

APPENDIX D: MEASURE TO LIMIT LARGE-VESSEL FISHING IN THE BOTTOM FISHERY IN THE EEZ AROUND GUAM

(This appendix was prepared by the staff of the Western Pacific Regional Fishery Management Council, the NMFS Pacific Islands Fisheries Science Center, and the NMFS Pacific Islands Regional Office.)

SUMMARY

The bottomfish fishery in the federal waters around Guam is managed under the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (FMP), which was developed by the Western Pacific Regional Fishery Management Council (Council) and became effective 27 August 1986 (51 FR 27413). The federal waters around the Commonwealth of the Northern Mariana Islands are not currently subject to the FMP, but a separate FMP amendment, currently under development, would include those waters within the FMP's management area. Aside from restrictions on the use of certain destructive fishing methods, which apply to the bottomfish fisheries throughout the Western Pacific Region, the bottomfish fishery in the federal waters around Guam is not regulated.

There is a newly emerging component of Guam's bottomfish fishery in which deep-slope species, particularly *onaga* (*Etelis coruscans*), are caught on offshore banks in federal waters, landed at Guam's commercial port, and exported by air to Japan. It is not clear how much fishing effort or catches have been made in this component of the fishery, which started in early 2002, but it appears that two or three vessels have been engaged in it to date. The vessels are large compared to most of the vessels in the fishery. The new activity is occurring on some or all of Guam's southern banks, which include Galvez, 11-mile, Santa Rosa, White Tuna, and Baby Banks. The banks to the north of Guam (including Rota Bank) and far to the west of Guam (including Bank A) appear not to have been fished. The closer banks have been fished for many years by Guam-based small-boat bottomfish fishermen that engage in a mix of subsistence, recreational, and small-scale commercial fishing, particularly in the summer months, when weather conditions tend to be calmer. Most of the vessels fishing on the southern banks target the shallow-water bottomfish complex, but some target the deep-water complex.

The new bottomfish fishing activity on the offshore banks has prompted concerns about: 1) information on the fishery being inadequate for effective management; 2) the potential for local catch rates to decline to levels that are not viable for the small-vessel component of the fishery; 3) threats to sustained community participation in the fishery; and 4) disruptions to traditional patterns of supply of bottomfish products to the local market.

Consistent with the FMP objectives and the National Standards of the Magnuson-Stevens Act, this management action has the following objectives: 1) to ensure that adequate information is routinely collected on the bottomfish fishery taking place in federal waters around Guam,

including the new export-oriented activity targeting *onaga*; 2) to maintain adequate opportunities for small-scale commercial, recreational, and subsistence bottomfish fishermen in the federal waters around Guam; 3) to provide for sustained community participation in the Guam bottomfish fishery; and 4) to encourage consistent availability of fresh deepwater bottomfish products to Guam consumers.

After considering a wide range of preliminary management options, many of them suggested through a public scoping process, the Council analyzed the likely effects of four management alternatives: 1) no action; 2) require federal permitting and logbook reporting for all vessels greater than 50 feet in length ("large vessels") that land bottomfish management unit species in Guam and close all federal waters within 50 nautical miles of Guam to bottomfish fishing by large vessels; 3) impose a 250-pound-per-trip landing limit on *onaga* for trips in federal waters around Guam; and 4) establish a limited access program for the bottomfish fishery in federal waters around Guam.

The Council has found Alternative 2 (large vessels subject to closed area and permit and reporting requirements) to be preferred. The Council rejected Alternative 1 (no-action) because of the risks it brings in terms of maintaining viable bottomfish catch rates, providing for sustained community participation in the fishery, and maintaining a consistent availability of locally caught fish to the Guam market. The Council rejected Alternative 3 (250-pound trip limit for *onaga*) because although it would likely help achieve the objectives of the action, it would encourage high-grading of *onaga* by fish quality, resulting in greater *onaga* bycatch rates than under other alternatives, and it might needlessly inhibit fishery efficiency in the waters beyond the range of the small-vessel component of the Guam bottomfish fishery. Alternative 4 (limited access program) would have several advantages over Alternative 2 in terms of achieving the objectives of this action, including providing more complete fishery information (through vessel logbooks) and providing more fine-tuned and adjustable control over total bottomfish fishing effort and the distribution of fishing effort by vessel size. However, the Council rejected Alternative 4 because its advantages would come at greater cost, at least in the short term, than Alternative 2, including greater implementation costs associated with administration, enforcement, and monitoring, greater compliance costs on the part of fishery participants, and a greater likelihood of individuals being denied the opportunity to participate in the fishery. Given the problem being addressed, these costs do not appear to be justified at this time. Alternative 2 would not preclude the implementation of a limited access program in the future should such an action become warranted.

Notwithstanding the advantages of Alternative 2 relative to the others, it is difficult to predict to what extent, it would succeed in achieving the objectives of the action. For example, it is possible that the type of fishery development this action is aimed at curbing (i.e., large-scale, intensive, export-oriented fishing) would take place on more or less the same scale under Alternative 2 (e.g., using vessels less than 50 feet (ft) in length) as it would under the no-action scenario. In that case, further management action might be needed in the future.

Summary of Environmental Impacts of the Alternatives

The preferred alternative calls for closing federal waters within 50 nautical miles (nm) of Guam to bottomfishing by large-scale vessels (greater than 50 ft in length). The proposed action is expected to maintain the opportunity for viable bottomfish catch rates, sustained community participation and local supply of fresh bottomfish but it would decrease the opportunity for large-scale vessels to harvest bottomfish at well-known banks and force them to search for new bottomfishing grounds (that could produce high catch rates initially) along a poorly-charted chain of seamounts west of Guam. Large-scale vessels that cannot invest time and operating expenses to precisely locate the offshore seamounts and discover unfished pockets of deepwater bottomfish may choose to relocate to the Commonwealth of the Northern Mariana Islands (CNMI) to engage in deepwater bottomfishing trips to the islands and banks north of Saipan. Taking no action could lead to greatly reduced bottomfish populations and catch rates within the fishing range of Guam's small-scale fleet. Economic, social and cultural costs would be severe for this fishery, which does not have the range or capacity to travel to more distant seamounts to obtain higher bottomfish catch rates.

TABLE OF CONTENTS

SUMMARY	D-1
TABLE OF CONTENTS	D-3
List of Tables	D-5
List of Figures	D-5
Abbreviations and Acronyms	D-6
1. INTRODUCTION	D-7
1.1 Existing Regulations	D-7
1.2 Responsible Agencies	D-9
1.3 Public Review Process and Schedule	D-9
1.4 List of Preparers	D-11
2. PURPOSE AND NEED FOR ACTION	D-11
2.1 Issues for Resolution	D-11
3. MANAGEMENT OBJECTIVES	D-11
4. MANAGEMENT ALTERNATIVES	D-16
4.1 Alternatives Considered but not Analyzed in Detail	D-16
4.2 Alternatives Further Considered	D-20
5. CONSISTENCY WITH NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT	D-22
6. RELATIONSHIP TO OTHER APPLICABLE LAWS	D-25
6.1 National Environmental Policy Act	D-25
6.1.1 Purpose and Need for Action	D-25
6.1.2 Alternatives Considered	D-25
6.1.3 Affected Environment Given Cumulative Impacts	D-25
6.1.4 Environmental Impacts of the Alternatives	D-25
6.1.4.1 Biological and Ecological Impacts	D-25
6.1.4.1.1 Impacts on Target and Non-target Stocks	D-25
6.1.4.1.2 Impacts on Essential Fish Habitat	D-28
6.1.4.1.3 Impacts on Biodiversity and Ecosystem Function	D-29
6.1.4.1.4 Impacts on Marine Mammals	D-31
6.1.4.1.5 Impacts on Sea Turtles	D-33
6.1.4.1.6 Impacts on Seabirds	D-35
6.1.4.2 Economic, Social and Cultural Impacts	D-36
6.1.4.2.1 Impacts on Fishery Participants	D-36
6.1.4.2.2 Impacts on Public Health and Safety	D-38

6.1.4.2.3	Impacts on Markets and Consumers	D-39
6.1.4.3	Cumulative Impacts	D-39
6.1.4.4	Controversy Regarding Environmental Effects	D-46
6.1.5	Reasons for Selecting the Preferred Alternative	D-47
6.2	Paperwork Reduction Act	D-48
6.3	Coastal Zone Management Act	D-48
6.4	Endangered Species Act	D-48
6.5	Marine Mammal Protection Act	D-50
6.6	Regulatory Impact Review and Regulatory Flexibility Act	D-52
7.	REFERENCES	D-62

LIST OF TABLES

Table 1.	Preliminary management options	D-17
Table 2.	Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for species managed under the FMPs for the Pelagics, Bottomfish and Seamount Groundfish, Precious Corals, and Crustaceans Fisheries of the Western Pacific Region	D-29

LIST OF FIGURES

Figure 1.	Map of Guam's southern banks	12
-----------	------------------------------------	----

ABBREVIATIONS AND ACRONYMS

BMUS	Bottomfish and Seamount Groundfish Management Unit Species
CDP	Community Development Program
CNMI	Commonwealth of the Northern Mariana Islands
CFR	Code of Federal Regulations
CPUE	catch per unit of effort
CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EO	Executive Order
ESA	Endangered Species Act
FAD	Fish Aggregation Device
FMP	Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region
FR	Federal Register
Guam DAWR	Guam Division of Aquatic and Wildlife Resources, Department of Agriculture
FSM Federated	States of Micronesia
ft	feet
HAPC	Habitat of Particular Concern
HDAR	State of Hawaii Division of Aquatic Resources
lb	pound
IRFA	Initial Regulatory Flexibility Analysis
m	meter
MFMT	Maximum Fishing Mortality Threshold
MHI	Main Hawaiian Islands
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWHI	Northwestern Hawaiian Islands
PRA	Paperwork Reduction Act
PRIA	Pacific Remote Island Areas
RIR	Regulatory Impact Review
RFA	Regulatory Flexibility Act
SPR	Spawning potential ratio
WPACFIN	Western Pacific Fishery Information Network

1. INTRODUCTION

1.1 Existing Regulations

The Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (FMP) became effective by a final rule published on August 27, 1986 (51 FR 27413). The FMP prohibits certain destructive fishing techniques, including explosives, poisons, trawl nets, and bottom-set gillnets; establishes a moratorium on the commercial harvest of seamount groundfish stocks at the Hancock Seamounts, and implements a permit system for fishing for bottomfish in the Exclusive Economic Zone (EEZ) around the Northwestern Hawaiian Islands (NWHI) (the current moratorium on the seamount groundfish fishery was published June 29, 1998 (63 FR 35162) and is in effect until 2004). The plan also establishes a management framework that provides for adjustments to be made, such as catch limits, size limits, area or seasonal closures, fishing effort limitation, fishing gear restrictions, access limitation, permit and/or catch reporting requirements, and a rules-related notice system.

Amendment 1 became effective on November 11, 1987 (52 FR 38102) and established limited access systems for bottomfish fisheries in the EEZ surrounding American Samoa and Guam within the framework measures of the FMP.

Amendment 2 became effective on September 6, 1988 (53 FR 299907). It was developed to reduce the risk of biological overfishing and improve the economic health and stability of the bottomfish fishery in the NWHI. The amendment divides the EEZ around the NWHI into two zones, the Hoomalu Zone and Mau Zone. A limited access system was established for the Hoomalu Zone, including landing requirements for permit renewal and for new entry into the fishery. One requirement for permit issuance is that the primary vessel operator must complete a protected species workshop. Access to the Mau Zone was left unrestricted, except for excluding vessel owners permitted to fish in the Hoomalu Zone. The Mau Zone is intended to serve as an area where fishermen can gain experience fishing in the NWHI, thereby enhancing their eligibility for subsequent entry into the Hoomalu Zone.

Amendment 3, which became effective on January 16, 1991 (56 FR 2503), defines recruitment overfishing as a condition in which the ratio of the spawning stock biomass per recruit at the current level of fishing to the spawning stock biomass per recruit that would occur in the absence of fishing is equal to or less than 20%. Amendment 3 also delineates the process by which overfishing is monitored and evaluated.

Amendment 4 became effective on May 26, 1991 (56 FR 24351). It requires vessel owners or operators to notify the National Marine Fisheries Service (NMFS) at least 72 hours before leaving port if they intend to fish in a protected species study zone that extends 50 nautical miles (nm) around the NWHI. This notification allows federal observers to be placed on board bottomfish vessels to record interactions with protected species if deemed necessary.

Amendment 5 became effective on May 28, 1999 (64 FR 22810). It establishes a limited entry program for the Mau Zone in the NWHI, including landing requirements for permit renewal. One

requirement for permit issuance is that the primary vessel operator must complete a protected species workshop.

Amendment 6 includes new provisions required under the 1996 Sustainable Fisheries Act. Certain portions of the amendment became effective on April 19, 1999 (64 FR 19067). These portions included designations of essential fish habitat, descriptions of the various fishing sectors, and the identification of each of the island groups of American Samoa, the Northern Mariana Islands, and Guam as fishing communities. Other portions of the amendment, including those regarding overfishing definitions, bycatch, and the identification of fishing communities in the State of Hawaii, were initially disapproved (64 FR 19067), but a supplemental amendment, Amendment 6 (Supplement), was subsequently prepared and became effective on July 3, 2003 (68 FR 46112). Amendment 6 (Supplement) identifies each of the seven regularly inhabited islands of Hawaii as a fishing community. It describes existing bycatch patterns, bycatch reduction measures, and bycatch reporting measures, and it establishes several non-regulatory measures aimed at further reducing bycatch and bycatch mortality. It also establishes new specifications and procedures for determining the status of the fishery and fish stocks with respect to overfishing, which modify the overfishing-related specifications and procedures established in Amendment 3.

Of relevance to the management of the NWHI bottomfish fishery is the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established December 4, 2000 through Executive Order (EO) 13178 (65 FR 76903), as modified by EO 13196 on January 18, 2001 (66 FR 7395). The Reserve is managed by the Department of Commerce under the National Marine Sanctuaries Act. The EO includes prohibitions on commercial and recreational fishing, including the taking of living coral and dead coral, in certain "Reserve Preservation Areas" within the Reserve. It also includes provisions that cap the number of permits and the "annual aggregate take" for particular types of fishing based on historical levels of permit issuance and "take." The intent and effects of the fishing-related provisions, however, are not entirely clear. The EO calls for the Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary. The public scoping associated with that process began in April 2002.

In June 1998 the State of Hawaii implemented several management measures for bottomfish in the state waters of the Main Hawaiian Islands (MHI) (Hawaii Administrative Rule, Chapter 13-94). Because bottomfish are managed under the FMP on an archipelagic-wide basis and because there are bottomfishing grounds in federal waters that are adjacent to state waters, these measures directly impact the stocks managed under the Bottomfish FMP. The new rules apply to seven species of bottomfish and include gear restrictions, bag limits for non-commercial fishermen, areas closed to fishing and possession of fish, and a requirement that bottomfishing vessels be registered with the state.

In 2000 Guam began enforcing a system of marine preserves that was established by law in 1997.

A number of FMP amendments and framework adjustments are in various stages of preparation and approval. Although they have not been approved or implemented through regulations, the following descriptions give an indication of the actions being proposed and considered.

Amendment 7 was prepared and submitted in parallel with the FMP for Coral Reef Ecosystems of the Western Pacific Region. NMFS issued a Record of Decision on June 14, 2002 that partially approves the Coral Reef Ecosystems FMP and Amendment 7 to the Bottomfish FMP, but a final rule has yet to be published. The amendment would prohibit the harvest of Bottomfish and Seamount Groundfish Management Unit Species (BMUS) in the no-take marine protected areas established under the Coral Reef Ecosystems FMP. The Coral Reef Ecosystems FMP would establish such areas at Rose Atoll in American Samoa, Kingman Reef, Jarvis Island, Howland Island, and Baker Island. No-take areas were also proposed in the NWHI, but all proposed measures in the Coral Reef Ecosystems FMP that would have applied to the waters around the NWHI (including Midway) were disapproved in the Record of Decision because of possible conflict and duplication with the management regime of the NWHI Coral Reef Ecosystem Reserve.

A proposed regulatory adjustment to the FMP would establish provisions for allowing new entry into the Mau Zone, with eligibility criteria based on historical participation in the Hawaii bottomfish fishery.

A proposed regulatory adjustment to the FMP would suspend the minimum landing requirements for annual permit renewal in the NWHI Hoomalu and Mau Zone limited access programs.

Draft Amendment 8, currently under review, would include the federal waters around the Commonwealth of the Northern Mariana Islands (CNMI) and the Pacific Remote Island Areas (PRIA) under the FMP and designate 49 additional bottomfish species (most of which are part of the shallow-water bottomfish species complex) as BMUS.

1.2 Responsible Agencies

The Council was established by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to develop management plans for fisheries operating in the U.S. EEZ around American Samoa, Guam, Hawaii, the Northern Mariana Islands and the U.S. possessions in the Pacific.¹ A fishery management plan or amendment is submitted to the Secretary of Commerce for review and approval. If the plan or amendment is approved, NMFS implements it through Federal regulations, which authorizes the conduct of administration, monitoring and enforcement activities. For further information, contact:

Kitty M. Simonds
Executive Director
Western Pacific Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, HI 96813
Telephone: (808) 522-8220

William L. Robinson
Administrator
Pacific Islands Regional Office
National Marine Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700
Telephone: (808) 973-2937

¹ Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Island, Palmyra Island, and Wake Island.

1.3 Public Review Process and Schedule

This measure was developed with the assistance of the Bottomfish Plan Team and Advisory Panel members from Guam. Public meetings and hearings regarding this amendment are listed below.

Date	Meeting (Location)/Distribution	Published Notice
22-23 October 2001	Advisory Panel Meeting (Honolulu)	Federal Register Notice October 9, 2001 (51367)
23-26 October 2001	111 th Council Meeting (Honolulu)	Federal Register Notice October 9, 2001 (51367)
10-11 April 2002	Bottomfish Plan Team Meeting (Honolulu)	Federal Register Notice March 28, 2002 Honolulu Advertiser April 7, 2002
14-16 May 2002	80 th Scientific and Statistical Committee Meeting (Lihue, Kauai)	Federal Register Notice April 29, 2002 (20960)
24-27 June 2002	113 th Council Meeting (Pago Pago, American Samoa)	Federal Register Notice June 7, 2002 (39330)
37475	Guam Bottomfish Scoping Meeting (Guam)	Pacific Daily News August 4, 2002
37532	Bottomfish Plan Team	Distributed options document for comment
8-10 October 2002	81 st Scientific and Statistical Committee Meeting (Honolulu)	Federal Register Notice
14-17 October 2002	115 th Council Meeting (Honolulu)	Federal Register Notice
28-30 January 2003	82 st Scientific and Statistical Committee Meeting (Honolulu)	Federal Register Notice
37659	Guam Public Meeting (Guam)	Pacific Daily News
37661	CNMI Public Meeting (Saipan)	Marianas Variety
11-13 February 2003	117 th Council Meeting (Saipan)	Federal Register Notice Marianas Variety
22-23 April 2003	Bottomfish Plan Team Meeting (Honolulu)	Federal Register Notice

5-8 May 2003	83 rd Scientific and Statistical Committee Meeting (Honolulu)	Federal Register Notice
10-13 June 2003	118 th Council Meeting (Honolulu)	Federal Register Notice

The Council took initial action on a preferred alternative on February 13, 2003 at its 117th Council meeting held in Saipan, CNMI. A range of alternatives was presented to the Council for consideration. The preferred alternative is to require federal permitting and logbook reporting for all vessels over 50 feet (ft) in length that land deepwater bottomfish in Guam. In addition the action will close all federal waters within 50 nm of Guam to bottomfish fishing by vessels over 50 feet in length. At its 118th meeting, in June 2003, the Council took final action on the preferred alternative.

1.4 List of Preparers (listed alphabetically within agencies)

Western Pacific Fishery
Management Council:

Paul Bartram (contractor), Tom Graham
(contractor), Mark Mitsuyasu, Eric Kingma

NMFS Pacific Islands
Fisheries Science Center:

Stewart Allen

NMFS Pacific Islands Regional Office:

Marcia Hamilton, Alvin Katekaru

2. PURPOSE AND NEED FOR ACTION

2.1 Issues for Resolution

There is a newly emerging component of Guam's bottomfish fishery in which deep-slope species are caught on offshore seamounts (or "banks") in federal waters, landed at Guam's commercial port, and exported to Japan.² The exports are apparently made by air and destined for Okinawa (T. Flores, Guam Division of Aquatic and Wildlife Resources, pers. comm.). It is not yet clear how much fishing effort or catches are being made in this new fishery, which is believed to have started in early 2002 (T. Flores, pers. comm.). *Onaga* (*Etelis coruscans*) appears to be the primary species that is targeted for export. This fishery was initiated by a single large-scale vessel (T. Flores, pers. comm.) that subsequently grounded and was damaged. A second vessel under the same ownership was damaged by the supertyphoon that struck Guam in December 2002. A third large-scale vessel (53 ft in length) has joined the Guam domestic fleet and its owner

² There is apparently also a component of the bottomfish fishery in which relatively large vessels land Guam-EEZ-caught fish in the CNMI (WPRFMC 2002a). Whether this activity is new or related to the export-to-Japan venture is not clear.

apparently intends to engage in large-scale bottomfishing with Hawaii rather than Japan as a possible export market.

The new fishery is occurring on some or all of Guam's southern banks, which include Galvez, 11-mile, Santa Rosa, White Tuna, and Baby Banks (T. Flores, pers. comm.) (see Figure 1). The banks to the north of Guam (including Rota Bank) and far to the west of Guam (including Bank A) appear not to have been fished. The closer banks have been fished for many years by Guam-based bottomfish fishermen that engage in a mix of subsistence, recreational, and small-scale commercial fishing, particularly in the summer months, when weather conditions tend to be calmer. Most of the vessels fishing on the southern banks target the shallow-water bottomfish complex, but some target the deep-water complex.

3. MANAGEMENT OBJECTIVES

Bottomfishing in the EEZ of Guam is managed under the Bottomfish FMP but no federal regulations for the Guam fishery specifically have been established to date. The proposed action is needed to resolve existing and potential management problems associated the new large-scale bottomfishing activity. The objectives of the proposed action are:

- 1) to ensure that adequate information is routinely collected on the bottomfish fishery taking place in federal waters around Guam, including the new export-oriented activity targeting *onaga*;
- 2) to maintain adequate opportunities for small-scale commercial, recreational, and subsistence bottomfish fishermen in the federal waters around Guam;
- 3) to provide for sustained community participation in the Guam bottomfish fishery; and
- 4) to encourage consistent availability of fresh deepwater bottomfish products to Guam consumers.

Ensure Adequate Monitoring and Data Collection for the Large-Scale Bottomfish Fishery

An immediate management issue is that there is not enough information to determine whether the new deepwater bottomfishing activity is causing any problems, such as adverse impacts on marine resources, fishermen, or consumers. Because Guam's creel survey does not cover fish landing activity at the commercial port and because these fish-for-export are not sold through any establishments that participate in the voluntary sales ticket monitoring program, this component of the bottomfish catch from the federal waters around Guam is not currently monitored.³

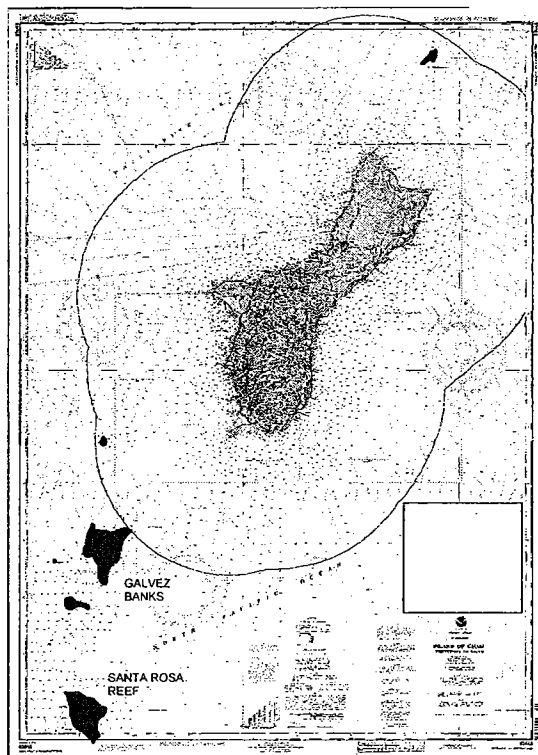
³ This is apparently not the only component of Guam's bottomfish fishery that is not measured by the creel survey. Much of the bottomfishing activity (including deep-slope fishing) on the east side of Guam is also not measured, as no landing sites on the east side are surveyed (T. Flores, pers. comm.). The government of Guam monitors certain exports of fish but the existing systems either do not capture locally caught bottomfish exports or do not provide enough detail to distinguish them from other products (D. Harris, Guam Bureau of Statistics and Plans, pers. comm.). Other possible sources of information on bottomfish exports, including carrier records and Japan's import monitoring systems, have not been investigated.

The only recent information about large-scale bottomfishing in the Marianas region has come from a fleet of 4-5 vessels operating in waters offshore of the Commonwealth of the Northern Mariana Islands (CNMI). Since the termination of this fishery about October 2002, fishery scientists and managers no longer have a source of data about large-scale bottomfishing in the region from which to draw inferences about the new large-scale fishery in Guam's EEZ.

Figure 1. Map of Guam's southern banks

Even if landings data become available for the new Guam bottomfish fishery, the catch per unit of effort (CPUE) cannot be estimated without information about the fishing effort. The new activity has introduced a method of dropline bottomfishing, possibly from Okinawa, that deploys 20-30 hooks per line instead of the 5-7 hooks per line deployed by small-scale vessels (M. Duenas, pers. comm.). Thus, calculation of CPUE per fishing station or per day for this type of bottomfishing cannot apply effort parameters from the small-scale fishery.

Unless they are self-recruiting, seamount populations of benthic marine animals depend on larvae transported by currents from other geographically removed larger bank masses. Recruitment in such cases may be variable and unpredictable (Rogers 1994) and the seamount populations become "dependent populations" (Boehlert et al. 1994). Deepwater bottomfish resources associated with Guam's offshore banks, therefore, may be more sensitive to fishing pressure than resources on the island slopes. For this reason alone, large-scale fishing of seamount bottomfish needs to be closely monitored.



Maintain Viable Catch Rates Within the Limited Fishing Range of the Small-Boat Fishery

Initial consultations with fishery managers and Guam's fishing community (through a public scoping meeting held in Guam August 8, 2002) indicate that the potential problem of most concern is that catch rates of deepwater bottomfish may drop below economically viable levels within the limited fishing range of the small boat fleet (WPRFMC 2002a).

There is no evidence that the bottomfish stocks are being overfished, but fishing pressure on the most accessible sub-populations (i.e., those closest to small boat landing sites in Guam) are under heavy fishing pressure (WPRFMC 2003c). The extent to which some areas have been locally depleted of bottomfish is not known but experiments to fish down localized bottomfish

populations have demonstrated the potential for local depletion (Ikehara et al. 1970; Polovina and Ralston 1986).

Public commenters have not explicitly raised concern about conflict or competition with the new fishery or its participants. However, there does appear to be concern among some members of the local fishing community that because the new activity may, through large catches, contribute to local depletion of bottomfishing areas that are accessible to small-boat fishermen, adversely impacting deepwater bottomfish catch rates in the only areas that can be accessed by small boats. Although there are no obvious signs of conflict among the resource users, there are certain characteristics of the new fishery that set its participants apart from the majority of participants in Guam's bottomfish fisheries – namely, the vessel(s) is comparatively large, fishing is done fairly intensively and for purely commercial purposes, and the catch is sold abroad rather than locally.

When ocean conditions are favorable, small-scale vessels can access several of the seamounts south of Guam for bottomfishing: "11 Mile," "White Tuna," "Baby" and "Galvez." The average size of *onaga* received by the Guam Fishermen's Cooperative Association from members' bottomfishing trips to these seamounts has declined from 25 lb per fish (indicative of an unfished resource) to about 15 lb per fish in a short period of time (M. Duenas, pers. comm.).

Similar concerns about declining catch rates and sizes of *onaga* at seamounts isolated from larger island bank bottomfish resources have stimulated efforts in some Pacific island countries to control bottomfishing pressure at seamounts. For example, heavy fishing of *onaga* at seamounts close to the main island of the Kingdom of Tonga was one of the reasons that the U.S. Agency for International Development sponsored in the early 1990s a project to shift small-scale fishing effort from seamount bottomfishing to pelagic longline fishing. The agency also assisted the government of Tuvalu in establishing a deepwater bottomfish management plan before developing a small-scale export-oriented fishery targeting *onaga* and *opakapaka* (S. Swerdloff, RDA International Chief of Party pers. comm. to P. Bartram 1993).

Deepwater bottomfish is an inherently limited resource because only a narrow portion of the ocean bottom satisfies the habitat requirements of these species. Bottomfish populations are not evenly distributed within this habitat. Concentrations of deepwater bottomfish occur in pockets, and when discovered, these pockets may be heavily fished. After initial catches of old, large fish decline to reduced catches of smaller fish, fishermen shift to new or less-exploited pockets of bottomfish. If fishing effort increases to the extent that most pockets within the range of fishing vessels have already been fished down, then a decline in catch rates is inevitable (WPRFMC 1986). The need to "rest" heavily-fishing sites is a well-known method of bottomfish conservation once voluntarily practiced by professional fishermen in Hawaii. Rotation of bottomfishing grounds allows local populations to recover from intensive fishing (C. Yamamoto, pers. comm. cited in WPRFMC 1986).

According to professional fishermen (now deceased) in Hawaii and Guam, *onaga* has a small home range and is more strongly associated with deep bottom relief (i.e., pinnacles) than other species of deepwater snappers. When pockets of *onaga* are heavily fished, local catch rates can

decline in a remarkably short time. If a local population of *onaga* is depleted, it may take 5 years or more for a particular pinnacle to produce a viable catch rate again (C. Yamamoto, K. Sakamoto, pers. comm. to P. Bartram 1984). Thus, large-scale bottomfishing at Guam's offshore banks could have an adverse impact on catch rates of *onaga* and other deepwater bottomfish species.

Provide for Sustained Community Participation in Bottomfishing

In characterizing Guam's fisheries, Knudson (1987) concludes that "the commercial fishery on Guam is the product of many relatively small sales by a large number of 'semi-commercial' fishermen and that the non-commercial fishery is the product of a considerable pool of subsistence fishermen plus another sizeable pool of recreational fishermen," and that, "on the whole, catches in the Guam fishery are small, but that the number of participants is quite large."

Domestic fishing on Guam supplements family subsistence, which is gained by a combination of small scale gardening, ranching and wage work (Amesbury and Hunter-Anderson 1989). The availability of economic activities such as part-time fishing is one of the major reasons that Guam has not experienced more social problems during times of economic hardship. The subsistence component of the local economy has gained significance in recent years with the downturn in Guam's major industries and increasing unemployment (WPRFMC 2003a).

Guam's indigenous Chamorro culture is maintained by systems of interdependence and social reciprocity, including sharing of seafood gathered by fishing. Beyond their dietary importance, fish have value for exchange and gift-giving that promotes social harmony, community cohesion, and cultural identity. Various types of seafood served on holidays or during celebrations may become imbued with specific symbolic meanings. High value is placed on sharing one's fish catch with relatives and friends. Sometimes fish are sold in order to earn money to buy gifts for friends and relatives on important Catholic religious occasions such as novenas, births and christenings, and other holidays (Amesbury and Hunter-Anderson.1989). Deepwater bottomfish are often sold for this purpose because they command good market prices (M. Duenas, pers. comm.). Fishing in Guam continues to be important not only in contributing to subsistence needs but also in terms of preserving Chamorro history and identity. Fishing assists in perpetuating the strong maritime traditions and knowledge of the Chamorro culture.

Community participation in Guam's bottomfish fishery is sustained through ownership and operation of small vessels (most less than 25 ft in length) that do not have the range or capacity to fish the more distant seamounts banks south and west of Guam. If seamount bottomfish populations are locally depleted by large-scale bottomfishing, recovery to harvestable levels could take many years. Recovery times required for local populations of bottomfish to rebuild would depend on the nature of the reproductive biology and recruitment of the affected species. Recruitment may occur through the return of larval fish to the adult habitat where they were spawned (i.e., populations that are self-recruiting) or it may occur through the settlement of larval fish spawned at distant islands and banks and dispersed long distances by currents. The latter would be chance events dependent on infrequent oceanographic conditions with a possible long-

term disruption of community participants in the deep-slope bottomfish fishery (WPRFMC 1986).

With the small size of Guam, the dispersal of fishery participants and extensive community networks for sharing locally caught fish, it is likely that the social benefits of small-scale fishing are widely shared by most of the island's long-term residents (WPRFMC 2003a). A "boom and bust" pattern of uncontrolled large-scale bottomfishing in the EEZ around Guam has the potential to disrupt community participation in the small-scale fishery and weaken its cultural value. Boom-and-bust cycles have been experienced in bottomfish fisheries of other U.S. Pacific islands. Two such cycles in American Samoa reduced fish supply and domestic fishing effort for many years after each "bust" (Itano 1991).

Encourage Consistent Availability of Locally-Caught Fish to Domestic Consumers

Guam's domestic fishery is characterized by sharp seasonal pulses in fishing effort and fish catches. As a result, there is inconsistency in the supply of high quality fresh seafood available to Guam consumers. Approximately 85 percent of the seafood consumed on Guam is imported and, during periods of low domestic fish landings, dependence on lower quality imported fish increases (GFCA 1998).

Based on creel surveys of fishermen, only about one-quarter to one-third of the inshore catch is sold. The remainder enters non-commercial channels (Knudson 1987). Reef fish continues to be important for social obligations, such as fiestas and food exchange with friends and families. One study found a preference for inshore fish species in non-commercial exchanges of food (Amesbury and Hunter-Anderson 1989). Many of the nearshore reefs around Guam appear to have been badly degraded by a combination of natural and human impacts, especially sedimentation, tourist overuse and overharvesting (WPRFMC 2003b). Even if coastal marine resources were in better condition, the local harvest of reef fish is insufficient to meet domestic demand, and there are substantial imports from the Federated States of Micronesia and the Philippines. The quality and food safety of some of these imports have been questioned (GFCA 1998). For example, roadside vendors importing fish from Micronesian islands were shut down by the Guam Department of Health due to health concerns (WPRFMC 2003c).

Appreciation of deepwater bottomfish by local consumers is increasing as the availability of reef fish and shallow-water bottomfish declines (M. Duenas, pers. comm.). The availability of *onaga* and other deepwater bottomfish is also important to Guam's tourist industry, the mainstay of the island economy. Japanese visitors often want to enjoy the traditional foods and symbols of Japan while they vacation in Guam, including high quality fresh fish.

The new large-scale deepwater bottomfishing activity in the EEZ of Guam is primarily export oriented, although non-target species would probably marketed on Guam. In the short term, a "boom" of large-scale bottomfishing could increase the domestic supply of deepwater bottomfish but a subsequent "bust" of reduced catch rates on banks close to Guam could disrupt the long-term supply of locally-caught fresh bottomfish, adding to periodic scarcities.

4. MANAGEMENT ALTERNATIVES

4.1 Alternatives Considered but not Analyzed in Detail

A wide range of management options was identified during the scoping process. At its 115th meeting, 14-17 October 2002, the Council considered a preliminary set of 10 options, including a number of variants under each option (WPRFMC 2002c). These included options identified in a public scoping meeting (WPRFMC 2002a), as well as a number of other options devised by the Council. These preliminary options were formulated to be as narrow as possible in terms of purpose and effect so that they could be combined in various ways. The options were subsequently narrowed down, and in the case of Alternative 2, combined, to form four reasonable alternatives that were determined to represent a wide range of actions that had the potential to successfully address the purpose and need of the action. These four alternatives are described in Section 4.2 and considered throughout this document. The options that were eliminated from inclusion among those alternatives are briefly described here, along with the reasons for eliminating them.

Table D-1 lists the 10 options that were initially considered (in rows), along with a number of more specific variants that were considered for each option (in columns). For example, the second option, requiring logbook reporting, had three types of variants, and two or three possibilities under each type. The reporting requirement could be applied according to whether a vessel fishes for any species, just BMUS, or just certain BMUS (e.g., just *onaga*). It could also be applied according to vessel size, specifically, either to all vessels or just vessels greater than 40 feet in length. Finally, the requirement could be applied either in the portion of the EEZ just around Guam or around both Guam and the CNMI.

The cross-hatched cells in Table D-1 indicate option-variants that were never considered, either because they were not possible, not reasonable, or not practical. The remaining cells indicate the options and variants that were initially considered. The cells filled with the numbers 2, 3, or 4 indicate the option-variants that were ultimately selected as the four alternatives. The no-action option was also selected, as Alternative 1. Thus, the empty cells indicate the options and variants that were initially considered but eliminated from further consideration and analysis. The reasons for eliminating them are discussed below.

Table D-1. Preliminary management options

Options ↓	by species being fished for			by vessel type		by portion of the EEZ		by area		by actor type		by type of measure		by season	
	all species	all BMUS	certain BMUS	only > 40 ft	all vessels	only Guam	Guam & CNMI	only w/i 50 nm	entire EEZ	only buyers	only sellers	by weight	by number	all year	certain seasons
No action															
Require		2		2*		2									
Require sales															
Require VMS															
Require that															
Impose trip			3		3	3		3				3			
Impose vessel						2		2							
Impose limit on															
Establish closed		2		2		2		2						2	
Establish						4									

The cross-hatched cells indicate the variants for a given option that were never considered.

The numbers in the cells refer to the three action alternatives that were selected for further analysis (the no-action option is Alternative 1).

* Alternative 2 would set the vessel size limit at 50 feet in length rather than 40 feet, as initially considered.

** As a practical matter, the logbook reporting option would necessitate that vessel owners or operators be required to obtain a federal permit, but eligibility for a permit would not be restricted in any way, and there would not be any fee charged to applicants.

Require logbook reporting: This option was further considered, as part of Alternative 2. The variant of applying it to all fishing (for any species, including pelagic species) was eliminated because the problem addressed in this amendment is limited to the bottomfish fishery. It does not preclude a similar measure from being implemented under other FMPs. The variant of applying it to just some BMUS (e.g., *onaga*) was eliminated because current management is aimed at managing BMUS as holistically as possible. The variant of applying this option to all vessels fishing for BMUS (rather than just large vessels) was eliminated because it would likely impose an excessively large burden on the many small-vessel, part-time fishermen that participate in the fishery, hindering their ability to participate. The variant of applying it to the EEZ waters around the CNMI as well as Guam was eliminated because the fisheries in the two areas appear to be largely distinct in terms of participants and landing points, so the two can, to a large extent, be managed independently, and the current problem appears limited to the waters around Guam.

Require sales reporting: The option of requiring reporting of bottomfish sales transactions (e.g., by fishermen, processors, or dealers) would serve to improve the quality of measurements made of the commercial component of the bottomfish fishery. However, the option was determined to likely be a cost-ineffective one, for several reasons. First, it would largely duplicate the information currently gathered through the voluntary sales ticket data collection program administered by the Government of Guam. Its main utility would be in improving the reliability of those data rather than providing new information. A potential advantage of this option would be its ability to monitor commercial activity in cases where the first sales transaction takes place outside of Guam (e.g., in the CNMI, Japan, or other transshipment points or markets). However, in those cases it would be prohibitively costly to both achieve compliance with the reporting requirement and to administer the reporting system. If the requirement were applied to sellers, it would impose a substantial new burden on fishermen, as the current sales tracking system relies on reporting by purchasers.

Require VMS transmitters: The option of requiring fishing vessels to carry and operate transmitters as part of a vessel monitoring system (VMS) would be useful only in concert with area-based controls, as its primary function would be to provide information about a vessel's position and movement (rather than specific activities). Such information would facilitate enforcement and encourage compliance with area-based rules. Thus, it could be useful in concert with Alternative 2, which would prohibit bottomfish vessels greater than 50 feet in length from fishing in federal waters within 50 nm of Guam. However, given the relatively small size of the bottomfish fishery, the cost of operating a VMS system devoted solely to the Guam bottomfish fishery would likely be prohibitive.

Require that fish be landed in Guam: The main purpose of the option of requiring that Guam-EEZ-caught BMUS be landed in Guam would be to help ensure that Guam-based information systems are able to monitor the entirety of the fishery operating in the EEZ around Guam. This option would not be aimed at preventing the export of bottomfish from Guam, but it might have the effect of discouraging such exports. It was determined that the utility of the requirement (improving the quality of information on landings) would not be justified by its severity

(effectively discouraging exports). Further, it would likely be prohibitively costly to achieve compliance with the requirement.

Impose trip catch limit: This option was further considered, as Alternative 3. The variant of applying it to all fishing (for any species) was eliminated because the problem addressed in this amendment is limited to the bottomfish fishery. It does not preclude a similar measure from being implemented under other FMPs. The variant of applying a catch limit to all BMUS rather than just selected deepwater BMUS was eliminated because the problem is limited to just some of the deepwater BMUS, particularly *onaga*, and in the case of this fishery, where species are easily distinguished, the application of species-specific catch limits is quite feasible. The variant of applying it to the EEZ waters around the CNMI as well as Guam was eliminated because the fisheries in the two areas appear to be largely distinct in terms of participants and landing points, so the two can, to a large extent, be managed independently, and the current problem appears limited to the waters around Guam. The variant of applying the limit to just federal waters within 50 nm of shore (rather than the entire EEZ) was eliminated because a geographically seamless rule has the advantage of simplicity and ease of enforcement. The variant of expressing the catch limit in terms of number rather than weight was eliminated because in spite of its advantage to fishermen, many of whom do not have a weighing scale on board, it would encourage high-grading by fish size, with smaller fish killed and discarded, leading to greater waste and a greater risk of overfishing. A limit expressed in terms of weight might encourage high-grading by fish quality or value, with lower-quality fish killed and discarded, but the consequent waste and risk of overfishing would likely be less severe than in the case of a number-based limit.

Impose vessel size limit: The option of limiting the size of bottomfishing vessels in federal waters would serve to preserve fishing opportunities for small vessels and small-scale fishing enterprises, as well as reduce the risk of overfishing (by hindering the potential for growth of fishing capacity in the fishery). A variation of this option is integrated into Alternative 2, which would impose reporting requirements and a closed area within 50 nm of Guam for vessels greater than 50 feet in length. The variant of applying this option to the EEZ waters around the CNMI as well as Guam was eliminated because the fisheries in the two areas appear to be largely distinct in terms of participants and landing points, so the two can, to a large extent, be managed independently, and the current problem appears limited to the waters around Guam. The variant of applying this option to the entire EEZ of Guam was eliminated because it was determined that the banks beyond 50 nm of Guam are for the most part not accessible to the smaller vessels whose fishing opportunities this action aims to preserve, and that because of their distance from port, the fish stocks on those banks are not currently in need of additional protection, and so closing those banks to large vessels would needlessly constrain their operations. It should be noted, however, that the advantage of establishing the large vessel closed area boundary at 50 nm from Guam rather than at the outer edge of the EEZ depends on the size of the banks and associated fish stocks that are available in the beyond-50-nm area of the EEZ. If there are very few fishing grounds and bottomfish resources available in the outer area, it might be more cost-effective in terms of enforcement to move the boundary out to the edge of the EEZ rather than creating an additional boundary. It has been tentatively estimated that 10 percent of the fishable banks in the EEZ around Guam are located beyond 50 nm from Guam.

Impose limit on number of fishing gears: The option of limiting the number of fishing gears (e.g., reels) on bottomfishing vessels in federal waters would be similar in intent and effect as a limitation on vessel size. It would effectively limit fishing power per vessel, discourage the participation of large vessels, and hinder the potential for growth of fishing capacity in the fishery as a whole. It was determined that a limit on vessel size would be a more cost-effective option than a limit on fishing gears, primarily because achieving compliance with the latter would be more costly.

Establish closed areas: This option was further considered, as part of Alternative 2. The variant of applying it to all fishing (for any species) was eliminated because the problem addressed in this amendment is limited to the bottomfish fishery. It does not preclude a similar measure from being implemented under other FMPs. The variant of applying it to just some BMUS (e.g., *onaga*) was eliminated because it would be an impractical way to manage BMUS as a whole, since many species are caught in a given trip at a given location. The variant of applying this option to all vessels fishing for BMUS (rather than just large vessels) was eliminated because one purpose of the closures would be to maintain fishing opportunities for small vessels in the waters to which they have practical access (i.e., waters relatively close to shore). The variant of applying it to the EEZ waters around the CNMI as well as Guam was eliminated because the fisheries in the two areas appear to be largely distinct in terms of participants and landing points, so the two can, to a large extent, be managed independently, and the current problem appears limited to the waters around Guam. The variant of applying the closures seasonally rather than year-round was eliminated because seasonal closures would be less likely to solve the problem (the problem of maintaining fishing opportunities for small vessels is a year-round one).

Establish limited access program: This option was further considered, as Alternative 4. The variant of applying it to the EEZ waters around the CNMI as well as Guam was eliminated because the fisheries in the two areas appear to be largely distinct in terms of participants and landing points, so the two can, to a large extent, be managed independently, and the current problem appears limited to the waters around Guam.

4.2 Alternatives Further Considered

At its 117th meeting, February 11-13, 2003, the Council selected four alternatives for further detailed analysis and consideration prior to taking final action to manage the bottomfish fishery in federal waters around Guam. These alternatives would address some or all of the four objectives of the management action that are identified in Section 2. The alternatives bracket a wide range of potential control measures and impacts. They are described in a general order of increasing restrictions in terms of the participation and fishing effort that would be allowed in the deepwater bottomfish fishery in the EEZ of Guam.

Alternative 1: No action

Every proposed action by the Council includes a “no action” baseline against which other alternatives are compared. Under Alternative 1, no changes would be made to the FMP or its

implementing regulations. The Council would wait until further evidence is available to document that there are problems in need of resolution and/or it would pursue non-regulatory actions to address the problem outside the FMP process (e.g., prior to or instead of any formal federal management action). Examples include actions to:

- Conduct a rapid investigation of the new fishery and the problems it may present.
- Modify the existing fishery information system in Guam so that it captures the activity of the new fishery (e.g., modify the creel survey or sales ticket system or establish a voluntary logbook program for the export component of the fishery or integrate export data collected through Customs into the fishery information system).
- Encourage the government of Guam to take non-regulatory or regulatory action, such as modifying its export monitoring systems to adequately measure bottomfish exports, restricting the export of certain species of bottomfish, or controlling catch or effort through local landings laws.

Under no action, Guam laws and regulations would continue to govern bottomfishing in the island's territorial sea but no specific federal regulations would be immediately proposed for bottomfishing in the EEZ of Guam.

Alternative 2: Require federal permitting and logbook reporting for all vessels greater than 50 feet in length that land bottomfish management unit species in Guam. Close all federal waters within 50 nautical miles of Guam to bottomfish fishing by vessels greater than 50 feet in length

In order to ensure that Guam-based information systems are able to monitor the entirety of the bottomfish fishery in the EEZ of Guam, large-scale vessels (> 50 ft) that land bottomfish in Guam would be required to hold federal permits to engage in bottomfishing in the EEZ around Guam and to submit logbooks of fishing catch, effort and other information.

In order to maintain the potential for the small-scale fishery to maintain viable deepwater bottomfish catch rates, sustained community participation and local consumer supply of fresh bottomfish, the permits for large-scale vessels would include a provision prohibiting them from bottomfishing in federal waters within 50 nm of Guam.

Vessel length is not an indicator of bottomfishing capability, only of fishing range and storage capacity. Vessels under 25 feet in length use electric reels to bottomfish. However, hydraulic systems can be used effectively and economically on vessels as small as 25 feet. For example, "Radon" vessels of this size on the island of Kauai are equipped with systems that use an aircraft hydraulic pump for Cessnas with hoses having adjustable veins that allow hydraulic pressure to remain constant at three stations. The cost is \$9,000 for the system, including pump, haulers, hoses and reservoir. Less expensive hydraulic pumps can be purchased for much less (\$300-600) but these have fluctuating pressure and reduced performance (D. Kalthoff, pers. comm.). Vessels over 50 feet in length have the range (1,000 miles from port) and fish storage capacity to bottomfish at the more distant seamounts (> 50 nm from shore).

Bottomfish yields in the western Pacific bottomfish fishery are usually estimated on the basis of yield per unit of bottomfish habitat. As deepwater bottomfish are concentrated along the submarine drop-off zones below the 100-fathom isobath, the length of the 100-fathom isobath around an island or bank is frequently used as an index of bottomfish habitat rather than an area measure, which is difficult to compute for the steep-sloped Pacific islands (Polovina 1985). Based on this measure, as much as 90 percent of the presently charted bottomfish habitat (including areas presently unfished) off Guam lies within 50 nm of the island. These areas would be closed to bottomfishing by large-scale vessels (> 50 ft). Bottomfishing by these vessels would be permitted in the EEZ beyond 50 nm from Guam, subject to general qualification for federal permits and compliance with logbook reporting requirements.

Compliance with the permitting and reporting requirements would probably be pursued through such strategies as occasional dock-side surveillance of vessels landing fish. Achieving compliance with the closed area measure might require on-water surveillance by enforcement vessels and aircraft. The reporting of suspected violations among fishermen themselves might also contribute to compliance.

Alternative 3: Impose a per-trip *onaga* landing limit of 250 pounds on vessels fishing in federal waters around Guam

In order to limit the fishing effort of individual vessels, the amount of *onaga* landed in Guam from a given fishing trip in the federal waters around Guam would be limited to 250 pounds.

The majority of Guam small-scale fishermen in a large sample interviewed by Rubinstein (2001) reported fish sales averaging less than \$500 per month. The more commercially oriented small-scale fishermen earn over \$1,000 per month from selling fish (Rubinstein 2001). A survey of 40 small-scale fishermen in the Commonwealth of the Northern Mariana Islands (CNMI) shows that the average bottomfish catch per trip is 10-110 lb for part-time fishermen (average 41 lb) and 100-200 pound (average 150 lb) for full-time fishermen (Miller 2001). From this information, it is surmised that catch rates of at least 100 lb of bottomfish per trip are necessary to maintain bottomfishing as a viable activity at the seamounts within the range of Guam's commercially-oriented small-scale fishermen. Landings of 50 lb of deepwater bottomfish per trip may be sufficient for part-time fishermen who combine bottomfishing with trolling on trips to the closer seamounts.

Alternative 4: Establish a federal limited access program for all vessels bottomfishing in federal waters around Guam

In order to limit harvest capacity, fishing effort, and catch, access to the bottomfish fishery in federal waters around Guam would be limited to a specified number of participants. Access to the fishery might be granted according to historical participation, as in the NWHI limited access program. Limited access would require owners of vessels qualified under the eligibility requirements to obtain federal permits. The permit would be issued on a calendar year basis with payment of an annual application fee (set to cover administrative costs only). Operators or owners

of permitted vessels would be required to report EEZ bottomfishing effort, landings and bycatch in vessel logbooks and regularly submit them to NMFS.

5. CONSISTENCY WITH NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT

Section 301 of the Magnuson-Stevens Act establishes ten National Standards for fishery conservation and management. FMPs and their associated regulations must be consistent with the National Standards. The degree of consistency of the proposed management measure (Alternative 2) is discussed below.

- (1) *Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.*

The proposed measure will discourage entry into the Guam bottomfish fishery by large vessels, thereby constraining growth of the fishery, effectively limiting fishing effort, and thereby reducing the risk of overfishing. Because optimum yield cannot be achieved if overfishing occurs, the proposed measure will serve to increase the likelihood of achieving optimum yield.

- (2) *Conservation and management measures shall be based upon the best scientific information available.*

The proposed measure was developed using the best available information, including the results of Guam-based fishery monitoring systems, previous research on bottomfish stocks, their habitat, and associated resources, vessel observer programs conducted in similar fisheries, and anecdotal information provided by fishery participants and local fishery managers.

- (3) *To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.*

The proposed measure will directly affect only bottomfishing in the federal waters around Guam, and it may indirectly affect fishing in Guam territorial waters and waters around the CNMI. The degree of interconnectedness of the bottomfish stocks on the banks around Guam and the CNMI and in the waters of the broader Pacific Ocean is not well understood. Currently, based on the best available information, the bottomfish in the Guam EEZ are managed as a single unit. The proposed measure will not have any effect on how bottomfish are managed in terms of stock definition.

- (4) *Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.*

The proposed management measure will not discriminate between residents of different States and it will not allocate or assign fishing privileges among various United States fishermen. It will, however, deny certain fishing privileges (fishing for bottomfish within 50 nm of Guam from a vessel greater than 50 ft in length) based on vessel size, but this restriction will apply to all United States fishermen.

- (5) *Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.*

The proposed measure will discourage the participation of vessels greater than 50 feet in length in the Guam bottomfish fishery. To the extent that such vessels and their fishing practices offer efficiencies greater than those available in smaller vessels, the measure could discourage economic performance of the Guam bottomfish fishery as a whole, at least in the short term. However, given the risk of stock depletion associated with the participation of large, high-capacity vessels, and in general, larger fleet size, the measure may actually encourage long-term economic performance in the fishery by reducing the degree of stock depletion. Further, if the economic benefits associated with sustained community participation and associated values are taken into account, the measure may serve to enhance efficiency in the fishery regardless of any effect on stock condition.

- (6) *Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.*

The proposed measure is aimed primarily at preventing adverse conditions in the Guam bottomfish fishery from arising, rather than reversing any such conditions. The largely preemptive measure is being taken in spite of the difficulty in predicting the course of the fishery under the no-action alternative.

- (7) *Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.*

The proposed measure will require that bottomfish vessels greater than 50 feet in length that land bottomfish in Guam obtain a federal permit and provide catch reports. The issuance of the permit will not be restricted in any way, allowing for simple and inexpensive application, processing, and issuance costs. The data provided in the catch reports may overlap with the data already collected through the Guam-based creel survey, but the latter does not cover certain landing points in Guam, so the overlap will not be complete, and furthermore, the catch report data will have a higher degree of coverage. Where the data do overlap, they may be useful in terms of data validation and adjustment. The permit, reporting, and close-area restrictions will require some enforcement. Enforcement costs are difficult to predict, and will depend to a large extent on the degree of support shown by fishermen. The closed area measure, for example, would probably be costly to enforce if on-water and by-air surveillance were the only means available, but if fishermen and other stakeholders have enough support for the measure to encourage compliance

among themselves, even to the extent of reporting suspected violations, enforcement costs could be relatively minor. The scoping meetings and public hearings conducted to date indicate a relatively high degree of support for the proposed measures.

- (8) *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

The proposed measure responds directly to the problem of sustained participation by the Guam fishing community in the Guam bottomfish fishery being threatened by the entry of large vessels and consequent adverse impacts on stock condition, and it has as one of its objectives, "providing for sustained community participation in bottomfishing." The proposed measure, which would serve to decrease future fishing effort on bottomfish stocks in the federal waters within 50 nm of Guam, is consistent with the conservation requirements of the Act.

- (9) *Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*

The proposed measure, which will serve to decrease future fishing effort on bottomfish stocks in the federal waters within 50 nm of Guam, will not have any direct impact on bycatch or bycatch mortality rates. Because the measure may result in some fishing trips being longer and more distant than they otherwise would be (because large-vessel fishing would be limited to waters more than 50 nm from Guam), and because discard rates might be greater on longer trips (because hold capacity is likely to be more valuable on longer trips than on shorter trips), the measure could result in greater relative bycatch rates than the no-action alternative, at least among large vessels.

- (10) *Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.*

The proposed measure will have the effect of constraining expansion of the Guam bottomfish fishery, with the possible result of fewer participants in the fishery compared to the no-action scenario, with the result of fewer fishermen being exposed to the risks associated with fishing at sea. However, because the measure will provide a disincentive for participants in the Guam bottomfish fishery to buy or use vessels greater than 50 feet in length, certain fishery participants may make trade-offs in terms of vessel range and safety (in other words, they may buy or use a smaller vessel than they would have in the no-action scenario), possibly leading to greater risks at sea being taken by these participants.

6. RELATIONSHIP OTHER APPLICABLE LAWS

6.1 National Environmental Policy Act

6.1.1 Purpose and Need for Action

The purpose and need for action are described in Section 2 of this appendix.

6.1.2 Alternatives Considered

The alternative management measures are described in Section 4 of this appendix.

6.1.3 Affected Environment Given Cumulative Impacts

See Chapter 3 of the FEIS for a detailed description of the affected environment given cumulative impacts, as well as a description of the Guam's bottomfish fishery and fishing sectors.

6.1.4 Environmental Impacts of the Alternatives

6.1.4.1 Biological and Ecological Impacts

6.1.4.1.1 Impacts on Target and Non-target Stocks

Direct Impacts – Target Fish Stocks

None of the alternatives are likely to cause overfishing of deepwater bottomfish populations throughout their range in the EEZ of Guam. However, uncontrolled expansion of large-scale bottomfishing effort under Alternative 1 (no action) would be expected to have a detrimental impact on catch rates. Deepwater bottomfish have life history characteristics that cause their populations to be sensitive to heavy fishing. Low productivity but relatively high standing stocks at unfished sites may encourage fisheries to develop relying almost entirely on the standing stock rather than the surplus production. Thus, pockets of bottomfish can be locally depleted (i.e., catch rates are no longer economically viable without a population recovery period) (WPRFMC 1986). According to professional fishermen (now deceased) in Hawaii and Guam, *onaga* has a small home range and is more strongly associated with deep bottom relief (i.e., pinnacles) than other species of deepwater snappers. When pockets of *onaga* are heavily fished, local catch rates can decline in a remarkably short time. If a local population of *onaga* is depleted, it may take 5 years or more for a particular pinnacle to produce a viable catch rate again (C. Yamamoto, K. Sakamoto, pers. comm. to P. Bartram 1984). Large-scale bottomfishing at Guam's offshore banks could have an adverse impact on catch rates of *onaga* and other deepwater bottomfish species because large vessels (> 50 ft length) are not likely to limit their catches, as in small-scale bottomfishing. Alternatives that would more tightly restrict large-scale bottomfishing off Guam through closed areas (Alternative 2, preferred) or high inefficiency (Alternative 3) have greater potential to maintain whatever level of self recruitment is occurring in bottomfish populations at the offshore seamounts than Alternative 1 (no action) or a limited number of permits (Alternative 4).

Alternative 2 (preferred) would be better than Alternative 1 in controlling the risk of local depletion of deepwater bottomfish populations closest to Guam by closing areas within 50 nm of the island to bottomfishing by large-scale vessels. Larger vessels would be able to bottomfish at

more distant seamounts (> 50 nm from shore), however, and deepwater populations at these sites could be locally depleted by heavy fishing pressure unless self-restraint is practiced by fishermen. A chain of seamounts parallels the Marianas Archipelago nearly 200 miles to the west. Some of these seamounts rise to shallow depths (Myers 1997) but this chain is poorly charted and the amount of associated bottomfish habitat is not known. Whether large-scale vessels (> 50 ft) would invest time and money in exploring this chain for bottomfishing grounds cannot be predicted. In 1997, a highliner vessel made several bottomfishing trips to "Bank A," a rarely fished bank 117 miles west of Guam (WPRFMC 2003c).

Bottomfish populations at the more distant seamounts are likely to be "dependent populations" depending on larvae transported from larger bank fish resources on Guam's island slopes. Recruitment in such cases may be variable and unpredictable, causing seamount populations of deepwater bottomfish to be more sensitive to heavy fishing than island slope resources. Alternative 3 is more likely than Alternative 1 or 2 to limit fishing pressure on deepwater bottomfish populations at distant seamounts (> 50 nm from Guam). Alternative 3 would be expected to cause large vessels to be too inefficient to operate in terms of the possible revenue from selling only 250 pounds of *onaga* (plus other, unrestricted, species) catch per trip.

Alternative 4 would limit total bottomfishing effort through a limited access program based on historical participation in the fishery, predominantly by small-scale vessels. The effect on bottomfish stocks would depend on the details of the program. If no replacement or upgrading of qualifying small-vessels with larger vessels is allowed, this alternative would have an impact similar to that of Alternative 3. If replacement or upgrading of small vessels with large vessels is allowed, this alternative could have an adverse impact equal to or greater than that of Alternative 1.

Direct Impacts – Non-Target Fish Stocks

The only practical method of bottomfishing for deepwater snappers in the EEZ of Guam is the use of vertical droplines with several branching lines. This is a highly selective method of fishing because it targets depth ranges inhabited by particular bottomfish species. Guam fishermen report heavy losses of bottomfish to shark predation when lines are retrieved. Sharks are known to be abundant on many seamounts off Guam and bottomfishing rarely directly catches or kills sharks, although the bottomfish catch provides a food subsidy.

Shark bycatch is more likely to occur in association with bottomfishing when Guam fishermen deliberately catch and kill them to thin the local population and reduce predation in areas infested by sharks. Alternative 1 (no action) would be expected to increase shark bycatch because large-scale vessels entering the bottomfish fishery in the EEZ would be able to carry extra gear for the specific purpose of targeting and killing these animals. Alternative 2 could increase shark bycatch above the levels under Alternative 1 because large-scale bottomfishing would be redirected to more distant seamounts that are less heavily fished. Sharks are known to infest such areas and bottomfishing is often preceded by intensive fishing of sharks. Alternative 3 is likely to result in shark bycatch levels substantially below those of Alternative 1 and 2. The impact of Alternative 4 on shark bycatch would depend on whether the limited access program for bottomfishing allows replacement or upgrading of qualified small-scale vessels with large vessels that are more capable

of fishing at distant seamounts where shark removal often precedes bottomfishing and of carrying gear specifically to target sharks.

Indirect Impacts – Redirection of Fishing Effort

The alternatives would be expected to redirect fishing effort, to varying degrees, from deepwater bottomfish to shallow water bottomfish populations, and from bottomfish resources in the Guam EEZ to those in the EEZ of the CNMI. Under present conditions, fishing for deepwater bottomfish off Guam produces higher catch rates than fishing for shallow water bottomfish. Under Alternative 1 (no action), large-scale bottomfishing could continue in the same areas where small-scale deepwater bottomfishing is occurring. If this pattern of bottomfishing on the grounds closest to Guam contributes to reduce deepwater catch rates to or below the level of shallow water bottomfishing, then some deepwater effort may switch to the shallow-water bottomfish fishery, which is considered to be fully exploited on the closest banks (WPRFMC 2003c).

Alternative 2 would direct large-scale bottomfishing to distant seamounts (> 50 nm from Guam), removing this source of fishing pressure on the closer banks. A chain of seamounts parallels the Marianas Archipelago nearly 200 miles to the west. Some of these seamounts rise to shallow depths (Myers 1997) but this chain is poorly charted and the amount of associated bottomfish habitat is not known. Whether large-scale Guam vessels (> 50 ft) would invest time and money in exploring this chain for bottomfishing grounds cannot be predicted. In 1997, a highliner vessel made several bottomfishing trips to “Bank A,” a rarely fished bank 117 miles west of Guam. (WPRFMC 2003c). Large-scale vessels may instead relocate to the CNMI for deepwater bottomfishing at more northern banks in the EEZ of the CNMI.

Deepwater bottomfishing in the EEZ of Guam would be expected to continue as a viable option for the small-scale fishery and little effort would be redirected to shallow-water bottom populations by small vessels. Thus, Alternative 2 would be more positive than Alternative 1 in limiting redirection of bottomfishing effort by Guam’s small-scale domestic fleet to more heavily stressed shallow-water bottomfish. However, this alternative would probably cause large-scale vessels to relocate from Guam to the CNMI, with a redirection of deepwater bottomfishing effort to the latter area. The EEZ of the CNMI has a larger bottomfish resource than Guam’s EEZ but intensive large-scale fishing would ultimately have a similar effect – local bottomfish population depletion in intensively fished areas.

Alternative 3 would also be expected to maintain deepwater bottomfishing as a viable option and would likely have an impact on redirection of small-scale fishing effort similar to that of Alternative 2. This alternative could also provide an incentive for large-scale vessels to relocate to the CNMI, thereby redirecting fishing to a larger but still limited bottomfish resource base. Alternative 4 would limit total bottomfishing effort through a limited access program based on historical participation in the fishery, predominantly by small-scale vessels. The effect on redirection of fishing effort from deepwater to shallow-water bottomfish populations would depend on the details of the program. If no replacement or upgrading of qualifying small-vessels with larger vessels is allowed, this alternative would have an impact similar to that of Alternative

3. If replacement or upgrading of small vessels with large vessels is allowed, this alternative could have an adverse impact equal to or greater than that of Alternative 1.

6.1.4.1.2 Impacts on Essential Fish Habitat

As concluded in the DEIS for the bottomfish fishery in the Western Pacific Region, the fishery as currently managed is not expected to adversely affect essential fish habitat (EFH) or habitat areas of particular concern (HAPC) for any species managed under the Pelagics, Bottomfish and Seamount Groundfish, Precious Corals, or Crustaceans Western Pacific Fishery Management Plans, as it is not likely to lead to substantial physical, chemical, or biological alterations to the habitat of these species or their prey (WPRFMC 2003a). EFH and HAPC for these species groups have been defined as presented in Table D-2.

None of the four alternatives is likely to adversely affect EFH or HAPC for any managed species as they are not likely to lead to substantial physical, chemical, or biological alterations to the habitat of these species or their prey. For the same reason, none of the alternatives is expected to cause substantial damage to the ocean or coastal habitats.

Table D-2. Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for species managed under the FMPs for the Pelagics, Bottomfish and Seamount Groundfish, Precious Corals, and Crustaceans Fisheries of the Western Pacific Region

SPECIES GROUP (FMP)	EFH (juveniles and adults)	EFH (eggs and larvae)	HAPC
Pelagics	water column down to 1,000 m	water column down to 200 m	water column down to 1,000 m that lies above seamounts and banks
Bottomfish	water column and bottom down to 400 m	water column down to 400 m	all escarpments and slopes between 40-280 m, and three known areas of juvenile <i>opakapaka</i> habitat (2 off Oahu and 1 off Molokai)
Seamount Groundfish	(adults only:) water column and bottom from 80 to 600 m, bounded by 29° - 35° N and 171° E - 179° W	(including juveniles:) epipelagic zone (0 to ~200m), bounded by 29° - 35° N and 171° E - 179° W	
Precious Corals	Keahole, Makapu'u, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Miloli'i, S. Kauai and Au'au Channel black coral beds	not applicable	Makapu'u, Wespac, and Brooks Bank beds, and the Au'au Channel
Crustaceans	bottom habitat from shoreline to a depth of 100 m	water column down to 150 m	all banks within the Northwestern Hawaiian Islands with summits less than 30 m

All areas are bounded by the shoreline and the outer boundary of the EEZ unless indicated otherwise.

6.1.4.1.3 Impacts on Biodiversity and Ecosystem Function

To the extent that the Western Pacific bottomfish fishery and the Guam bottomfish fishery have the capacity to adversely impact biodiversity and ecosystem function, it can be assumed that any such impacts occur, or have the likelihood to occur, in rough proportion to the level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of biodiversity and ecosystem function).

Each of the action alternatives can be expected to affect overall fishing effort in the bottomfish fishery (relative to the no-action scenario), as well as affect the distribution of fishing effort, both geographically and among different types of fisheries (i.e., gear types and target species). While fishery-wide fishing effort is an important determinant of the magnitude of any adverse impacts on biodiversity and ecosystem function, the distribution of fishing mortality among species is also important, because it affects the predator-prey relationships that determine the structure and function of the ecosystem. None of the action alternatives would be likely to result in substantial changes in the distribution of fishing mortality among species (except as a result of any geographical shift in fishing effort, as described below). Although Alternative 3 would encourage high-grading of the *onaga* portion of the catch (i.e., discarding the poorer quality fish in order to maximize the value of the 250-pound limit), the fishing mortality rate of *onaga* would not be likely to change relative to that of the other components of the catch, since the survival rate of discarded *onaga* is likely to be very small (although the “excess” discarded *onaga* under Alternative 3 would be a source of food not available under the no-action alternative).

Overall impacts

Alternative 2 (preferred) would discourage the entry of large vessels into the Guam bottomfish fishery and thereby hinder expansion of the size and fishing capacity of the fleet as a whole. It is therefore likely to result in lower levels of fishing effort in the Guam bottomfish fishery than the no-action alternative, and it is therefore unlikely to result in greater adverse impacts on biodiversity and ecosystem function than the no-action alternative.

Alternatives 3 and 4 would, like Alternative 2, discourage expansion of the Guam bottomfish fishery and its fishing capacity (and possibly result in a *reduction* in fleet size, fishing capacity, and fishing effort relative to recent levels), so they would be likely to result in lower levels of fishery-wide fishing effort and fewer adverse impacts on biodiversity and ecosystem function than the no-action alternative. It is not possible to predict how these outcomes and impacts would compare among Alternatives 2, 3, and 4.

Distribution of impacts

Because Alternative 2 would prohibit bottomfish fishing by large vessels within 50 nm of Guam, it would both encourage large-vessel fishing in waters beyond 50 nm from Guam and encourage fishery participants to purchase and use vessels less than 50 feet in length. The former effect could result in the distribution of future bottomfish fishing effort being shifted to banks more distant from the island of Guam (possibly including those in the portion of the EEZ around the CNMI) relative to the no-action scenario. The latter effect, in contrast, could result in the distribution of future fishing effort being shifted to waters closer to Guam (possibly including the slopes around the perimeter of Guam), since the tendency to purchase and use small vessels would have the effect of discouraging distant trips (compared to the no-action scenario). It is not possible to predict which of these two countervailing effects would be stronger, so it is difficult to predict how Alternative 2 would impact the distribution of impacts on biodiversity and ecosystem function. It should be noted, however, that if it is assumed that biodiversity and/or ecosystem function are more valuable or at-risk in waters closer to Guam than in waters more distant from

Guam (e.g., because waters closer to shore tend to be shallower, and shallower waters tend to have more coral reef habitat and tend to be comparatively biodiverse), then a shift in fishing effort closer to Guam would probably be more adverse in terms of biodiversity and ecosystem function impacts than a comparable shift in fishing effort away from Guam.

Alternative 3 would be likely to shift the distribution of fishing effort (and any adverse impacts on biodiversity and ecosystem function) to fishing grounds closer to Guam than under the no-action alternative, as it would become comparatively less cost-effective to make more distant trips. As noted above, such an effect could result in more adverse biodiversity and ecosystem function impacts than the no-action alternative. That effect, however, might be offset by the fact that bottomfish landings in the CNMI would not be subject to the trip limit of Alternative 3, possibly encouraging bottomfish fishing in areas more distant from Guam.

Alternative 4 would not be likely to result in a substantially different distribution of fishing effort within the Guam EEZ (or any adverse impacts on biodiversity and ecosystem function) than under the no-action scenario, unless access to the fishery were made dependent on vessel size. Like Alternatives 2 and 3, however, Alternative 4 could result in greater fishing effort (and biodiversity and ecosystem function impacts) in the EEZ around the CNMI than under the no-action alternative.

To the extent that any of the action alternatives succeed in the objective of maintaining viable catch rates, particularly in the waters within 50 nm of Guam, they would have the effect of keeping the distribution of fishing effort close to Guam (because ignoring any differences in catch efficiency, more distant trips are less cost-effective) relative to the no-action scenario, possibly resulting in the fishing effort distribution-related impacts on biodiversity and ecosystem function described above.

Because all three action alternatives would serve to constrain expansion of the Guam bottomfish fishery, they could result in greater future fishing effort in other fisheries (e.g., pelagic fisheries), particularly other Guam-based fisheries, than under the no-action alternative, with a consequent increase in the likelihood of any adverse impacts on biodiversity and ecosystem function that may occur in those fisheries. Any such effects, however, would be likely to be small. It is not possible to predict how these outcomes and impacts would be likely to differ among the three action alternatives.

6.1.4.1.4 Impacts on Marine Mammals

The Guam fishery has virtually no chance of interacting with the endangered Hawaiian monk seal, which is endemic to the Hawaiian archipelago. As for the six whale species protected under the ESA, the 2002 Biological Opinion found that the probability of encounter with any of the species in the Western Pacific bottomfish fishery as a whole is extremely low, and that the fishery, as managed under the FMP, is not likely to adversely affect these species (NMFS 2002). As for marine mammal species that are not protected under the ESA, several occur in the area affected by this action, but there have been no reported interactions in the Guam bottomfish fishery. On the other hand, the paucity of data for the fishery, particularly the lack of any vessel observer data,

makes it difficult to conclude with certainty that marine mammal interactions do not occur in the fishery.

To the extent that the Western Pacific bottomfish fishery and the Guam bottomfish fishery have the capacity to adversely impact marine mammals, it can be assumed that any such impacts occur, or have the likelihood to occur, in rough proportion to the level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of marine mammals and their habitat).

Each of the action alternatives can be expected to affect overall fishing effort in the bottomfish fishery (relative to the no-action scenario), as well as affect the distribution of fishing effort, both geographically and among different types of fisheries (i.e., gear types and target species).

Overall impacts

Alternative 2 (preferred) would discourage the entry of large vessels into the Guam bottomfish fishery and thereby hinder expansion of the size and fishing capacity of the fleet as a whole. It is therefore likely to result in lower levels of fishing effort in the Guam bottomfish fishery than the no-action alternative, and it is therefore unlikely to result in greater adverse impacts on marine mammals than the no-action alternative.

Alternatives 3 and 4 would, like Alternative 2, discourage expansion of the Guam bottomfish fishery and its fishing capacity (and possibly result in a *reduction* in fleet size, fishing capacity, and fishing effort relative to recent levels), so they would be likely to result in lower levels of fishery-wide fishing effort and fewer adverse impacts on marine mammals than the no-action alternative. It is not possible to predict how these outcomes and impacts would compare among Alternatives 2, 3, and 4.

Distribution of impacts

Because Alternative 2 would prohibit bottomfish fishing by large vessels within 50 nm of Guam, it would both encourage large-vessel fishing in waters beyond 50 nm from Guam and encourage fishery participants to purchase and use vessels less than 50 feet in length. The former effect could result in the distribution of future bottomfish fishing effort being shifted to banks more distant from the island of Guam (possibly including those in the portion of the EEZ around the CNMI) relative to the no-action scenario. The latter effect, in contrast, could result in the distribution of future fishing effort being shifted to waters closer to Guam (possibly including the slopes around the perimeter of Guam), since the tendency to purchase and use small vessels would have the effect of discouraging distant trips (compared to the no-action scenario). It is not possible to predict which of these two countervailing effects would be stronger, so it is not possible to predict how Alternative 2 would impact the distribution of impacts on marine mammals.

Alternative 3 would be likely to shift the distribution of fishing effort (and any adverse impacts on marine mammals) to fishing grounds closer to Guam than under the no-action alternative, as it would become comparatively less cost-effective to make more distant trips. That effect, however, might be offset by the fact that bottomfish landings in the CNMI would not be subject to the trip limit of Alternative 3, possibly encouraging bottomfish fishing in areas more distant from Guam. Alternative 4 would not be likely to result in a substantially different distribution of fishing effort within the Guam EEZ (or any adverse impacts on marine mammals) than under the no-action scenario, unless access to the fishery were made dependent on vessel size. Like Alternatives 2 and 3, however, Alternative 4 could result in greater fishing effort (and marine mammal impacts) in the EEZ around the CNMI than under the no-action alternative.

To the extent that any of the action alternatives succeed in the objective of maintaining viable catch rates, particularly in the waters within 50 nm of Guam, they would have the effect of keeping the distribution of fishing effort close to Guam (because ignoring any differences in catch efficiency, more distant trips are less cost-effective) relative to the no-action scenario, possibly resulting in the fishing effort distribution-related impacts on marine mammals described above.

Because all three action alternatives would serve to constrain expansion of the Guam bottomfish fishery, they could result in greater future fishing effort in other fisheries (e.g., pelagic fisheries), particularly other Guam-based fisheries, than under the no-action alternative, with a consequent increase in the likelihood of any adverse impacts on marine mammals that may occur in those fisheries. Any such effects, however, would be likely to be small. It is not possible to predict how these outcomes and impacts would be likely to differ among the three action alternatives.

6.1.4.1.5 Impacts on Sea Turtles

No interactions with sea turtles have been reported in the Western Pacific bottomfish fishery, and it was concluded in the 2002 Biological Opinion that the Western Pacific bottomfish fishery, as managed under the FMP, is not likely to adversely affect any sea turtle species (NMFS 2002). However, the paucity of data for the Guam bottomfish fishery, particularly the lack of any vessel observer data, makes it difficult to conclude with certainty that sea turtle interactions do not occur in the fishery.

To the extent that the Western Pacific bottomfish fishery and the Guam bottomfish fishery have the capacity to adversely impact sea turtles, it can be assumed that any such impacts occur, or have the likelihood to occur, in rough proportion to the level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of sea turtles and their habitat).

Each of the action alternatives can be expected to affect overall fishing effort in the bottomfish fishery (relative to the no-action scenario), as well as affect the distribution of fishing effort, both geographically and among different types of fisheries (i.e., gear types and target species).

Overall impacts

Alternative 2 (preferred) would discourage the entry of large vessels into the Guam bottomfish fishery and thereby hinder expansion of the size and fishing capacity of the fleet as a whole. It is therefore likely to result in lower levels of fishing effort in the Guam bottomfish fishery than the no-action alternative, and it is therefore unlikely to result in greater adverse impacts on sea turtles than the no-action alternative.

Alternatives 3 and 4 would, like Alternative 2, discourage expansion of the Guam bottomfish fishery and its fishing capacity (and possibly result in a *reduction* in fleet size, fishing capacity, and fishing effort relative to recent levels), so they would be likely to result in lower levels of fishery-wide fishing effort and fewer adverse impacts on sea turtles than the no-action alternative. It is not possible to predict how these outcomes and impacts would compare among Alternatives 2, 3, and 4.

Distribution of impacts

Because Alternative 2 would prohibit bottomfish fishing by large vessels within 50 nm of Guam, it would both encourage large-vessel fishing in waters beyond 50 nm from Guam and encourage fishery participants to purchase and use vessels less than 50 feet in length. The former effect could result in the distribution of future bottomfish fishing effort being shifted to banks more distant from the island of Guam (possibly including those in the portion of the EEZ around the CNMI) relative to the no-action scenario. The latter effect, in contrast, could result in the distribution of future fishing effort being shifted to waters closer to Guam (possibly including the slopes around the perimeter of Guam), since the tendency to purchase and use small vessels would have the effect of discouraging distant trips (compared to the no-action scenario). It is not possible to predict which of these two countervailing effects would be stronger, so it is difficult to predict how Alternative 2 would impact the distribution of impacts on sea turtles. It should be noted, however, that for sea turtle species and life stages that are likely to be more abundant in nearshore waters than in offshore waters (e.g., adult hawksbill and green turtles), a shift in fishing effort closer to Guam would probably be more adverse in terms of sea turtle impacts than a comparable shift in fishing effort away from Guam.

Alternative 3 would be likely to shift the distribution of fishing effort (and any adverse impacts on sea turtles) to fishing grounds closer to Guam than under the no-action alternative, as it would become comparatively less cost-effective to make more distant trips. As noted above, such an effect could result in a greater frequency or likelihood of interactions with certain species and life stages of sea turtles than the no-action alternative. That effect, however, might be offset by the fact that bottomfish landings in the CNMI would not be subject to the trip limit of Alternative 3, possibly encouraging bottomfish fishing in areas more distant from Guam.

Alternative 4 would not be likely to result in a substantially different distribution of fishing effort within the Guam EEZ (or any adverse impacts on sea turtles) than under the no-action scenario, unless access to the fishery were made dependent on vessel size. Like Alternatives 2 and 3,

however, Alternative 4 could result in greater fishing effort (and sea turtle impacts) in the EEZ around the CNMI than under the no-action alternative.

To the extent that any of the action alternatives succeed in the objective of maintaining viable catch rates, particularly in the waters within 50 nm of Guam, they would have the effect of keeping the distribution of fishing effort close to Guam (because ignoring any differences in catch efficiency, more distant trips are less cost-effective) relative to the no-action scenario, possibly resulting in the fishing effort distribution-related impacts on sea turtles described above.

Because all three action alternatives would serve to constrain expansion of the Guam bottomfish fishery, they could result in greater future fishing effort in other fisheries (e.g., pelagic fisheries), particularly other Guam-based fisheries, than under the no-action alternative, with a consequent increase in the likelihood of any adverse impacts on sea turtles that may occur in those fisheries. Any such effects, however, would be likely to be small. It is not possible to predict how these outcomes and impacts would be likely to differ among the three action alternatives.

6.1.4.1.6 Impacts on Seabirds

To the extent that the Western Pacific bottomfish fishery and the Guam bottomfish fishery have the capacity to adversely impact seabirds, it can be assumed that any such impacts occur, or have the likelihood to occur, in rough proportion to the level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of seabirds and their habitat).

Each of the action alternatives can be expected to affect overall fishing effort in the bottomfish fishery (relative to the no-action scenario), as well as affect the distribution of fishing effort, both geographically and among different types of fisheries (i.e., gear types and target species).

Overall impacts

Alternative 2 (preferred) would discourage the entry of large vessels into the Guam bottomfish fishery and thereby hinder expansion of the size and fishing capacity of the fleet as a whole. It is therefore likely to result in lower levels of fishing effort in the Guam bottomfish fishery than the no-action alternative, and it is therefore unlikely to result in greater adverse impacts on seabirds than the no-action alternative.

Alternatives 3 and 4 would, like Alternative 2, discourage expansion of the Guam bottomfish fishery and its fishing capacity (and possibly result in a *reduction* in fleet size, fishing capacity, and fishing effort relative to recent levels), so they would be likely to result in lower levels of fishery-wide fishing effort and fewer adverse impacts on seabirds than the no-action alternative. It is not possible to predict how these outcomes and impacts would compare among Alternatives 2, 3, and 4.

Distribution of impacts

Because Alternative 2 would prohibit bottomfish fishing by large vessels within 50 nm of Guam, it would both encourage large-vessel fishing in waters beyond 50 nm from Guam and encourage fishery participants to purchase and use vessels less than 50 feet in length. The former effect could result in the distribution of future bottomfish fishing effort being shifted to banks more distant from the island of Guam (possibly including those in the portion of the EEZ around the CNMI) relative to the no-action scenario. The latter effect, in contrast, could result in the distribution of future fishing effort being shifted to waters closer to Guam (possibly including the slopes around the perimeter of Guam), since the tendency to purchase and use small vessels would have the effect of discouraging distant trips (compared to the no-action scenario). It is not possible to predict which of these two countervailing effects would be stronger, so it is difficult to predict how Alternative 2 would impact the distribution of impacts on seabirds. It should be noted, however, that because the likelihood of seabird interactions is likely to decrease with increasing distance from land, a shift in fishing effort closer to Guam would probably be more adverse in terms of seabird impacts than a comparable shift in fishing effort away from Guam.

Alternative 3 would be likely to shift the distribution of fishing effort (and any adverse impacts on seabirds) to fishing grounds closer to Guam than under the no-action alternative, as it would become comparatively less cost-effective to make more distant trips. As noted above, such an effect could result in a greater frequency or likelihood of seabird interactions than the no-action alternative. That effect, however, might be offset by the fact that bottomfish landings in the CNMI would not be subject to the trip limit of Alternative 3, possibly encouraging bottomfish fishing in areas more distant from Guam.

Alternative 4 would not be likely to result in a substantially different distribution of fishing effort within the Guam EEZ (or any adverse impacts on seabirds) than under the no-action scenario, unless access to the fishery were made dependent on vessel size. Like Alternatives 2 and 3, however, Alternative 4 could result in greater fishing effort (and seabird impacts) in the EEZ around the CNMI than under the no-action alternative.

To the extent that any of the action alternatives succeed in the objective of maintaining viable catch rates, particularly in the waters within 50 nm of Guam, they would have the effect of keeping the distribution of fishing effort close to Guam (because ignoring any differences in catch efficiency, more distant trips are less cost-effective) relative to the no-action scenario, possibly resulting in the fishing effort distribution-related impacts on seabirds described above.

Because all three action alternatives would serve to constrain expansion of the Guam bottomfish fishery, they could result in greater future fishing effort in other fisheries (e.g., pelagic fisheries), particularly other Guam-based fisheries, than under the no-action alternative, with a consequent increase in the likelihood of any adverse impacts on seabirds that may occur in those fisheries. Any such effects, however, would be likely to be small. It is not possible to predict how these outcomes and impacts would be likely to differ among the three action alternatives.

6.1.4.2 Economic, Social and Cultural Impacts

6.1.4.2.1 Impacts on Fishery Participants

Potential for decline in catch rates below vessel breakeven levels: Under Alternative 1 (no action), economic impacts on small-scale commercial, recreational and charter fishing sectors could be negative if localized depletion of bottomfish occurs within their limited fishing range. Not only would this disrupt their income, investment value and lifestyle but, over a longer term, future generations would have one less option to make fishing an attractive occupation. With no action, the large-scale commercial sector of the fishery would continue to receive positive benefits from unrestricted fishing unless or until catch rates decline throughout EEZ. If large-scale bottomfishing causes a shift from domestic to foreign consumption of bottomfish resources around Guam, it could reduce the supply of fresh fish and cause higher prices for local consumers. An increase in prices would also increase the incentive to fish, possibly leading to greater fishing pressure on the resource.

Alternative 2 is more positive than Alternative 1 for the small-scale commercial, recreational, charter fishing sectors by maintaining opportunity for viable catch rates at banks within their limited fishing range. This could promote social and economic stability within Guam's fishing community and help preserve elements of local fishing culture. Unlike Alternative 1, Alternative 2 would cause negative impacts on the large-scale commercial sector of the fishery by increasing operating cost to venture to banks > 50 nm from Guam, although this impact might be offset initially by higher bottomfish catch rates at more distant seamounts that remain open to large-scale vessels. Likely areas for bottomfishing over 50 nm from shore are a chain of seamounts, some rising to shallow depths, about 200 miles west of the Marianas Archipelago. As these areas have not been previously fished by the Guam fleet, there would be a high cost associated with exploring the bottomfishing potential of these seamounts. Guam large-scale vessels making bottomfish trips to these seamounts would likely have trip characteristics and economics similar to those of vessels operating in the "Mau Zone" of the Northwestern Hawaiian Islands. In the Mau Zone operations, the average bottomfishing trip must catch enough on a 5.5 day trip to cover operating expenses of \$660 (year-2000 dollars) per day (fishing and travel days combined) (WPRFMC 2002b). Operating expenses of a similar magnitude would also be likely if large-scale vessels relocate to the CNMI to engage in large-scale bottomfishing trips to the northern islands and banks of the Commonwealth.

Alternative 3 would be expected to be the most beneficial for the small-scale commercial, recreational, charter fishing sectors by maintaining the opportunity for viable catch rates at banks within their limited fishing range without the prospect of large-scale commercial bottomfishing anywhere in the EEZ. The low expectation of fishing revenue with a per-trip limit of only 250 pounds of *onaga* would discourage large-scale fishing. Alternative 4 is likely to have a positive economic impact for vessel owners with a history of bottomfishing in EEZ but a negative impact for other vessel owners. This would promote economic stability for qualifying vessel owners but might divide the fishing community based on who is "in" and who is "out."

Potential for inefficiency: The various sizes, fish storage capacities and fishing capabilities of existing and potential vessels in Guam's bottomfish fishery cause large differences in harvesting efficiency. Except for Alternative 1 (no action), all alternatives would limit new large-scale fishery participants in some manner. Alternative 2 would create greater inefficiency than Alternative 1 for large-scale bottomfishing vessels by redirecting them to the more distant seamounts in Guam's EEZ, where higher bottomfish catch rates may initially offset higher operating costs (estimated \$660 per day based on the similarity of Guam-based long-range bottomfishing trips to those by NWHI vessels operating in the Mau Zone). Alternative 3 would create the greatest inefficiency for large-scale vessels because it would establish a landing limit (for *onaga* only, of 250 per trip), which would discriminate against larger vessels. Large-scale fishermen could circumvent this by making more trips but the limited quantity of bottomfish landed per trip essentially places a ceiling on the potential revenue per trip. If fishing costs remain constant or increase with inflation, larger vessels with higher operating costs would become economically unfeasible under Alternative 3. This might prompt relocation to engage in large-scale bottomfishing in the EEZ of the CNMI.

Under Alternative 4, limited access would place a ceiling on the number of bottomfishing vessels. Small vessels with a history of historical participation in EEZ bottomfishing and lower fishing efficiency would be most likely to qualify initially. If the limited access permit system allowed for upgrading or replacing small vessels with larger vessels, however, Alternative 4 would not affect fishing efficiency.

Potential economic value of limited access permits: Only Alternative 4 proposes a limited access system that could create an economic value for a limited number of permits if they were freely transferrable.

6.1.4.2.2 Impacts on Public Health and Safety

None of the action alternatives are likely to have substantial impacts, positive or negative relative to the no-action scenario, on public health or safety. There could be some relatively small effects in terms of safety of fishermen at sea, described below.

All the action alternatives would have the effect of constraining expansion of the Guam bottomfish fishery, with the possible result of fewer participants in the fishery compared to the no-action scenario. Fewer fishermen in the fishery could result in a lower frequency of at-sea accidents and injuries, and given that fishing is a relatively risky occupation, the result could be a net increase in public safety. There could be some countervailing effects, however, described below.

Because Alternative 2 would discourage large vessels from entering the fishery, it would effectively encourage the participation of small-vessel fishermen, including current and prospective fishermen. Alternative 2 could thereby result in a greater number of fishery participants (but probably not fishing effort) than the no-action alternative. This effect, if it occurred, would result in there being more fishermen exposing themselves to the risks associated

with fishing, but the level of risk faced by individual fishermen would be no different than under the no-action scenario.

Alternative 2 would put a maximum limit of 50 feet on the length of vessel allowed to operate in waters within 50 nm of Guam. Fishery participants that would otherwise consider buying or using a greater-than-50-foot vessel would therefore have an incentive to buy or use a smaller vessel. If a decision to purchase or use a less-than-50-foot boat is made in part because of the length restriction, it could involve a trade-off being made in terms of the range of the vessel and vessel safety. In other words, it is conceivable that Alternative 2 could contribute to certain individual fishermen being exposed to greater levels of risk than under the no-action alternative, with a consequent decrease in public safety.

Alternative 3 would make it less cost-effective to make more distant trips. Given that more distant trips are likely to be more risky than shorter trips, the result is likely to be less overall risk and greater public safety. Alternative 3 could, however, encourage bottomfish landings to be made in the CNMI, meaning more distant and longer trips for boats that are based in Guam, with consequent increases in risk.

Unless access to the fishery were made dependent on vessel size in Alternative 4, it would probably have little effect in terms of the vessel sizes that fishermen choose to use or where in the Guam EEZ they choose to fish. However, Alternative 4 could serve to encourage fishing in the EEZ around the CNMI, and if such fishing is done by Guam-based boats, it could involve more distant, risky trips, and result in a decrease in public safety relative to the no-action alternative.

To the extent that any of the action alternatives succeed in the objective of preventing stock depletion and maintaining viable catch rates in the waters within 50 nm of Guam, they could have the result of encouraging shorter fishing trips, with the effect of decreasing the at-sea risks faced by fishery participants.

6.1.4.2.3 Impacts on Markets and Consumers

Alternative 1 (no action) would not create any barriers to the development of large-scale bottomfishing and export market development. To the extent that large-scale fishing causes a shift from domestic to foreign consumption of the bottom resources around Guam, it could lead to smaller local supplies and higher local prices for deepwater bottomfish species. This could benefit harvesters, by increasing ex-vessel prices, but adversely impact local consumers.

Alternative 2 (preferred) would serve to discourage, although not prevent, exports. The Guam seafood industry would be hindered in efforts to develop a reputation for high-quality seafood in overseas markets but these alternatives would dampen the tendency for local bottomfish prices to increase with export market development and/or declining catch rates. Alternative 3 would limit *onaga* catches per trip, and indirectly, the catch of other bottomfish species, but it would probably not reduce the local market supply of deepwater bottomfish from the collective fishing effort of the small-scale participants. This alternative would greatly complicate fresh bottomfish export

because several landings of 250 pounds of *onaga* per trip would need to be combined to ship a sufficient quantity of bottomfish that would qualify for an affordable air freight rate. Alternative 4 would, through limited access, limit total fishing effort and catch but this would be expected to stabilize the availability of deepwater bottomfish to local consumers, while allowing permit holders to land exportable surpluses.

6.1.4.3 Cumulative Impacts

Cumulative effects would occur when direct and indirect effects of the alternatives combine with effects of factors exogenous to Guam's bottomfish fishery to produce a net effect different than the separate effects or the exogenous factors. These net effects can be beneficial or adverse. Principles of cumulative effects analysis identified by the Council on Environmental Quality include the following:

- Cumulative effects are caused by the aggregate of past, present and reasonably foreseeable future actions.
- Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem and human community of all actions taken, no matter who (Federal government, other government or private) has taken the actions.
- Cumulative effects must be analyzed in terms of the specific resource, ecosystem and human community being affected.
- It is not practical to analyze the cumulative effects of an action on the universe. The list of environmental effects must focus on those that are truly meaningful. In addition, there must be a relationship or "nexus" between the direct and indirect effects of the alternatives being evaluated and external effects.
- Cumulative effects on a given resource, ecosystem and human community are rarely aligned with political or administrative boundaries.
- Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
- Cumulative effects may last for many years beyond the life of the action that caused the effects.
- Each affected resource, ecosystem or human community must be analyzed in terms of the capacity to accommodate additional effects, based on its own time and space parameters.

The following sections analyze the cumulative effects of the alternatives following a standard methodology:

1. The exogenous factor(s) that may directly affect each resource component are summarized. The list of exogenous factors and the overall conclusions for each factor remain constant across all of the alternatives. The potential impacts of fisheries not managed under the Bottomfish FMP are considered as exogenous factors.
2. The potential direct effects of the alternatives are summarized for each major resource component. Each alternative may have a different effect on a particular resource.

3. The potential indirect effects of the alternatives are summarized for each major resource component. This procedural step only needs to be addressed if the indirect effects of alternatives affect exogenous factors. There may be no identifiable indirect effects.
4. Effects of exogenous factors (1) combined with potential direct affects of the alternatives (2), as modified by any indirect effects (3), result in the potential cumulative effects.
5. Possible mitigation measures are discussed for the potential cumulative effects that are likely to be significant.

Exogenous Factors – Target and Non-Target Fish Resources

Two major exogenous factors were identified as having the potential to contribute to cumulative effects on bottomfish resources in the EEZ of Guam:

- Fluctuations in the ocean environment and possible effects on bottomfish recruitment
- Redirection of fishing effort to non-bottomfish resources in Guam or CNMI fisheries
- Illegal bottomfishing by foreign longliners waiting for entry to Port of Guam

Fluctuations in the ocean environment and possible effects on bottomfish recruitment:

Recruitment to populations of deepwater bottomfish depends largely on pathways of larval dispersal. Future ocean climate shifts may alter surface currents and water temperature in ways that could significantly affect the level of recruitment and restocking (for better or worse) of deepwater bottomfish at “biologically dependent” seamounts.

Redirection of fishing effort to non-bottomfish resources in Guam or CNMI fisheries: An indirect effect of the alternatives could be to redirect fishing effort from deepwater bottomfish to other fisheries resources around Guam. If effort were redirected to pelagic fisheries, the impact would be far less significant than if the effort were redirected to reef fisheries. If large-scale vessel owners were able to relocate to the CNMI, their resource options would be similar to those off Guam – pelagic fish, deep slope bottomfish or reef resources – but the larger EEZ around the CNMI would reduce the impact of added fishing pressure in the latter area.

Illegal bottomfishing by foreign longliners waiting for entry to Port of Guam: Guam is a center of fresh tuna transshipment by foreign longline fleets. They fish in and around the Federated States of Micronesia and land catches at the Guam Commercial Port for air transport to Japan *sashimi* tuna markets. The Port does not permit these vessels to enter at night and some of them anchor on seamounts south of Guam until the next day. While at the seamounts, they are known to engage in bottomfishing to obtain fresh fish for crew consumption and shark harvesting and finning to increase crew income. Illegal bottomfishing activity by foreign longliners occurs on a larger scale in the EEZ of the Federated States of Micronesia (FSM). For example, in 1997, several tons of assorted bottomfish were unloaded from a Taiwan-flag vessel impounded in Yap by the FSM government (P. Bartram, pers. observation at Yap Fishing Authority, August 1997). Foreign

bottomfishing adds to the pressure on local bottomfish populations and on sharks at the EEZ seamounts over 50 nm from Guam.

Cumulative Effects of the Alternatives – Target and Non-Target Fish Resources

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with c) the effects of exogenous factors, as modified by (b).

Indirect effects of each alternative could modify exogenous factors having to do with redirection of bottomfishing effort to other fisheries resources and with illegal bottomfishing by foreign vessels at the southern seamounts.

Alternative 2 (preferred) and Alternative 3 are more likely than other alternatives to redirect large-scale fishing effort from bottomfish to pelagic fish because of the larger vessels that would be affected. To the extent that Guam fishermen shift their effort to deep-slope bottomfishing from reef fisheries, Alternative 1 could lessen the pressure on other heavily exploited resources. Alternative 1 (no action) is more likely than other alternatives to redirect small-scale fishing effort from bottomfish to reef resources because of the smaller vessels that would be effected. The possible impact of Alternative 4 on redirection of fishing effort is difficult to evaluate but is likely to affect larger vessels that are more likely to engage in pelagic fishing than in reef-related fishing.

Removal of large-scale domestic bottomfishing from the southern seamounts that would be expected under Alternative 3 is less likely than the other alternatives to maintain a domestic fishing presence that might deter illegal bottomfishing by foreign longline vessels. However, Alternative 2 (preferred) and Alternative 3 would be expected to add less bottomfishing effort than Alternative 1 and 4 to the existing domestic and foreign fishing pressure on seamount bottomfish populations.

Exogenous Factors – Essential Fish Habitat and the Marine Environment

Three major exogenous factors were identified as having the potential to contribute to cumulative effects on essential fish habitat and the marine environment:

- Fluctuations in the ocean environment
- Vessel anchoring, groundings, marine debris and waste disposal
- Introduction of marine species

Fluctuations in the Ocean Environment: Environmental fluctuations are characteristic of marine benthic ecosystems in shallow waters. Significant sources of inter-annual physical and biological variation are *El Niño* and *La Niña* events (Lehodey *et al.* 1997). Physical and biological oceanographic changes have also been observed on decadal time scales. These low-frequency changes, termed regime shifts, can affect productivity over extensive areas and may account for large fluctuations in population abundance. In a study of the marine ecosystem of the

Northwestern Hawaiian Islands for example, Polovina et al. (1994) found that 30-50 percent declines in the abundance of a number of species representing various trophic levels between the early 1980s and the early 1990s could be explained by a shift in oceanographic conditions. This factor, therefore, could contribute significantly to cumulative effects on essential fish habitat and the marine environment.

Vessel Anchoring, Groundings, Marine Debris, Waste Disposal: Anchor damage from large vessels, possibly foreign longliners waiting overnight to enter the Port of Guam, is reported at some of the shallower southern seamounts (WPRFMC 2003b). The accidental grounding of fishing or non-fishing vessels along the coast of Guam can damage coral reefs and other types of bottom habitat both locally and more broadly, if the vessel breaks up and releases fuel and oil that result in pollution of habitat. Purse seine fleets operating in the western and central Pacific deploy drifting fish aggregation devices to increase the harvesting efficiency. With up to 200 purse seiners of several nations operating in the central and western Pacific, the total number of untethered FADS could be several thousand (SPC 13th Tuna and Billfish Technical Standing Committee report, 2000). After these untethered FADs drift out of the normal operating range of the purse seine vessels, they become marine debris. Several of these devices have grounded on Guam's southern banks. This exogenous factor has greater potential to add to cumulative effects on essential fish habitat and the marine environment in coral reef ecosystems than in the deep slope ecosystem inhabited by bottomfish.

Introduction of marine species: Transport of introduced marine species among world ports has occurred with increasing frequency in the last 25 years and introductions have sometimes produced devastating changes in the marine ecosystems of receptor areas. Worldwide shipping is believed to be the primary vector responsible for such invasions. Ships may transport viable organisms within their ballast water or on their hulls as fouling organisms. If precautions are not taken, these potential invaders may be discharged in ports where, with no natural predators or controls, they may proliferate rapidly. Guam is one of the major commercial ports in the western Pacific and potentially represents a regional center where marine species introductions may occur and spread. This exogenous factor has greater potential to add to cumulative effects on essential fish habitat and the marine environment in coral reef ecosystems than in the deep slope ecosystem inhabited by bottomfish.

Cumulative Effects of the Alternatives – Essential Fish Habitat and the Marine Environment

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b). The exogenous factor relating to vessel grounding could be modified by Alternative 1 (no action) that is more likely than other alternatives to redirect small-scale domestic fishing effort from deepwater bottomfish to fisheries that operate small boats closer to Guam's shallow reefs. Except for Alternative 1, when the estimated direct and indirect effects are combined with the potential effects of exogenous factors, none of the alternatives are likely to have effects that could be detectable against the background of cyclical oceanographic processes.

Exogenous Factors – Sea Turtles

The survival and recovery of protected sea turtle populations is threatened by multiple natural and human-induced hazards. Natural hazards include nest washover, beach erosion, egg predation, in addition to the basic sex- and stage-specific survival probabilities. Anthropogenic hazards include beach egg harvest, juvenile/adult harvest, boat strikes, debris ingestion and incidental capture in driftnet, longline and coastal net fisheries. Dr. Milani Chalpouka has developed simulation models that mimic populations of sea turtles, applying all known aspects of growth, mortality, demographics, density dependence, environmental effects, natural hazards and anthropogenic hazards. Stochasticity was built into the models at nearly all steps in an attempt to imitate natural variability. Kobayashi (2002) used this model to evaluate the relative impacts of anthropogenic hazards to the western Pacific loggerhead and leatherback turtle populations. Egg harvest and coastal net fisheries were the most significant of the man-induced hazards.

Cumulative Effects of the Alternatives – Sea Turtles

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b). There have been no reported or observed incidental captures of sea turtles in the history of the Guam bottomfish fishery. When the estimated direct and indirect effects are combined with the potential effects of exogenous factors, none of the alternatives would be likely to add to the already significant cumulative effects on sea turtle populations in the western Pacific.

Significant Cumulative Effects Requiring Mitigation – Sea Turtles

Because of multiple natural and anthropogenic threats to sea turtle populations, effective conservation will need to consider which populations and life stages are the highest priority for conservation efforts. Juvenile and adult sea turtles migrate through the waters of many nations, so conservation solutions will require international cooperation.

Exogenous Factors – Seabirds

Fluctuations in the ocean environment have the potential cause changes in seabird abundance; hence this factor could contribute significantly to cumulative effects on seabirds.

Cumulative Effects of the Alternatives -- Seabirds

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b). None of the alternatives would be expected to significantly change the cumulative effects on seabird species whose range includes Guam.

Exogenous Factors – Marine Mammals: Most stocks of large whales were severely depleted by modern whaling. Moratoriums on hunting by the International Whaling Commission have

restricted this activity, but poaching of whales and other marine mammals still occurs. Four other major exogenous factors were identified as having the potential to contribute to cumulative effects on marine mammals:

- Fluctuations in the ocean environment
- Incidental take in fisheries
- Ship traffic and anthropogenic noise
- Marine debris and waste disposal

Fluctuations in the Ocean Environment: Ocean climate fluctuations that change the habitat quality or the prey availability of marine mammals have the potential to affect their short-term or long-term distribution and abundance. Changes in oceanographic conditions may also alter rates of incidental takes of marine mammals in commercial fisheries. The magnitude of potential effects are uncertain but this factor could contribute significantly to cumulative effects on marine mammals.

Incidental Take in Pacific Basin Fisheries: Pacific basin fisheries may adversely affect marine mammals through gear hooking, entanglement or ingestion or by removal of prey species. This factor may contribute significantly to cumulative effects on marine mammals.

Ship Traffic and Anthropogenic Noise: Collisions with vessels and disturbance from low frequency noise are potential threats to the recovery of large cetaceans. Because many of the ship strikes occur far offshore and, thus, are unreported, this impact on large whales is most likely underestimated (NMFS 2000). The increasing levels of anthropogenic noise in the world's oceans may have an adverse effect on whales, particularly deep-diving whales that feed in the oceans' "sound channel" (Forney *et al.* 2000). These effects are difficult to assess but they may be significant as part of cumulative effects on marine mammals.

Marine Debris and Waste Disposal : Activities that may have adverse effects on marine mammal habitat include the dispersal of marine debris, large oil spills and other types of marine pollution. Petroleum has the potential to be toxic to marine mammals if it is inhaled, ingested or absorbed through the skin, mucous membranes or eyes, or if it inhibits feeding by fouling the baleen plates of whales. Hydrocarbons can also bio-accumulate in zooplankton and fish eaten by marine mammals and other wildlife. Any detrimental effects of marine pollution on their prey species would also affect marine mammals. Aside from large, catastrophic spills, the long-term effects of low levels of petroleum exposure are unknown.

Marine debris can be toxic to marine mammals if ingested or it can entangle them, leading to decreased ability to breathe, feed, breed, swim or haul out. The animals affected may be more vulnerable to predators or disease, reducing their survival or ability to reproduce.

Cumulative Effects of the Alternatives – Marine Mammals

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b). There have been no reported or observed incidental captures of whales in the history of the Guam bottomfish fishery. None of the alternatives would be expected to significantly change the cumulative effects on marine mammals whose range includes Guam.

Exogenous Factors – Economic Impacts

Air transportation from Guam to overseas fresh fish markets: Despite downsizing of aircraft and schedules by the commercial airlines serving Guam, there is still sufficient air cargo capacity to transport fresh fish to Japan and Hawaii in substantial quantities. Most of the present fresh fish export from Guam is tuna being transhipped to the Japan *sashimi* market by foreign longline vessels that land catches at the Commercial Port.

Guam economy: Guam's economy remains in a severe economic downturn that began in the late 1990s. Although complete, up-to-date data on the economy's main parameters, such as gross island product and gross business receipts, are unavailable, secondary indicators, such as unemployment and gross receipt taxes, suggest that the U.S. territory ended the 20th century with a severe recession (Bank of Hawaii Economic Report on Guam, August 28, 2001). Economic problems in the primary industry – tourism – deepened in 2001 with curtailment of air travel by Japanese visitors because of safety concerns brought about by September 11, 2001, terrorist events in the U.S. Two major typhoons in 2002 damaged tourist industry infrastructure, further discouraging tourist traffic to Guam. Although the U.S. strengthened its military presence in Guam 2003 in response to North Korean threats, the island economy is reportedly in the worst condition in two decades.

Tourism represents a substantial source of demand for good quality fresh fish on Guam but this market niche is shrinking with the drop off in Japanese visitors and visitor spending. Domestic demand for fresh fish, especially better quality and higher priced products, in Guam is not expected to grow substantially while there is high unemployment and declining resident income.

Cumulative Effects of the Alternatives – Economic Impacts

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b). None of the alternatives would be expected to add enough fresh fish exports to strain air cargo capacity. Nor would the expected income from such exports under any of the alternatives change Guam's present trade or economic situation.

Exogenous Factors – Social Impacts: Two major exogenous factors were identified as having the potential to contribute to cumulative social impacts.

- Fishermen's options for switching fisheries or relocating effort
- Economic climate

Options for Switching or Relocation: The possibilities for switching fisheries or relocating fishing effort could contribute significantly to cumulative social effects.

Economic Climate: Unemployment on Guam has been over 15 percent since 2000. The ratio of unemployment to total population has decreased on Guam every year in the past decade, from a ratio of 49.9 percent in 1992 to 35.2 percent in 2001. As the ratio shows, fewer and fewer pay support for an increasingly larger population (Bank of Hawaii Economic Report on Guam, August 28, 2001). The situation could become even worse if the downturn in Guam's tourism industry is prolonged or if there is a further reduction in local government employment and spending. The economic climate, therefore, could have major significance for cumulative social impacts.

Cumulative Effects of the Alternatives – Social Impacts

The cumulative effects of each alternative are analyzed by combining (a) the direct effects of each alternative and (b) the indirect effects of each alternative with (c) the effects of exogenous factors, as modified by (b).

Future regulatory changes could add significantly to negative cumulative effects on large-scale participants under all of the alternatives except no action (Alternative 1) by redirecting or encouraging relocation of deep bottomfishing effort to less profitable fisheries off Guam or to areas outside Guam's EEZ.

The condition of the island's economy could improve or worsen the effects of all of the alternatives. Should employment opportunities expand, displaced fishermen could possibly find new jobs. Should employment opportunities decrease, they will have more difficulty in finding new livelihoods. Therefore, the cumulative social effects associated with these economic variables may or may not be significant in a positive or negative direction. The social costs are likely to be more severe for the small-boat fleet and indigenous participants than for larger vessels and transients. Larger vessels may be able to compensate by relocating to other island areas, including the nearby CNMI, whereas the small-scale longline fleet does not have this opportunity. Thus, alternatives that emphasize unlimited or additional participation by large-scale vessels (> 50 ft) (Alternative 1) would be expected to contribute more negatively to cumulative social effects than the other alternatives (No. 2-4). Small-scale vessels have greater flexibility to change fisheries (e.g., to troll, handline or spearing) than large-scale vessels. Hence, alternatives that emphasize small-scale participation (No. 2, 3) and possibly No. 4 have less potential for adverse cumulative impacts than the others.

6.1.4.4 Controversy Regarding Environmental Effects

As indicated in certain sections of this document, there are several types of effects of the alternatives that are difficult to predict. For example, it is difficult to predict the degree to which

the preferred alternative would hinder the further development of the export-oriented deepwater component of the bottomfish fishery around Guam. It is also difficult to predict the extent to which the preferred alternative would cause a geographical shift in fishing effort from the federal water around Guam to the waters around the CNMI. Although there is a high degree of uncertainty regarding these and certain other effects of the alternatives, there does not appear to be substantial controversy about these possible effects among the public, the scientific community, or other parties.

6.1.5 Reasons for Selecting the Preferred Alternative

The Council rejected Alternative 1 (no-action) because of the risks it brings in terms of maintaining viable bottomfish catch rates in the waters within range of the small-vessel component of the Guam bottomfish fishery, providing for sustained community participation in the Guam bottomfish fishery, and maintaining a consistent availability of locally caught fish to the Guam market.

The Council rejected Alternative 3 (250-pound trip limit for *onaga*) because although it would likely help achieve the objectives of this action, it would have at least two disadvantages relative to Alternative 2 (permits and reporting required of large vessels and no fishing by large vessels within 50 nm of Guam), including: 1) it would encourage high-grading of *onaga* by fish quality (which is likely to be a function of fish size), resulting in greater relative *onaga* bycatch rates, and 2) it might needlessly inhibit fishery efficiency in the waters beyond the range of the small-vessel component of the Guam bottomfish fishery (i.e., beyond 50 nm from shore).

Alternative 4 (limited access program) would have some advantages over Alternative 2 in terms of achieving the objectives of this action, including: 1) it would provide more complete information on bottomfish fishing activity in the EEZ around Guam (through vessel logbooks), 2) it would provide more fine-tuned and adjustable control over total bottomfish fishing effort in the EEZ around Guam and the distribution of fishing effort by vessel size, improving the likelihood of maintaining viable catch rates, providing for sustained community participation, maintaining a consistent availability of locally caught fish to the local market, and achieving other management objectives. However, the Council has rejected Alternative 4 because its advantages would come at greater costs – at least in the short term – than Alternative 2, including: 1) greater implementation costs associated with administration, enforcement, and monitoring, 2) greater compliance costs on the part of fishery participants, and 3) greater likelihood of individuals being denied the opportunity to participate in the fishery. Given the problem being addressed, these costs do not appear to be justified at this time. Furthermore, Alternative 2 would not preclude the implementation of a limited access program in the future should such an action become warranted.

Notwithstanding the advantages of Alternative 2 relative to the others, it is difficult to predict with confidence whether, and to what extent, it would succeed in achieving the objectives of this action. For example, it is possible that the type of fishery development that this action is aimed at curbing (e.g., large-scale, intensive, export-oriented) could take place on more or less the same

scale with only less-than-50-foot-vessels as it could with no restrictions on vessel size. In that case, further management action might be needed.

In summary, the Council has determined that Alternative 2 has the greatest likelihood of achieving the objectives of the action and the goal and objectives of the FMP while being consistent with the National Standards, the purposes of the Magnuson-Stevens Act, and other applicable law.

6.2 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act of 1995 (PRA) is to minimize the paperwork burden on the public. The Act requires federal agencies to ensure that information collected from the public is needed and is collected in an efficient manner (44 U.S.C. 3501 (1)).

The proposed action would include two collection-of-information requirements that would be subject to approval by the Office of Management and Budget (OMB), pursuant to the PRA.

First, the proposed action would require that vessels larger than 50 feet in length that land or transship bottomfish management unit species shoreward of the outer boundary of the EEZ around Guam be registered under a valid permit. Eligibility for such a permit would not be restricted in any way, and the permit would be renewable on an annual basis. In order to obtain a permit for a given year, a prospective participant would have to complete and submit an application form to an office of the NMFS. No application or issuance fee would be charged.

Second, the proposed action would require that operators of vessels subject to the above permit requirement maintain on board the vessel an accurate and complete record of catch, effort, and other data on report forms provided by the NMFS. All information specified on the forms would have to be recorded on the forms within 24 hours after the completion of each fishing day, and the original logbook form for each day of the fishing trip would have to be submitted to the Regional Director within 72 hours of each landing of management unit species.

The estimated paperwork burden for the permit application process is 30 minutes per application. It is estimated that zero to five permit applications would be submitted each year, resulting in a total paperwork burden of between 0 and 2.5 hours per year.

The estimated paperwork burden for the reporting requirement is 5 minutes per daily log sheet. It is estimated that zero to five vessels would be subject to the reporting requirement at any given time, and that each vessel would fish, on average, no more than 220 days each year, resulting in a total paperwork burden of between 0 and 92 hours per year.

6.3 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) requires a determination that a proposed management measure has no effect on the land, water uses, or natural resources of the coast zone, or is consistent to the maximum extent practicable with the enforceable policies an affected state's

approved coastal zone management program. A copy of this document will be submitted to the appropriate territorial and commonwealth government agencies in Guam and the CNMI for review and concurrence with a determination made by the Council that the proposed measure is consistent, to the maximum extent practicable, with state and territorial coastal zone management programs.

6.4 Endangered Species Act

The Endangered Species Act of 1973 (ESA), as amended (Public Law 93-205; 87 Stat. 884) prohibits the taking of endangered species except under limited circumstances. In 1986, 1991, and 2002 formal Section 7 consultations were completed for the FMP (for sea turtles and marine mammals, not seabirds). The results of the consultations are Biological Opinions as to whether the action – in this case, management of the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region according to the prevailing management regime, as set forth in the FMP – is likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. This document incorporates by reference NMFS' entire 2002 Biological Opinion on the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (NMFS 2002).

Listed below are the species listed as endangered or threatened under the ESA that have been observed in the area where the Western Pacific bottomfish fishery occurs. The relationship between these species and the Western Pacific bottomfish fishery, particular the portion of the fishery that occurs in the waters around the Mariana Islands, is then reviewed, based primarily on the findings of the 2002 Biological Opinion. Finally, the likely impacts of the proposed action on these species are discussed.

Marine Mammals

	Status
Hawaiian monk seal (<i>Monachus schauinslandi</i>)	Endangered
Humpback whale (<i>Megaptera novaeangliae</i>)	Endangered
Sperm whale (<i>Physeter macrocephalus</i>)	Endangered
Right whale (<i>Eubalaena glacialis</i>)	Endangered
Blue whale (<i>Balaenoptera musculus</i>)	Endangered
Fin whale (<i>Balaenoptera physalus</i>)	Endangered
Sei whale (<i>Balaenoptera borealis</i>)	Endangered

Sea Turtles

	Status
Green turtle (<i>Chelonia mydas</i>)	Threatened/Endangered
Hawksbill turtle (<i>Eretmochelys imbricata</i>)	Endangered
Leatherback turtle (<i>Dermochelys coriacea</i>)	Endangered
Loggerhead turtle (<i>Caretta caretta</i>)	Threatened
Olive Ridley turtle (<i>Lepidochelys olivacea</i>)	Threatened/Endangered

Seabirds

Status

Additional information on the biology, distribution, and status of these species, and their relationships with the Western Pacific bottomfish fishery, can be found in the DEIS for the FMP (WPRFMC 2003a).

The Hawaiian monk seal has been documented to interact with the Western Pacific bottomfish fishery, but only in the NWHI. The 2002 Biological Opinion (NMFS 2002) found that the bottomfish fishery – as managed under the current FMP – is not likely to jeopardize the continued existence of the Hawaiian monk seal or result in the destruction or adverse modification of its critical habitat. Because the proposed action would affect bottomfish fishing activity only around the Mariana Islands, beyond the range of the Hawaiian monk seal, it would be expected to have no impact on the Hawaiian monk seal or its critical habitat.

The 2002 Biological Opinion (NMFS 2002) found that the Western Pacific bottomfish fishery – as managed under the current FMP – is not likely to adversely affect humpback, sperm, right, blue, fin, or sei whales, or hawksbill, leatherback, loggerhead, olive ridley, or green turtles.

Little information on seabird interactions in the bottomfish fisheries around the Mariana Islands is available, so it is difficult to make any conclusions about the types, frequency, or likelihood of interactions with short-tailed albatross in that fishery. The DEIS for the FMP (WPRFMC 2003a) found that the Western Pacific bottomfish fishery as a whole is expected to have no effect on seabird distribution, survival, or population structure.

It can be assumed that any impacts of the bottomfish fishery on listed species of whales, sea turtles, seabirds, and their critical habitat occur, or have the likelihood to occur, in rough proportion to the fishery-wide level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of these species and their habitat).

Relative to the no-action scenario, the proposed action would likely result in a reduction in fishing effort in the bottomfish fisheries around the Mariana Islands, making it unlikely that the proposed action would have any adverse impact on these species or their critical habitat. However, the proposed action could also result in a shift, relative to the no-action scenario, in the geographical distribution of fishing effort towards waters closer to Guam and/or towards waters farther from Guam, possibly including the waters around the CNMI. This could result in adverse impacts to certain of these species or their critical habitat (e.g., those more abundant or more vulnerable in the areas towards which any shift occurs), but any such impacts are likely to be small.

6.5 Marine Mammal Protection Act

The bottomfish fisheries around Guam and the CNMI are classified as Category III under Section 118 of the Marine Mammal Protection Act (MMPA) (62 FR 28657, 27 May 1997), meaning that the fisheries have been determined by NMFS “to have a remote likelihood of, or no known

incidental mortality and serious injury of marine mammals” (50 CFR 229.2). Vessel owners and crew that are engaged only in Category III fisheries may incidentally take marine mammals without registering or receiving an Authorization Certificate under the MMPA, but they are required to: 1) report all incidental mortality and injury of marine mammals to NMFS, 2) immediately return to the sea with minimum of further injury any incidentally taken marine mammal, 3) allow vessel observers if requested by NMFS, and 4) comply with guidelines and prohibitions under the MMPA when deterring marine mammals from gear, catch, and private property (50 CFR 229.5, 229.6, 229.7).

Any species listed as endangered or threatened under the ESA, such as the Hawaiian monk seal, is considered to be depleted under the MMPA, and any incidental take of that species must be authorized under Section 101(a)(5) of the MMPA, subject to a determination by the Secretary of Commerce that any incidental mortality or serious injury will have a negligible impact on the affected species or stock and that a recovery plan has been developed or is being developed under the ESA for the species or stock. The expected impacts of the proposed action on the Hawaiian monk seal are addressed in the preceding section.

Species of marine mammals that are protected under the MMPA but not listed as threatened or endangered under the ESA and that may occur in the areas where Western Pacific bottomfish fisheries operate include the following:

Blainsville's beaked whale (*Mesoplodon densirostris*)
Bottlenose dolphin (*Tursiops truncatus*)
Bryde's whale (*Balaenoptera edeni*)
Cuvier's beaked whale (*Ziphius cavirostris*)
Dwarf sperm whale (*Kogia simus*)
False killer whale (*Pseudorca crassidens*)
Killer whale (*Orcinus orca*)
Melon-headed whale (*Peponocephala electra*)
Northern elephant seal (*Mirounga angustirostris*)
Pilot whale (*Globicephala melas*)
Pygmy killer whale (*Feresa attenuata*)
Pygmy sperm whale (*Kogia breviceps*)
Risso's dolphin (*Grampus griseus*)
Rough-toothed dolphin (*Steno bredanensis*)
Short-finned pilot whale (*Globicephala macrorhynchus*)
Spinner dolphin (*Stenella longirostris*)
Spotted dolphin (*Stenella attenuata*)
Striped dolphin (*Stenella coeruleoalba*)

Of the above species, the Western Pacific bottomfish fishery has been documented to interact with only one, the bottlenose dolphin. In the NWHI, the only area in which a vessel observer program has been conducted for the bottomfish fishery (1990-1993), bottlenose dolphin were observed taking fish from hooks, with an average of one bottlenose dolphin interaction observed for every

38 fishing hours (Nitta 1999). No hookings were observed during the 26 trips observed during the program. Additional information on biology, distribution, and status of bottlenose dolphin in the affected area is available in the DEIS for the Bottomfish and Seamount Fishery in the Western Pacific Region (WPRFMC 2003a). Several sightings of spinner dolphin were also made during the 1990-1993 NWHI observer program, but no interactions were observed (Nitta 1999).

Although the other species listed above may be found within the action area and could interact with bottomfish fisheries (e.g., through bait-taking or catch-taking incidents or vessel collisions), no interactions with any of these species have been reported in the Western Pacific bottomfish fishery. However, there has been no observer program in the bottomfish fisheries around Guam or the CNMI, so it is difficult to conclude with certainty that no injuries or mortalities have taken place.

It can be assumed that any impacts of the bottomfish fishery on marine mammals and their habitat occur, or have the likelihood to occur, in rough proportion to the fishery-wide level of fishing effort. The likelihood and magnitude of impacts are also a function of how fishing effort is temporally and geographically distributed (i.e., relative to the distributional aspects of these species and their habitat).

Relative to the no-action scenario, the proposed action would likely result in a reduction in fishing effort in the bottomfish fisheries around the Mariana Islands, making it unlikely that the proposed action would have any adverse impact on any of the above-listed species or their habitat. However, the proposed action could also result in a shift, relative to the no-action scenario, in the geographical distribution of fishing effort towards waters closer to Guam and/or towards waters farther from Guam, possibly including the waters around the CNMI. This could result in adverse impacts to certain of these species or their habitat (e.g., those more abundant or more vulnerable in the areas towards which any shift occurs), but any such impacts are likely to be small.

6.6 Regulatory Impact Review and Regulatory Flexibility Act

Regulatory Impact Review

In order to meet the requirements of Executive Order (EO) 12866, "Regulatory Planning and Review," the National Marine Fisheries Service requires that a Regulatory Impact Review (RIR) be prepared for all regulatory actions that are of public interest. This review provides an overview of the problem, policy objectives, and anticipated impacts of the proposed action, and ensures that management alternatives are systematically and comprehensively evaluated such that the public welfare can be enhanced in the most efficient and cost effective way.

In accordance with EO 12866, the following is set forth: (1) This rule is not likely to have an annual effect on the economy of more \$100 million or to adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) This rule is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency; (3) This

rule is not likely to materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; (4) This rule is not likely to raise novel or policy issues arising out of legal mandates, or the principles set forth in the Executive Order; and; (5) This rule is not controversial.

An complete analysis of the expected costs and benefits of each of the alternatives is provided in Appendix II. A summary is provided here.

Alternatives 2 and 3 would have similar effects in terms of fishery participation, fishing effort, catch, and the tendency to market abroad versus domestically. They would therefore be likely to have similar types of impacts on producer surplus and consumer surplus relative to the no-action scenario, if not the same magnitude of impacts. They both would be likely to have positive impacts on consumer surplus. Their likely directional impacts on producer surplus are difficult to predict, but they both would be less risky in terms of producer surplus than the no-action alternative. Among the various management costs associated with each of the alternatives, enforcement would probably be the costliest component under both Alternatives 2 and 3. The management costs of Alternative 2 (which would probably involve some on-water surveillance of the large vessel closed area) would likely be substantially greater than those of Alternative 3.

Alternative 4 would be likely to result in a greater future stream of net benefits to producers than Alternatives 1, 2, or 3. Its directional impacts on consumer surplus are not possible to predict. The public costs of implementing Alternative 4 would probably be substantially greater than those of any of the other alternatives. In addition to the ongoing management costs, there would probably be additional up-front costs of research that would be needed to design the system so as to successfully achieve its objectives. It might also result in substantial short-term private transition costs, including the costs associated with lost fishing opportunities.

Regulatory Flexibility Act

The Regulatory Flexibility Act, 5 U.S.C. 601 *et seq.* (RFA), requires government agencies to assess the impact of their regulatory actions on "small entities," including small business, small organizations, and small governmental jurisdictions. A "small entity" is considered to include commercial fishing companies with annual receipts up to \$3.5 million, processing companies with no more than 500 employees, wholesalers with no more than 100 employees, non-profit organization that are independently owned and operated and not dominant in their field, and government jurisdictions governing a population of less than 5,000. The potential impacts of a proposed action on small entities are assessed via the preparation of a Regulatory Flexibility Analysis. An Initial Regulatory Flexibility Analysis of the expected impacts of each of the alternatives is provided in Appendix II. A summary is provided here.

Description of affected small entities

Under Alternative 2 (closed area and permit and reporting requirements for large vessels), the directly affected entities (those subject to the new rules) would be those fishery participants that

fish for bottomfish management unit species (BMUS) within 50 nm of the island of Guam from large vessels and those that land or transship BMUS within the outer boundary of the EEZ around Guam from large vessels. It is believed that there is currently one such entity that is active in the fishery, and there may be several others that are planning to become active. It is likely that all these directly affected entities are “small entities,” as defined by the RFA. In addition to the directly affected, or regulated, small entities, a substantial number of small entities would be indirectly affected, including 200 to 400 entities in the harvesting sector of Guam’s bottomfish fishery, most of which are part-time commercial fishermen, but also a number charter fishing entities, and between 50 and 200 entities in the processing and marketing sectors.

Under Alternative 3 (250-pound landing limit for *onaga*), the directly affected entities would be those bottomfish fishery participants that fish in the federal waters around Guam. The number is probably between 100 and 300, and virtually all are probably small entities. Indirectly affected small entities would include virtually all the commercial participants in the harvesting sector of the Guam bottomfish fishery that are not directly affected by the action; that is, 100 to 300 fishing entities, as well as the same 50 to 200 processors and marketers that would be indirectly affected under Alternative 2.

Under Alternative 4 (limited access program), the affected entities would be those bottomfish fishery participants that fish in the federal waters around Guam. The number is probably between 100 and 300, and virtually all are probably small entities. Indirectly affected small entities would include virtually all the commercial participants in the harvesting sector of the Guam bottomfish fishery that are not directly affected by the action; that is, 100 to 300 fishing entities, as well as the same 50 to 200 processors and marketers that would be indirectly affected under Alternatives 2 and 3.

Adverse impacts on regulated small entities

Alternative 2 would affect large-vessel fishery participants in two different ways; first, by prohibiting them from fishing for BMUS within 50 nm of Guam, and second, by requiring those that land or transship BMUS in Guam to obtain permits and report their fishing activity. Both of these measures, but primarily the former (the paperwork burden for the permit requirement has been estimated to be only about 30 minutes per annual application and the paperwork burden for reporting has been estimated to be only about 5 minutes per fishing day), would constrain the ability of large vessels to operate in the Guam bottomfish fishery, and at least in the short term, reduce the cost-efficiency of large vessel operations in the fishery. The economic impact on the regulated small entities is difficult to predict, in part because of their many possible responses to the measures, including: 1) they continue to fish with large vessels in the portion of their traditional fishing grounds not inside the large-vessel closed area; 2) they switch to using small vessels, in which case they may fish throughout their traditional fishing grounds but they might be effectively constrained to waters closer to Guam; 3) they shift operations to ports or waters not subject to the measures (e.g., the territorial waters of Guam or the ports of the CNMI and surrounding waters; 4) they shift operations to other target species (e.g., pelagic species), and; 5) they cease fishing operations altogether. In short, although it is likely that the affected small

entities would bear at least short-term adverse impacts associated with transition-making, it is not possible to predict the magnitude or duration of those impacts, or whether the economic viability of any regulated entities would be put at substantial risk.

Although the trip limit of Alternative 3 would apply to all fishery participants that fish in federal waters around Guam, virtually all of which are small entities, it would actually affect the behavior of only a small proportion of those participants; that is, those that have the capacity and interest to land more than 250 pounds of *onaga* during a single fishing trip. This number is probably no more than a few, and these few "large-scale commercial enterprises" probably overlap to a large extent with the "large-vessel" small entities that would be affected under Alternative 2. Like Alternative 2, Alternative 3 would constrain the ability of large-scale commercial enterprises (rather than large vessels, per se) to operate in the Guam bottomfish fishery. The responses of affected small entities to the measure and the economic effects on them would therefore be of the same type as those described for Alternative 2. Which of the two alternatives would be more constraining in terms of the economic efficiency of fishing operations is not possible to predict. It is not possible to predict whether Alternative 3 would result in the economic viability of any regulated entities being put at substantial risk.

The details of the limited access program under Alternative 4 have not been formulated, so it is not possible to rigorously predict how fishery participants would respond or how they would be affected. Assuming that the program would be designed in part to achieve the FMP objective "to maintain existing opportunities for rewarding experiences by small-scale commercial, recreational, and subsistence fishermen, including native Pacific islanders," the program would presumably be designed so as to minimize the adverse impacts on existing participants, particularly small-scale participants, possibly at the expense of large-scale participants. Any short-term adverse economic effects of Alternative 4 would therefore probably be felt by largely the same entities as those that would be adversely affected under Alternatives 2 and 3, and their responses and the economic effects on them would therefore be of the same type as those described for Alternatives 2 and 3. It is not possible to predict whether Alternative 4 would result in the economic viability of any regulated entities being put at substantial risk.

Management Needs, Potential Remedies and Costs of No Action

Management Needs	Potential Remedies	Potential Costs of No Action
Lack of monitoring of large-scale bottomfishing on seamounts in EEZ.	Logbook reporting of catch and effort.	Inadequate catch and effort data to assess impact of large-scale fishery on seamount bottomfish populations isolated from larger island slope resources.

Small-scale domestic bottomfishing could become less productive.	Limit impact of large-scale bottomfishing on areas within range of small-scale fleet.	Decline in small-scale bottomfishing catch rate below viable levels.
Disruption of community participation in bottomfish fishery.	Sustain community participation in small-scale fleet that is limited by range and capacity.	After "boom and bust" of large-scale bottomfishing, community would have to wait for recovery of bottomfish populations within range of small-scale fleet.
Continued availability of locally-caught fresh bottomfish in Guam market.	Separate bottomfishing activities for export and domestic markets based on vessel capabilities.	Increased scarcity of bottomfish and higher consumer prices in local market.

Comparison of How Alternatives May Further Management Needs and Objectives

Management Needs, Bottomfish FMP Objectives	Adequate monitoring of large-scale bottomfishing on seamounts isolated from island slope resources?	Maintain viable catch rates in small-scale bottomfishing?	Sustain small-scale community participation, avoid "boom and bust" fishery development?	Encourage continued availability of locally-caught bottomfish in domestic market?
1. No action	No	No	No	No
2. Large vessels (> 50 ft) cannot bottomfish within 50 nm of Guam; large vessels that land BMUS in Guam must hold federal permits and submit logbook reports to NMFS.	Yes	Likely	Likely	Maybe
3. Limit of 250 lb of <i>onaga</i> landed per fishing trip in EEZ.	No	Likely	Likely	Doubtful
4. Limit number of vessels permitted to bottomfish in EEZ; vessel owners must hold federal permits and submit logbook reports to NMFS.	Yes	Maybe	Maybe	Maybe

Summary and Comparison of Impacts by Alternative

Environmental Resource Category	Alternative 1: No Action	Alternative 2: (Preferred Alternative): Close EEZ waters within 50 nm of Guam to bottomfishing by large vessels (> 50 ft) and require federal permitting and reporting for large vessels that land BMUS in Guam	Alternative 3: Limit weight of deepwater bottomfish landed from trips in EEZ around Guam (250 lb of <i>onaga</i> per trip)	Alternative 4: Limit number of vessels bottomfishing in EEZ around Guam; require federal permitting and logbook reporting
Target Fish Species	Local bottomfish population depletion may occur.	Reduces risk of localized depletion by large-scale bottomfishing at EEZ banks closest to Guam but may cause large-scale vessels to relocate bottomfishing effort to CNMI.	May reduce risk of localized depletion by causing large-scale bottomfishing to be inefficient. Would encourage high grading of catch by species or fish size, thereby increasing bycatch.	Limits total bottomfishing effort but does not necessarily distribute it in the EEZ to avoid localized depletion. Reduces incentive for large-scale vessels to relocate bottomfishing effort to CNMI.
Non-Target Fish Species	Catch would continue at low levels due to selectivity of bottomfish gear. Shark removal may increase.	Catch would continue at low levels due to selectivity of bottomfish gear. Shark removal likely to increase.	Catch would continue at low levels due to selectivity of bottomfish gear. Shark removal not likely to increase in Guam fishery but possibly in CNMI fishery if large-scale vessels relocate.	Catch would continue at low levels due to selectivity of bottomfish gear. Shark removal may or may not increase depending on whether qualified small vessels could be upgraded or replaced with larger vessels.
Sea Turtles	No impact on adults because of depth of bottomfish gear.	Same as "No Action."	Same as "No Action."	Same as "No Action."
Seabirds	Little if any impact because of rapid deployment of gear.	Same as "No Action."	Same as "No Action."	Same as "No Action."

Environmental Resource Category	Alternative 1: No Action	Alternative 2: (Preferred Alternative): Close EEZ waters within 50 nm of Guam to bottomfishing by large vessels (> 50 ft) and require federal permitting and reporting for large vessels that land BMUS in Guam	Alternative 3: Limit weight of deepwater bottomfish landed from EEZ per fishing trip (250 lb of <i>onaga</i> per trip)	Alternative 4: Limit number of vessels bottomfishing in EEZ around Guam; require federal permitting and logbook reporting
Marine Mammals	Continued fishing would expose cetaceans to very low level risk of hooking, collision and behavioral disturbance.	Same as "No Action."	Same as "No Action."	Same as "No Action."
Essential Fish Habitat; Biodiversity; Ecological Function	Continued bottomfishing would expose deep slope seamount habitat to low-level risk of anchor damage and exposure to marine pollution.	Risk of fishing impacts by large vessels reduced at EEZ banks within 50 nm of Guam but could increase in CNMI if large-scale Guam bottomfish vessels relocate.	Risk of fishing impacts may be reduced because of inefficiency of large-scale vessels venturing to EEZ banks for bottomfishing. Impact could increase in CNMI if large-scale bottomfish vessels relocate.	Risk of fishing impacts reduced because of limit on number of vessels permitted to bottomfish in EEZ.

Environmental Resource Category	Alternative 1: No Action	Alternative 2: (Preferred Alternative): Close EEZ waters within 50 nm of Guam to bottomfishing by large vessels (> 50 ft) and require federal permitting and reporting for large vessels that land BMUS in Guam	Alternative 3: Limit weight of deepwater bottomfish landed from EEZ per fishing trip (250 lb of <i>onaga</i> per trip)	Alternative 4: Limit number of vessels bottomfishing in EEZ around Guam; require federal permitting and logbook reporting
Commercial, Recreational and Charter Fishing Sectors	Economic impacts on small-scale commercial, recreational and charter fishing sectors could be negative if bottomfish catch rates decline within their limited fishing range in EEZ. Continued positive impact for large-scale commercial bottomfishing unless or until catch rates decline throughout EEZ.	Positive impact on small-scale commercial, recreational, charter fishing sectors by maintaining opportunity for viable catch rates at banks within their limited fishing range. Negative impact on large-scale fishery by increasing operating cost to venture to banks > 50 nm from Guam (but may be offset initially by higher catch rates). Possible negative impact on CNMI fishing sectors if large-scale Guam bottomfish vessels relocate to CNMI.	Positive impact on small-scale commercial, recreational, charter fishing sectors by maintaining opportunity for viable catch rates at banks within their limited fishing range. Major negative impact on Guam large-scale fishery by causing high inefficiency and limiting potential fishing revenue. Possible negative impact on CNMI fishing sectors if large-scale Guam bottomfish vessels relocate to CNMI.	Positive economic impact for vessel owners with a history of bottomfishing in EEZ. Negative impact for other vessel owners. Reduces risk that large-scale Guam bottomfish vessels might relocate to CNMI.
Island Economy	Export of deepwater bottomfish could increase significantly because of large-scale bottomfishing; contribution to island economy would remain small.	Same as "No Action."	No increase in deepwater bottomfish export; contribution to island economy would not change.	Little increase in deepwater bottomfish export because most historical EEZ fishery participants are small-scale; contribution to island economies would not change if large-scale bottomfishing effort relocates to CNMI.

Environmental Resource Category	Alternative 1: No Action	Alternative 2: (Preferred Alternative): Close EEZ waters within 50 nm of Guam to bottomfishing by large vessels (> 50 ft) and require federal permitting and reporting for large vessels that land BMUS in Guam	Alternative 3: Limit weight of deepwater bottomfish landed from EEZ per fishing trip (250 lb of <i>onaga</i> per trip)	Alternative 4: Limit number of vessels bottomfishing in EEZ around Guam; require federal permitting and logbook reporting
Fishing Community	If localized depletion of bottomfish occurs within limited range of small-scale participants, could disrupt their income, investment value and lifestyle. If no recovery, longer term negative impacts are possible because future generations would have one less option to make fishing a more attractive occupation.	By maintaining opportunity for viable catch rates within limited fishing range of small-scale participants, could promote social and economic stability within Guam fishing community and help preserve elements of local fishing culture. Possible negative impact on CNMI fishing community if large-scale bottomfish vessels relocate to CNMI.	Same as Alternative 2.	Would promote economic stability for those with a history of bottomfishing in the EEZ but might divide fishing community based on who is "in" and who is "out." Reduces risk that large-scale Guam bottomfish vessels might relocate to CNMI.
Chamoru (also known as Chamorro) Community	If localized depletion of bottomfish occurs within limited range of small-scale participants, could hasten erosion of Chamoru traditional fishing knowledge and cultural identification with the ocean.	By maintaining opportunity for viable catch rates within limited fishing range of small-scale participants, could promote perpetuation of Chamoru traditional fishing knowledge and cultural identification with the ocean. Possible negative impact on CNMI Chamoru fishing community if large-scale bottomfish vessels relocate to CNMI.	Same as Alternative 2.	Could promote perpetuation of Chamoru traditional fishing knowledge and cultural identification with the ocean for those families having a history of bottomfishing in the EEZ but might divide the community based on who is "in" and who is "out." Reduces risk that large-scale Guam bottomfish vessels might relocate to CNMI.

Environmental Resource Category	Alternative 1: No Action	Alternative 2: (Preferred Alternative): Close EEZ waters within 50 nm of Guam to bottomfishing by large vessels (> 50 ft) and require federal permitting and reporting for large vessels that land BMUS in Guam	Alternative 3: Limit weight of deepwater bottomfish landed from EEZ per fishing trip (250 lb of <i>onaga</i> per trip)	Alternative 4: Limit number of vessels bottomfishing in EEZ around Guam; require federal permitting and logbook reporting
Domestic Seafood Market and Consumers	If large-scale bottomfishing remains export oriented and localized depletion of bottomfish occurs within limited range of small-scale fishery, could cause scarcity and raise prices of fresh domestic bottomfish for local consumers.	Could promote continued availability of fresh domestic bottomfish in local market by maintaining opportunity for viable catch rates within limited fishing range of small-scale fishery. Possible negative impact if large-scale Guam bottomfish vessels relocate to CNMI.	Same as Alternative 2.	Limiting the number of bottomfishing vessels could stabilize the availability of locally-caught fresh bottomfish to Guam consumers or it could encourage an export-oriented fishery that reduces the local bottomfish supply.
Public Health and Safety	Fishing vessel safety not changed.	The federal permitting process could promote vessel safety. Closed areas would not compromise vessel safety.	Same as "No Action."	The federal permitting process could promote vessel safety.

Administration and Enforcement	Current administrative and enforcement procedures and associated costs would not change.	Administrative costs would increase because of federal permitting. Data collection costs would increase because of federal logbook reporting. Area closure might be difficult to enforce without VMS, depending on degree of cooperation by fishermen.	Enforcement costs would increase substantially because of the need to monitor every landing of bottomfish and to determine if the catch was made in the EEZ.	Administrative costs would increase substantially because of federal limited access permitting. Data collection costs would increase because of federal logbook reporting.
--------------------------------	--	--	--	--

7. REFERENCES

- AECOS, Inc. 1983. *Central and Western Pacific Regional Fisheries Development Plan*, Vol. 2, "Guam Component." Prepared for the Pacific Basin Development Council, Honolulu.
- Allen, S.D. 2000. Social impact assessment: how we assess the effects of our actions on visitors, neighbors, and other stakeholders. In Fulton, D.C., Nelson, K.C., Anderson, D.H. and Lime, D.W. (Eds.) *Human dimensions of natural resource management: emerging issues and practical applications (BRD-2000-1)*. St. Paul, MN: Minnesota Cooperative Fish and Wildlife Research Unit and University of Minnesota.
- Amesbury, S.S. and P. Callaghan. 1981. Territory of Guam fisheries development and management plan. Agana, Guam: Guam Coastal Management Program, Bureau of Planning.
- Amesbury, S.S. and P. Callaghan. 1981. Territory of Guam fisheries development and management plan. Agana, Guam: Guam Coastal Management Program, Bureau of Planning.
- Amesbury, J. and R. Hunter-Anderson. 1989. Native Fishing Rights and Limited Entry in Guam. Western Pacific Regional Fishery Management Council, Honolulu.
- Amesbury, J., R. Hunter-Anderson, and E. Wells 1989. Native Fishing Rights and Limited Entry in the CNMI. Western Pacific Regional Fishery Management Council, Honolulu.
- Amesbury, S.S., and R.F. Myers. 2001. Guide to the Coastal Resources of Guam, Vol 1. The Fishes. www.uog.edu/marinelab/fish/thefishes.html.
- Anon. 1945. "Co-op fishing on Guam setup under military." *Honolulu Star Bulletin*, 6 July 1945, p.2.
- Birkeland, C. 1997. Status of coral reefs in the Marianas. In: R. Grigg and C. Birkeland (eds.), *The Status of Coral Reefs in the Pacific*. Sea Grant College Program, University of Hawaii, Honolulu.
- BOH (Bank of Hawaii). 1997. Guam Economic Report September 1997. Bank of Hawaii.
- BOH (Bank of Hawaii). 2001. Economic report on Guam, August 28, 2001.
- Boehlert et al. 1994.
- Brooke, James. 2003. Guam, hurt by slump, hopes for economic help from military. New York Times Monday March 10, 2003, p. A14.

- Davis, G.W. 2001. Guam's sport fishing history, evolution, and progress. In: Miller, Marc L., Charles Daxboeck, Christopher Dahl, Kevin Kelley, and Paul Dalzell (eds.) Proceedings of the 1998 Pacific Island Gamefish Tournament Symposium, July 29 - August 1, 1998, Kailua Kona, HI. Honolulu HI: Western pacific Regional Fishery Management Council.
- Driver, M. 1983. "Fray Juan Pobre de Zamora and his account of the Mariana Islands." *Journal of Pacific History* 18(3):198-216.
- Duenas, M. undated. "Guam's local fishing industry: the fishermen's co-op perspective." Guam Fishermen's Cooperative Association, Guam.
- Dumat-ol Daleno, Gaynor. 2003. Industry sees signs of travel slump. Guam Pacific Daily News, March 25, 2003. www.guampdn.com/news/stories/20030325/localnews/1243137.html (accessed March 25, 2003).
- Eads, John. 2001. Charter and derby fishing in Guam. In Miller, Marc L., Charles Daxboeck, Christopher Dahl, Kevin Kelley, and Paul Dalzell (eds.) Proceedings of the 1998 Pacific Island Gamefish Tournament Symposium, July 29 - August 1, 1998, Kailua Kona, HI. Honolulu HI: Western pacific Regional Fishery Management Council.
- Forney, K.J. Barlow, M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J. Carreta. 2000. "Draft U.S. Pacific Marine Mammal Stock Assessments: 2000." NMFS Southwest Fisheries Science Center, La Jolla.
- GFCFA (Guam Fishermen's Cooperative Association). 1998. Preserving Quality and Market Value of Guam Indigenous Fishermen's Surplus Catches. Application for Federal Assistance to Administration for Native Americans, U.S. Dept. Of Health and Human Services.
- Gov. of Guam. 2001. The Guam Comprehensive Economic Development Strategy, Department of Commerce, June, 2001.
- Gov. of Guam. 2003. Government of Guam Department of Commerce Social Indicators web page, www.admin.gov.gu/commerce/guam_social_indicators.htm (accessed March 26, 2003).
- Green, A. 1997. An Assessment of the Status of the Coral Reef Resources, and their Patterns of Use, in the U.S. Pacific Islands [Draft]. Prepared for the Western Pacific Regional Fisheries Management Council, Honolulu. A report of the National Oceanic and Atmospheric Administration.
- Haight, W. 1989. "Trophic relationships, density and habitat associations of deepwater snappers (Lutjanidae) at Penguin Bank, Hawaii." MS Thesis, University of Hawai'i. 89p.

- Haight, W., J. Parrish, and T. Hayes. 1993a. "Feeding ecology of deepwater lutjanid snappers at Penguin Bank, Hawaii: depth, time of day, diet, and temporal changes." *Trans. Am. Fish. Soc.* 122(3):38-347.
- Haight, W., D. Kobayashi and K. Kawamoto. 1993b. "Biology and management of deepwater snappers of the Hawaiian Archipelago." *Marine Fisheries Review* 55(2):20-27.
- Hamnett, M. and C. Anderson. 2000. "Impact of ENSO events on tuna fisheries in the U.S. affiliated Pacific islands." Pelagic Fisheries Research Program, Joint Institute for Marine and Atmospheric Research, University of Hawai'i.
- Hamnett, M. and W. Pintz. 1996. "The contribution of tuna fishing and transshipment to the economies of American Samoa, the Commonwealth of the Northern Mariana Islands, and Guam." Pelagic Fisheries Research Program, Joint Institute for Marine and Atmospheric Research, University of Hawai'i.
- Hensley, R.A. and T.S. Sherwood. 1993. An overview of Guam's inshore fisheries. *Marine Fisheries Review* 55(2):129-138.
- Hunter, C. 1995. Review of Coral Reefs around American Flag Pacific Islands and Assessment of Need, Value and Feasibility of Establishing a Coral Reef Fishery Management Plan for the Western Pacific Region. Western Pacific Regional Fishery Management Council, Honolulu.
- Ikehara, I.I., H.R. Kami, and R.K. Sakamoto. 1970. Exploratory fishing survey of the inshore fisheries of Guam. In: K. Sugawara (ed.), *The Kuroshio II, Proceedings of the 2nd Symposium on the Results of the Cooperative Study of the Kuroshio and Adjacent Regions*, Tokyo, September 28 - October 1, 1970. Saikon Publ. Co., Tokyo, pp. 425-437.
- Itano, D.G. 1991. A review of the development of bottomfish fisheries in American Samoa. South Pacific Commission. Noumea, New Caledonia.
- Jennison-Nolan, J., 1979. "Guam: changing patterns of coastal marine exploitation." Sea Grant Publication UGSG 79-12.
- Kobayashi, D.R. 2002. Application of the Chaloupka simulation model to evaluate impacts on sea turtle populations. Presentation dated 6 August 2002. National Marine Fisheries Service.
- Knudson. 1987.
- Kobayashi, D.R. and K.E. Kawamoto. 1995. Evaluation of shark, dolphin, and monk seal interactions with Northwestern Hawaiian Island bottomfishing activity: a comparison of two time periods and an estimate of economic impacts. *Fisheries Research*, 23:11-22.

- Laurs, R.M. 2000. 2000 External Program Review. NOAA, National Marine Fisheries Service, Southwest Fisheries Science Center, Honolulu.
- Ledohey, P., M. Bertignac, J. Hampton, A. Lewis and J. Picaut. 1997. ENSO and tuna in the Western Pacific. *Nature*, 389: 715-717.
- Leis, J.M. 1987. Review of the early life history of tropical groupers (Serranidae) and snappers (Lutjanidae). In J.J. Polovina and S. Ralston (eds.), *Tropical Snappers and Groupers: Biology and Fisheries Management*. pp 189-237. Westview Press, Boulder, Colorado.
- Miller, S.A. 2001. Economic assessment of the domestic fisheries development potential of the Commonwealth of the Northern Mariana Islands. Prep. for National Marine Fisheries Service, Saltonstall-Kennedy Grant Program, Grant No. NA 96FD0471.
- Moffitt, R., and F. Parrish. 1996. "Habitat and life history of juvenile Hawaiian pink snapper *Pristipomoides filamentosus*." *Pac. Sci.* 50(4):371-381.
- Myers, R. 1993. "Guam's small-boat-based fisheries." *Marine Fisheries Review* 55(2):117-128.
- Myers, R. 1997. "Assessment of coral reef resources of Guam with emphasis on waters of federal jurisdiction." Western Pacific Regional Fisheries Management Council, Honolulu
- Nitta, E. 1999. Draft. Summary Report. Bottomfish Observer Trips in the NWHI. October 1990 to December 1993. NMFS Pacific Islands Area Office, Pacific Islands Protected Species Program, Honolulu.
- NMFS (National Marine Fisheries Service). 1999. Biological Assessment: Effects of the Hawaii-based Longline Fishery on the Short-Tailed Albatross around the Hawaiian Islands. Pacific Islands Area Office, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, 40 pp.
- NMFS (National Marine Fisheries Service). 2000.
- NMFS (National Marine Fisheries Service). 2002. National Marine Fisheries Service Endangered Species Act - Section 7 Consultation [for Management of the Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region According to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region]. Sustainable Fisheries Division, Southwest Region, Pacific Islands Area Office.
- NMFS (National Marine Fisheries Service). 2003. Annual Report to Congress on the Status of U.S. Fisheries – 2002. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Springs, Maryland, 156 pp.

- Orbach, M. 1980. "Report on the social, cultural, and economic aspects of fishery development in the Commonwealth of the Northern Mariana Islands." Center for Coastal Marine Studies, University of California, Santa Cruz.
- Parrish, F. 1989. "Identification of habitat of juvenile snappers in Hawaii." *Fish. Bull.* 87:1001-1005.
- Pinhey, Thomas K., Donald H. Rubinstein, and Stephen M. Vaughn. Undated. Fishing and fiestas: an explanatory note on the reinforcement of cultural traditions in Guam. Unpublished manuscript available from the primary author, University of Hawaii-Hilo.
- Polovina. 1985.
- Polovina, J., G. Mitchum, N. Graham, M. Craig, E. DeMartini and E. Flint. 1994. "Physical and biological consequences of a climate event in the Central North Pacific." *Fisheries Oceanography* 3(1):15-21.
- Polovina, J.J. and S. Ralston. 1986. An approach to yield assessment for unexploited resources with application to the deep slope fishes of the Marianas. *Fishery Bulletin*, 84(4):759-770.
- Ralston, S., M. Gooding, and G. Ludwig. 1986. "An ecological survey and comparison of bottomfish resource assessments (submersible versus hand-line fishing) at Johnston Atoll." *Fish. Bull.* 84(1):141-155.
- Rogers, A.D. 1994. The biology of seamounts. *Advances in Marine Biology*, vol. 30. Academic Press Ltd., p. 305-350.
- Rubinstein, D. 2001. A Sociocultural Study of Pelagic Fishing Activities in Guam. Final progress report available from University of Hawaii Joint Institute for Marine and Atmospheric Research, Pelagic Fisheries Research Program. Also available at: <http://www.soest.hawaii.edu/PFRP/pdf/rubinstein01.pdf>
- SPC (Secretariat of the Pacific Community). 2000. 13th Tuna and Billfish Technical Standing Committee report. Secretariat of the Pacific Community, Noumea, New Caledonia.
- U.S. Department of Commerce 2002. Population and housing profile: Guam. Washington, D.C.: U.S. Census Bureau, issued February 2002.
- U.S. Fish and Wildlife Service. 2002. Draft economic impact analysis of proposed critical habitat for three endangered species on Guam and Rota. Revised determination. Report available from U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office, Honolulu HI.

- WPRFMC (Western Pacific Regional Fishery Management Council). 1986. Combined Fishery Management Plan, Environmental Assessment and Regulatory Impact Review for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Final March 1986. Western Pacific Regional Fishery Management Council, Honolulu.
- WPRFMC (Western Pacific Regional Fishery Management Council). 1998. Magnuson-Stevens Act Definitions and Required Provisions; Amendment 6 to the Bottomfish and Seamount Groundfish Fisheries Management Plan; Amendment 8 to the Pelagic Fisheries Management Plan; Amendment 10 to the Crustaceans Fisheries Management Plan; Amendment 4 to the Precious Corals Fisheries Management Plan. Western Pacific Regional Fishery Management Council, Honolulu.
- WPRFMC (Western Pacific Regional Fishery Management Council). 1999. "Bottomfish and seamount groundfish fisheries of the Western Pacific Region 1998 annual report." Western Pacific Regional Fishery Management Council, Honolulu.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2000. Preliminary Draft Environmental Impact Statement; Bottomfish and Seamount Groundfish Fishery in the Western Pacific Region. Honolulu, Hawaii. November 2, 2000.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2000b. "Prohibition on fishing for pelagic management unit species within closed areas around the islands of American Samoa by vessels more than 50 feet in length: framework measure under the fishery management plan for the pelagic fisheries of the Western Pacific Region." Western Pacific Regional Fishery Management Council, Honolulu.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2001.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2002a. Draft Guam Bottomfish Scoping Meeting Report; August 8, 2002, Guam Fishermen's Cooperative, Agana, Guam.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2002b. Draft Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region 2000 Annual Report. Honolulu, Hawaii.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2002c. Options for Managing the Bottomfish Fishery in Federal Waters around Guam; for consideration in adjusting or amending the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Draft, September 25, 2002.
- WPRFMC (Western Pacific Regional Fishery Management Council). 2003a. Draft Environmental Impact Statement; Bottomfish and Seamount Groundfish Fishery in the Western Pacific Region. Honolulu, Hawaii. 14 March 2003.

WPRFMC (Western Pacific Regional Fishery Management Council). 2003b. Fishery Management Plan for Coral Reef Ecosystems of the Western Pacific Region. Volumes I-III [including Regulations, Regulatory Impact Review / Initial Regulatory Flexibility Analysis, Environmental Impact Statement, and Essential Fish Habitat for Management Unit Species]. Honolulu, Hawaii. 14 March 2003.

WPRFMC (Western Pacific Regional Fishery Management Council). 2003c. Draft Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region 2001 Annual Report. Honolulu, Hawaii.

WPRFMC (Western Pacific Regional Fishery Management Council) Draft Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region 2002 Annual Report. Honolulu, Hawaii.