

Appendix 4

Commonwealth of the Northern Mariana Islands

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Summary

Landings of bottomfish decreased (11% fewer pounds in 2003 than in 2002), from the highest total landings in 2001, to slightly higher than the 21-yr mean. Bottomfish landings in the CNMI have been higher than the 21-yr mean for the last 8 years. The number of trips during which bottomfishes were caught also remained near the 21-yr mean, and the average bottomfish catch per trip decreased to just below the 21-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.

There were a large number of days in 2003 where the sea conditions were very rough, as large storms and typhoons passed close to the CNMI. In addition, 3 of the 8 larger vessels previously fishing the northern islands did not fish in 2003 and a 4th large vessel sunk after returning from the northern islands. Commercial trips made by these larger 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.

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 2003 than in 2002, with the inflation-adjusted revenue and the inflation-adjusted average price per pound less than the 21-yr means. Only 3 years in the last 21 have had lower values for the inflation-adjusted average price per pound. Prices decreased for all groups (from 2[¢] to 79[¢]/lb) from last year, with the exception of assorted jacks (increased 7[¢]/lb), giant trevally (increased 65[¢]/lb), grouper (increased 37[¢]/lb), and onaga (increased 7[¢]/lb). Onaga commanded a best price this year, with only opakapaka and gindai within 50[¢] per pound.

Between 1997 and 2002, 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.

Bycatch was all within the charter fishery (with the exception of a single interview in 2000). During 2003, bycatch was part of 19.57% of the fishes taken, but was all released alive.

Historical Annual Statistics for CNMI Bottomfishes

| Year | Total landings (lbs) | CPUE (lbs/trip) | CPI | Inflation- adjusted revenue (\$) | Inflation- adjusted average price (\$/lb) | Number of fishermen | Spawning potential ratio |
|-----------------------|-------------------------|--------------------|---------------|--|---|------------------------|-----------------------------|
| 1983 | 28,529 | 43 | 140.90 | 96,549 | 3.38 | 90 | n/a |
| 1984 | 42,664 | 70 | 153.20 | 131,265 | 3.08 | 101 | n/a |
| 1985 | 40,975 | 117 | 159.30 | 117,717 | 2.87 | 62 | n/a |
| 1986 | 29,911 | 104 | 163.50 | 93,538 | 3.12 | 55 | n/a |
| 1987 | 49,715 | 169 | 170.70 | 142,838 | 2.88 | 46 | n/a |
| 1988 | 47,313 | 181 | 179.60 | 130,336 | 2.75 | 28 | n/a |
| 1989 | 24,438 | 73 | 190.20 | 73,965 | 3.03 | 31 | n/a |
| 1990 | 12,927 | 81 | 199.33 | 42,354 | 3.28 | 33 | n/a |
| 1991 | 7,093 | 47 | 214.93 | 25,281 | 3.57 | 19 | n/a |
| 1992 | 10,598 | 59 | 232.90 | 30,877 | 2.91 | 36 | n/a |
| 1993 | 18,461 | 84 | 243.18 | 51,768 | 2.81 | 20 | n/a |
| 1994 | 25,469 | 74 | 250.00 | 76,199 | 2.99 | 32 | n/a |
| 1995 | 36,101 | 93 | 254.48 | 128,991 | 3.57 | 34 | n/a |
| 1996 | 66,387 | 119 | 261.98 | 228,003 | 3.43 | 71 | n/a |
| 1997 | 64,143 | 137 | 264.95 | 217,078 | 3.39 | 68 | n/a |
| 1998 | 59,022 | 148 | 264.18 | 206,111 | 3.49 | 50 | n/a |
| 1999 | 55,991 | 156 | 267.80 | 204,633 | 3.66 | 53 | n/a |
| 2000 | 45,258 | 56 | 273.23 | 128,120 | 2.83 | 72 | n/a |
| 2001 | 71,256 | 68 | 270.98 | 218,462 | 3.07 | 74 | n/a |
| 2002 | 46,765 | 101 | 271.53 | 135,146 | 2.89 | 53 | n/a |
| 2003 | 41,710 | 89 | 271.05 | 118,538 | 2.84 | 58 | n/a |
| Mean | 39,273 | 99 | | 123,703 | 3.13 | 52 | |
| Standard deviation | 18,629 | 40 | | 62,889 | 0.29 | 22 | |

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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 27 participating local fish purchasers in 2003; which include the majority of the fish markets, stores, restaurants, hotels, government agencies, and roadside vendors (fish-mobiles). This marked reduction from 34 participants last year is likely the result of reduction in the number of vendors, as well as a slight decrease in voluntary compliance with the program.

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, and kalikali were added to sales invoices in 2001). 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 local commercial and subsistence fishing, although a few (generally <5) larger vessels (30–60 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 commonly used gear for small-scale fishing operations, whereas electric reels and hydraulics are the commonly used gear 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 30 ft long that are usually limited to a 50-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 2003, three of the larger vessels did not fish and a fourth sunk after returning from the northern islands during rough weather.

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 (12–29 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 (30-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.

Fishermen targeting the deep-water bottomfish, if successful, tend to fish for 1–4 years before leaving the fishery, whereas the majority of fishermen targeting shallow-water bottomfish tend to leave the fishery after the first year. The overall participation of fishermen in the bottomfishery tends to be very short term (less than 4 years). The slight difference between the shallow-water fishermen and the deep-water fishermen 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

2003 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.

2002 Recommendations & Progress

- 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.

This recommendation is currently being acted upon, with mapping planned for 2004/2005. This recommendation was therefore continued in 2003 (above).

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

The very successful MARAMP cruise continues to be planned for 2005. This recommendation was therefore continued in 2003 (above).

- 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.

This review was postponed until ongoing regulatory uncertainties with respect to Federal/CNMI jurisdictional boundaries are clarified. Note that the CNMI has sought and will likely receive funding for an inshore creel survey to begin in FY05.

Figures, Interpretations, Calculations, and Tables

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

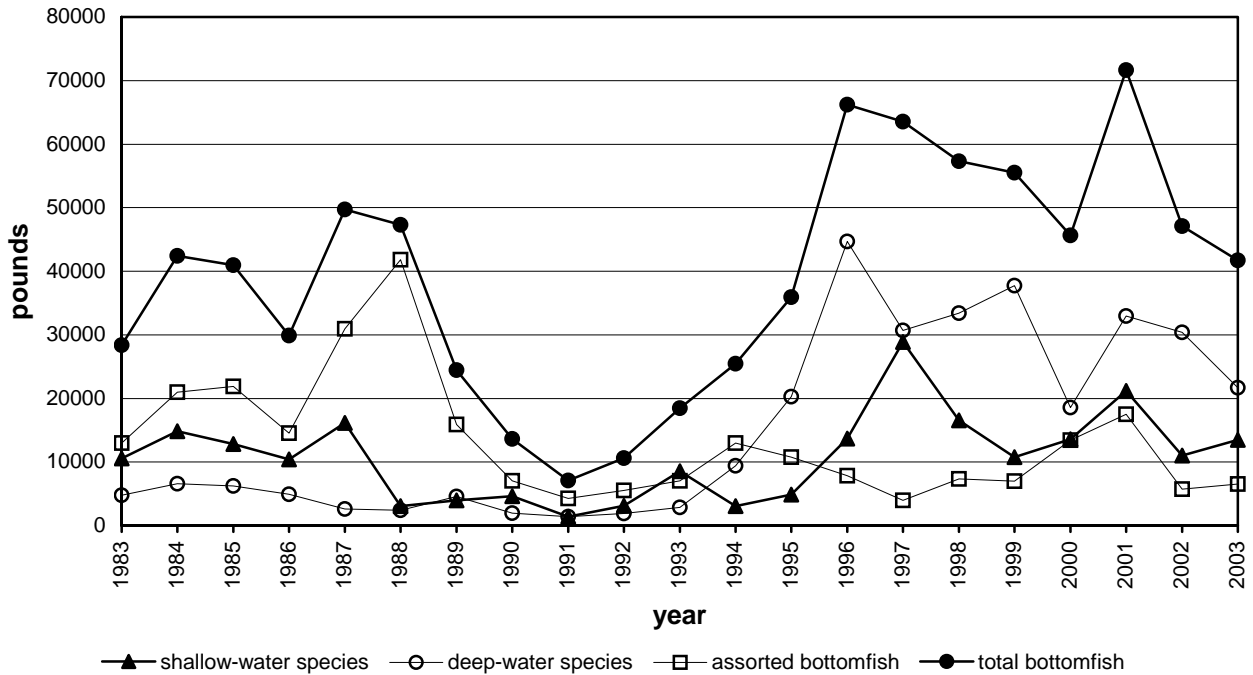


Figure 2.—Commercial bottomfish landings of deep-water species.

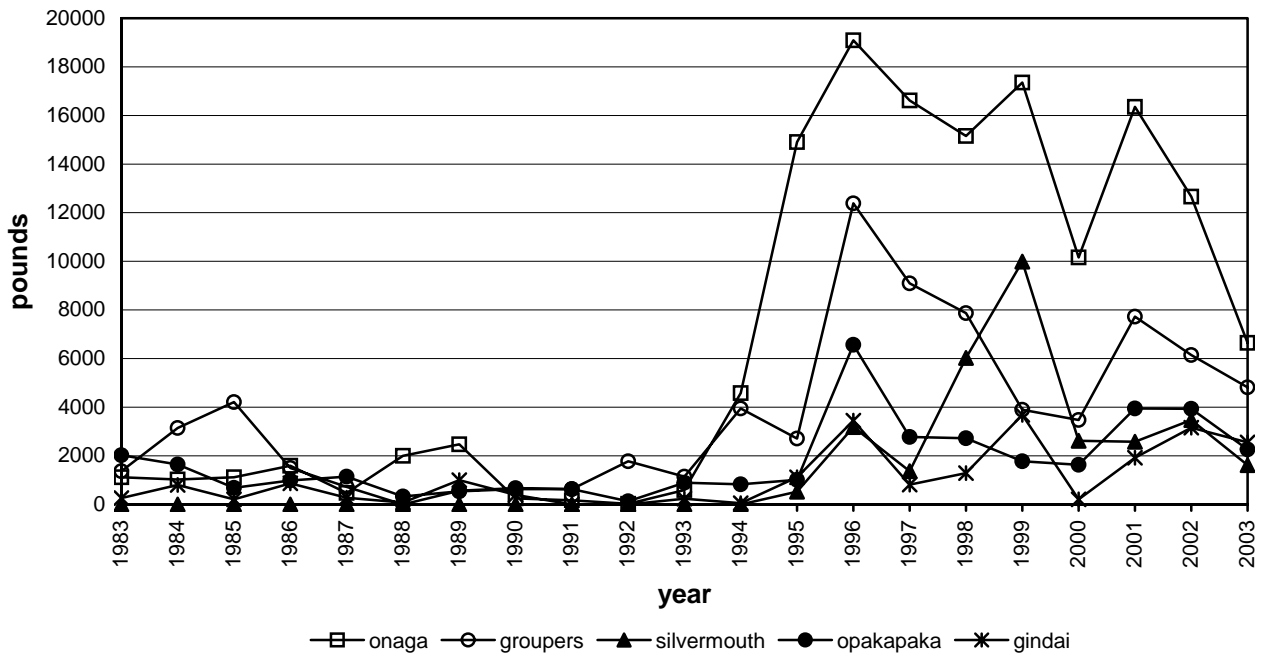
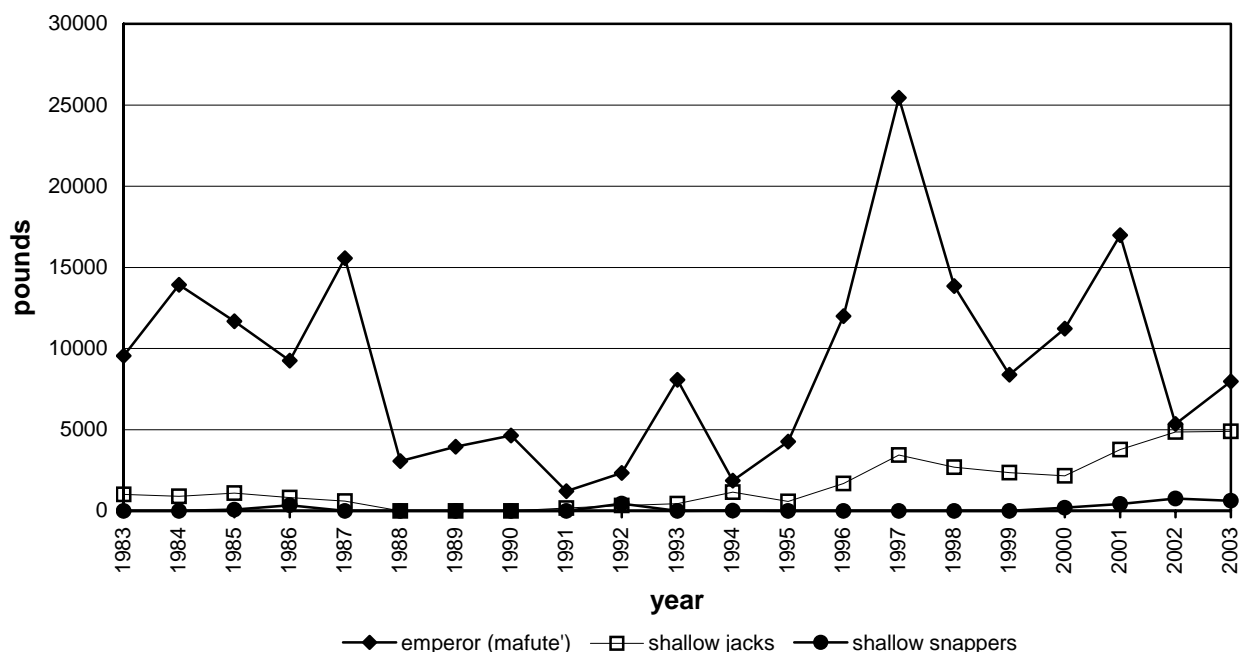


Figure 3.—Commercial bottomfish landings of shallow-water species.



Interpretation: Taken as a whole, the number of pounds of bottomfishes sold (landings) decreased in 2003 by 11% from that of 2002. In part, this may be explained by a large number of days in 2003 where the sea conditions were too rough for small vessels, as large storms and typhoons passed close to the CNMI. In addition, 3 of the 8 larger vessels previously fishing the northern islands did not fish in 2003 and a fourth large vessel sunk after returning from the northern islands during rough weather. Moreover, for the past 2 years the number of fishermen landing bottomfishes in the CNMI has dropped to near the 21-year mean.

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 2003. The slight rise in landings of “assorted bottomfish” in 2000 and 2001 probably reflects a change in staff at DFW. In 2003, “assorted bottomfishes” accounted for 15.6% of the landings. 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.

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. Also note that 3 of the 8 larger vessels previously fishing the northern islands did not fish in 2003 and a fourth large vessel sunk after returning from the northern islands during rough weather. The variation in participation of these larger vessels greatly affects this part of the fishery. The landings of onaga (*Etelis coruscans* and some *Etelis radiosus*) fell

steeply in 2003, to below the 21-year mean. Note that this sector of the industry also has a high turnover, but differs from the mafute' in that successful onaga fishermen often participate for more (1–4) 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 and in 2003, 19 fishermen made sales of onaga. The landings of groupers (primarily *Epinephelus octofasciatus*, but almost certainly including shallow-water BMUS species such as *Variola louti* and *E. fasciatus*) have varied widely over the last 9 years, with a 20.3% decrease in landings in 2002 from 2001 and a further 21.6% decrease in landings for 2003, but still remain over the 20-year mean. Silvermouth (*Aphareus rutilans*) have been reported since 1995, and landings have fluctuated considerably. Landings in 2003 were very low, less than half the 9-year mean. Opakapaka (*Pristipomoides filamentosus*, and likely some *P. flavipinnis*) landings have varied somewhat in the last 9 years, with the 2003 landings 42.5% less than those for 2001 but remain more than the 21-year mean. Gindai (*Pristipomoides zonatus*, and likely some *P. argyrogrammicus*) landings have also varied over the last 9 years, with this year's landings 19.2% less than last year's but remain more than twice the 19-year mean. Reported landings of ehu (*Etelis carbunculus*) were 177.2% greater than last year, and more than twice the 6-year mean. The increases reported in 2002 and 2003 likely are a result of the addition of this species category to the new sales invoice. Kalikali (*Pristipomoides auricilla* and *P. sieboldii*) were reported in 1998, 1999, 2002, and 2003, although they appeared on the new sales invoice for the first time in 2002. The landings this year were an order of magnitude greater this year than last.

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. In 2003, the number of pounds of mafute' landed increased slightly, but is still below the 21-year mean. This is likely the result of turnover in this sector of the industry and the reduction in the number of fishermen selling mafute' (28 in 2002 compared to 22 in 2002, 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*], brassy trevally [*C. papuensis*], 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 2003. However, landings of jacks were only 0.57% higher (28 pounds greater) in 2003, than 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, as well as *Carangoides orthogrammus*, *Caranx melampygus*, *C. papuensis*, and *C. sexfasciatus*. Landings of amberjack were higher in 2003 than for any previous year except 1999. Giant trevally and black jack were reported in 2002 for the first time and brassy trevally was reported in 2003 for the first time, both likely as a result of being added to the new sales invoice. Jobfish (*Aprion virescens*) have been reported in 8 of the last 20 years, and in 2003 landings were the highest ever reported. Reported landings of blueline snapper (*Lutjanus kasmira*) were much less than last year, but this species is often lumped within assorted reef fishes. Humpback snapper (*Lutjanus gibbus*) were only reported in 2002.

Bottomfish Management Unit species (BMUS) that were specifically itemized on the sales receipts (and including emperors, the vast majority of which are BMUS species *Lethrinus rubrioperculatus*) increased from 1983 through 1987. They then dropped to a low in 1991 and generally climbed again through 2001. The reported landings of BMUS species decreased in 2002 by 28.3%, and decreased a further 14.3% in 2003, but remain above the 21-year mean.

This report only represents the commercial fishery as reported on sales invoices in the CNMI. Charter vessels that do not sell their catch and recreational/subsistence catches are not included here.

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 1.—Commercial landings (in pounds) of all bottomfishes, BMUS species identified to species on invoices, all shallow-water bottomfishes, all deep-water bottomfishes, and selected deep-water bottomfishes.

| Year | Total bottomfish | Total BMUS species | All shallow-water bottomfishes | All deep-water bottomfishes | Onaga | Groupers | Silvermouth | Opakapaka | Gindai | Ehu | Kalikali |
|--------------------|------------------|--------------------|--------------------------------|-----------------------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|
| 1983 | 28529 | 12962 | 10587 | 4770 | 1118 | 1363 | | 2022 | 267 | | |
| 1984 | 42664 | 17387 | 14830 | 6604 | 1026 | 3141 | | 1639 | 798 | | |
| 1985 | 40975 | 13899 | 12855 | 6216 | 1117 | 4210 | | 681 | 208 | | |
| 1986 | 29911 | 13072 | 10431 | 4955 | 1598 | 1494 | | 987 | 874 | | |
| 1987 | 49715 | 17458 | 16175 | 2611 | 472 | 721 | | 1146 | 271 | | |
| 1988 | 47313 | 5490 | 3077 | 2412 | 2001 | | | 326 | 85 | | |
| 1989 | 24438 | 7984 | 3962 | 4584 | 2478 | 563 | | 538 | 1006 | | |
| 1990 | 12927 | 5921 | 4648 | 1950 | 253 | 678 | | 628 | 393 | | |
| 1991 | 7093 | 2016 | 1386 | 1434 | 175 | 629 | | 629 | | | |
| 1992 | 10598 | 2945 | 3125 | 1930 | 21 | 1773 | | 136 | | | |
| 1993 | 18461 | 9805 | 8537 | 2869 | 593 | 1146 | | 898 | 232 | | |
| 1994 | 25469 | 7346 | 3055 | 9412 | 4578 | 3953 | | 824 | 58 | | |
| 1995 | 36101 | 21840 | 4872 | 20279 | 14910 | 2715 | 521 | 1019 | 1114 | | |
| 1996 | 66387 | 44283 | 13687 | 44676 | 19093 | 12383 | 3179 | 6570 | 3452 | | |
| 1997 | 64143 | 47033 | 28891 | 30675 | 16613 | 9086 | 1375 | 2780 | 821 | | |
| 1998 | 59022 | 39699 | 16550 | 33391 | 15158 | 7864 | 6028 | 2729 | 1295 | 197 | 124 |
| 1999 | 55991 | 42361 | 10759 | 37755 | 17351 | 3901 | 9986 | 1772 | 3686 | 821 | 6 |
| 2000 | 45258 | 26106 | 13582 | 18586 | 10159 | 3474 | 2614 | 1633 | 214 | 45 | |
| 2001 | 71256 | 42251 | 21195 | 32980 | 16358 | 7719 | 2585 | 3951 | 1916 | 8 | |
| 2002 | 46765 | 30285 | 11003 | 30389 | 12655 | 6149 | 3479 | 3932 | 3157 | 263 | 410 |
| 2003 | 41710 | 25957 | 13495 | 21690 | 6649 | 4819 | 1624 | 2262 | 2550 | 729 | 3057 |
| Mean | 39273 | 20767 | 10795 | 15246 | 6875 | 3889 | 3488 | 1767 | 1179 | 344 | 899 |
| Standard deviation | 18629 | 14921 | 6831 | 14325 | 7121 | 3276 | 2896 | 1550 | 1195 | 348 | 1448 |

Table 2.—Commercial landings (in pounds) of fishes only identified as assorted bottomfishes, and selected shallow-water bottomfishes.

| Year | Assorted bottomfish | Emperor (mafute') | Assorted jacks | Amberjack | Giant trevally | Brassy trevally | Black jack | Jobfish | All shallow-water jacks | Blueline snapper | All shallow-water snappers |
|--------------------|---------------------|-------------------|----------------|------------|----------------|-----------------|------------|------------|-------------------------|------------------|----------------------------|
| 1983 | 12998 | 9555 | 1031 | | | | | | 1031 | | |
| 1984 | 20971 | 13925 | 906 | | | | | | 906 | | |
| 1985 | 21904 | 11676 | 962 | 135 | | | | 81 | 1098 | | 81 |
| 1986 | 14528 | 9250 | 818 | | | | | 363 | 818 | | 363 |
| 1987 | 30929 | 15568 | 607 | | | | | | 607 | | |
| 1988 | 41823 | 3078 | | | | | | | | | |
| 1989 | 15891 | 3963 | | | | | | | | | |
| 1990 | 7030 | 4648 | | | | | | | | | |
| 1991 | 4296 | 1211 | 175 | | | | | | 175 | | |
| 1992 | 5543 | 2338 | 337 | | | | | 450 | 337 | | 449 |
| 1993 | 7055 | 8083 | 454 | | | | | | 454 | | |
| 1994 | 13002 | 1870 | 1169 | | | | | 16 | 1169 | | 16 |
| 1995 | 10778 | 4276 | 596 | | | | | | 596 | | |
| 1996 | 7846 | 11990 | 1697 | | | | | | 1697 | | |
| 1997 | 3998 | 25444 | 3447 | | | | | | 3447 | | |
| 1998 | 7351 | 13853 | 2380 | 317 | | | | | 2697 | | |
| 1999 | 7004 | 8396 | 2019 | 343 | | | | | 2362 | | |
| 2000 | 13451 | 11223 | 2142 | 28 | | | | 190 | 2169 | | 190 |
| 2001 | 17485 | 16987 | 3761 | 21 | | | | 425 | 3782 | | 425 |
| 2002 | 5718 | 5364 | 4584 | 184 | 48 | | 52 | 389 | 4868 | 352 | 771 |
| 2003 | 6526 | 7698 | 3685 | 322 | 26 | 725 | 138 | 556 | 4896 | 75 | 631 |
| Mean | 13149 | 9066 | 1709 | 193 | 37 | 725 | 95 | 309 | 1839 | 214 | 366 |
| Standard deviation | 9495 | 6001 | 1354 | 138 | 16 | | 61 | 191 | 1526 | 196 | 262 |

Table 3.—Commercial landings of bottomfishes, and their associated revenues and prices for 2003.

| Species | Landings (lbs) | Revenue (\$) | Average Price (\$/lb) |
|--------------------------------|-----------------------|---------------------|------------------------------|
| Assorted jacks | 3,685 | 8,374 | 2.27 |
| Giant trevally | 26 | 66 | 2.50 |
| Blackjack | 138 | 337 | 2.45 |
| Amberjack | 322 | 835 | 2.59 |
| Brassy trevally | 725 | 1,794 | 2.47 |
| Grouper | 4,819 | 12,449 | 2.58 |
| Emperor (mafute') | 7,968 | 22,292 | 2.80 |
| Silvermouth | 1,624 | 4,597 | 2.83 |
| Jobfish | 556 | 1,283 | 2.31 |
| Onaga | 6,649 | 22,978 | 3.46 |
| Ehu | 729 | 1,918 | 2.63 |
| Blueline snapper | 75 | 177 | 2.34 |
| Gindai | 2,550 | 7,706 | 3.02 |
| Opakapaka | 2,262 | 7,424 | 3.28 |
| Kalikali | 3,057 | 8,760 | 2.87 |
| Assorted bottomfish | 6,526 | 17,549 | 2.69 |
| Total BMUS species only | 25,957 | 78,372 | 3.02 |
| Total | 41,710 | 118,538 | 2.84 |

Interpretation: Prices decreased for all groups (from 2[¢] to 79[¢]/lb) from last year, with the exception of assorted jacks (increased 7[¢]/lb), giant trevally (increased 65[¢]/lb), grouper (increased 37[¢]/lb), and onaga (increased 7[¢]/lb). Onaga commanded the best price this year, with only opakapaka and gindai 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 goatfishes (\$2.96/lb) and rabbitfishes (\$3.22/lb).

This report only represents the commercial fishery as reported on sales invoices in the CNMI. Charter vessels that do not sell their catch and recreational/subsistence catches are not included here.

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 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002).

Table 4.—CNMI seafood imports for 2003. (The most commonly imported form is shown in boldface type.)

| Species/Taxon | Imported amount (lbs) | Form | Revenue (\$) | Average Price (\$/lb) |
|-------------------------|-----------------------|---|--------------|-----------------------|
| Yellowfin tuna | 2,632 | fresh/frozen loins ; fresh | n/a | n/a |
| Marlin/swordfish | 3,862 | fresh/frozen loins ; fresh; frozen | n/a | n/a |
| Tuna | 44,543 | fresh/frozen loins ; fresh | n/a | n/a |
| Pelagic fish | 10,002 | fresh ; frozen; dried | n/a | n/a |
| Reef fish | 67,445 | frozen ; smoked; cooked | n/a | n/a |
| Milkfish | 1,903 | frozen ; smoked | n/a | n/a |
| Eel | 19 | smoked | n/a | n/a |
| Salmon | 8,767 | fresh ; frozen; smoked | n/a | n/a |
| Fish | 1,464 | frozen ; fresh; dried; salted | n/a | n/a |
| Clam | 261 | fresh ; dried | n/a | n/a |
| Oyster | 859 | frozen ; fresh | n/a | n/a |
| Lobster | 6,168 | live ; cooked | n/a | n/a |
| Shrimp | 2,081 | frozen ; fresh | n/a | n/a |
| Mangrove crab | 2,229 | live ; frozen; cooked | n/a | n/a |
| Coconut crab | 27 | cooked ; frozen | n/a | n/a |
| Land crab | 453 | cooked ; frozen | n/a | n/a |
| Crab | 230 | frozen | n/a | n/a |
| Seafood | 57,378 | assorted ; fresh; frozen | n/a | n/a |
| Total bottomfish | 0 | | | |
| Total | 210,323 | | | |

Interpretation: Table 4 includes all commercially imported seafood products. None of these were specifically listed as bottomfishes, although “reef fish” may include some BMUS and/or shallow-water groupers, jacks, emperors, and/or snappers. Note that pelagic fishes (including yellowfin tuna, marlin/swordfish, tuna, and pelagic fish) were approximately equal in weight to reef fish. This seems to parallel the sales data as well, where pelagic fishes and reef fishes are highly sought after, but bottomfishes are far less highly prized as a whole.

Calculation: Imported amount in pounds are from a simple database summation of all seafood listed on commercial import bills of lading. The forms of the seafood (fresh/frozen loins, fresh, frozen, live, salted, smoked, cooked, dried, and assorted) are taken from the import bill of lading. Because these data are taken only from the import bill of lading, there are no data on the value or ultimate price per pound of these imports.

Figure 4.—Commercial bottomfish landings and inflation-adjusted revenue.

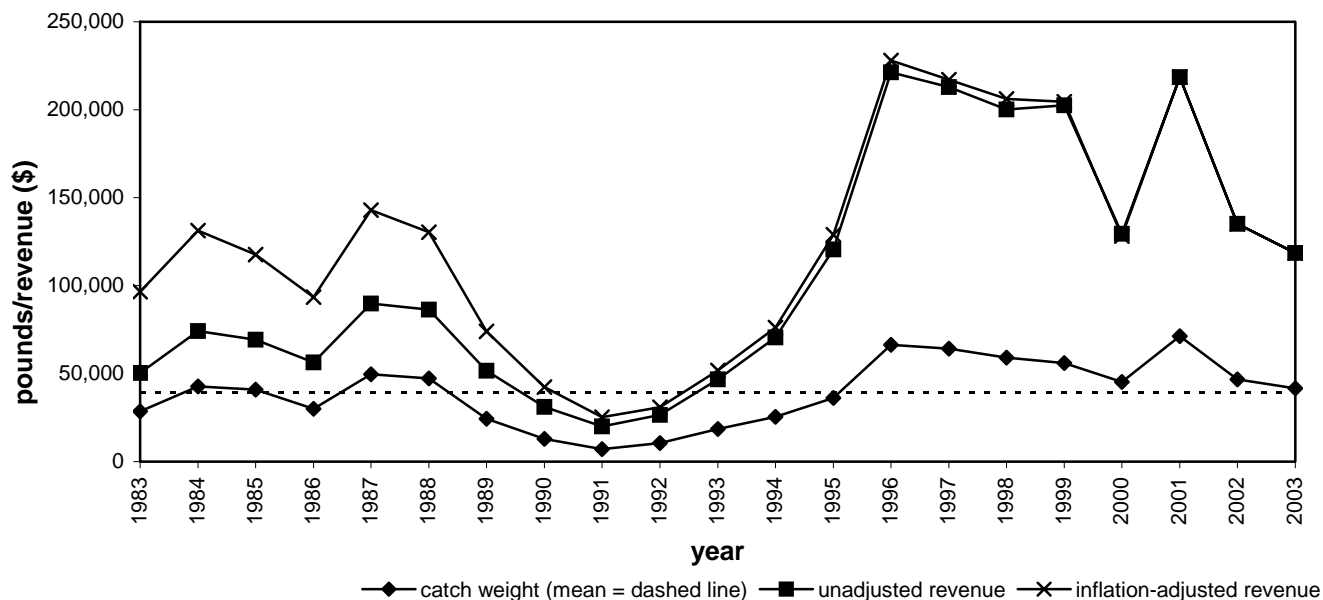
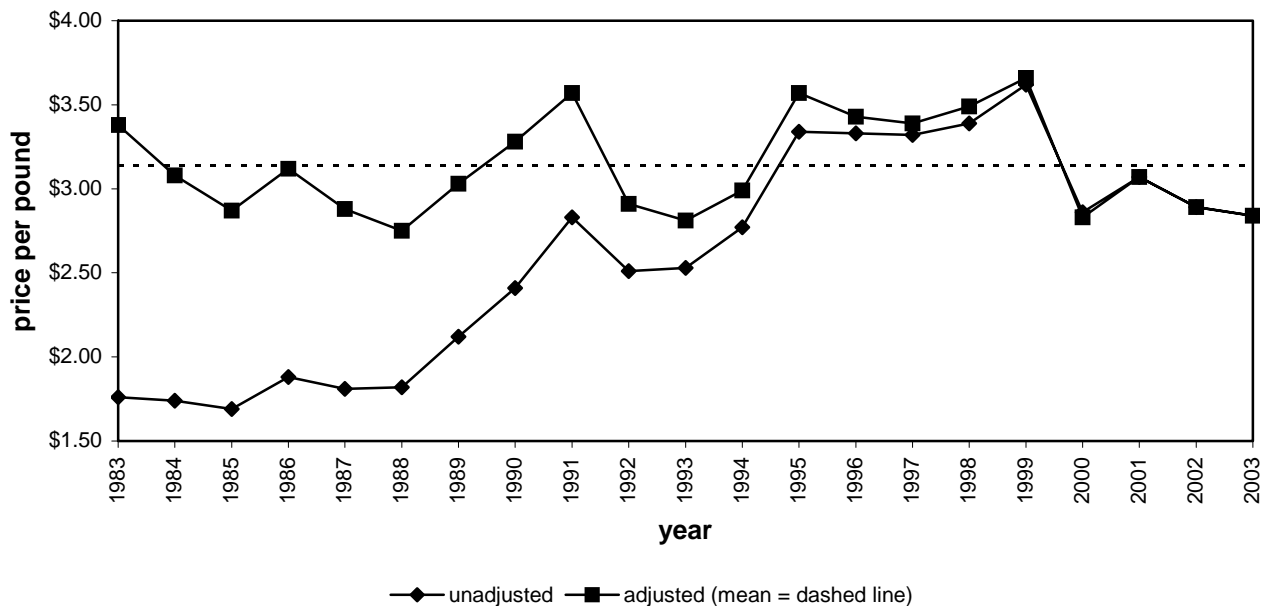


Figure 5.—Average price of bottomfish.



Interpretation: Landings, revenues, and adjusted revenues for 2003 all fell to nearer the 21-year mean. Although the landings, revenues, and adjusted revenues for bottomfishes has been comparatively high for the last 8 years compared to the preceding 13 years, there have been considerable changes in the composition of the fishery during the last 8 years.

Inflation-adjusted bottomfish revenues recovered slightly from the marked decrease of 2000, but fell 12.3% from last year. The inflation-adjusted revenue for 2003 is 4.2% below the 21-yr mean. 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. Moreover, 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). 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, as seen by the loss of 4 of the 8 vessels from the fishery in 2003.

Prices for bottomfishes have also decreased over the past few years. Prices for bottomfishes were less in 2003 than in 2002 and 2001, with the adjusted average price per pound lower than the 21-yr mean for the last 4 years. Only 3 years in the last 21 have lower adjusted average prices than 2003. 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 average price was 29¢ lower than the 21-yr mean and 5¢ lower than last year. Bottomfishes are not commanding the high prices they once did. Local buyers seem to increasingly prefer reef fishes and reef fishes are commanding higher prices each year.

Calculation: The CNMI's 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 proportionally adjust the 1988 CNMI CPI. The CNMI Department of Commerce "reset" the CPI to 1.00 for the 1st quarter of 2003, with the 3 subsequent quarters showing devaluation.

Revenue in dollars is from a simple summation of the value field. 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 2003 CPI figure as the basis by which calculations of previous years' prices are made.

Table 5.—Commercial landings, consumer price indices (CPIs), revenue, and prices for all bottomfishes.

| Year | Landings (lbs) | CPI | CPI adjustment factor | Unadjusted revenue (\$) | Inflation-adjusted revenue (\$) | Unadjusted price (\$/lb) | Inflation-adjusted price (\$/lb) |
|--------------------|----------------|---------------|-----------------------|-------------------------|---------------------------------|--------------------------|----------------------------------|
| 1983 | 28,529 | 140.90 | 1.92 | 50,286 | 96,549 | 1.76 | 3.38 |
| 1984 | 42,664 | 153.20 | 1.77 | 74,161 | 131,265 | 1.74 | 3.08 |
| 1985 | 40,975 | 159.30 | 1.70 | 69,245 | 117,717 | 1.69 | 2.87 |
| 1986 | 29,911 | 163.50 | 1.66 | 56,348 | 93,538 | 1.88 | 3.12 |
| 1987 | 49,715 | 170.70 | 1.59 | 89,835 | 142,838 | 1.81 | 2.88 |
| 1988 | 47,313 | 179.60 | 1.51 | 86,315 | 130,336 | 1.82 | 2.75 |
| 1989 | 24,438 | 190.20 | 1.43 | 51,724 | 73,965 | 2.12 | 3.03 |
| 1990 | 12,927 | 199.33 | 1.36 | 31,143 | 42,354 | 2.41 | 3.28 |
| 1991 | 7,093 | 214.93 | 1.26 | 20,064 | 25,281 | 2.83 | 3.57 |
| 1992 | 10,598 | 232.90 | 1.16 | 26,618 | 30,877 | 2.51 | 2.91 |
| 1993 | 18,461 | 243.18 | 1.11 | 46,638 | 51,768 | 2.53 | 2.81 |
| 1994 | 25,469 | 250.00 | 1.08 | 70,555 | 76,199 | 2.77 | 2.99 |
| 1995 | 36,101 | 254.48 | 1.07 | 120,552 | 128,991 | 3.34 | 3.57 |
| 1996 | 66,387 | 261.98 | 1.03 | 221,362 | 228,003 | 3.33 | 3.43 |
| 1997 | 64,143 | 264.95 | 1.02 | 212,822 | 217,078 | 3.32 | 3.39 |
| 1998 | 59,022 | 264.18 | 1.03 | 200,108 | 206,111 | 3.39 | 3.49 |
| 1999 | 55,991 | 267.80 | 1.01 | 202,607 | 204,633 | 3.62 | 3.66 |
| 2000 | 45,258 | 273.23 | 0.99 | 129,414 | 128,120 | 2.86 | 2.83 |
| 2001 | 71,256 | 270.98 | 1.00 | 218,462 | 218,462 | 3.07 | 3.07 |
| 2002 | 46,765 | 271.53 | 1.00 | 135,146 | 135,146 | 2.89 | 2.89 |
| 2003 | 41,710 | 271.05 | 1.00 | 118,538 | 118,538 | 2.84 | 2.84 |
| Mean | 39,273 | | | 106,283 | 123,703 | 2.60 | 3.14 |
| Standard deviation | 18,629 | | | 68,162 | 62,889 | 0.64 | 0.29 |

Figure 6.—Number of fishermen (boats) making bottomfish landings.

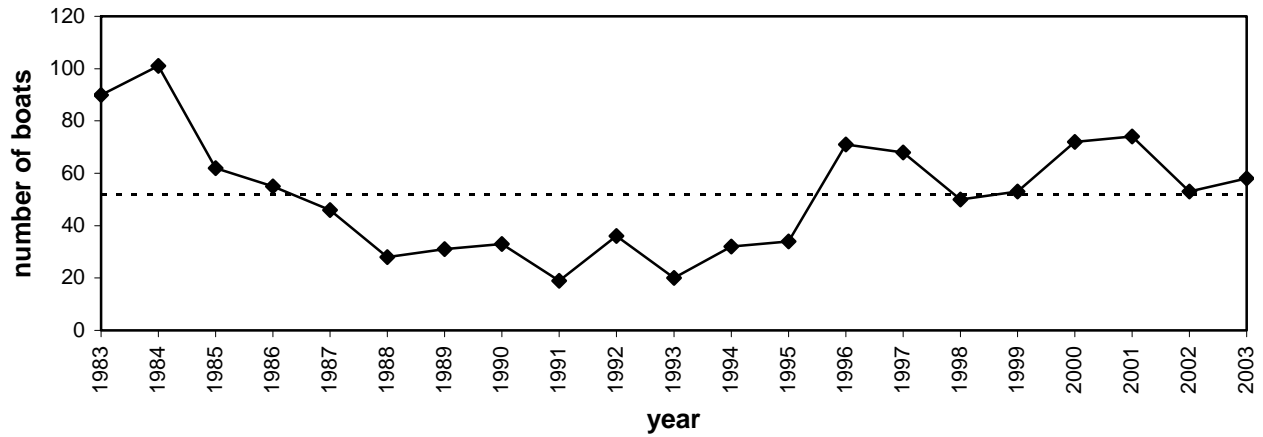


Figure 7.—Number of bottomfish trips.

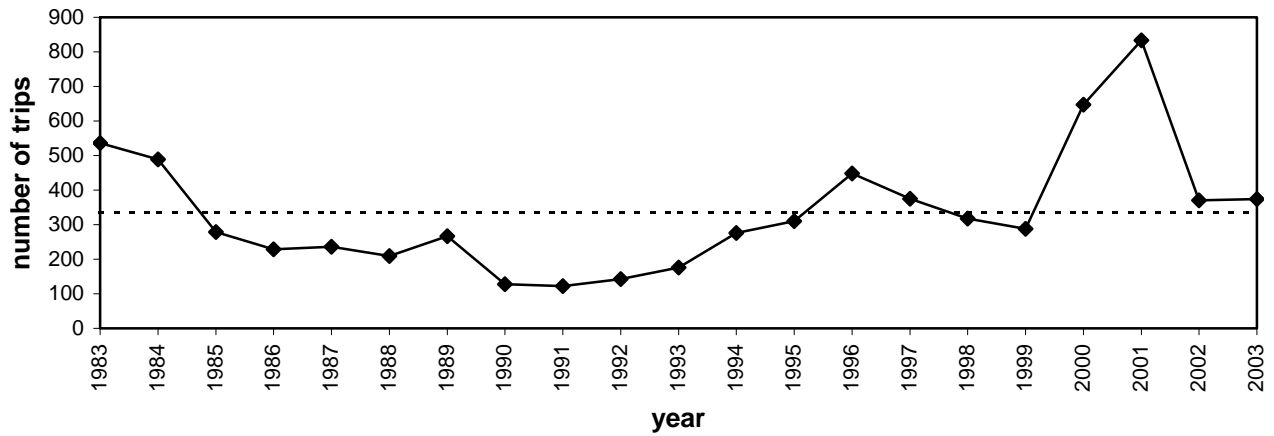


Figure 8.—Bottomfish catch in average pounds per trip.

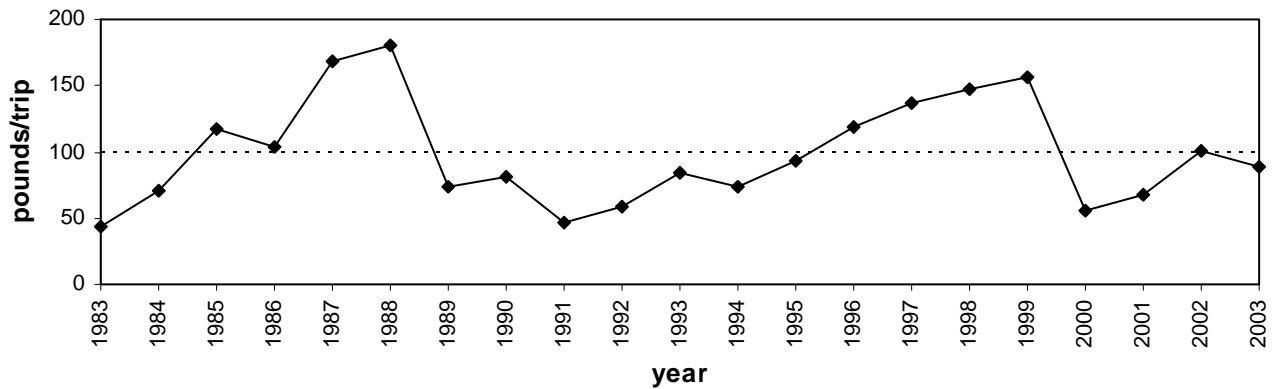
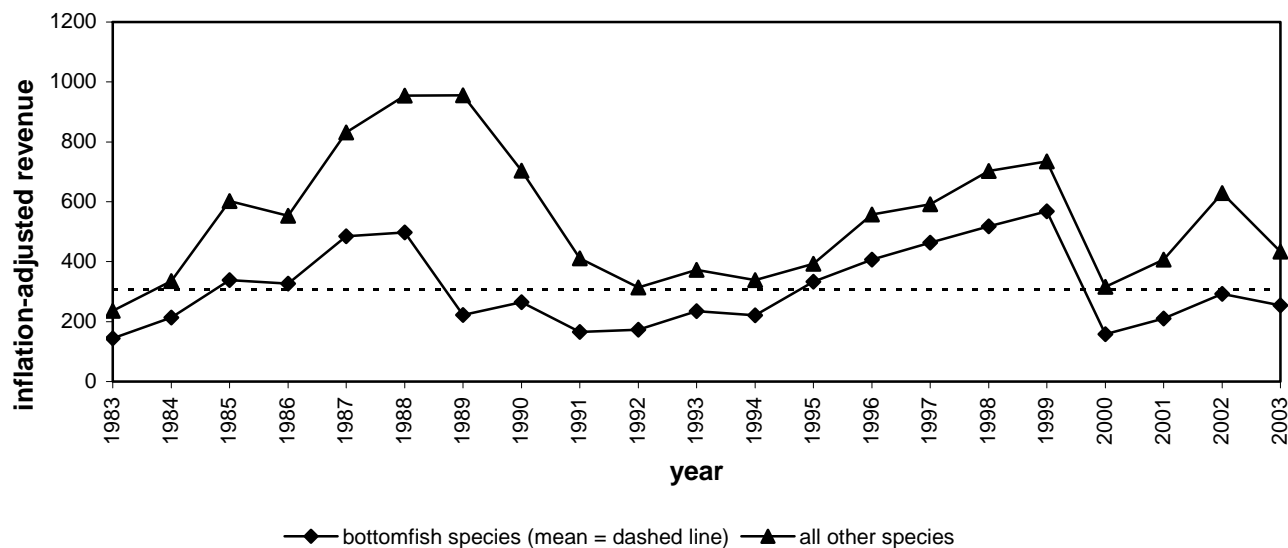


Figure 9.—Average inflation-adjusted revenue per trip landing bottomfish.



Interpretation: The number of fishermen (used as a proxy for the number of boats) making commercial sales of any bottomfish species has varied widely over the last 20 years. This year there were a few more fishermen selling bottomfish than last (58 vs. 53), but the number remains near the 21-year mean. Most of these fishermen are using small vessels and when catching bottomfish, are more likely to target the shallow-water species.

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 (although participation seems to be dropping this year). The number of bottomfish trips more than doubled in 2000 and 2001 to reach the highest levels in 18 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 and remained at this lower level in 2003 (near the 20-year mean), probably as a result of fewer fishermen focusing on catching bottomfishes at all.

The substantial increase in pounds of bottomfish sold per trip 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 and 2002. This year the average pounds of bottomfish sold per trip decreased again, to 9.7% below the 21-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 purchase 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, 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.

Inflation-adjusted bottomfish revenues recovered slightly from the marked decrease of 2000, although they were 13.0% lower this year than last year. This year's revenues were also 17.8% lower than the 21-year mean. This reflects the lower CPUEs as well as the lower prices that bottomfish are now commanding. In addition, it reflects the decrease in number of vessels fishing the northern islands, thereby decreasing the landings of the more valuable deep-water bottomfishes.

This report only represents the commercial fishery as reported on sales invoices in the CNMI. Charter vessels that do not sell their catch and recreational/subsistence catches are not included here.

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

Adding each recorded fisherman's sales for each 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. These actions will cause this measure of trips to underestimate the fishing effort tallied here as trips.

The catch rate 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.

Bottomfish revenue per trip is the total revenue of the bottomfish sold from a trip. The revenue per bottomfishing trip for all species is the total revenue for all trips that resulted in sales of any bottomfish. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2003 CPI figure as the basis by which calculations of previous years' prices are made. 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).

Table 6.—Number of fishermen (used as a proxy for number of boats), number of trips, catch rate, revenue per trip, inflation-adjusted revenue per trip for bottomfish, and inflation-adjusted revenue per trip for all species when bottomfishing.

| Year | Number of fishermen | Number of trips | Catch rate (lb/trip) | Revenue per trip (\$) | Inflation-adjusted revenue per trip for bottomfish (\$) | Inflation-adjusted revenue per trip for all species when bottomfishing (\$) |
|--------------------|---------------------|-----------------|----------------------|-----------------------|---|---|
| 1983 | 90 | 536 | 43 | 75 | 144 | 236 |
| 1984 | 101 | 489 | 70 | 121 | 214 | 335 |
| 1985 | 62 | 279 | 117 | 199 | 338 | 602 |
| 1986 | 55 | 229 | 104 | 197 | 327 | 553 |
| 1987 | 46 | 236 | 169 | 305 | 485 | 832 |
| 1988 | 28 | 209 | 181 | 330 | 498 | 954 |
| 1989 | 31 | 267 | 73 | 155 | 222 | 955 |
| 1990 | 33 | 128 | 81 | 195 | 265 | 704 |
| 1991 | 19 | 122 | 47 | 132 | 166 | 411 |
| 1992 | 36 | 143 | 59 | 149 | 173 | 314 |
| 1993 | 20 | 176 | 84 | 212 | 235 | 373 |
| 1994 | 32 | 276 | 74 | 205 | 221 | 338 |
| 1995 | 34 | 310 | 93 | 311 | 333 | 393 |
| 1996 | 71 | 448 | 119 | 395 | 407 | 557 |
| 1997 | 68 | 375 | 137 | 454 | 463 | 591 |
| 1998 | 50 | 318 | 148 | 503 | 518 | 702 |
| 1999 | 53 | 288 | 156 | 563 | 568 | 734 |
| 2000 | 72 | 647 | 56 | 160 | 158 | 316 |
| 2001 | 74 | 833 | 68 | 210 | 210 | 407 |
| 2002 | 53 | 370 | 101 | 292 | 292 | 629 |
| 2003 | 58 | 374 | 89 | 254 | 254 | 433 |
| Mean | 52 | 336 | 99 | 258 | 309 | 541 |
| Standard deviation | 22 | 177 | 40 | 130 | 132 | 213 |

Table 7.—Bycatch during bottomfishing (totals for 4 years).

| sector | species | total number of interviews | number of interviews with bycatch | number released alive | total number taken | % with bycatch |
|-------------|--------------------|----------------------------|-----------------------------------|-----------------------|--------------------|----------------|
| non-charter | | 99 | 1 | | | 1.00 |
| | black jack | | | 1 | 25 | 4.00 |
| | dogtooth tuna | | | 1 | 5 | 20.00 |
| | all species | | | 2 | 7887 | 0.02 |
| charter | | 41 | 10 | | | 24.39 |
| | jobfish | | | 1 | 2 | 50.00 |
| | blueline snapper | | | 3 | 10 | 30.00 |
| | blacktip grouper | | | 4 | 50 | 8.00 |
| | lyretail grouper | | | 5 | 6 | 83.33 |
| | red snapper | | | 5 | 9 | 55.56 |
| | redgill emperor | | | 6 | 94 | 6.38 |
| | emperors (mafute') | | | 7 | 8 | 87.50 |
| | triggerfish | | | 39 | 86 | 45.35 |
| | all species | | | 70 | 690 | 10.14 |

Table 8.—Bycatch during bottomfishing (2003).

| sector | species | total number of interviews | number of interviews with bycatch | number released alive | total number taken | % with bycatch |
|-------------|--------------------|----------------------------|-----------------------------------|-----------------------|--------------------|----------------|
| non-charter | | 17 | 0 | | | 0.00 |
| charter | | 14 | 5 | | | 35.71 |
| | blueline snapper | | | 3 | 10 | 30.00 |
| | red snapper | | | 1 | 4 | 25.00 |
| | emperors (mafute') | | | 7 | 8 | 87.50 |
| | triggerfish | | | 25 | 47 | 53.19 |
| | all species | | | 36 | 184 | 19.57 |

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*). Table 7 shows the total bycatch for 4 years (2000–2003) of interviews of fishermen during boat-based creel surveys. Table 8 shows the entire reported bycatch during bottomfishing for 2003. The interviews are divided into vessels engaged in non-charter (including commercial, non-commercial, and subsistence fishermen) and charter fishing. In 2003, there was only a single charter vessel engaged in bottomfishing. 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.

Figure 10.—Overfishing and overfished criteria from the Sustainable Fisheries Act.

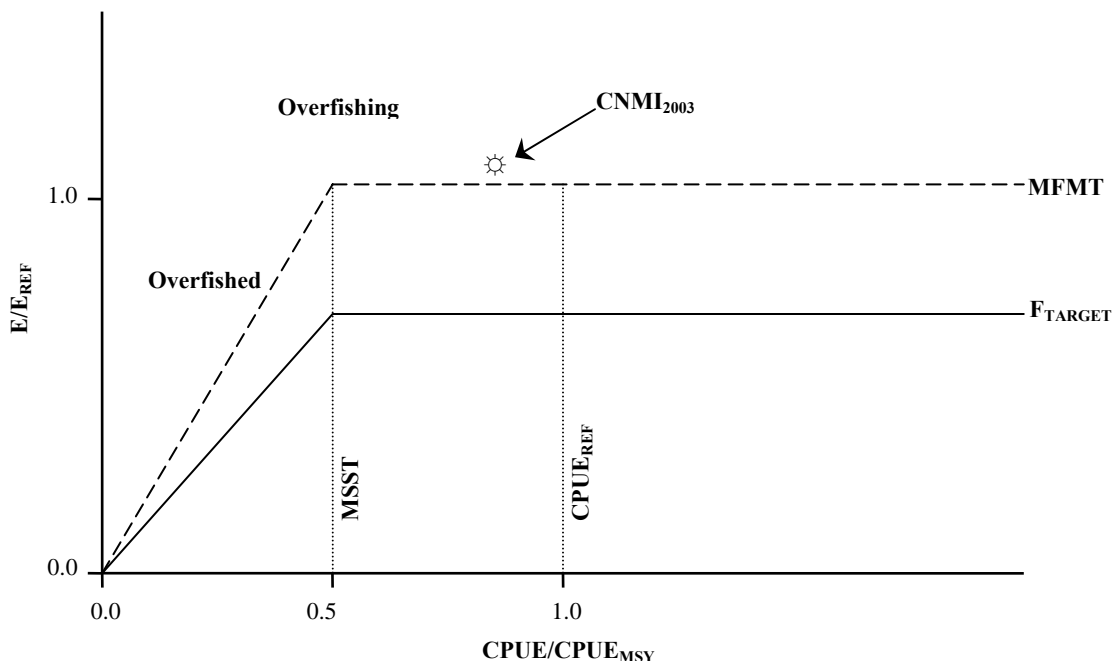


Table 9.—Overfishing and overfished criteria from the Sustainable Fisheries Act.

| Criterion | Code | Value | Standard deviation |
|--|---------------------|-----------------|--------------------|
| Controlling years/time series for CPUE | | 1983–1989 | |
| Mean CPUE for controlling years | CPUE _{REF} | 108.14 lbs/trip | 51.71 |
| Minimum stock size threshold (at 50% CPUE _{REF}) | MSST | 54.07 lbs/trip | |
| CPUE ₂₀₀₃ | | 89.00 lbs/trip | |
| CPUE ₂₀₀₃ /CPUE _{REF} | | 0.82 | |
| Controlling year/time series for E | | 1983–1989 | |
| Mean E for controlling years | E _{REF} | 320.71 | 133.77 |
| Long-term average E | E _{AVE} | 335.86 | 177.23 |
| E ₂₀₀₃ | | 374 | |
| E ₂₀₀₃ /E _{REF} | | 1.17 | |

Interpretation: Although Figure 10 might suggest that the CNMI bottomfishery is experiencing slight overfishing, knowledge of the fishery and fisheries in similar areas of the Pacific suggest that this impression is false. Given the data-poor situation in the CNMI, Figure 10 depends on averaging the first 7 years of data for the bottomfishery in the CNMI to determine reference values for catch-per-unit-effort (CPUE) and effort (E). The choice of years (and the status of the fishery they represent) that are used to determine these reference values is critical. However, there are no data to suggest that these 7 years represent fishing on a virgin stock or that the fishing was near or approaching a Maximum Sustainable Yield (MSY) or Optimum Yield (OY). Unfortunately, there are no data to suggest that some other span of years might be preferable. Moreover, the amount of variation in the data is very large, such that the 2003 values are well within a single standard deviation of the means for the controlling years. Most troubling are the calculations for effort. These assume that effort is being maximized during the controlling years. There is no evidence that effort has ever

been near maximal in the CNMI. This exercise, although required, is very likely statistically and biologically meaningless with respect to the bottomfishery in the CNMI.

The bottomfishery in the CNMI is very small-scale compared to those from Guam or Hawaii. Although the bottomfish habitat in the CNMI might be expected to at least equal to that of Guam, landings of bottomfishes in the CNMI tend to be an order of magnitude lower than those in Guam. There have never been any large-scale commercial bottomfishers in the CNMI that exported significant quantities of fishes outside the CNMI. This model was designed for fisheries that are at risk of overfishing or being overfished. Given the data available for the CNMI, the model does not accurately portray the undercapitalized and underutilized local bottomfishery.

Calculation: The only biological and fisheries data for the CNMI are commercial landings by species (or species group) and catch-per-unit-effort (CPUE) for all bottomfishes as a whole. It is not possible to partition effort among BMUS or even among groups of BMUS. This means that fishing effort (number of bottomfishing trips) is used as a proxy for fishing mortality and CPUE (catch rate in pounds per trip) is used as a proxy for stock biomass. The Maximum Sustainable Yield (MSY) control rule would govern the Maximum Fishing Mortality Threshold (MFMT). Reliable estimates of the CPUE at MSY ($CPUE_{MSY}$, the proxy for B_{MSY}) are also not available for the CNMI, so the mean CPUE for the first 7 years of data for the fishery was used as the $CPUE_{REF}$ and 50% of the $CPUE_{REF}$ was used for the Minimum Stock Size Threshold (MSST).

Similarly, reliable estimates of effort (E) at the Maximum Sustainable Yield (E_{MSY} , the proxy for F_{MSY}) are not available for the CNMI, so the mean E for the first 7 years of data for the fishery (E_{REF}) and for all 21 years of the fishery were calculated (E_{AVE}). The more conservative estimate of long-term average effort is E_{REF} . Above $CPUE/CPUE_{MSY}$ values of MSST, E/E_{REF} is equal to the MFMT.

Although a secondary set of reference points on recruitment overfishing that can be used to determine whether or not a particular species within the bottomfish complex has a mortality rate that would lead to protection through the Endangered Species Act is desirable, there are no data for the CNMI bottomfishery that can be used to accurately estimate spawning stock biomass, including a lack of data regarding percentage of mature fish in the catch.