populated islands. Redgill emperor (mafute') is the most frequently harvested and easily identified species in this complex, although a variety of snappers and groupers are also harvested.

The number of large-vessel commercial bottom-fishing ventures active in the northern islands appeared to increase to eight during 2000, but only four were active for more than a few trips. Of these four, two primarily sold their catches off the island of Saipan (mostly to the large hotels in Tinian). Commercial trips made by these large vessels are no longer sampled on a monthly basis. These vessels catch the majority of the deep-water bottomfishes, although in 2002 one high liner for onaga used small vessels to fish locally off Saipan. In 2002, the most consistent high liner of previous years did not fish, and a second high liner only fished the first 5 months of 200.

Domestic US, joint-venture, and foreign vessels continue to inquire about full-time bottom fishing throughout much of the CNMI. The impact of these ventures on the commercial market is still unclear despite a fish-market assessment study conducted in 1994, and completed in late 1996. The results of this study did not correspond with the significant increase in the northern islands bottomfish harvest.

Revenues and prices for bottomfishes were lower in 2002 than in 2001, with the inflation-adjusted revenue greater than the 20-year mean, but the average price per pound (adjusted) continued to be lower than the 20-yr mean. Only 5 years in the last 20 have had lower values. Prices decreased for all groups (from 10¢ to 79¢ /lb) from last year, with the exception of ehu (increased 4¢ /lb), gindai (increased 5¢ /lb), sickle pomfret (increased 18¢ /lb), and “assorted bottomfish” (increased 2¢ /lb). Onaga still command the best prices, but the range is narrowing with opakapaka, blueline snapper, gindai, ehu, kalikali, emperor (mafute'), and silvermouth within 50¢ per pound.

Over the last 6 years, 64% of mafute fishermen and 62% of onaga fishermen making commercial sales participated for only a single year and no fishermen participated in all 6 years (regardless of how small the sales). Fishermen utilizing larger vessels have greater access to the deep-water bottomfish resources, especially in the northern islands of the CNMI. However, this sector of the industry requires more investment, consistent long-term effort, and knowledge to recoup the costs than the shallow-water bottomfish sector. This industry could continue to expand with support from a training program in bottomfishing that addresses the following: proper fish handling and maintenance of product quality, use of fathometers, nautical charts, modern electronic equipment such as GPS, fish finders, electric reels, anchoring techniques, marketing, and financial planning. Moreover, side-band sonar mapping of the banks used by commercial fishermen from Farallon de Medinilla to Rota should assist the growth of this sector.

Historical Annual Statistics for CNMI Bottomfishes

year	total landings (lbs)	CPUE (lb/trip)	inflation-adjusted revenue ($)	average price (per lb)	number of boats
1983	28,529	53	97,054	3.40	90
1984	42,664	87	131,267	3.08	102
1985	40,975	145	117,717	2.87	55
1986	29,912	131	93,539	3.13	54
1987	49,715	210	142,838	2.87	43
1988	47,313	224	130,336	2.75	29
1989	24,438	95	73,965	3.03	29
1990	13,628	106	44,748	3.28	29
1991	7,116	57	25,385	3.57	20
1992	10,598	74	31,144	2.94	37
1993	18,461	104	52,235	2.83	20
1994	25,470	92	76,905	3.02	32
1995	36,102	116	128,992	3.57	34
1996	66,362	148	230,123	3.47	70
1997	64,090	170	216,833	3.38	69
1998	59,040	185	206,157	3.49	50
1999	56,201	196	205,158	3.65	51
2000	45,619	72	128,488	2.82	66
2001	71,660	86	219,183	3.06	75
2002	**47,110**	**126**	**135,823**	**2.88**	**53**
mean	39,250	124	124,394	3.15	50
standard deviation	19,107	51	64,522	0.29	23

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Introduction

The Commonwealth of the Northern Mariana Islands' (CNMI) bottomfish fishery occurs primarily around the islands and banks from Rota Island to Zealandia Bank north of Sarigan. However, the data are limited to the catches landed on Saipan, which is by far the largest market. For this reason, Mr. David Hamm strongly recommended that these landings (in pounds) and revenues be inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market). The results presented in this report do so. The fishery is characterized in this report by data collected through the Commercial Purchase Database, which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon voluntary participation by first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collected and distributed invoice books to 34 participating local fish purchasers in 2002; which include the majority of the fish markets, stores, restaurants, hotels, government agencies, and roadside vendors (fish-mobiles). This is a marked reduction from 42 participants last year, because many vendors are no longer open.

Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fishery. The identification and categorization of fishes on the sales invoices has improved markedly in the last 10 years. Unfortunately, two inherent problems remain in the database. First, a number of the bottomfish MUS are not listed on the sales receipts. This was partially corrected by the addition of new taxa (but not all BMUS species) to the receipts (black jack, giant trevally, amberjack, ehu, blueline snapper, kalikali, and sickle pomfret were added to sales invoices in 2001). However, not all vendors are using the new receipts. Moreover, for those BMUS species not specifically listed on the receipts there remains some confusion regarding where they should be added to the receipts. Second, the market is changing, with more fishermen pooling their catches and sales often representing more than a single one-day trip by a single fisherman.

The CNMI's bottomfishery still consists primarily of small-scale local boats engaged in commercial and subsistence fishing, although a few (generally <5) larger vessels (35–60 ft) usually participate in the fishery. The bottomfishery can be broken down into two sectors: deep-water (>500 ft) and shallow-water (100–500 ft) fisheries. The deep-water fishery is primarily commercial, targeting snappers and groupers. The snappers targeted include members of *Etelis* and *Pristipomoides,* whereas the eight-band grouper (*Epinephelus octofasciatus*) is the only targeted grouper. The shallow-water fishery, which targets the redgill emperor (*Lethrinus rubrioperculatus*), is mostly commercial but also includes subsistence fishermen. These fishermen are taking not only bottomfishes, but many reef fishes (especially snappers and groupers) as well. Hand lines, home-fabricated hand reels and electric reels are the common gear used for small-scale fishing operations, whereas electric reels and hydraulics are the common gear used for the larger operations in this fishery. Historically, some trips have lasted for more than a day, but currently, effort is defined and calculated on a daily trip basis. Fishing trips are often restricted to daylight hours, with vessels presumed to return before or soon after sunset, unless fishing in the northern islands. In terms of participation, the bottomfish fleet consists primarily of vessels less than 24 ft long that are usually limited to a 30-mi radius from Saipan. The larger commercial vessels that are able to fish extended trips and which focus their effort from Esmeralda Bank to Zealandia Bank are presumed to have landed the majority of the deep-water bottomfish reported through the purchase receipt forms. In 2002, the most consistent high liner of previous years did not fish and a second high liner only fished the first 5 months of 2002.

Bottomfishing requires more technical skill than pelagic trolling, including knowledge of the location of specific bathymetric features. Presently, bottomfishing can still be described as “hit or miss” for most of the smaller size (14–25 ft) vessels. Without fathometers or nautical charts, the majority of fishermen utilizing smaller vessels often rely on land features for guidance to a fishing area. This type of fishing is inefficient and usually results in a lower catch-per-unit-effort (CPUE) in comparison with pelagic trolling. These fishermen tend to make multi-purpose trips—trolling on their way to reefs where they fish for shallow-water bottomfish and reef fish. Larger sized (25-ft and larger) vessels typically utilize Global Positioning System (GPS), fathometers, and electric reels, resulting in a more efficient operation. In addition, reef fishes are now commanding a consistently higher price than in previous years. This appears to be reflected in an increased number of fishermen using small vessels focusing on reef and/or pelagic species over bottomfishes.

The participation of fishermen in the bottomfishery tends to be very short term. During the past 6 years, 64% of the mafute' fishermen and 62% of the onaga fishermen only sold fishes for a single year, and none sold fishes in all 6 years. Among high liners selling more than 500 lbs/yr, 67% of both the mafute' and onaga fishermen only made large sales in a single year, and none made sales >500 lbs/yr in more than 3 of the 6 years. Whereas tenacity of mafute' fishermen in the bottom fishery drops with each year (64% participate for 1 yr, 20% for 2 yrs, 10% for 3 yrs, 6% for 4 yrs, and 1% for 5 yrs), the tenacity of onaga fishermen is higher for 3 yrs of participation than for 2 yrs (62% participated for 1 yr, 10% for 2 yrs, 20% for 3 yrs, 6% for 4 yrs, and 2% for 5 yrs). This likely reflects the greater skill and investment required to participate in the deep-water bottomfishery. In addition, these tend to be larger ventures that are more buffered from the vagaries of an individual’s choices and are usually dependent on a skilled captain/fisherman. Overall, the long-term commitment to hard work, maintenance and repairs, and staff retention appear to be difficult, if not impossible for CNMI bottomfishermen to sustain more than a few years.

Recommendations

2002 Recommendations

1) To request NMFS and the Council continue to assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.

2) To request NMFS and the Council continue to assist the CNMI by supporting the MARAMP cruises to the northern islands of the CNMI.

3) To request the council to hire a consultant to examine and assess the best way to capture the data necessary for fishery management (potentially through creel surveys, community development programs, commercial purchase systems, or other types of data collection systems), while including the local social, political, legal, and economic constraints within the CNMI.

2001 Recommendations & Progress

1) To request NMFS and the Council to assist DFW in identifying an expert who is capable of and willing to prepare otoliths of redgill emperor and then count daily growth rings.

   This recommendation was removed from this list, because DFW identified an expert who was willing to and capable of preparing the otoliths of redgill emperor at the ORC Reef Research Center in Townsville, Australia.

2) To request NMFS and the Council assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.

   This recommendation remains a high priority for the CNMI, and has been continued as a recommendation for 2002.

3) To request that Council merge the Bottomfish Plan Team (as well as the Crustacean Plan Team) with the Coral Reef Ecosystem Plan Team.

   No action was taken.

Figures, Interpretations, Calculations, and Tables

Table 1.—CNMI consumer price indices (CPIs).

year	CPI	CPI adjustment factor
1983	140.90	1.93
1984	153.20	1.77
1985	159.30	1.70
1986	163.50	1.66
1987	170.70	1.59
1988	179.60	1.51
1989	190.20	1.43
1990	199.33	1.36
1991	214.93	1.26
1992	232.90	1.17
1993	243.18	1.12
1994	250.00	1.09
1995	254.48	1.07
1996	261.98	1.04
1997	264.95	1.02
1998	264.18	1.03
1999	267.80	1.01
2000	273.23	0.99
2001	270.98	1.00
2002	**271.53**	**1.00**

Calculation: The Commonwealth of the Northern Mariana Islands' Consumer Price Index is computed by the CNMI Department of Commerce using the Laspeyres' formula. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Figure 1.—Commercial bottomfish landings, allocated to sector of the fishery (or categorized as "assorted bottomfishes").

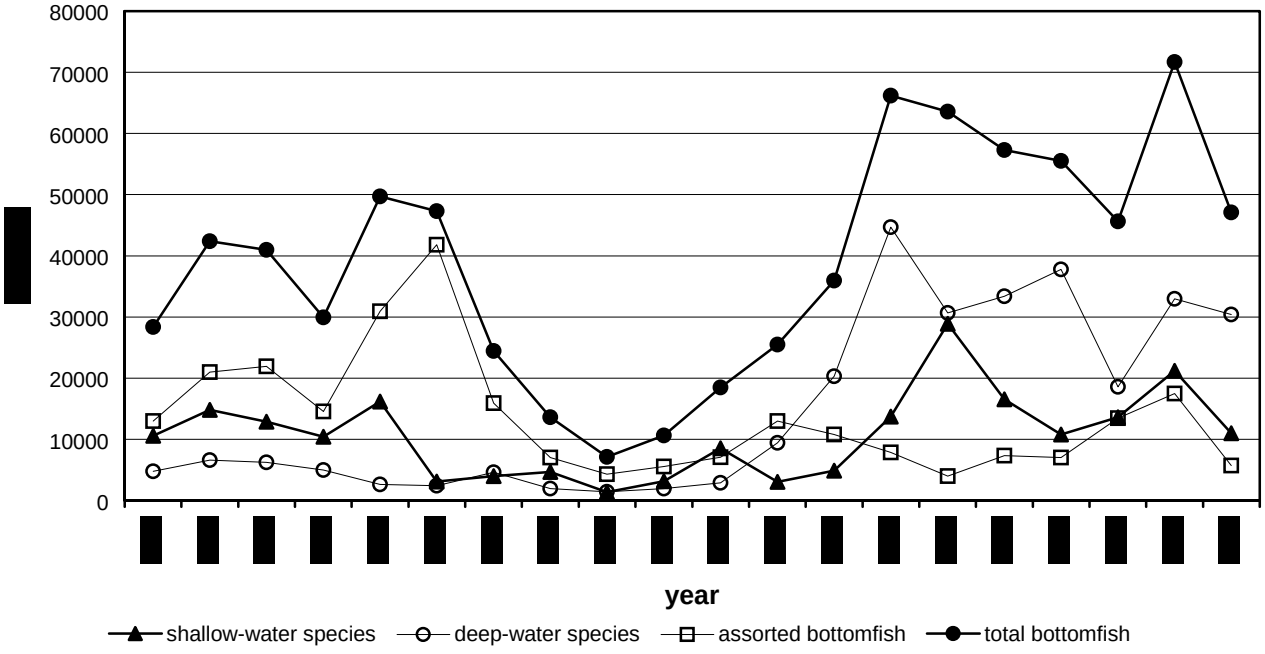


Figure 2.—Commercial bottomfish landings of shallow-water species.

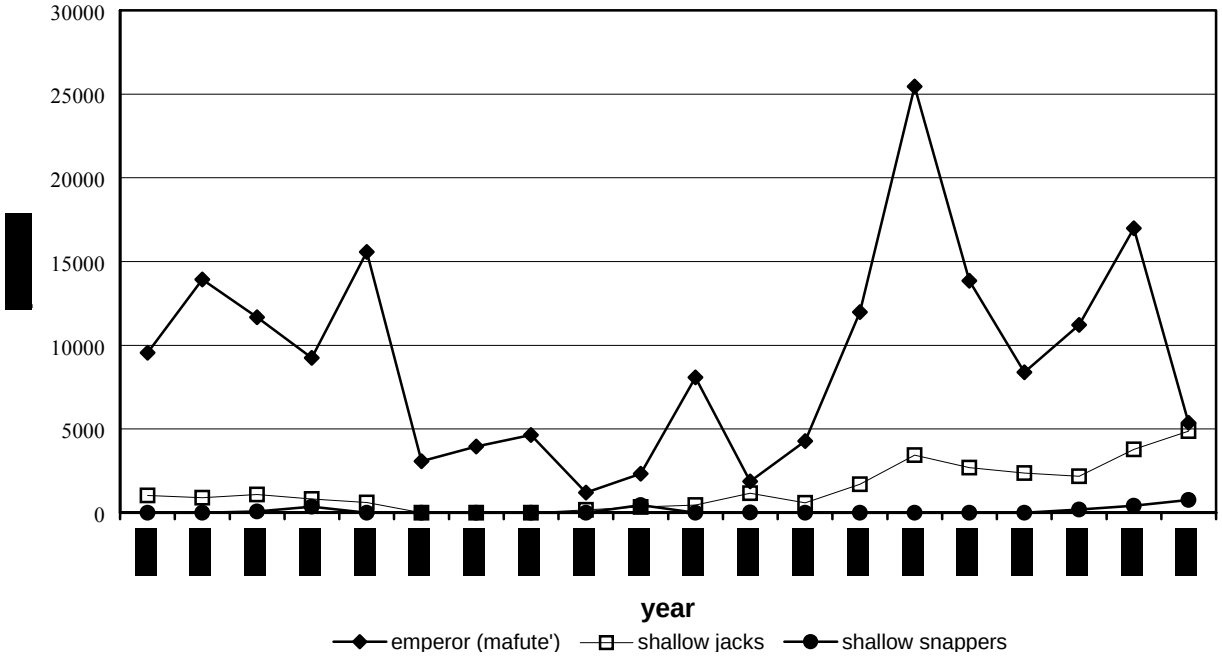
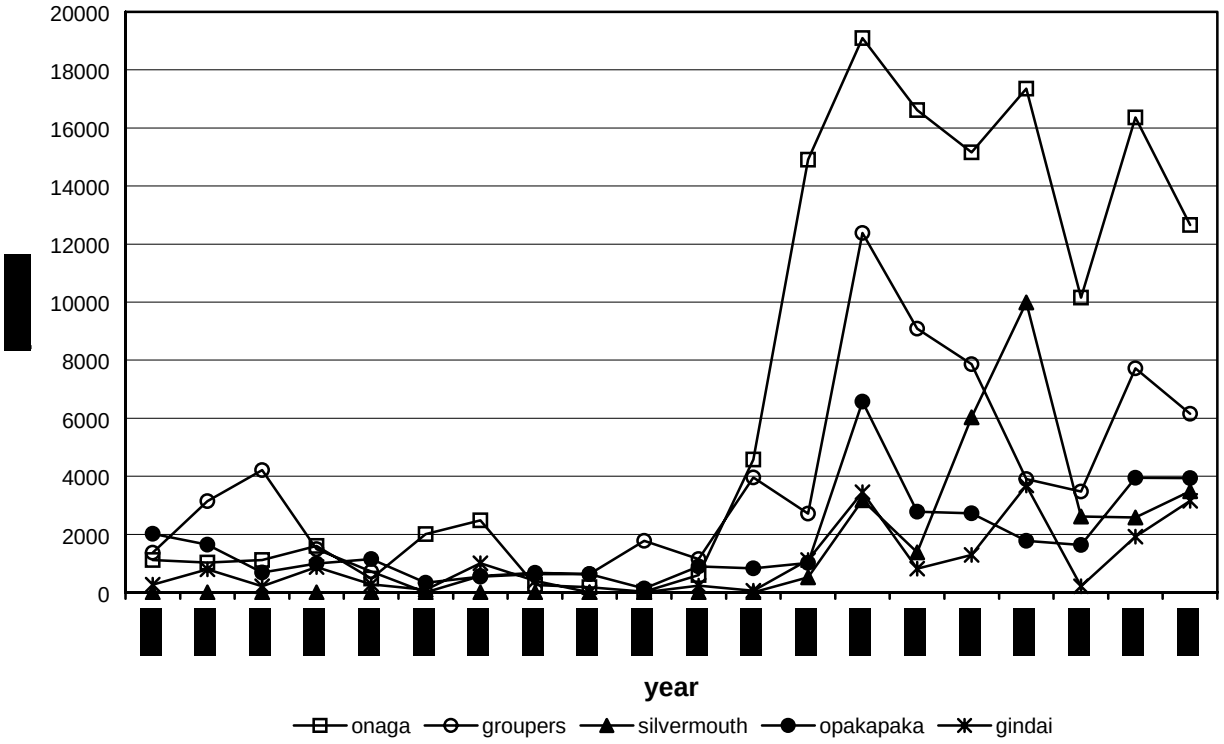


Figure 3.—Commercial bottomfish landings of deep-water species.



Interpretation: Taken as a whole, the number of pounds of bottomfishes sold (landings) decreased in 2002 by 34% from that of 2001. In part, this may be explained by a large number of days in 2002 where the sea conditions were too rough for small vessels (including the passage of super-typhoons Chataan and Pongsona). In addition, fewer fishermen are landing bottomfishes in the CNMI. Only 53 fishermen sold bottomfishes as part of their catch in 2002, compared to 75, 66, 51, 50, and 69 in each of the previous 5 years.

Bottomfishes that were categorized simply as "assorted bottomfish" were the largest portion of the landings until 1995. Since 1995, deep-water bottomfishes have been the largest portion of the catch, with shallow-water bottomfishes becoming the second largest portion of the catch in 1996, and remaining there through 2002. The slight rise in landings of "assorted bottomfish" in 2000 and 2001 probably reflects a change in staff at DFW. In 2002, "assorted bottomfishes" decreased to 12.1% of the landings (or 1.26% of the bottomfish records). This probably reflects the use of the new sales invoice forms, with more species specifically listed and increased efforts on the part of staff to encourage buyers to list purchases as exactly as possible. The use of the category "assorted bottomfish" will likely continue, because the diversity of the catch is great and many buyers sell these species as "assorted bottomfish," so there is little perceived need to identify them more completely.

The number of pounds of shallow-water bottomfishes commercially sold (landings) appeared to peak between 1996 and 2001. It is likely that there was a comparable peak in landings between 1984 and 1987, but this result is difficult to discern because of the large number of bottomfishes that were categorized as "assorted bottomfish" during the earlier period. The landings of emperor (mafute' of the family Lethrinidae)

have experienced large fluctuations over the last 20 years, and particularly over the last 8 years. In 2002, the number of pounds of mafute' commercially sold fell below the 20-year mean to the lowest level since 1995. This is likely the result of turnover in this sector of the industry (64% of the mafute' fishermen made sales [of any size] in only 1 of the last 6 years) and the ⅓ reduction in the number of fishermen selling mafute' (22 in 2002 compared to 36 in 2001, 32 in 2000, 1999, and 1998, and 46 in 1997). The landings of jacks fished in shallow areas (itemized as "jacks," amberjack [*Seriola dumerili*], giant trevally [*Caranx ignobilis*], and black jack [*C. lugubris*] on the sales invoices) appears to have slowly increased over the last 10 years, with the highest landings reported in 2002. This is likely related to the decrease in the amount of the landings sold as "assorted bottomfish," but may also partially reflect an actual increase in landings of shallow-water jacks given that "jacks" have been specifically reported for most of the last 20 years. The category "jacks" may include any carangids sold, including BMUS species *Carangoides orthogrammus, Caranx melampygus, C. papuensis,* and *C. sexfasciatus*. Landings of amberjack were slightly higher in 2002 than the 20-year mean. Giant trevally and black jack were reported in 2002 for the first time, likely as a result of being added to the new sales invoice. Jobfish (*Aprion virescens*) have been reported in 7 of the last 20 years, and in 2002 landings were higher than the 7-year mean. Landings of blueline snapper (*Lutjanus kasmira*) and humpback snapper (*Lutjanus gibbus*) were reported for the first time in 2002.

Deep-water bottomfish landings increased significantly in 1995 and have remained fairly high since then. This is likely the result of an increase in the number of large vessels participating in the deep-water bottomfishery that are capable of fishing the islands and banks north of Farallon de Medinilla. Note however, that deep-water bottomfishes are still caught in large numbers near Saipan. For example in 2002, 1 of the 3 onaga high liners (landing >1600 lbs of onaga) fished locally around Saipan. The landings of onaga (*Etelis coruscans* and some *Etelis radiosus*) fell again in 2002, but are still almost twice the 20-year mean. Note that this sector of the industry also has a high turnover, (62% of the onaga fishermen made sales [of any size] in only 1 of the last 6 years), but differs from the mafute' in that successful fishermen often participate for more years (10% of the onaga fishermen made sales [of any size] in 2 of the last 6 years, but 20% of these fishermen made sales in 3 of the last 6 years). This sector of the fishery has remained nearly constant at 10–15 fishermen for 5 of the last 6 years; but in 2001, 22 fishermen made sales of onaga. The landings of groupers (primarily *Epinephelus octofasciatus,* but almost certainly including shallow-water species such as *Variola louti* and *E. fasciatus*) have varied widely over the last 8 years, with a 20.3% decrease in landings in 2002 from 2001 but still remain over the 20-year mean. Silvermouth (*Aphareus rutilans*) have been reported since 1995, and landings have fluctuated considerably. Landings in 2002 were 34.6% higher in 2002 than 2001, but slightly lower than the 8-year mean. Opakapaka (*Pristipomoides filamentosus,* and likely some *P. flavipinnis*) landings have varied somewhat in the last 8 years, but the 2002 landings were indistinguishable from those of 2001 and remain more than twice the 20-year mean. Gindai (*Pristipomoides zonatus,* and likely some *P. argyrogrammicus*) landings have also varied over the last 8 years, with this year's landings 64.8% greater than last year's. The landings of gindai in 2001 were almost 3 times the 18-year mean. Reported landings of ehu (*Etelis carbunculus*) were more than 3000% greater than the landings in 2001, but essentially the same as the 5-year mean. The increase reported in 2002 likely is a result of the addition of this species category to the new sales invoice. Landings of sickle pomfret (*Taractichthys steindachneri*) have been reported the last 4 years, with a 14.8% decrease from those of 2001, but remain just slightly below the 4-year mean. This species was also added to the new sales invoice this year. Kalikali (*Pristipoimoides auricilla* and *P. sieboldii*) were reported in 1998, 1999, and 2002, although they appeared on the new sales invoice for the first time in 2002.

Calculation: Annual summaries for each species from sales invoice datasheets are totaled and then inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002).

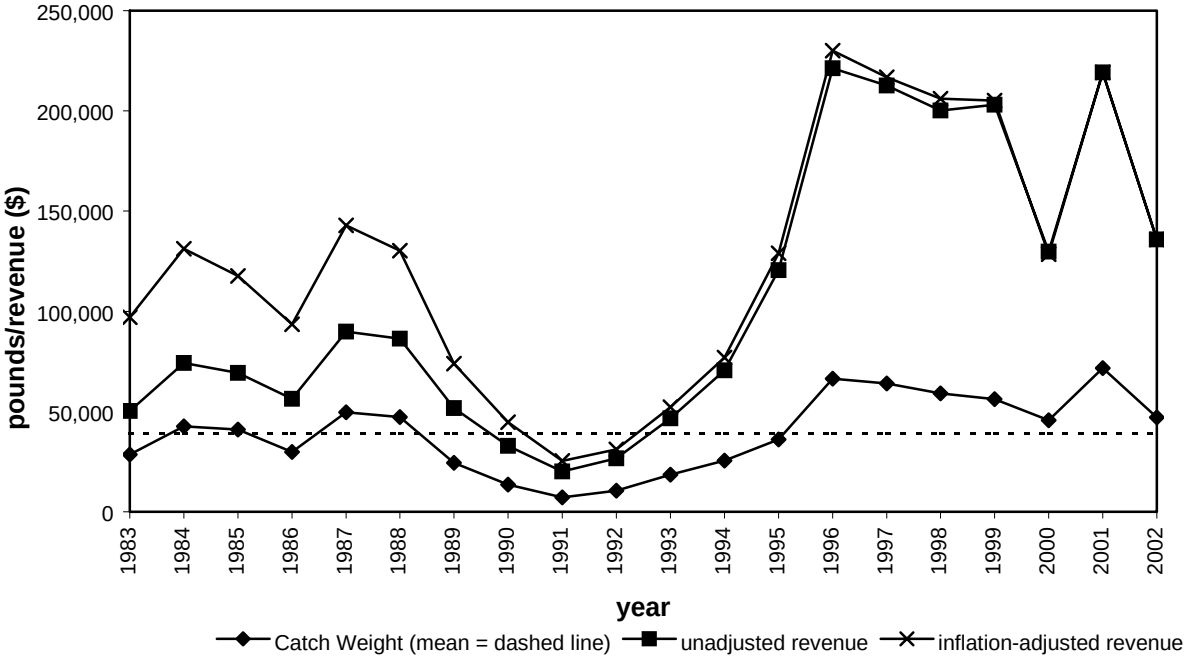
Table 2.—Commercial landings (in pounds) of shallow-water bottomfishes.

year	emperor (mafute')	jacks	amberjack	giant trevally	black jack	jobfish	blueline snapper	humpback snapper	assorted bottomfish
1983	9555	1031							12998
1984	13925	906							20971
1985	11676	962	135			81			21904
1986	9250	818				363			14528
1987	15568	607							30929
1988	3078								41823
1989	3963								15891
1990	4648								7030
1991	1211	175							4296
1992	2338	337				450			5543
1993	8083	454							7055
1994	1870	1169				16			13002
1995	4276	596							10778
1996	11990	1697							7846
1997	25444	3447							3998
1998	13853	2380	317						7351
1999	8396	2019	343						7004
2000	11223	2142	28			190			13451
2001	16987	3761	21			425			17485
2002	5364	4584	184	48	52	389	352	29	5718
mean	9135	1593	171	48	52	274	352	29	13480
standard deviation	6148	1299	138			176			9617

Table 3.—Commercial landings (in pounds) of deep-water bottomfishes.

year	onaga	groupers	silvermouth	opakapaka	gindai	ehu	sickle pomfret	kalikali	alfonsin
1983	1118	1363		2022	267				
1984	1026	3141		1639	798				
1985	1117	4210		681	208				
1986	1598	1494		987	874				
1987	472	721		1146	271				
1988	2001			326	85				
1989	2478	563		538	1006				
1990	253	678		628	393				
1991	175	629		629					
1992	21	1773		136					
1993	593	1146		898	232				
1994	4578	3953		824	58				
1995	14910	2715	521	1019	1114				
1996	19093	12383	3179	6570	3452				
1997	16613	9086	1375	2780	821				
1998	15158	7864	6028	2729	1295	197		124	
1999	17351	3901	9986	1772	3686	821	233	6	
2000	10159	3474	2614	1633	214	45	446		
2001	16358	7719	2585	3951	1916	8	404		40
2002	12655	6149	3479	3932	3157	263	344	410	
mean	6886	3840	3721	1742	1103	267	357	180	40
standard deviation	7306	3359	3004	1586	1181	327	93	208	

Figure 4.—Commercial bottomfish landings and revenue.



Interpretation: Landings, revenues, and adjusted revenues for 2002 all fell significantly to nearer the 20-year mean. Although the landings, revenues, and adjusted revenues for bottomfishes has been comparatively high for the last 7 years compared to the preceding 13 years, there have been considerable changes in the composition of the fishery during the last 7 years. Prices for bottomfishes have also decreased over the past few years. Local buyers seem to increasingly prefer reef fishes and they are commanding higher prices each year.

The number of fishermen selling mafute' (as representative of the shallow-water bottomfish sector) fell to 22 in 2002, a marked decrease from the previous 5 years (36 in 2001, 32 in 2000, 32 in 1999, 32 in 1998, and 46 in 1997). In each of these years, 1 to 4 fishermen have landed >1000 lbs (4 to 6 have landed more than 500 pounds), but no one has been a high liner in more than 3 years. Many of the fishermen catching mafute' do so locally, but appear to be increasing their focus on reef fishes. The bottomfishes are a smaller portion of their sales and seem to be co-lateral catch (i.e., if caught in sufficient numbers while focusing on other species, then they too will be sold).

The number of fishermen selling onaga (as representative of the deepwater bottomfish sector) has remained relatively constant from 1997 to 2000 (10, 14, 13, and 15 respectively). In 2001, 22 fishermen made at least 1 sale of onaga. This year, 12 fishermen sold onaga. In each of the years 1997–2000, 2 or 3 fishermen landed >1000 lbs (3 or 4 landed >500 lbs). In 2001, 5 fishermen landed >1000 lbs (and 6 landed >500 lbs). This year, only 2 fishermen landed >1000 lbs and 3 landed >500 lbs. No single fisherman was a high liner every year and only 2 sold >750 lbs in 3 of the last 6 years. Vessels capable of landing large amounts of onaga are usually larger vessels fishing the northern islands. The difficulty of maintaining the equipment, vessel, and crew to consistently and routinely make these trips successful appears to be difficult in the long term for fishermen in the CNMI.

Revenues and prices for bottomfishes were less in 2002 than in 2001, with the average price per pound (adjusted) lower than the 20-yr mean. Only 5 years in the last 20 have lower values. Prices decreased for all groups (from 10¢ to 79¢ /lb) from last year, with the exception of ehu (increased 4¢ /lb), gindai (increased 5¢ /lb) sickle pomfret (increased 18¢ /lb), and "assorted bottomfish" (increased 2¢ /lb). Onaga still command the best prices, but the range is narrowing, with opakapaka, blueline snapper, gindai, ehu, kalikali, emperor (mafute'), and silvermouth within 50¢ per pound. Most fishes are sold as whole fish (and very few as filets or steaks). The larger species are often purchased by the hotel restaurants, which are now seeing far fewer customers and often importing fishes from outside the CNMI. In addition, the local public appears to show a greater demand for reef fishes. This may be reflected in the high price commanded by reef fishes such as parrotfishes ($3.04/lb) and rabbitfishes ($3.28/lb).

Calculation: Landings in pounds are from a simple database summation of reported purchases of each species of bottomfish. Total bottomfish landings sum across all bottomfish species. Revenue in dollars is from a simple summation of the value field. The landings and revenues values listed are inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

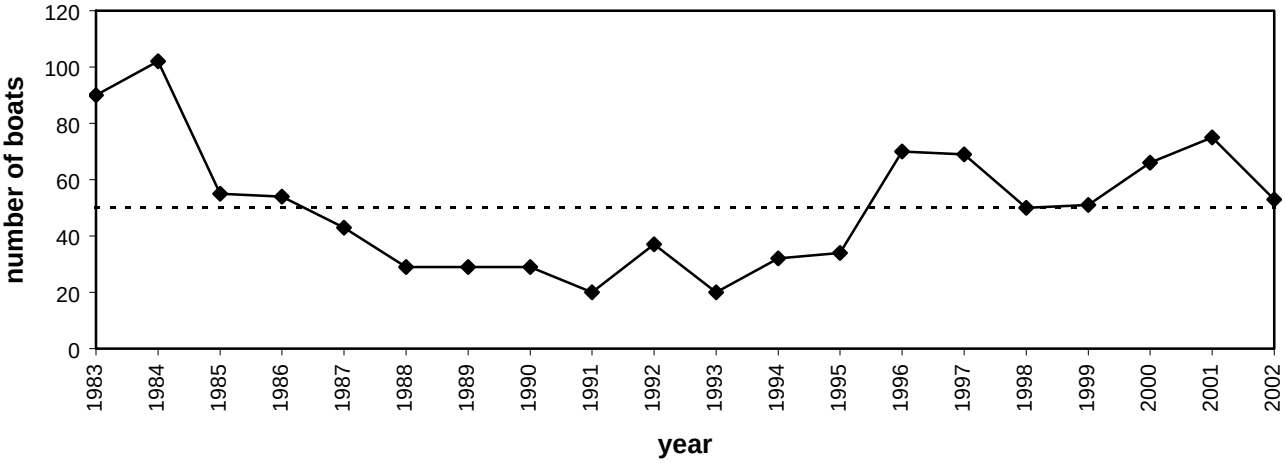
Table 4.—Commercial landings of and revenue for bottomfishes for 2002.

species	landings (lb)	revenue ($)	average price ($/lb)
jacks	4,584	10,067	2.20
giant trevally	48	89	1.85
black jack	52	138	2.66
amberjack	184	491	2.66
grouper	6,149	13,595	2.21
emperor (mafute')	5,364	15,577	2.90
silvermouth	3,479	10,103	2.90
jobfish	389	908	2.33
onaga	12,655	42,876	3.39
ehu	263	798	3.04
blueline snapper	352	1,101	3.13
humpback snapper	29	73	2.50
gindai	3,157	9,630	3.05
opakapaka	3,932	12,965	3.30
kalikali	410	1,214	2.96
sickle pomfret	344	676	1.96
assorted bottomfish	5,718	15,524	2.72
total	**47,110**	**135,823**	**2.88**

Table 5.—Commercial landings of and revenue for bottomfishes.

year	pounds	unadjusted revenue	inflation-adjusted revenue
1983	28,529	50,287	97,054
1984	42,664	74,162	131,267
1985	40,975	69,245	117,717
1986	29,912	56,349	93,539
1987	49,715	89,835	142,838
1988	47,313	86,315	130,336
1989	24,438	51,724	73,965
1990	13,628	32,903	44,748
1991	7,116	20,147	25,385
1992	10,598	26,619	31,144
1993	18,461	46,638	52,235
1994	25,470	70,555	76,905
1995	36,102	120,553	128,992
1996	66,362	221,272	230,123
1997	64,090	212,581	216,833
1998	59,040	200,152	206,157
1999	56,201	203,127	205,158
2000	45,619	129,786	128,488
2001	71,660	219,183	219,183
2002	**47,110**	**135,823**	**135,823**
mean	39,250	105,863	124,395
standard deviation	19,107	69,867	64,522

Figure 5.—Number of fishermen (boats) making bottomfish landings.



Interpretation: The number of fishermen (used as a proxy for the number of boats) making commercial landings of any bottomfish species has varied widely over the last 20 years and fell in 2002 to near the 20-year mean.

Calculation: The purchasers identify the fisherman or boats selling the catch on the sales invoices used when they purchase fishes from the fishermen. The plot shows the number of unique fishermen selling their catch of bottomfish within a given year.

Table 6.—Number of fishermen (used as a proxy for number of boats) making commercial landings of bottomfishes.

year	boats
1983	90
1984	102
1985	55
1986	54
1987	43
1988	29
1989	29
1990	29
1991	20
1992	37
1993	20
1994	32
1995	34
1996	70
1997	69
1998	50
1999	51
2000	66
2001	75
2002	**53**
mean	50
standard deviation	23

Figure 6.—Number of bottomfish trips.

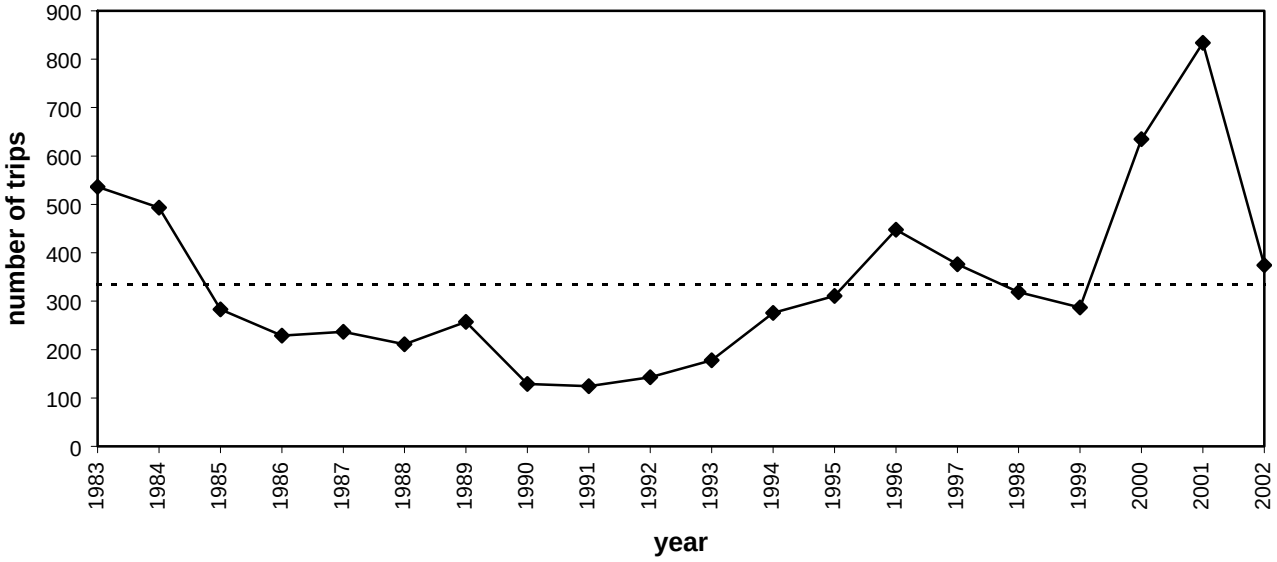
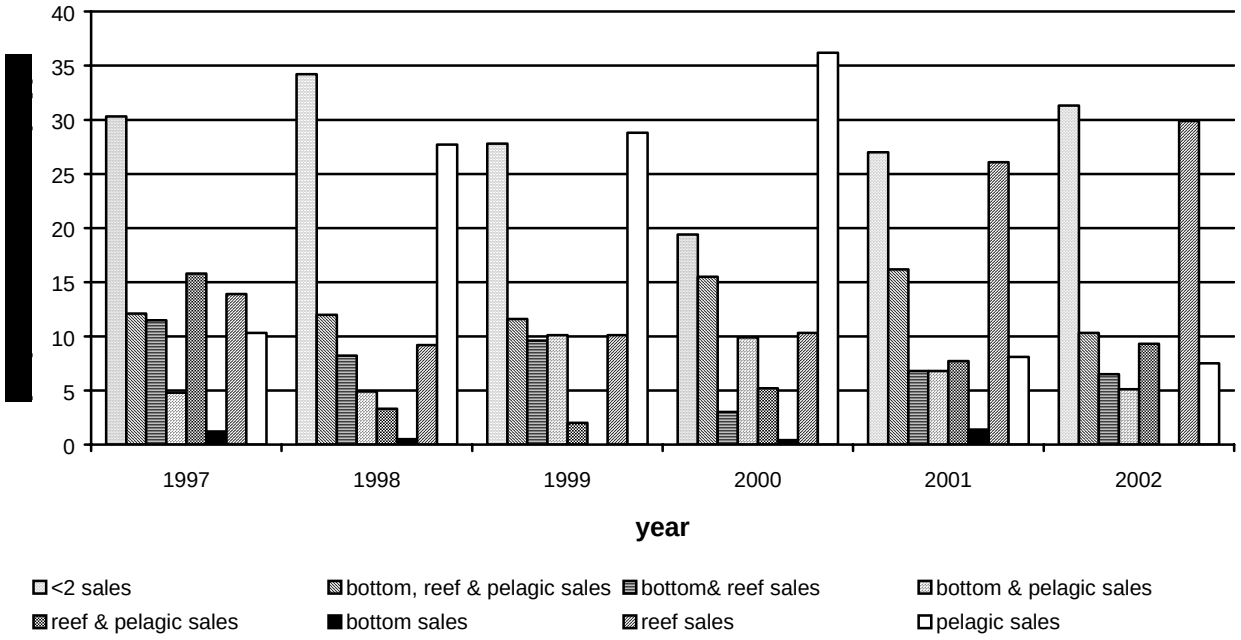


Figure 7.—Types of sales made by fishermen (based on the types of sales made by each fisherman as a proportion of the total number of fishermen).



Interpretation: The number of bottomfish trips was high from 1983 through 1989 as a result of consistent fishing activity centered on the island of Farallon de Medinilla. This fishery subsequently largely ceased in 1990, resulting in a drop in bottomfish trips in the early 1990s. In 1994, consistent fishing activity in the northern islands began once more and has continued to the present. The number of bottomfish trips more than doubled in 2000 and 2001 to reach the highest levels in the 20 years. During this time, more of the smaller vessels increased their focus on reef fishes, and although bottomfishes were still being caught and sold, they were no longer the largest (or most valuable) part of the catch. This resulted in fishermen catching bottomfishes as co-lateral catch on more trips. The number of trips decreased in 2002, to near the 20-year mean, probably as a result of fewer fishermen focusing on catching bottomfishes at all.

The percentage of fishermen that incorporated bottomfishes into their sales was lower in 2002 across all categories (fishermen that sold bottomfish, reef fish and pelagics [BRP], bottomfishes and reef fishes [BR], bottomfishes and pelagics [BP]) and was lower than the 5-year mean in all categories. No fishermen exclusively sold bottomfishes in 2002. In contrast, the percentage of fishermen selling reef fishes (as reef fishes and pelagics [RP] and reef fishes alone [R]) increased in 2002 to greater than the 5-year mean. The percentage of fishermen exclusively selling pelagics (P) also decreased in 2002 to below the 5-year mean. Note that there were also a greater number of fishermen that only made 1 or 2 sales in 2002 than in the previous 3 years.

Calculation: Adding each recorded fisherman's sales on a given day tallies the number of trips that resulted in landing any bottomfish. This assumes that each fisherman lands only once in a given day, and that all of the catch is sold on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing. In addition, many fishermen are no longer selling the bulk of their catch immediately after returning to the island. Fishermen are often pooling their catch with other fishermen before selling them to buyers, as well as freezing all or part of their catch to sell as a multi-trip aggregate at a later date. Both of these actions will cause this measure of trips to underestimate the fishing effort tallied here as "trips." For any individual fisherman that made more than 2 sales in a given year, the type of sales was tallied for each fisherman. These were then summed and divided by the number of fishermen to result in the percentage of fishermen making each type of sales in a given year.

Table 7.—Number of bottomfishing trips.

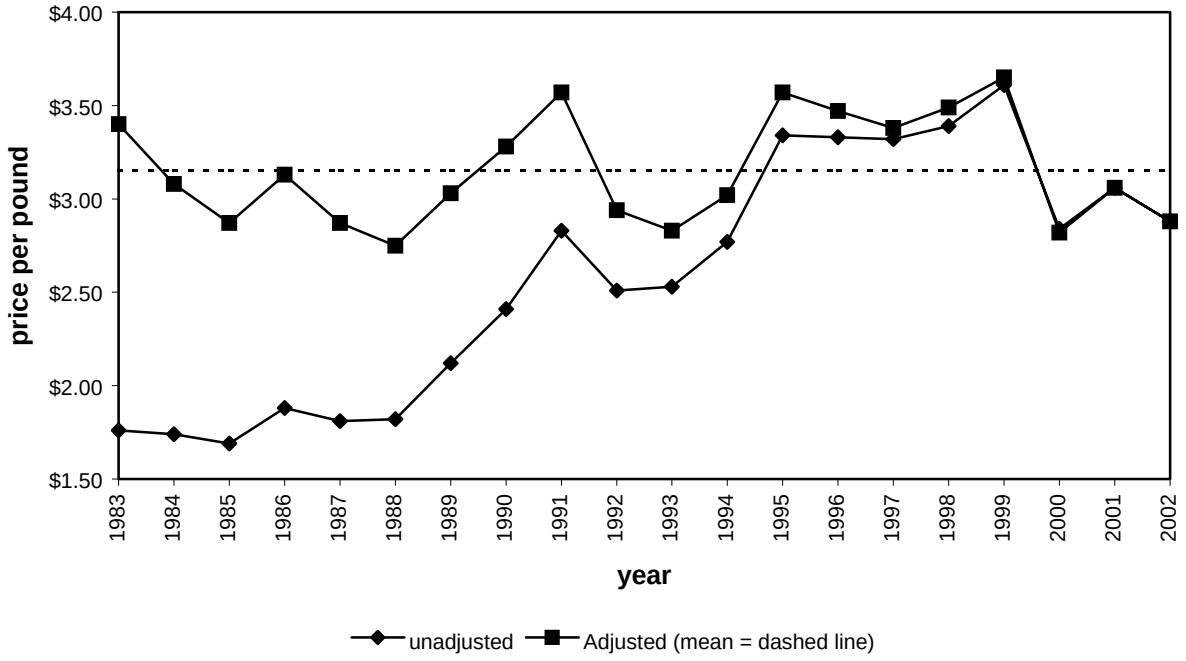
year	trips
1983	536
1984	493
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	143
1993	178
1994	276
1995	311
1996	448
1997	376
1998	319
1999	287
2000	635
2001	834
2002	**374**
mean	334
standard deviation	181

Table 8.—Percentage of fishermen making various types of sales in a given year.

year	≤2 sales	BRP*	BR	BP	RP	B	R	P
1997	30.3	12.1	11.5	4.8	15.8	12.1	13.9	10.3
1998	34.2	12.0	8.2	4.9	3.3	0.5	9.2	27.7
1999	27.8	11.6	9.6	10.1	2.0	0.0	10.1	28.8
2000	19.4	15.5	3.0	9.9	5.2	0.4	10.3	36.2
2001	27.0	16.2	6.8	6.8	7.7	1.4	26.1	8.1
2002	**31.3**	**10.3**	**6.5**	**5.1**	**9.3**	**0.0**	**29.9**	**7.5**
mean	28.3	13.0	7.6	6.9	7.2	0.6	16.6	19.8
standard deviation	5.1	2.4	2.9	2.5	5.0	0.6	9.1	12.6

*BRP—bottom, reef, & pelagic fishes, BR—bottom & reef fishes, BP—bottom & pelagic fishes, RP—reef & pelagic fishes, B—bottomfishes, R—reef fishes, and P—pelagic fishes.

Figure 8.—Average price of bottomfish.



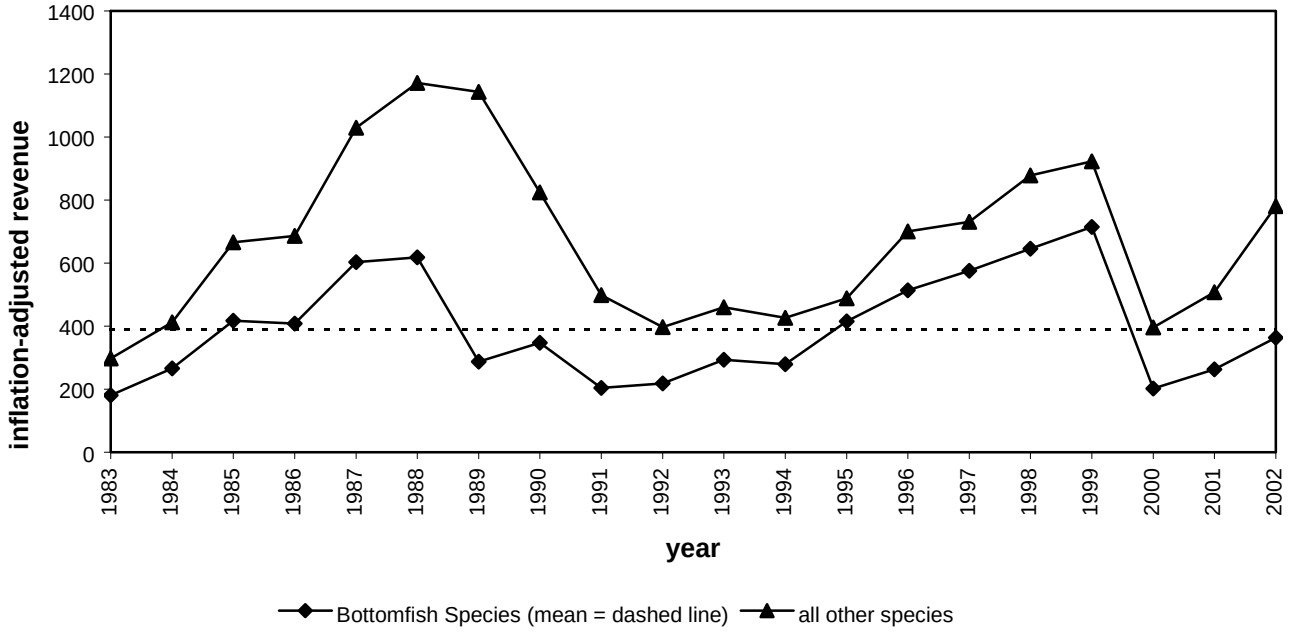
Interpretation: The unadjusted average price increased steadily from 1988 to 1991, where it reached what was once a record high of $2.83. In 1995, the price increased to a new record high of $3.34. This unadjusted price remained essentially constant through 1997, increased to $3.39 in 1998, and reached a new record high of $3.61 in 1999. The adjusted price continued to increase from 1997. Both the unadjusted and adjusted prices fell steeply in 2000, recovered slightly in 2001, but fell again in 2002. Other than the drop in 2000, the unadjusted and adjusted prices in 2002 were the lowest since 1993. The unadjusted price is slightly higher than the 20-yr mean. The adjusted price was 27¢ lower than the 20-yr mean, and 18¢ lower than last year. Only 5 years in the last 20 have had lower adjusted price values. Bottomfishes are not commanding the high prices they once did.

Calculation: The average price for bottomfish is calculated by dividing the total revenue by the total landings. (Note that the landings and revenues values are both inflated by 20% to represent the CNMI as a whole [assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].) The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Table 9.—Unadjusted and adjusted average price per pound for bottomfishes.

year	unadjusted $/lb	adjusted $/lb
1983	1.76	3.40
1984	1.74	3.08
1985	1.69	2.87
1986	1.88	3.13
1987	1.81	2.87
1988	1.82	2.75
1989	2.12	3.03
1990	2.41	3.28
1991	2.83	3.57
1992	2.51	2.94
1993	2.53	2.83
1994	2.77	3.02
1995	3.34	3.57
1996	3.33	3.47
1997	3.32	3.38
1998	3.39	3.49
1999	3.61	3.65
2000	2.84	2.82
2001	3.06	3.06
2002	**2.88**	**2.88**
mean	2.58	3.15
standard deviation	0.65	0.29

Figure 9.—Average inflation-adjusted revenue per trip landing bottomfish.



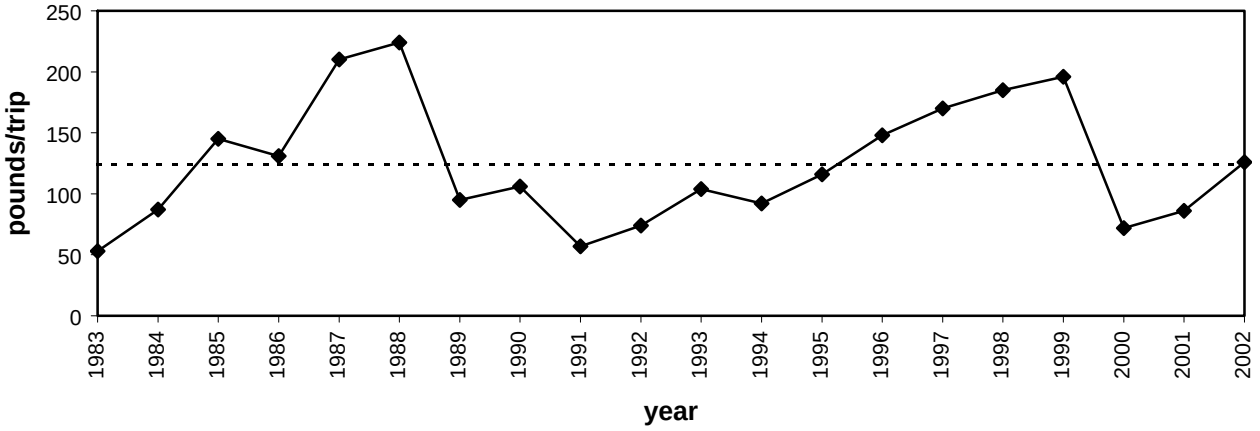
Interpretation: Inflation-adjusted bottomfish and inflation-adjusted all-species revenues both recovered slightly from the marked decrease of 2000. The "bottomfish species" inflation-adjusted revenue recovered to 92.8% of the 20-yr mean adjusted revenue for bottomfishes. At the same time, the "all-species" inflation-adjusted revenue recovered to 16.4% greater than the 20-yr mean. These data may suggest a decadal cycle in abundance (reflected in catch) with peaks in 1987–1989 and 1997–1999. The bottomfish fishery has always been a small proportion of the total fisheries, and it appears that bottomfish are now a relatively lower percentage of the trip revenue on trips where bottomfish were caught.

Calculation: Only trips that landed bottomfish are included in these calculations. "Bottomfish revenue/trip" is the total revenue of the bottomfish sold from a trip, and "all species revenue/trip" is the total trip revenue of all other species combined (e.g., any pelagic and reef fish that were sold). (Note that the revenues values are inflated by 20% to represent the CNMI as a whole [assuming 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].) The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Table 10.—Unadjusted and adjusted revenues for bottomfishes and for all other species sold commercially.

	bottomfish species		all other species	
year	**unadjusted**	**adjusted**	**unadjusted**	**adjusted**
1983	94	181	154	297
1984	150	266	233	412
1985	245	417	392	666
1986	246	408	413	686
1987	379	603	647	1029
1988	409	618	776	1172
1989	201	287	799	1143
1990	255	347	606	824
1991	162	204	395	498
1992	186	218	339	397
1993	262	293	411	460
1994	256	279	391	426
1995	388	415	456	488
1996	494	514	674	701
1997	565	576	717	731
1998	627	646	852	878
1999	708	715	914	923
2000	204	202	400	396
2001	263	263	508	508
2002	**363**	**363**	**781**	**781**
mean	323	391	543	671
standard deviation	163	163	211	255

Figure 10.—Bottomfish catch in average pounds per trip.



Interpretation: The substantial increase since the low in 1991 can be primarily attributed to the northern islands fishery, coincident with the increase in vessels making bottomfish trips, increased revenues, and annual landings during the next 8 years. The average pounds of bottomfish landed per trip in 2000 decreased 63.1% from 1999, and recovered slightly in 2001. The recovery continued in 2002, with fewer fishermen selling bottomfishes (such that the average catch per trip increased) to just over the 20-year mean.

Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g., changes in trip length and relative amounts of bottom fishing compared to trolling or reef fishing); it is the only measure readily obtained from the commercial landings system. However, the smaller vessels commonly make mixed trips and the relative proportions of bottom fishes to pelagic and reef fishes are changing. Given that fishermen are changing the focus of their trips to include more reef fishing and less bottom fishing, this measure is an increasingly inaccurate portrayal of the actual CPUE. It has been suggested that it may be possible to improve this measure of CPUE by using only those trips that landed bottomfish exclusively. However, in the past 5 years only 2 fishermen exclusively sold bottomfishes in 1997, 1 in 1998, none in 1999, 1 in 2000, 3 in 2001, and none in 2002. These numbers are too low to be indicative of the entire fishery.

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips that landed bottomfish, regardless of the amount of bottomfish landed on any given trip. (Note that the landings values are inflated by 20% to represent the CNMI as a whole [assuming 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].)

Table 11.—Average number of pounds landed per "trip."

year	pounds/trip
1983	53
1984	87
1985	145
1986	131
1987	210
1988	224
1989	95
1990	106
1991	57
1992	74
1993	104
1994	92
1995	116
1996	148
1997	170
1998	185
1999	196
2000	72
2001	86
2002	**126**
mean	124
standard deviation	51

Table 12.—Bycatch during bottomfishing (totals for 3 years)

sector	species	total number of interviews	number of interviews with bycatch	number released alive	total number taken	% with bycatch
non-charter		82	1			1.22
	black jack			1	25	4.00
	dogtooth tuna			1	5	20.00
	all species			2	2147	0.09
charter		27	5			18.52
	jobfish			1	2	50.00
	blacktip grouper			4	50	8.00
	lyretail grouper			5	6	83.33
	red snapper			4	5	80.00
	redgill emperor			6	94	6.38
	triggerfish			14	39	35.90
	all species			34	506	6.72

Table 13.—Bycatch during bottomfishing (2002)

sector	species	total number of interviews	number of interviews with bycatch	number released alive	total number taken	% with bycatch
non-charter		27	0			0.00
charter		12	2			16.67
	triggerfish			14	17	82.35
	all species			14	181	7.73

Interpretation: Almost all fishes caught in the CNMI are considered food fishes, including many that show a high incidence of ciguatera locally, including lyretail grouper (*Variola louti*) and red snapper (*Lutjanus bohar*). Above are all the data collected during 3 years (2000–2002) of interviews of fishermen during boat-based creel surveys. Table 4 shows the entire reported bycatch during bottomfishing for 2002. The interviews are divided into vessels engaged in non-charter (including commercial, non-commercial, and subsistence fishermen) and charter fishing. The charter fishing sector largely caters to the tourist population, of which the majority is Japanese. This sector targets blacktip grouper (*Epinephelus fasciatus*) and redgill emperor (*Lethrinus rubrioperculatus*). Catch rates in this sector must remain high to ensure that the clientele are satisfied with the charter. For this reason, small fishes are often released alive, so that they may be recaptured on subsequent charters. All bycatch, in both sectors, was released alive.