U.S. DEPARTMENT OF COMMERCE

NOAA/NMFS/F-CM

October 14, 1981

To : F/CM6 - Clem Bribitzer

From: F/CM - Peter Fricke

Subject: Final FMP of Pacific Billfish Fisheries

I have reviewed the FMP as requested and have the following comments to make:

a) A summary of employment in the commercial fishing sectors and in processing and handling would be a very useful exercise and would assist in assessing socioeconomic impact;

b) The charter boat fishery is described in useful detail, but no reference is made to secondary employment and related economic values to island economies. Justification of the socioeconomic value of the FMP could make use of this information;

c) No reference is made to ethnicity of fishermen although the FMP refers to subsistence fishing. If the majority of fishermen are native islanders and if, as I suspect, fishing is a major commercial activity in relation to other employment/investment opportunities available to native islanders, it would make sense to manage the billfish fishery on socioeconomic grounds.

TRANSMITTAL FORM CD-82A (10-67)
PRESCRIBED BY DAO 214-2

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GPO : 1976 O - 216-459

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

F/CM6:PNE

SEP 11 1981

TO: Distribution*

FROM: F/CM6 - Roland Finch

SUBJECT: Review of the Fishery Management Plan for Billfish of the Western Pacific Region

Attached for your review and comment is the Fishery Management Plan for Billfish of the Western Pacific Region. Also attached is a copy of the NMFS comments on the Draft Fishery Management Plan.

Your response, including negative comments, would be appreciated by October 23, 1981. Please address questions to Clem Bribitzer (634-7449).

Attachments

*Distribution

F/UD1 - Hutchinson
F/CMx1
F/CM1
F/CM5
F/CM6 - Martenson, Siegel
F/CM7
F/IA - Beasley
Fx51 - Blatt
Fx53 - Neil Williams
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F/SR1 - Thompson
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GCF
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PP - Wood
CZx4 - Tolson
F/CM - Fricke
F/SWR - without attachment

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

JUL 2 8 1981 F/SWR31:JG

Mr. Wadsworth Y.H. Yee, Chairman
Western Pacific Fishery Management Council
1164 Bishop Street, Suite 1608
Honolulu, Hawaii 96813

Dear Mr. Yee:

Enclosed are comments of the National Marine Fisheries Service (NMFS) on the Draft Fishery Management Plan for the Billfish of the Western Pacific Region (the plan) submitted by the Western Pacific Fishery Management Council (Council) May 11, 1981. These comments are organized in two categories. Critical comments focus on the plan's conformance with the national standards (Magnuson Fishery Conservation and Management Act, Section 301), other applicable laws and national policies. These issues might preclude Secretarial approval of the plan. The second category is substantive comments which are less serious but, if taken into consideration, would improve and strengthen the plan.

These comments are designed to give the Council an insight into the basic concerns of NMFS if the plan were to be submitted to the Secretary of Commerce for approval in its present form. As such, these comments should be viewed as preliminary. They should not be construed as anticipating or guaranteeing approval by the Secretary of any final plan.

Overall, we commend the Council and its staff for the plan. All available information appears to be included in a well organized presentation. We fully appreciate the difficulties of designing a management regime for billfish vis-a-vis our national policy on highly migratory species. Officials of NMFS, the Department of State and other Federal agencies have enunciated this policy many times, formally and informally, while the plan was in preparation. Our views at this time remain essentially unchanged. In short, we cannot endorse sweeping closures of the U.S. fishery conservation zone (FCZ) to foreign longline fishing for tuna without more substantial benefits to the conservation and management of billfish than are identified in the plan.

We have similar critical concerns about the need for this plan and the specified management unit. Without a conservation purpose, the plan bears much greater burden in demonstrating social and economic benefit. The predicted benefits are based on theoretical assumptions only and appear to be small when viewed against to costs of plan implementation and policy considerations. The Council must realize that the costs of implementing any new regulations are of primary concern to the Administration. Ultimately, the marginal benefits of changing any Federal fishery regulations or adding to them must be sufficiently large to justify the change.

Some features of the plan appear to make improvements over the existing preliminary fishery management plan, however. We would not like to see any potential improvements lost due to an inability to compromise in other areas. Therefore, we offer what we believe are reasonable alternatives to the proposed management regime.

Sincerely yours,

Mary W Thompson

Roland F. Smith
Acting Director, Office of Resource
Conservation and Management

Enclosure

cc: F/CM, F/CM6(2), F/SWR, SWFC, F/SWR1

F/SWR31:NMFS:JGinter:796-2518:7/17/81
Received via NBI, for F/CM6:C.Bribitzer:7/17/81:sp (ca BillF/lt)
Revised:CBribitzer:7/24/81:plj (d)
Revised:CBribitzer:7/27/81:sp (f)

F/CM6:CB

CRITICAL AND SUBSTANTIVE COMMENTS ON THE DRAFT FISHERY MANAGEMENT PLAN FOR BILLFISH OF THE WESTERN PACIFIC REGION

Critical Comment 1

Need for the plan:

The marginal benefits to be expected by adopting and implementing the plan do not appear warranted in light of their costs.

Essentially, the plan appears to be designed to achieve a transfer of billfish catches from foreign tuna fishermen using longline gear to domestic fishermen. The term "domestic fishermen" includes commercial and recreational fishermen. The conservation and management problem that the plan attempts to alleviate is the incidental catch of billfish by foreign longliners. Theoretically, prohibiting foreign longliners from certain areas of the U.S. fishery conservation zone (FCZ) would result in a greater abundance of billfish in the FCZ and, therefore, greater availability to, and higher catch rates for, domestic fishermen. Ultimately, this would result in desirable development of the domestic billfish fishery, particularly off Hawaii and Guam. As it is currently understood, this is the purpose for which the Council recommends Federal intervention in the form of regulations and restrictions to be imposed on foreign longline fishermen.

This rationale for Federal intervention is considered weak for the following reasons:

A. Although there is an expressed concern for the conservation of billfish, particularly blue marlin, the plan does not consider any conservation measures as alternative management options. This is considered a weakness also in meeting the National Environmental Policy Act (NEPA) and regulatory requirements (see substantive comment 1 below).

B. The projected marginal benefits from implementing the plan are small. Increased catches due to plan implementation probably would be statistically imperceptable when compared to all other sources of variability affecting annual landings. It is doubtful that benefits to domestic fishermen by implementing the plan would be measurable.

C. It is not clear that development of the domestic billfish fishery is necessary and, if it ~~is,~~ that implementing the plan would be the best way to achieve this desired development.

Each of these reasons are discussed in more detail below.

Conservation:

The two points are made on this aspect of the plan's need.

First, no biological conservation is considered by the plan although conservation is considered desirable, particularly for blue marlin and in the FCZ around Guam. Biological conservation, though, is clearly one of the central purposes of the Magnuson Fishery Conservation and Management Act (Magnuson Act). Section 2(b)(3) of the Magnuson Act states one purpose of the Act, "to promote domestic commercial and recreational fishing under sound conservation and management principles" (emphasis added). "conservation and management" is defined ~~in~~ Section 3(2) as measures". . . which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining any fishery resource. . ." Since the plan eschews biological conservation measures, apparently there is no perceived need to "rebuild, restore or maintain" the fishery resource. In fact, the reverse could happen. If relocated foreign fishing continues to catch billfish at or above the same rate they were caught inside the would-be closed areas of the FCZ, and if domestic fishing effort and catch grows to replace or possibly exceed previous foreign catches in the closed areas, then the ocean-wide billfish stocks will suffer greater fishing mortality then they do at present and their overall abundance will continue to decline. This decrease in abundance would probably be evident within the FCZ around Hawaii and Guam as it would elsewhere in the species' wide oceanic distribution. If this happens, little would be achieved by the plan since its short-term gains could not be sustained. Overfishing would not be prevented while achieving optimum yield on a continuing basis (Section 301(a)(1)). The supply of food and other products, including recreational benefits, would not be obtained on a continuing basis (Section 3(2)(B)(i)). Irreversible or long-term adverse effects on the fishery would not be avoided (Section 3(2)(B)(ii)). There would not be a multiplicity of options available with respect to future uses of these resources (Section 3(2)(b)(iii)).

This does not mean that fishery management plans can be approved only for biological conservation purposes. The Atlantic butterfish plan, for example, has fishery development as a key purpose. (More on the development aspect of the plan's need is presented below). However, fishery management plans should not contribute to any existing biological conservation problems of a fishery. This is what this plan appears to suggest, since none of the Magnuson Act's conservation principles seem to be upheld.

Second, the plan's usefulness as a first step toward international cooperation in managing billfish stocks is questionable. The difficulty of effecting meaningful conservation for wide ranging oceanic species such as

underused by U.S. fishermen. The plan indicates a steady increase in domestic commercial landings throughout the 1970s, and the number of domestic longline vessels operating in Hawaii also shows a recent increase (Tables 5.10 and 5.3). Recreational catches are four to five times greater than commercial catches of billfish and have probably increased at a faster rate (Section 5.4.2). Results of the 1979 billfish angler survey indicate an increase in CPUE from 1978 to 1979 of 0.20 to 0.22 billfish per angler day (1981 Billfish Newsletter, J. Squire, NOAA/NMFS, Southwest Fisheries Center). Hence, the domestic billfish fishery, in Hawaii at least, seems to be developing well without the plan. If we assume that ocean-wide foreign longlining effort and billfish catches have remained constant or increased during the time domestic catches also increased, then it seems that developing the domestic fishery any more would put us on a collision course with a serious billfish conservation problem. We do not believe that this is the kind of fishery development contemplated by the Magnuson Act.

For these reasons, on the basis of need only, the plan is vulnerable to disapproval.

Critical Comment 2

Impacts on domestic policy regarding highly migratory species:

The plan would not provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ and would not impose the least burden on such vessels that would achieve conservation and management of billfish covered by the plan. Domestic gains would not balance equitably with foreign losses.

While area closures may be used as management measures in the billfish fishery, closing 30 percent of the FCZ to foreign longline fishing for tuna does not appear to be supported by a demonstrable need to protect a U.S. fishery. The potential loss of tuna to foreign longline fishermen in the proposed closed areas around Hawaii alone is substantial--about 1,500 mt, based on average historical catches (Table 8.2, page 189)--compared to the predicted gains to domestic fishermen. Foreign losses would be real and measurable while domestic gains probably would not be measurable.

The argument (for example on pages 200-202) that foreign longline fishermen could compensate losses from closed areas by shifting their effort to open areas of FCZ or areas beyond the FCZ has only tangential relevence. Even if it could be proved that foreign longliners could make up all their FCZ catches outside the FCZ, we could not use this as a reason to prohibit foreign tuna fishing in the FCZ. The issue is not whether foreign longliners need to fish for tuna in the proposed closed areas of the FCZ (obviously they don't since they haven't since early 1980), but that they have a right to do so. Foreign tuna fishermen may exercise that right, limited only by the extent to which domestic fisheries for other species affected by such foreign fishing require protection.

It follows that the likelihood of increased domestic catches of tuna in the FCZ cannot be used in balancing domestic gains with foreign losses as

required by the NOAA legal opinion (Appendix H). Tuna fishing benefits to domestic fishermen may be accounted for, however, in analyzing the effect of the proposed regulations as required by Executive Order 12291.

Critical Comment 3

The management unit:

The omission of wahoo, oceanic sharks, mahimahi, and any other important species caught incidentally to longline fishing is viewed as a violation of National Standard 3, which requires interrelated stocks of fish to be managed as a unit or in close coordination. Since the plan recommends a major change in the existing PMP for billfish and associated species, billfish management under the plan and separate management of associated species under the PMP would not result in coordinated management of these interrelated stocks as a unit.

The plan claims that mahimahi, wahoo, and some oceanic sharks are very important to domestic fishermen in the Council's area (page 41). It is further illustrated in the plan (e.g., Table 5.11, page 97) that wahoo and mahimahi are a substantial part of the total catch and revenues of domestic fishermen. Therefore, it is difficult to understand why the Council chose to exclude the concerns and interests of fishermen in wahoo and mahimahi (page 41). Also, including these associated species in the plan would increase the marginal benefits expected from plan approval and implementation. It seems likely that a legally defensible and policy supportable statement on optimum yield could be made that would recognize the difficulty of deriving quantitative yield estimates for these species while allowing their inclusion in the management unit.

Substantive Comment 1

Alternative to the proposed action:

The NEPA implementation regulations require that alternatives including the proposed action be considered in environmental impact statements (Section 1502.14 FR 43: 55996).

Since the plan expresses concern and presents evidence indicating that blue marlin and possibly some other species may be overharvested, it seems surprising that the plan does not consider some conservation measures for blue marlin among the alternatives it considers. All of the plan's management alternatives are designed to maximize economic gains to domestic fishermen. To achieve this, the plan intends to maximize the probability of domestic fishermen catching billfish that would have been caught by foreign tuna fishermen. A one-to-one transfer of foreign-caught billfish to domestic-caught billfish is the ideal the plan apparently seeks.

Although the plan more or less recognizes that this ideal cannot be achieved in reality, the fact that the plan seems oriented in this direction belies the fundamental conservation purpose and environmental mitigation aspect any fishery management plan/environmental impact statement should have.

This basic conservation purpose would seem to be a principal reason for "rigorously exploring and objectively evaluating all reasonable alternatives" as required by NEPA (1502.14(a)). Some kind of conservation measures for blue marlin, especially around Guam, would be reasonable alternatives to evaluate (and perhaps eliminate), even if their only advantage was to demonstrate U.S. leadership in this area and form the basis for international cooperation on billfish conservation. By omitting conservation measures for blue marlin, the plan may be considered weak or inadequate as an environmental impact statement.

Substantive Comment 2

Catch data reporting procedures:

The plan's rationale for continuation of State and territorial reporting procedures for domestic fishermen (Section 13.2.2) is contradicted by the proposed additional reporting requirements for the Hawaiian charter boat sector. The proposed logbook system for this sector would be costly to the operators and the NMFS and would result in duplicate reporting of catch data. This is inconsistent with the plan's position on domestic reporting (pages 163; 290-296). The duplication of data collection results from the sale of charter boat catches. Charter boat operators generally sell all or most of the catch not kept by their customers (Section 6.0). Therefore, they are required to submit a monthly catch report of all fish caught under existing State commercial license regulations, whether or not all the catch was sold. The proposed logbook would only duplicate the collection of these data.

Furthermore, it is unclear whether the mandatory reporting of charter boat operations is intended to be a State or NMFS responsibility, and if the latter, whether the proposal is for immediate or future consideration and promulgation by the Secretary of Commerce.

The comments in the previous section exemplify the inadequate specification and documentation of the data needs of the FMP. Substantiation of each data reporting requirement is necessary to allocate scarce data collection resources and satisfy requirements of the Paperwork Reduction Act (P.L. 95-511). The analysis of each reporting requirement should include the need for collecting each type of information and how it will be used to enhance management of the fishery. Throughout Section 13.2.2 the reporting requirements are ambiguous and are not substantiated by specific enforcement impact analysis or research needs.

A related problem in the plan concerns proposed data collection in the future under the Fishery Information Network and through survey samples of the "universe" of fishing vessel owners being established by the Council and the NMFS Honolulu Lab. (page 163). The plan's discussion of these potential data collection methods is inadequate because it fails to consider fully the available alternatives. However, of greater concern is the role the Council has assumed in the area of statistical reporting. The Council is not in the position to select the most statistically reliable and cost-effective data collection methodology. This function is the responsibility of the NMFS with input from the Council and other users. The primary objective of the Council

should be to state specifically the data needed and why they are required for management of the fishery. This distribution of tasks permits a more efficient use of limited data collection resources and helps to minimize the burden of data reporting on fishery participants.

Substantive Comment 3

Lovejoy model:

The Lovejoy model is obviously a keystone in the logical framework of the plan and the recommended management regime. Therefore, the model should be made available as a source document. Clear reference should be made in the plan as to how an interested reader could obtain a copy of the Lovejoy paper. Apparently this paper was not published in the regular scientific literature. Therefore, it is assumed that this paper has not been scrutinized by peer review. Such a review will be performed and/or arranged by NMFS. We will reserve comment on the scientific adequacy of the model and its interpretation in the plan until this review is complete.

Substantive Comment 4

Enforcement cost:

The enforcement costs presented in Section 13.2.1 are not particularly relevant because they were developed three years ago and do not reflect recent changes in costs. More significantly, they do not represent any differences between enforcing the plan and the PMP. It may be that eliminating the non-retention provisions of the PMP would save some incremental enforcement costs, however, surveillance of large closed areas of the FCZ would add expense. Extra surveillance flights would be required to enforce fully a complete closure of the FCZ around the main Hawaiian Islands and Guam. Such incrementally increased (or decreased) costs should be presented. The discussion in Section 13.3 should consider these factors more carefully than is indicated in the plan.

Suggested Alternative:

For the reasons discussed above, there would be some major difficulties with the NMFS recommending approval of the plan as it is now. The problem of rationalizing the need for the plan is especially difficult as long as foreign longline fishermen continue their apparent voluntary abstention from the FCZ. However, the potential problems in trying to enforce the PMP if all permitted foreign longline vessels decided to use their permits within the FCZ could be large and costly. We suggest that a good argument could be made for approving and implementing the plan or amending the PMP if either were designed better to treat these potential problems. These include problems related to the nonretention provision of the PMP, data and fee collection from foreign longliners in the FCZ, potential gear conflict between foreign and domestic fishermen, and conservation.

In general, we commend the plan as an improvement over the PMP in this respect. If permitted foreign longline vessels were to begin using their

permits, the basic idea of open and closed areas of the FCZ would be administratively simpler and more realistic to enforce. The plan would be much more rationally supportable from our perspective if it focused on these kinds of potential benefits rather than on the theoretical assumption that domestic catches will be measurably improved by forcing foreign longline effort further offshore. While this assumption may be correct, at this time there is no substantive evidence on which it can be supported. Hence, we suggest that the plan could be revised by recommending management measures in the following areas:

Retention: Eliminate the non-retention zones in the PMP and require recording of all incidentally caught non-tuna species on foreign longline gear. This plus changing the prohibited species definition, should force foreign longline fishermen to accept an allocation of non-tuna species. Taking an allocation would oblige such foreign fishermen to submit effort plans, catch and effort data, and payment of poundage fees--all of which they can easily avoid under our current non-retention provisions in the PMP. In addition, this would reduce the waste of non-tuna species unlikely to survive being hooked on longline gear and released. It seems conceivable that quotas could be established for such incidentally caught species that would allow foreign fishermen a reasonable opportunity to catch tuna in the FCZ. The only technical problem here is verification of the foreign data reports on non-tuna catches.

Closed areas: We agree that dividing the FCZ into open and closed areas of foreign longline fishing could be more cost effective than the PMP. Meaningful saving could be achieved, however, only if the closed areas were smaller than those proposed in the plan. For example, it would seem reasonable to prohibit foreign longline tuna from areas actually used for domestic fishing. We can envisage the difficulties that would occur for domestic fishermen if the historic foreign longline effort of about 2,300 days per year (page 107) were to resume in the FCZ around Hawaii. Assuming each foreign longline is about 50 miles in length, this effort represents about 115,000 miles of gear each year. If even a small part of this effort was concentrated in favored domestic fishing areas it would probably preempt space and access to non-tuna species by domestic fishermen. A large concentration of foreign fishing effort could impede surface transport, prevent normal trolling and other domestic fishing practices and frustrate legitimate domestic conservation and management programs for non-tuna species. Hence, a reasonable buffer zone could possibly be established beyond normal fishing grounds to insure no interference with domestic fishermen or with any current or proposed conservation and management program.

To use this rationale, the plan should include a more detailed description of actual domestic fishing areas. The following three references may be of use in this regard:

1. Hawaii Fisheries Development Plan, 1979. Note page 13, which states as follows: "Almost all fishing is still done within 20 miles of the main island, where resident resources and migratory stocks are quite limited." This document also provides information on recent fisheries development activities and areas considered for future fisheries development.

2. NOAA Technical Report, NMFS, SSRF-675, 1975. See Yoshida's paper, where he refers to a typical Hawaiian longline boat and states, "The length of a fishing trip averages 8 or 9 days for a Honolulu-based vessel and the majority of the trips are made within sight of the main Hawaiian Islands (Shomura, 1959)." (page 197).

3. Angler's Guide to the United States Pacific Coast, 1977. Particularly note charts 34 (Hawaii), 39 (American Samoa), and 40 (Guam). From a brief overview, it appears most recreational fishing is within 45 miles of Hawaii, 30 miles or less around Guam and American Samoa.

Associated species. The significance to the domestic fishery of other non-tuna species caught in association with billfish is obvious in the plan. Table 5.11 (page 97) demonstrates that the total wahoo and mahimahi catch in 1976 in Hawaii was over half as much as the total billfish catch by weight and over three times the average unit value of the billfish catch. Although to recreational fishermen, these other non-tuna species of wahoo, mahimahi, and shark may not be as desirable to catch as billfish, this is no reason to exclude them from the management unit. Indeed, including these other non-tuna species would substantially add to a supportable rationale for the plan.

Conservation. Conservation measures may be more symbolic than actually effective, but that is no reason to disregard them; it is even conceivable that long-term conservation benefits could be achieved which would benefit domestic fishermen also. Specific conservation measures must be considered carefully. We suggest that, as a start in this direction, the Council consider size limits (perhaps controlled by establishing minimum sized hooks), bag limits, season and/or area closures. Reasons why such measures would be unacceptable or biologically irrational should be clearly stated. Any other conservation measures should be similarly explored in the plan.

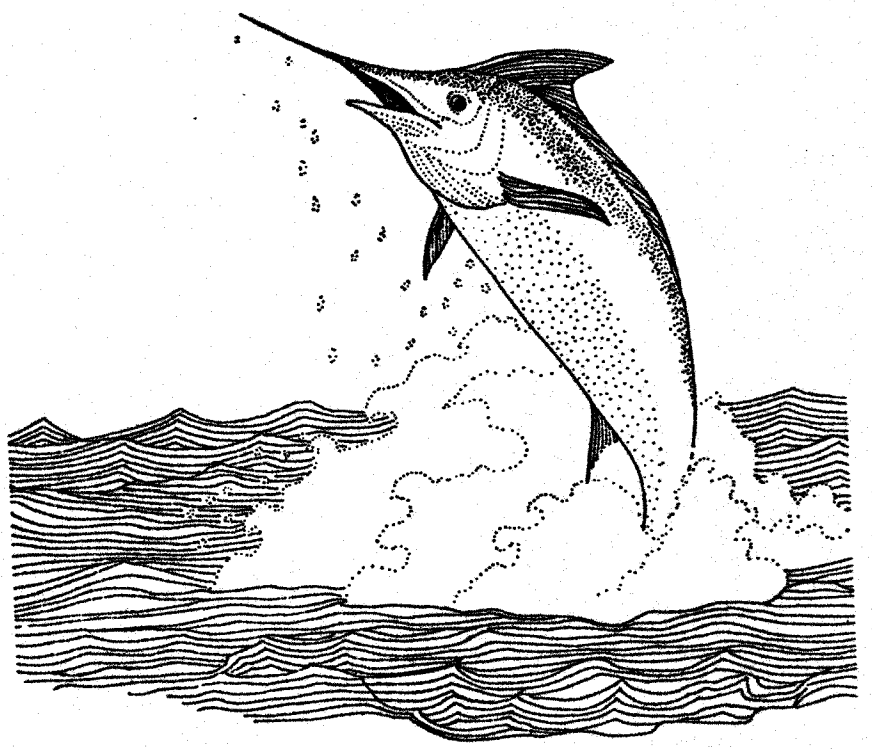
F/CM6:NMFS:CBribitzer:7/23/81:plj(d)
Revised:Bribitzer:7/24/81:plj (d)
Revised:CBribitzer:7/27/81:sp (f) (ca DFMP/CB)

FINAL FISHERY MANAGEMENT PLAN

FOR PACIFIC BILLFISH FISHERIES

OF THE WESTERN PACIFIC REGION

AUGUST 1981



WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

1164 Bishop Street

Honolulu, Hawaii 96813

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1.0 PREFACE TO COMBINED FISHERY MANAGEMENT PLAN (FMP), ENVIRONMENTAL IMPACT STATEMENT (EIS), AND REGULATORY ANALYSIS (RA)

1.1 Title And Location Of Proposed Action

This document presents a final Fishery Management Plan (FMP) for Pacific Billfish Fisheries of the Western Pacific Region. This FMP proposes conservation and management measures applicable to domestic and foreign fishing for billfish in the fishery conservation zone (FCZ) around Hawaii, American Samoa, and Guam. The FCZ is the area around each jurisdiction from the seaward boundary of the state or territory to a line 200 nautical miles from shore.

1.2 Responsible Agencies

The FMP has been prepared by the Western Pacific Regional Fishery Management Council. The Council was established by the Magnuson Fishery Conservation and Management Act (FCMA). The Council consists of members from the State of Hawaii, the Territories of Guam and American Samoa, and U.S. government agencies. The primary function of the Council is development of FMPs for the fisheries in the Council's area of authority to achieve the optimum yield (OY) from the fisheries under sound conservation and management principles. The Council is required to obtain public input in FMP preparation, and a draft of this FMP was previously distributed for public review and comment.

This final FMP is being submitted to the Secretary of Commerce for approval. The National Marine Fisheries Service and U.S. Coast Guard have

general authority to implement and enforce FMPs, and to the extent necessary and appropriate, will do this in cooperation with state and territorial agencies.

For further information, please contact:

Svein Fougner
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1164 Bishop Street, Suite 1608
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or

Doyle E. Gates
Administrator
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National Marine Fisheries Service
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Honolulu, Hawaii 96822
Telephone: (808) 946-2181

1.3 Relationship to Procedural Requirements of Other Planning Laws and Policies

This FMP presents biological, environmental, economic and social information relevant to the billfish management problems faced by the Council. The information and analyses are presented in a manner intended to satisfy FCMA requirements as well as requirements of other laws and policies. Section 4 presents the problems addressed and the need for action through the FMP. Section 5 describes the fisheries for billfish, including a description of the stocks and their habitat (i.e., the physical environment) and a description of domestic and foreign fishing for these stocks (i.e., the social and economic environment). Section 6 summarizes present management programs and research activities. Section 7 discusses the relative advantages and disadvantages of alternative management strategies, while Section 8 provides a deeper analysis and comparison of measures under the most effective strategy for meeting the Council's

objectives. Section 9 sets forth the preferred alternative for the FCZ of the Western Pacific Region including recommendations for federal agency actions to govern fishing for billfish in FCZ areas beyond the Council's authority. Section 10 defines the optimum yield (OY) from the fisheries. Section 11 contains determinations of domestic annual harvest (DAH), joint venture processing (JVP), and total allowable levels of foreign fishing (TALFF) for billfish in the FCZ. Section 12 discusses relationship of the FMP to other laws and policies. Section 13 identifies continuing administrative, enforcement, and research needs. Section 14 contains a glossary defining terms used in this FMP and Appendices, and Section 15 identifies references used in the preparation of this FMP. Section 16 is a summary of comments received on the draft plan and responses to those comments. Section 17 contains Appendices to the plan.

The National Environmental Policy Act of 1969 (NEPA) and associated regulations of the Council on Environmental Quality (CEQ) require that environmental impact statements (EISs) be prepared for major Federal actions significantly affecting the quality of the human environment. The FMP contains the information required to be presented in an EIS, including: the need for and purpose of the proposed action (Section 4); a description of the affected environment (Section 5); the alternatives considered, the impacts of the alternatives, and the rationale for accepting and rejecting alternatives (Sections 7, 8, and 9); and listings of preparers and of agencies and organizations to whom copies of the plan were sent for review (Preface). Procedural requirements of NEPA were satisfied in distribution of the draft FMP, scheduling the public review period, and holding public hearings on the draft plan. A summary of comments received and responses to those comments are presented in

Section 16. This document serves as a final EIS as well as a final FMP.

The Administrative Procedures Act (APA), the Regulatory Flexibility Act, Executive Order 12291, and NOAA Directive 21-24 establish requirements applicable to regulations to implement a FMP. These requirements include an assessment of beneficial and adverse effects of the proposed action, especially with regards to possible impacts on small businesses. The FMP contains all the information required for this assessment, including: a description of the problems addressed (Section 4); a description, evaluation, and comparison of the impacts of the major alternative ways to address those problems (Sections 7, 8, and 9); and an explanation of the rationale for choosing the proposed action (Section 9).

The Coastal Zone Management Act of 1972 (CZMA) requires that Federal agencies' actions be consistent to the maximum extent practicable with approved State and Territory Coastal Zone Management Plans. Section 12 contains proposed determinations of consistency with the programs of Hawaii, Guam, and American Samoa. Copies of the draft plan were sent to the relevant State and Territorial agencies to request their views on the draft determinations of consistency. The State of Hawaii has concurred with the determination. The Territories of Guam and American Samoa have not responded yet.

1.4 Comments and Distribution

The Council encouraged public review of and comment on this plan. Reviewers who offered written comments should note that the Council has summarized and responsed to those comments (Section 16). While review comments did not lead to changes in the proposed action, changes were made in some sec-

tions of the FMP to clarify issues and better describe the reasons for certain decisions.

The draft FMP/EIS was filed with the Environmental Protection Agency (EPA) on May 22, 1981.

The draft FMP was sent to more than 400 individuals, businesses, non-profit organizations, and government agencies, including:

Territory of American Samoa agencies

Territory of Guam agencies

State of Hawaii agencies

Commonwealth of the Northern Mariana Islands agencies

Environmental Protection Agency

U.S. Department of Commerce

U.S. Department of Interior

U.S. Department of State

U.S. Department of Transportation

U.S. Department of Defense

Foreign embassies

National and regional environmental and conservation organizations

National and regional commercial and sport fishing organizations and businesses

Public hearings were held as follows:

Date	Location
June 16, 1981	West Room, Pagoda Hotel, 1525 Rycroft Street, Honolulu, Hawaii, 7:00 p.m
June 17, 1981	Hilo County Council Room, 25 Aupuni Street, Hilo, Hawaii, 7:00 p.m.
June 18, 1981	Kona, Hawaii, 5:30 p.m. (site to be announced).
June 25, 1981	Conference Center, Rainmaker Hotel, Pago Pago, American Samoa, 7:00 p.m.
June 29, 1981	Lihue Library, 4344 Hardy Street, Lihue, Kauai, 6:30 p.m.
June 30, 1981	Conference Room, Kahului Library, Kamehameha and School Streets, Kahului, Maui, 6:30 p.m.
July 11, 1981	Governor's Conference Room, Saipan, Commonwealth of the Northern Mariana Islands, 7:00 p.m.
July 13, 1981	Guam Reef Hotel, Tumon Bay, Agana, Guam, 7:00 p.m.

1.5 List of Preparers

This FMP has been prepared over a period of four years by the Billfish Plan Development Team and the Council Staff. Justin Rutka, Analyst/Planner (economics) for the Council Staff, coordinated the team approach taken in the preparation of this document during the past year. Svein Fougner, Executive Director (natural resources management) also contributed to certain sections of the FMP.

The Members of the Billfish Plan Development Team are:

Mr. Richard S. Shomura, Fishery Biologist
Planning Team Chairman
Director, Honolulu Laboratory, NMFS

Dr. Michael Adams, Economist
Honolulu Laboratory, NMFS

Dr. Steve Amesbury, Fishery Biologist
University of Guam

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2.0 EXECUTIVE SUMMARY

This Fishery Management Plan (FMP) for Billfish Fisheries of the Western Pacific Region proposes a conservation and management program for harvesting billfish in the U.S. FCZ of the central and western Pacific Ocean. The FMP presents management measures and reporting requirements to regulate the take of billfish by foreign longline vessels in the FCZ surrounding Hawaii, Guam, and American Samoa. A complementary management program is proposed for consideration and adoption by the Department of Commerce for the longline fisheries conducted by foreign vessels in the FCZ around U.S. island possessions in the Pacific Ocean. The FMP does not propose controls on domestic fishing activities, but endorses continuation and strengthening of State and Territorial reporting requirements to better monitor domestic participation in the billfish and related species fisheries. The proposed conservation and management program is intended to achieve the optimum yield (OY) for the various billfish fisheries conducted in the FCZ of the Western Pacific Region.

2.1 Proposed Action

The Council proposes to replace the Preliminary Fishery Management Plan (PMP) with this FMP to promote enhancement of domestic recreational fishing experiences and to promote development of domestic commercial billfish fisheries. The FMP would prohibit foreign longlining in approximately 30 percent of the FCZ of the Western Pacific Region. Specifically, foreign longlining would not be permitted in: (1) the FCZ surrounding the main Hawaiian Islands and within 100 miles off of the Northwestern Hawaiian Islands; (2) the FCZ surrounding Guam; and (3) a portion of the FCZ between 14°S and 15°S latitude

and 168°W and 171°W longitude and within 12 nautical miles of any island of American Samoa (Section 9.1).

The Council also proposes that foreign vessels be required to: (a) obtain permits to fish where longlining would be allowed; (b) file effort plans as a condition for obtaining permits; (c) maintain logbooks and submit reports on their catch and effort in the FCZ; and (d) carry observers when so directed by the National Marine Fisheries Service. In developing this plan, the Council considered the possibility of these measures being adopted by voluntary agreements. No such agreements have been reached at this time, but there may be further consideration of this approach in the future.

Quotas and non-retention requirements for billfish, as established by the Preliminary Management Plan (PMP), would be eliminated (Section 6.2). The limitations presently applicable to foreign longlining in the FCZ around U.S. Possessions would also be lifted. Thus, foreign longlining will be less restricted than under the PMP, and compliance with the FMP will be relatively simple. Enforcement of area restrictions will be more cost-effective than enforcement of quotas and non-retention requirements for billfish taken incidentally to fishing for tunas.

Domestic vessels that capture billfish would continue to be subject to existing State and Territorial licensing and reporting regulations.

2.2 Need for the FMP

The FMP is needed to promote the enhancement of recreational billfish fishing experiences and promote development of domestic commercial fisheries for billfish in the FCZ (Section 4.7). The PMP which has been in effect since April

1, 1980, was intended to provide a short-term response to FCMA requirements for a plan to govern foreign fishing while the FMP was being developed. The PMP is inordinately complicated and is having the effect of keeping foreign longline vessels out of the FCZ altogether. The Council believes this unintended adverse effect can and should be mitigated through the FMP, which would liberalize the conditions for foreign longlining considerably. The FMP will promote conservation of billfish in the FCZ (to the extent possible); will promote optimum utilization of billfish resources in the FCZ; will promote development of international agreements for stock-wide management of billfish and tuna consistent with FCMA and Law of the Sea Conference principles; will provide a more cost-effective management program since area closures will be far simpler to monitor and enforce than effort limits, catch quotas, or other such restrictions; and will provide continued opportunities for foreign longliners to maintain historical tuna catches, although certain areas will be closed. In the Council's view, the FMP provides a better basis than the PMP for international negotiations to develop cooperative management programs for billfish and highly migratory tuna throughout their range. The easing of access to the FCZ should be viewed as a demonstration of the Council's and the U.S. Government's interest in maintaining good relations with nations which share the U.S. concern for effective management of fishery resources on the high seas and in the FCZ.

2.3 Rationale

The proposed FMP is intended to achieve optimum utilization of billfish and associated resources in the FCZ, in accordance with the FCMA National Standards.

a) Prevent overfishing while achieving the optimum yield (OY) - The FMP acknowledges that, on a stockwide basis, nothing can be done in the FCZ alone to prevent overfishing. A small portion of total fishing mortality is the result of fishing pressure in the FCZ. Nevertheless, there are conservation (i.e., wise use) benefits to be gained from eliminating the non-retention requirements of the PMP. Meanwhile, the optimum utilization of billfish in some areas is deemed to be domestic utilization; in other areas, optimality is achieved by providing unconstrained opportunity to retain any and all species caught by domestic and foreign vessels.

b) Best scientific information available - The FMP acknowledges the limitations of available data, but the Council believes it has used represents the best scientific information available.

c) Management of a stock or interrelated stocks as a unit throughout its range - The FMP acknowledges that in theory, the management unit should contain mahimahi, wahoo, and possibly sharks in addition to billfish. The Council notes, however, that this national standard is essentially inappropriate to the billfish FMP. First, the FCMA itself excludes tuna, one of the most important components of the pelagic species community to which billfish belong. Second, the FCZ is but a small part of the entire range of billfish and other pelagic species. Third, while the data on billfish stocks and fishing for the stocks are limited, it was possible to derive or obtain information on potential yields, harvest levels, ex-vessel values, etc., for billfish fishing. The data base for mahimahi and wahoo is much more limited, and the basic requirements of the FCMA would be extremely difficult to meet without a substantial delay in plan implementation. Further, it is questionable whether these species, though

pantropical and taken by longliners and trollers, are of the same migratory character as billfish and tuna. The unit, therefore, is restricted to billfish. The Council acknowledges that closures to foreign longlining should offer a degree of protection from foreign overfishing of these other species in the FCZ. As catch data are collected, we should learn more about the relationship between the pelagic community.

d) Discrimination between residents of different states - The plan does not propose any differential licensing programs or requirements for residents of different states. Tourists are major customers of the charter industry which has grown so rapidly in recent years, and out-of-State fishermen are encouraged to participate in the fishery.

e) Promote efficiency in utilization of fishery resources - The limited evidence available indicates there will be increases in domestic catch rate around Hawaii's main islands as a result of the closures. Increased catches by U.S. vessels in American Samoa and Guam also are likely. At the same time, foreign longliners in open areas will be permitted to retain all billfish caught at all times; they will not be required to discard dead fish or to release a billfish by cutting the line or leader while the fish is in the water. Thus, both domestic and foreign interests should become more efficient under the FMP than at present.

f) Allow for variations and contingencies - Year to year availability and vulnerability of billfish in the FCZ vary considerably. The FMP cannot control this in any way. However, by restricting the potential for considerable interception of billfish by foreign longliners in the FCZ, the FMP is intended to maximize the potential for good domestic catches in high abundance years, and

minimize the chance of poor domestic catches in low abundance years.

g) Minimize costs and avoid duplication - The FMP proposes a more cost-effective approach than the PMP to manage foreign fishing; and proposes that current state and territory management of domestic fishing be maintained. Thus, Federal costs will decrease relative to the PMP, and there will not be duplication of effort.

2.4 Alternatives Considered

The Council considered a large number of alternatives in selecting the proposed action (Sections 7 and 8). These alternatives include different management strategies (combinations of measures) and different area closure combinations. The alternatives were found to offer less chance of achieving the objectives of the plan.

Continued reliance on the PMP was rejected because the PMP would have undesirable effects whether or not foreign fishing occurs. If foreign fishing occurs, there would be a waste of billfish, enforcement burdens would be extremely high, and compliance by foreign vessels would be difficult. There could be gear conflicts, and there would be little likelihood that domestic catches and catch rates will increase. On the other hand, while domestic vessels are benefiting from the de facto closure of the FCZ under the PMP, this total closure is unwarranted. Some of the constraints on foreign longliners can and should be reduced so that a reasonable opportunity to fish for tuna in the FCZ is maintained.

Amendment of the PMP and regulations could address some of the concerns

about unneeded limitations on foreign vessels, but there are drawbacks to this approach. First, this would take a considerable amount of time, since the FCMA, NEPA, and other laws would require developing new draft and final documents for public review. This would essentially duplicate what the Council has already done, with no apparent gain in the ultimate decision. The implementation of the amended PMP would involve a long delay and high costs. Second, an amended PMP will not provide a basis for addressing domestic fishery problems if any arise. Preparation and implementation of an amendment to an existing FMP is much more likely to proceed rapidly than preparation, approval and implementation of a new FMP.

Alternative FMP strategies considered include limits on foreign catch, limits on foreign effort, area closures, and combinations of catch/effort area limits. The common failing of catch and effort limits is the difficulty of establishing reasonable limits and of implementing or enforcing those limits. An effective foreign catch or effort quota system invariably leads to a requirement for at-sea enforcement and high levels of observer coverage on foreign longliners. The area involved is so large, and there are so many vessels involved, that numerical quotas are almost impossible to enforce. In addition, there is extreme difficulty arriving at appropriate quotas, by area, by species, in a mixed species fishery. The prospect of a wasteful non-retention approach is unacceptable to the Council. The Council concluded that area closures, with removal of catch limits and reduction in observer coverage would be the best, most cost-effective approach to follow.

The Council explored in considerable detail a very large number of area closure alternatives (Sections 8 and 9). It is the Council's judgment that any

closures smaller than those proposed would not provide sufficient benefits to and protection of domestic interests and would not promote "optimum use" of billfish in the FCZ to the extent possible. Small area closures also could result in gear conflicts. Larger area closures would likely not result in significantly larger catches for domestic fishermen but could seriously affect foreign tuna catches in the FCZ. The proposed area closures will promote conservation to the extent possible in the FCZ; will promote optimum utilization of billfish in the FCZ by domestic and foreign vessels; will provide a reasonable opportunity for foreign vessels to maintain (or even increase) their tuna catches in the FCZ; and can be effectively patrolled and enforced with available resources.

The Council concluded that no restrictions on fishing activities are justified or necessary for ecological, economic or social reasons. It would be irrational to control the billfish catch by domestic fishermen in the absence of international cooperation when the catch by U.S. fishermen is such a small fraction of ocean-wide catches. Domestic fishermen would suffer with no measurable improvement in billfish stock productivity. In fact, billfish stocks in the FCZ are relatively underutilized by domestic fishermen, who have the capability and desire to take all billfish historically taken by foreign longliners. Further, domestic fishermen clearly place a much higher value on billfish in the FCZ than do foreign vessels.

There are no economic or social conflicts in the domestic fishery that need to be resolved under the FMP at this time. Charter, trolling, and ika-shibi fishing efforts have expanded rapidly in recent years, and there is occasional crowding around fish aggregating devices; but this is not a severe

problem warranting management controls at this time. There is no indication that significant economic or social gains would accrue from any allocations of fish or fishing space to different domestic fishery sectors. Further, monitoring and enforcing such allocations would be quite costly. All domestic vessels will be free to allocate their effort in the most efficient way possible. The Council will assess the status of the fishery annually to determine whether actions are necessary to address domestic user conflicts.

2.5 Determinations in the FMP

The FMP acknowledges the limitations of available data for accurate assessments of billfish stocks throughout the range of the various billfish species in the Pacific. The Council concludes that maximum sustainable yield (MSY) levels for the various species of billfish on a Pacific-wide basis are as derived by the Billfish Stock Assessment Workshop (Shomura, 1980) and as presented in the PMP (Section 5.1.5).

The optimum yield (OY) for billfish in the FCZ is defined in non-numerical terms. The large annual variability in abundance of billfish in the FCZ, the uncertainty of predicting responses by foreign fishermen to the measures proposed in the FMP, and the inability to accurately forecast catch rates by foreign and domestic vessels all militate against a useful, numerical determination of OY. Therefore, OY is defined as "the amount of billfish that will be caught by domestic and foreign vessels fishing in accordance with the measures contained in this plan" (Section 10).

The total allowable level of foreign fishing (TALFF) is likewise defined in non-numeric terms (Section 11.4). Almost all billfish caught by

domestic fishemen will either be sold through established local channels, or be directly consumed by family and friends of local fishermen. There is virtually no processing of domestic billfish catches in Hawaii, Guam, and American Samoa. Therefore, the amount of billfish available for joint venture processing (JVP) with foreign vessels is zero.

2.6 Benefits of the Proposed Action

Conservation - The FMP will not have a measurable effect on the condition of billfish stocks throughout their range. If foreign effort shifts from the FCZ around the main Hawaiian Islands and Guam to the open areas around the NWHI, a slight decrease in foreign catch of blue marlin will occur, and domestic catches of blue marlin will likely increase. The FMP will, however, be beneficial in eliminating the risk of waste of billfish resources associated with the PMP. The FMP will contribute to conservation in the "wise use" sense of that word.

Optimum yield - The FMP will promote optimum utilization of billfish resources in the FCZ. Domestic charter and sport/commercial trolling interests in Hawaii and Guam place extremely high values on billfish in general and blue marlin in particular. Domestic longline and handline fishermen in Hawaii place high values on striped marlin and swordfish, which now may contribute as much as 10-20% of total catch value in the ika-shibi fishery. Increased effort is moving into the FCZ around the NWHI and Guam rapidly, and the relative importance of billfish to domestic fishermen is greater than to foreign longliners. Around American Samoa, optimum utilization is achieved when domestic interests are protected in the closed area relatively near shore, and when longliners

delivering tuna to the American Samoa canneries are given relatively free access to billfish in waters farther from shore. There is no significant domestic fishery, around U.S. Possessions, and optimum utilization may be achieved if fish are available to foreign longliners throughout that part of the FCZ. In the Council's view, the pattern of use likely to occur under the FMP will result in optimum utilization of billfish in the FCZ.

Domestic fishery values - Domestic catches of billfish in the FCZ will increase under the FMP, but catches alone are an inadequate measure of the values associated with the FMP. The economic and social values associated with the recreational fishery are enormous, as reflected in the willingness to pay very high costs and to invest large amounts in vessels and gear to pursue billfish. Tournaments are becoming larger and more numerous, with participants from all over the world. They would not participate if there were not a reasonable likelihood or expectation of catching fish. The FMP will not guarantee an increase in catch rates, but will assure that everything possible in the FCZ alone is being done to maximize the chances for successful sportfishing opportunities. Limiting the risk of foreign longline interceptions of billfish in the FCZ will maximize the potential for increased domestic catches and ultimately increased recreational fishery values.

Similarly for commercial fishermen, the FMP will provide a greater likelihood that billfish will be available for harvest as their vessels become more active in waters far from shore around Guam and the main Hawaiian islands, along the NWHI chain, and in the closure zone around American Samoa. In the Council's view, it is especially important for vessels in a developing fishery to achieve high catch rates while they are learning the most effective fishing

patterns and techniques in new areas. Without high enough catch rates, there will be insufficient economic incentive to continue or even expand the fishery, and there will be insufficient information to determine fishery potentials and migratory patterns for billfish and related stocks in the FCZ. The proposed closures will assure that as much is being done in the FCZ as possible to give domestic fishermen a reasonable chance to achieve high catches.

Foreign fishing - The FMP will provide greater opportunities for foreign fishing in the FCZ than does the PMP. Quantitative limits on billfish catch will be eliminated. Not only can catches be maintained at or even above historic levels, but access to the FCZ will be less restricted by observer requirements or the requirement to release billfish by cutting fishing lines. The cost of foreign operations will be less than under the PMP. Available data indicate that foreign longline vessels are highly mobile, are not reliant on the FCZ for a substantial portion of their catches, and receive higher prices for striped marlin, swordfish, and bigeye tuna than for blue marlin and yellowfin tuna. Foreign catch rates for striped marlin, swordfish and albacore tuna are generally higher around the NWHI than around the main Hawaiian Islands, while bigeye tuna catch rates are almost identical. Therefore, while the main islands FCZ closure may result in a change in species composition of the catch, the total catch and total revenues can be maintained or even increased if average total effort from the Hawaii FCZ are directed to the open area around the NWHI, assuming no change in catch rates (see Table 9.4).

The dominant billfish species taken by foreign longliners around Guam is blue marlin, while yellowfin tuna are the dominant tuna species. However, the total billfish to tuna catch ratio is about 1 to 13, which is the same ratio

as in the entire Pacific Ocean area between 120°E to 180° and 0° to 20°N. Also, the tuna catch rate along the Norther Marianas archipelago is not much less than around Guam. This suggests that a shift out of the FCZ around Guam - which is actually a very small part of the total U.S. FCZ - would not materially affect foreign catches and net catch values.

Enforcement and administration - The FMP will be much simpler management program than the PMP. Area closures can be patrolled effectively by aircraft; vessel requirements will be minimal. Elimination of foreign quotas and non-retention provisions will greatly reduce monitoring requirements (e.g., observers), will simplify compliance with the FMP, and should promote accurate reports of catch and effort. The requirement to file effort plans will facilitate efficient deployment of surveillance flights and personnel efficient administration of the vessel permit program and processing of subsequent foreign catch reports. The effort plans will indicate to NMFS and the Coast Guard when vessels will be operating in different areas and when catch reports will be due from different sources. A cooperatively developed observer program should result in less fear by longliners of being forced to carry observers on all trips, and will allow observer placements on the types of vessels best suited for such coverage.

Other ecological impacts - To the extent foreign longlining is shifted away from sea turtle breeding grounds (e.g., French Frigate Shoals), the risk of interception of turtles in the FCZ may be lessened. The requirement for foreign vessels to report incidental taking of or interactions with sea turtles and marine mammals will add to the information base on this matter. Similarly, there will be reduced likelihood of foreign gear and debris being lost or dumped

in the FCZ. Whether there would be a decrease in the amount of gear or debris washed up on Hawaii, Guam or American Samoa beaches is impossible to predict. The extent to which there will be a change in foreign or domestic catches of wahoo, mahimahi or sharks in the FCZ cannot be predicted. Historic catch levels and catch rates in different areas are not well-documented. It appears, however, that wahoo and mahimahi are generally associated more with nearshore waters (i.e., 50-100 miles) than with the high seas. If so, the relocation of foreign effort will result in decreased foreign catches, and marginally greater abundance to domestic fishermen. The total impact on the stock(s) would probably be slight or insignificant.

International implications - the Council maintains that the proposed FMP provides a sound starting point for international agreements to manage billfish and highly migratory tuna in the central and western Pacific. In the Council's view, the FMP is consistent with the FCMA and with the Law of the Sea Conference (LOS) informal negotiating text on fisheries. The LOS negotiations enjoin all states involved in exploiting shared stocks (i.e., those ranging beyond or across economic zones) to "cooperate directly or through international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region..." (Article 64). However, no institutional structure nor ground rules are provided. One can presume that the general premise of the text requiring the coastal state to be responsible for the conservation of the fisheries (Article 61) and to promote the optimum utilization of the fishery resources (Article 62) should apply unilaterally in the absence of agreements for international cooperation. The Council strongly urges the Department of State to initiate negotiations to

achieve international agreements with distant water longline fleet nations, and proposes that the FMP be adopted while such agreements are being developed. In the Council's view, the FMP liberalizes foreign longliners' access to the FCZ and thus serves as a firmer basis for negotiations than did the PMP.

In summary, the FMP is intended to improve domestic recreational, commercial and subsistence fishery values. The areas most important to domestic vessels will be reserved for domestic use. Gear conflicts with foreign vessels will be precluded in these areas. Domestic fishing effort is expected to increase in response to these measures. Foreign vessels will have a reasonable opportunity to fish for tuna in the FCZ. Effort and catches will be relocated to open areas without limit or to the high seas. No significant effects on total foreign catches in the FCZ or in the Pacific are expected.

The FMP will not have a measurable impact on the overall health and productivity of billfish stocks. There is not likely to be any impact on endangered and threatened species as a result of the proposed action. There will be no irreversible or irretrievable commitments of resources made under this plan, nor will there be any unavoidable adverse effects which would require mitigation. The plan is not expected to affect uses of energy on other depletale resources by domestic or foreign vessels. The plan is believed to be consistent with the coastal zone management plans of Hawaii, Guam, and American Samoa.

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4.0 INTRODUCTION

4.1 Goal of Billfish Fisheries Management in the FCZ

The goal of the Council is to secure the approval and implementation of a billfish fisheries management regime that will achieve optimum yield of billfish resources in the FCZ by domestic and foreign vessels; will be cost-effective to administer and enforce; and will provide a sound basis for negotiating international agreements for conservation and management of billfish, highly migratory species of tuna, and other pelagic fishery resources throughout their range.

4.2 Objectives of the FMP

4.2.1 To promote the growth of domestic billfish harvests and domestic fishery values in the FCZ.

4.2.2 To enhance the opportunity for successful recreational fishing experiences for billfish by domestic fishermen.

4.2.3 To improve the opportunity for domestic commercial fishermen to engage in profitable fishing operations.

4.2.4 To enhance the marketability of sportfishing charter-boat services.

4.2.5 To promote domestic processing and marketing of billfish in lieu of foreign processing and marketing of billfish in Guam and American Samoa.

4.2.6 To eliminate waste of billfish and other fish taken incidentally to tuna on foreign longline gear.

4.2.7 To diminish the risk of domestic/foreign gear conflicts in the FCZ, and to preclude the possibilities of its occurrence in known areas of concentrated domestic fishing.

4.2.8 To the extent consistent with the above objectives, to minimize interference with foreign tuna fishing in the U.S. FCZ, with special regard for the need to maintain deliveries of tuna to American Samoa canneries.

4.2.9 To improve the statistical base for better stock assessments and for better future decisions to conserve and manage billfish resources throughout their range.

4.2.10 To promote international/regional management of highly migratory species throughout their range as long as domestic fishery benefits under this plan are maintained or enhanced.

4.2.11 To conserve billfish resources to the extent practicable in the FCZ while international agreements are being developed.

4.3 Relationship Between Objectives

The Council recognizes that the objectives are to some degree mutually exclusive. To provide maximum potential for the growth of domestic billfish fisheries, for example, would require total elimination of foreign longlining from the FCZ to eliminate the potential for interception of billfish in the FCZ.

This would, however, result in maximum interference of foreign longline fishing for tuna in the FCZ, could seriously impact on the willingness of foreign longliners to continue deliveries of tuna to American Samoa canneries, and could result in a curtailment of the flow of foreign catch data to the U.S. On the other hand, if minimal controls on foreign longliners were established, the potential for successful domestic fisheries and increased catches would decline, while the risk of gear conflicts would increase. The proposed FMP attempts to strike a balance between these objectives to the extent they are in conflict.

Objectives 1-5 reflect the Council's view that billfish in the FCZ generally are underutilized by domestic fishermen, and that transfers of catch from foreign longliners to domestic vessels will generate substantial increases in the economic and social values of the billfish fisheries. Domestic interests have the ability and desire to harvest a larger number of billfish than are now taken. Domestic recreational and commercial fisheries have expanded greatly in recent years, and further expansion is likely. Newer commercial vessels have longer range and better equipment to catch and maintain fish at sea in a high quality condition. The rapid increase in the overall level of recreational fishing effort and in the number of tournaments and catches of billfish in tournaments attests to the rapidly growing importance and value of the recreational fishery. The value of the fisheries by far exceeds the ex-vessel value of the catch. The PMP does not provide adequate protection for domestic fishery interests and will not promote higher values from the domestic fisheries. Foreign longline vessels can operate under the PMP throughout the FCZ with limits only on retention of billfish, not on hooking or killing of billfish. The majority of billfish released by longliners would probably not be available

to domestic vessels, since released billfish usually are dead or moribund. Also, foreign longlines can be set anywhere in the FCZ, with possible gear conflicts or with the result of discouraging domestic fishing in an area to avoid gear entanglement. Domestic fishermen also may avoid fishing in areas where foreign longline gear has been set because they will expect low catch rates in such areas. Thus, the PMP does not assure a high probability of increased domestic catches and subsequent enhancement of domestic fishery values. The FMP is intended to redress this situation.

Objectives 6 and 11 reflect the Council's concern that the FMP should result in wise use of the billfish resources in the FCZ. First, elimination of the non-retention approach is critical to avoid waste. Where billfish are taken, they should be retained and used unless there's a high probability of their survival after release. The PMP can result in substantial waste of billfish. Second, while there is little that can be done in the FCZ alone to control fishing mortality to improve or maintain healthy billfish stocks, relocation of longline gear from areas of high blue marlin incidental catches to areas of lower incidental catches may be marginally beneficial. The FMP can signal foreign interests about the Council's and U.S.' concern about billfish stocks; and so far as the FCZ is concerned, the FMP may result in slight decreases in blue marlin mortality.

Objective 7 is intended to assure that U.S. fishermen will not suffer gear damage or losses as they fish in new areas. This is not assured by the PMP. While there has not yet been any foreign longlining in the FCZ under the terms of the PMP, foreign vessels are continuing to obtain permits and could enter all parts of the FCZ. A foreign longline may be 50 or 60 miles long, and

even a small number of longlines can cover and effectively foreclose domestic fishing in large areas of fishing grounds. The Council believes action is needed to provide certainty that foreign-domestic gear conflicts will not occur.

Objectives 8, 9, and 10 recognize the international concerns related to billfish fishery management. First, the Council notes that foreign longliners have a conditional right to pursue tuna in the FCZ under the FCMA. The PMP, however, is having the effect of keeping foreign longline vessels entirely out of the FCZ. The Council believes action is necessary to provide a reasonable opportunity for longliners to fish in the FCZ with less red tape and less cost. The Council believes some relocation of foreign effort to different parts of the FCZ is preferable to closure of the FCZ. Second, the Council recognizes the importance of continued foreign longliners' tuna deliveries to American Samoa. The PMP apparently is viewed by American Samoa-based longliners as being too difficult to comply with, and the flow of data is being affected to some degree. Liberalized access to the FCZ around American Samoa may benefit these interests considerably. Third, international cooperation is necessary for effective protection against overfishing of billfish throughout their range. The de facto closure of the FCZ under the PMP does not provide a climate which is conducive to such agreements. The Council's view is that action under a FMP to give greater longlining opportunities in the FCZ will be more effective in generating international negotiations between the U.S. and other nations. Meanwhile, by allowing more freedom for foreign longlining, a FMP can promote the flow of data for stock assessments, determination of migration patterns, and other analyses for improved management.

The Council also is concerned with the potential cost of administration

and enforcement of the management regime ultimately chosen. The Council is of the size of the FCZ in the central and western Pacific and of the limited NMFS and Coast Guard resources available for enforcement. The PMP to date has not generated any unusual enforcement or administrative costs. Foreign permit processing and data collection activities in NMFS are in place. Regular Coast Guard surveillance flights have occurred with no significant deviation and with no additional costs due to PMP requirements, since there has been no documented foreign longlining in the FCZ. The Council must point out, however, that the PMP would be either unenforceable with current resources, or horribly costly to enforce, if foreign longliners were to enter the FCZ in several areas at once. The Council believes that a more cost-effective approach must and can be established under the FMP. Enforcement activities could be targetted to specific areas of the FCZ for the most efficient deployment of available resources. The billfish fishery management program should pose less need for increased enforcement budgets and achieve greater coverage current budgets.

In conclusion, the Council has adopted a set of objectives which are consistent with the Council's management goal, with the FCMA, and with established U.S. policy regarding highly migratory species of tuna. The objectives reflect the Council's view that the FMP can significantly enhance domestic fishery values and can effect changes needed to correct the weaknesses of the PMP.

4.4 Framework for Consideration of the FMP

4.4.1 Effects of the PMP

The PMP is, and was intended to be, a means to control

foreign longlining in the FCZ until the Council's FMP can be put in place. The PMP was not intended to be a long-term answer to the dilemma posed by the FCMA in relation to U.S. tuna management policies. It was originally anticipated the PMP could be a relatively short-term, short-lived, and simple response to the immediate problem of managing billfish harvests by foreign vessels in the FCZ. The very first approach considered by NMFS was a series of area closures to eliminate the risk of gear conflicts in waters used heavily by domestic fishermen. This simple approach was rejected because of concerns for FCMA requirements and prevailing U.S. tuna policies. The PMP strategy turned out to be a complex of quotas, non-retention zones, advance notification by foreign vessels of intentions to enter the FCZ to fish, and other complicated provisions (Section 6.2).

The effect of the PMP has been different from the intended outcome. There has been no documented foreign longlining in the FCZ since shortly after the PMP went into effect. Large numbers of foreign longlining permits have been obtained, but none has been used. Foreign longliners have effectively been shut out of the FCZ. This is neither necessary nor desirable. While this may maximize gains to domestic fishermen, it also maximizes disruption of traditional foreign longlining patterns in the FCZ. The Coast Guard and NMFS still must make random flights throughout the FCZ to check for illegal entry. There has been no disruption of longliners' tuna deliveries to American Samoa canneries, nor of foreign longliners' port calls in Honolulu and Maui to obtain fuel, equipment, and supplies; these activities continue despite the PMP. There is no flow of data on foreign fishing in the

FCZ, and foreign data on fishing elsewhere are limited and delayed. There have been informal discussions with Japanese tuna federation officials concerning possible voluntary abstention from certain areas, but no formal negotiations to develop international agreements for management of billfish and tuna fishing in the central and western Pacific have been held.

In short, the PMP may in theory provide a reasonable opportunity for foreign longlining for tuna in the FCZ, but the conditions associated with that opportunity - permits, quotas non-retention, observers, reporting, etc. - are such that foreign fishing is not occurring. The Council FMP will achieve a better outcome for all participants.

4.4.2 Geographic Context

The Council's present area of jurisdiction is the FCZ around Hawaii (648,000 square miles), American Samoa (75,000 square miles), and Guam (60,000 square miles). However, the Council's area should not and cannot be looked at in isolation. The following points are important:

1. Foreign longliners and baitboats operate throughout the Pacific (63,800,000 square miles). Total annual average catch of billfish in the Pacific by longliners, 1973-1977, was more than 56,000 metric tons (MT); the total longliners' annual tuna catch was more than 245,000 MT (Table 5.20). Only about 1.3 percent of the billfish and about 2.2 percent of the Pacific Ocean tuna was taken in the U.S. FCZ

of the Western Pacific Region, including U.S. Possessions (Palmyra, Kingman, Wake, Jarvis, Johnston, Howland-Baker) and the Commonwealth of the Northern Mariana Islands (CNMI). At the same time, average annual tuna catch by baitboats was about 553,700 MT; less than 2% of that amount was taken in the U.S. FCZ of the Western Pacific Region.

2. The PMP establishes conservation and management measures for the full FCZ. The FMP will only have an immediate, direct effect around Hawaii, American Samoa, and Guam; but if a degree of regional consistency is to be achieved, the FMP and amendments to the PMP should be considered as a package. The Council includes in this draft FMP recommendations for NMFS to amend the PMP to achieve such consistency.

3. Billfish and tuna stocks range throughout the Pacific. As a result, the extent to which the harvest is controlled in all or any parts of the FCZ will have virtually no effect on overall stock sizes. At the same time, there is not much apparent difference in annual catch per unit effort rates within and outside the FCZ for many species. Thus, to the extent foreign longlining might be allowed only in certain parts of the FCZ, it is evident that those vessels could catch equal amounts of fish with equal value in other parts of the FCZ or beyond the FCZ with current levels of effort.

4. Most U.S. vessels in the Council's Region fish for billfish exclusively within the FCZ. They are either not of a size capable of ranging vast distances, or they prefer to stay within striking range of home islands, or they are unable to find crew members

willing to stay at sea for long periods. Domestic vessels, for whatever the reason, are almost totally dependent on the FCZ for their billfish catches.

The Council has attempted to maintain a regional and, to some extent, an oceanwide perspective in this plan.

4.4.3 Legal Context

There is no disagreement about the authority of the U.S. to exercise exclusive management control over foreign longlining for billfish in the FCZ. Billfish are "fish" under the FCMA. Foreign longliners, though presumably pursuing highly migratory species of tuna (which are not subject to U.S. authority), catch large numbers of such non-tuna species as blue and striped marlin, swordfish, and sailfish. Unknown amounts of mahimahi, wahoo, and sharks also are taken. Longliners take "fish", and their activities in the FCZ are subject to U.S. management authority. This was established by NMFS in preparing and implementing the PMP.

The degree of control which can be exercised in any individual situation, however, is essentially a judgmental call. The National Oceanic and Atmospheric Administration (NOAA) has provided legal guidance on how to reach conclusions or judgments in each situation. In a legal opinion, NOAA concluded that:

> A billfish management plan may contain management measures which affect foreign longline fishing for tuna in the FCZ, including area closures and season or gear restrictions, if the measures will (1) provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ and (2) impose the least burden on such vessels that will achieve conservation and management of the billfish covered by the plan... [R]egulation of the foreign longline take of billfish must be carried out so that it does not constitute the exercise of exclusive jurisdiction over tuna fishing.[1/]

Several points are worth noting. First, it can be inferred from the opinion that absolute control over longline fishing for tuna was equated with "exclusive jurisdiction over tuna fishing". That is, the opinion implies that management measures cannot be so restrictive that longlining (i.e., tuna fishing) is prohibited in the area covered by the plan. This reflects the fact that the opinion was prepared in response to questions raised by East Coast and Gulf of Mexico interests. Foreign longlining is the only form of foreign tuna fishing in the FCZ in those areas. There, any control over foreign longlining would in fact be control over foreign tuna fishing.

In the central and western Pacific FCZ, however, foreign baitboat vessels are very active and catch twice as much tuna as foreign longliners. Even with the price differentials for skipjack tuna considered (Table 5.22), the baitboats' FCZ catches almost equal the longliners' FCZ catches in total value. Therefore, in the Council's view, even absolute prohibition of foreign longlining in the Western Pacific FCZ would not constitute "exclusive jurisdiction over tuna fishing".

1/ See Appendix H for full text; emphasis added by the Council.

Second, the Council does not propose to prohibit foreign longlining in the Western Pacific FCZ. The Council recommends that there be minimal limits or controls in more than 70% of the FCZ. In the Council's view, these proposals provide a reasonable opportunity for foreign longliners to fish for tuna in the FCZ, impose slight burdens on foreign longliners, and do not constitute the exercise of exclusive jurisdiction over tuna fishing. Tuna fishing by selective gear may be conducted at any time and place in the FCZ (seaward of 12 miles from shore).

Another side of the "legal framework" that must receive equal attention is the FCMA mandate to achieve "optimum yield" (OY) from the fishery. The Act defines OY as the amount of fish "which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities" (Section 3(18)). Under the Act, domestic fishermen are to have priority access to fish in the FCZ. There is little apparent benefit to the U.S. if foreign longliners are granted free access to areas which are or may be important to U.S. fishermen. "Optimum utilization" is domestic utilization in the FCZ. There is no apparent loss to foreign longliners if their activities in those areas are curtailed, because they would be given more liberal access to other FCZ areas. The Council is proposing a geographic shift of longlining in the FCZ rather than a prohibition. Domestic fishermen would then have priority to fish for billfish in waters most important to them, consistent with the FCMA mandate.

4.4.4 Inter-Fishery Aspects

The Council is aware of concern that this FMP could somehow be taken as a precedent by other nations to prohibit U.S. tuna fishing in those nations' exclusive economic zones. The Council does not believe that this FMP constitutes a basis for such action. This plan is not a veiled attempt to exercise exclusive jurisdiction over tuna fishing in the FCZ. Selective tuna-fishing techniques such as pole-and-line fishing and purse seining would be permitted throughout the FCZ. Only longline gear would be subject to control in certain areas to limit the incidental take of non-tuna species. Large parts of the Western Pacific FCZ would remain open to foreign longline fishermen subject to minimal permit and reporting requirements.

Foreign fisheries generate revenues in Hawaii, American Samoa, and Guam. Local services supply foreign longline vessels with fuel, foodstuffs, and recreational opportunities for the crews. No figures are available for the net benefits derived from these services in each area. The plan is not expected to affect these activities in any way.

Foreign longline vessels' tuna deliveries to American Samoa canneries are critical to the canneries operations. Other than the rectangular closure proposed, the FMP would give foreign longliners unlimited access to the FCZ around American Samoa. Tuna deliveries should not be affected by this plan.

Nations claiming authority to exercise exclusive jurisdiction

over tuna in their economic zones will continue to do so regardless of action on this plan. Those nations are not seeking ways to justify their actions under their domestic laws. The risk that this plan will be "precedent-setting" appears to be low.

4.4.5 Enforcement and Administrative Feasibility

The capabilities of NMFS and the U.S. Coast Guard to patrol and enforce fishery regulations in this vast ocean area are limited. The U.S. Coast Guard has two high endurance cutters, two buoy tenders, three patrol boats, three C-130 aircraft, and two helicopters available in Hawaii; one buoy tender and one patrol boat to patrol Guam and the CNMI; and one utility boat in American Samoa. Ships and planes are subject to occasional redeployment to other areas (e.g., Alaska) to address serious problems as they arise. These vehicles are used for a variety of enforcement programs as well as for search and rescue efforts. The vast distances involved in the billfish fishery make it very unlikely there could be substantial at-sea enforcement capability.

This illuminates a major weakness of the PMP. Quotas and non-retention requirements for foreign fishing vessels are impossible to enforce without on-scene observers or a large increase in Coast Guard vessels to inspect foreign fishing vessels at sea. An observer program can be useful, but the large numbers of vessels that can potentially get involved in the fishery militate against wide use of observers. Even if only a small number of foreign longline fishing vessels entered the FCZ in different areas at approximately the same time, the surface enforcement capability of the Coast Guard would in

all likelihood be insufficient to verify compliance with catch quotas or non-retention procedures under the PMP. This does not imply criticism of NMFS or U.S. Coast Guard capabilities. It simply demonstrates the need to consider a simpler, more cost effective enforcement plan.

While the closure of ocean areas by the FMP does not remove the requirements for the Coast Guard to patrol these areas, the patrols could be conducted by aircraft instead of surface vessels. Since U.S. Coast Guard aircraft carry NMFS observers as part of their surveillance patrols, the documentation of violations by foreign fishing vessels could easily be substantiated. Aerial photographs taken of the foreign fishing vessels in the act of fishing (as defined in the FCMA) could effectively document such violations. This documentation could be used in the civil penalty process.

Consideration of the Council's alternative management option in this plan involves evaluation of the relative simplicity and effectiveness of enforcement regimes which in effect mandate the stretching of enforcement assets to meet a substantial challenge in the Billfish Fishery (Section 13.3). The management option of area closures best utilizes the enforcement capabilities of U.S. Coast Guard and NMFS to achieve consistent and intensive enforcement of the Billfish FMP (Adm. B.E. Thompson, pers. comm.). Enforcement cost-effectiveness will be greatly improved under this FMP.

4.5 Limitations of the Data Base and Analytical Tools

The FCMA requires, among other things, that each FMP "be based on the

best scientific information available" (Section 301(a)(2)). Ideally, each FMP should contain complete and accurate descriptive data on the stocks; the fishing for the stocks; the nature and magnitude of impacts of alternative management measures on the stocks and the fishermen; and the anticipated benefits and costs (quantified) of the proposed management regime relative to a "no action" alternative and to other management regimes. The "best scientific information available" for this FMP and the analytical tools for assessing impacts are insufficient for such an exhaustive evaluation.

The practical difficulties presented by this situation can be understood by the following examples of the impact of not having such data or tools:

1. There is no statistical base from which to draw conclusions on likely foreign longlining patterns in response to different management approaches. This makes it extremely difficult to estimate possible benefits or costs of alternative approaches. The analysis and comparisons in chapter 8 imply that foreign longliners could "lose" varying amounts of tuna under different options. As pointed out earlier, however, catch rates in and outside the FCZ are quite comparable, so what is likely to happen is that longlining effort and catch will be relocated. There may be a slight shift in total catch, or in catch by species, with some impact on total value of catch and operating costs. Changes in costs of fishing or in catches, however, will most likely be slight. Appendix T presents comparisons of foreign longline catches under alternative management strategies and catch assumptions. Foreign longliners' tuna catches in the FCZ remain at comparable levels in almost all cases except when longliners voluntarily abstain from fishing in the FCZ. There is, however, no

evidence to indicate whether effort shifts will in fact occur.

2. If billfish are migrating toward domestic fishery areas, and if those fish are caught by foreign longliners before the fish arrive at domestic fishery areas, then those fish cannot be caught by U.S. fishermen. If the number of fish in a domestic fishing area is increased, and assuming catchability remains constant, then domestic catches will increase, and the values associated with the domestic fishery will increase. The value increase may or may not be proportional to the catch increase depending on the timing and location of the catch and the fishery sector making the catch. Ideally, the Council should have information or analyses that present the level and values of such "transfer" effects of alternative closure options. Unfortunately, such information and analyses are not available.

The first attempt to quantify potential catch shifts of blue and striped marlin from foreign longliners to domestic longliners and trollers in the FCZ around Hawaii, depending on different closure alternatives, was made by Lovejoy (1977). The "Lovejoy model" was based on information available at the time about stock levels, migration patterns, and foreign longline catch and effort. A large number of assumptions had to be made concerning relative abundance, catchability coefficients, seasonal variations of abundance, etc. (see Appendix U). The model estimates the relative changes in density of blue and striped marlin from one area to the next, leading to estimates of fish transfer amounts over time. Assuming relatively fixed fishing areas and effort levels for recreational and commercial fisheries, estimates of changes in domestic catch associated with changes in foreign longline catch in the FCZ are derived. The estimates derived in the model are that domestic recreational

trollers' blue marlin and striped marlin catches would increase by 2% and 7% respectively if foreign longlining were eliminated in the FCZ around Hawaii.

The Lovejoy model continues to be the most cohesive scientific information available on the possible transfer effect, but the model has been subject to a variety of criticisms. These range from the validity of the assumptions to the statistical significance of the results. Therefore, although sophisticated in its mathematics, the model is of limited value in assessing the impacts of options under the FMP. First, the model is only one view of the possible relationship between foreign catch and effort and domestic catch and effort for only two species of marlin. An equally valid view is that there is a range of possible transfer effects from no transfer (zero effect) to total transfer. Thus, if foreign longliners on average harvested 300 MT/year (1973-1977) of migrating billfish in the FCZ around Hawaii, and if foreign longlining in the FCZ is prohibited, then domestic vessels in the FCZ could potentially harvest 300 MT more billfish. The actual amount depends on whether or where foreign vessels relocate, the extent to which fishing outside the FCZ may intercept the same fish, and the susceptibility of those fish to capture by domestic vessels. The range of possible transfers is zero to 300 MT, or up to 40% of the estimated total domestic catch of billfish in 1976 (Table 5.21). This second approach is more plausible when the explosive growth of the recreational fishery, the recent increases in ika-shibi and longline fisheries, and the emergence of the NWHI fisheries are considered. Domestic fishery capabilities in Hawaii clearly have grown rapidly since 1977. The model is essentially not suited for assessment of transfer effects in a dynamic setting.

Second, the model does not attempt to address and incorporate the

values associated with the increased domestic catch in different fisheries, at different times or in different places. As pointed out in Section 5.4.5, if there's a 20% increase in blue marlin catch at a major tournament, it will probably generate a much higher value (per fish) than an average 20% increase in blue marlin catches for Hawaii as a whole. The value is not solely in the ex-vessel value of the fish but in the total economic value of each component of the fishery. For commercial fishermen, a 10% increase in striped marlin or swordfish catch in the NWHI may make the difference between a viable new fishery or no fishery. The Lovejoy model, however, deals only with averages over the full Hawaii FCZ, not with components of the region's fisheries.

Third, and most important, the central conclusion - that a transfer effect will occur - must not be forgotten in a preoccupation with the estimated quantitative level of transfers in the Hawaii FCZ for two species. The transfer effect is equally important in Guam and American Samoa. Note that in 1977 around Guam, foreign longliners took at least 87 MT of blue marlin. Given the small area of the FCZ around Guam, most of which is to the south, and assuming a south-north-south migratory route, it is logical to conclude that domestic catch rates and fishery values will increase when longlining is prohibited.

Thus, the Lovejoy model is helpful in understanding qualitative or directional catch effects of closures, but is not definitive in determining either the amount or value of transfers which would result from different closure options. The Council has recommended research to study this further.

3. The available information on the domestic fisheries is limited. value. In part this reflects the fact that before passage of the FCMA, it was not judged all that important to maintain accurate records of catches. In part

it reflects the relatively limited resources available for data collection in the Council's region. The result is that interest in, and the social and economic values of, domestic billfish fisheries are essentially understated. Gross, absolute dollar value of total domestic billfish and tuna catch in the FCZ does not provide an effective measure of this importance any more than the dollar value of foreign billfish and tuna catch in the FCZ represents the net economic value and relative importance of the FCZ to foreign fishing interests. As indicated earlier, domestic fishermen are essentially dependent on the FCZ; foreign longliners are able to and do go all over the Pacific and do not appear to be at all reliant on the FCZ.

In summary, the "best scientific information available" is of limited value in practical terms. The attempts in this FMP to quantitatively assess the trade-offs of different management options must be recognized as having a statistically weak foundation. The normative aspects (reasonableness, equity, fairness) and judgments must be recognized as having equal if not greater validity than the quantitative measures.

4.6 Achieving a Balanced Approach

The FCMA establishes the basis for recognizing both the priority of managing and developing domestic fisheries and the maintenance of the U.S. policy on highly migratory species of tuna. The Council proposes to achieve a balance by giving priority to domestic fishing interests in areas where domestic vessels are active and on which they are or may soon be dependent; maintaining free foreign access to highly migratory species in all parts of the FCZ by gear types which are selective in taking tuna; providing controlled access to tuna in

some parts of the FCZ by longline gear which inevitably takes non-tuna species; and liberalized access for foreign longliners to fish in the FCZ of U.S. Possessions. In the Council's view, the management approach proposed achieves this balance in that:

The plan maximizes the potential for enhancing the overall values of domestic recreational fisheries.

The plan promotes the growth of domestic commerciall billfish fisheries, especially in off-shore waters and the NWHI.

The plan provides a reasonable opportunity for foreign vessels to fish for tuna in the FCZ and to maintain their historical levels of tuna catch.

Foreign tuna fishery interests are not subject to unnecessary controls.

The management approach is relatively simple and easier to enforce than the PMP because of a tighter geographical focus and closures rather than quotas.

4.7 Data Sources

4.7.1 Data on Domestic Fishing

Hawaii - Estimates of Hawaii catches and sales of billfish and associated species and the associated sales revenues in 1976 were made by Cooper and Adams (1978). They were derived from a survey undertaken for the NMFS by Research Associates, Inc. (1977). Time series data (1973-1977), limited to reported commercial billfish catches, were compiled from commercial monthly catch reports collected under the auspices of the Hawaii Division of Fish and Game. Reported commercial catches are part of the data bank maintained by the Honolulu Laboratory of the NMFS. Two major gaps in the data base are unreported billfish sales and the recreational/subsistence catch. Social and eco-

nomic data are very limited.

American Samoa - Estimates of local billfish catches were provided by the Office of Marine Resources, Government of American Samoa. Only the most recent two years are included. Social and economic data relating to billfish are not available.

Guam - Catch estimates for 1979 and early 1980 were provided by the Aquatic and Wildlife Resources Division, Government of Guam and the Guam Fishermen's Cooperative. Social and economic data specific to billfish fisheries are essentially unavailable.

Preliminary data from NMFS' National Recreational Fisheries Survey are of unknown reliability, but have been included in some sections as indicative of more recent catch and effort data.

4.7.2 Data on Foreign Fishing

Yong and Wetherall (1980) summarized and tabulated available information on estimated nominal effort and catch of billfishes and tunas in the foreign longline fishery conducted within the United States FCZ in the central and western Pacific during the period 1965-1977.

The estimates of foreign longline catch and effort presented by Yong and Wetherall were based on a variety of statistical sources. Data were extracted from unpublished records of Japanese longline nominal fishing effort (number of hooks and days fished) and the resulting catches of billfish and tunas (number of fish) by month and 1° squares

of the Pacific Ocean overlapping the United States FCZ around Hawaii, American Samoa and Guam during the years 1971-1975.

Another source used by Yong and Wetherall was the Japanese longline statistics given by 5° squares throughout the entire range of the Japanese fleet in the Pacific for 1962-1977. These statistical summaries are published in the "Annual Report of Effort and Catch Statistics by Area on Japanese Tuna Longline Fishery" by the Fisheries Agency of Japan.

The Taiwan Fisheries Bureau made available monthly statistics on catch of billfish and tunas (number of fish and weight of fish) and effort (hooks fished) by 5° squares fished by Taiwanese longline vessels throughout the range of the fleet.

Data were available from the data base maintained by the Southwest Fisheries Center's Honolulu Laboratory on the foreign longline fishery based at Pago Pago, American Samoa.

The estimates presented by Yong and Wetherall (1980) are incomplete since they do not include data on operations of Korean longline vessels other than those based at American Samoa. Korean longliners are known to operate in all areas of the FCZ, and while catch and effort data are available, Yong and Wetherall declined to include them in their report because of unresolved problems with the accuracy of the data.

4.7.3 Biological Data Sources

Most of the relevant biological data for billfish have been summarized in the Summary Report of the Billfish Stock Assessment Workshop (Shomura, ed., 1980). Additional information was gleaned from the many sources listed in References (Section 15.0). There are major gaps in life history, migration patterns, and stock structure information.

There is insufficient information to quantify the expected impacts with precision and exacting confidence. In addition, the lack of data on stock structure, life history, and migratory patterns makes it impossible to determine accurate and reliable yield potentials in the FCZ and for stocks on an oceanwide basis. Research needs have been identified in Section 13.4.

5.0 DESCRIPTION OF FISHERY

5.1 Stocks in the Management Unit

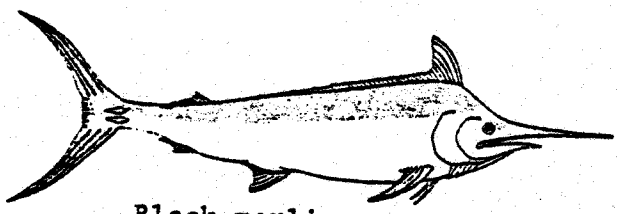
5.1.1 Species Included

The management unit consists of six species of billfish. The term billfish collectively embraces the broadbill swordfish, taxonomically placed in the family Xiphiidae; and spearfish, sailfish, and the various marlins, all placed in the family Istiophoridae. Billfish in general are called a'u in Hawaiian and sa'ula in Samoan. The various species of billfish are referred to by their common names in Guam.

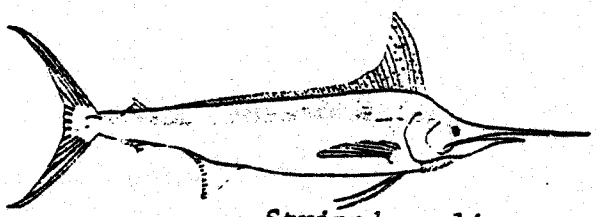
The management unit species are sketched in Figure 5.1. They are listed below by common and scientific names and, if available, by local names.

		Local Name	
Common Name	Scientific Name	Hawaii	Samoa
1. Blue marlin	Makaira nigricans	a'u	sa'ula
2. Striped marlin	Tetrapturus audax	a'u ki	sa'ula
3. Black marlin	Makaira indica	a'u	sa'ula
4. Swordfish	Xiphias gladius	a'u ku	sa'ula
5. Shortbill spearfish	Tetrapturus angustirostris	a'u	sa'ula
6. Sailfish	Istiophorus platypterus	a'u lepe	sa'ula lele

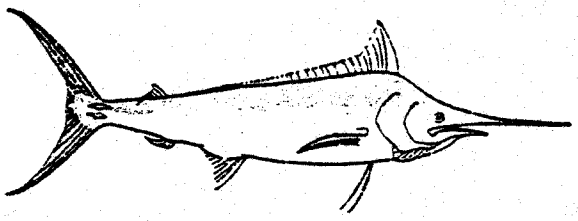
FIGURE 5.1 MANAGEMENT UNIT SPECIES



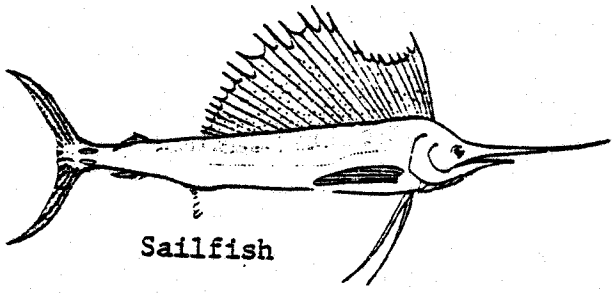
Black marlin



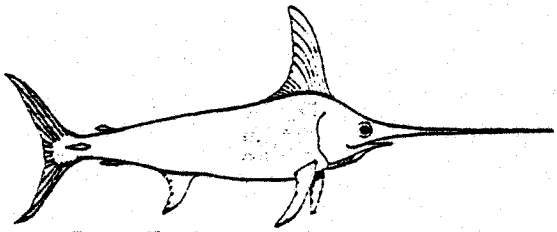
Striped marlin



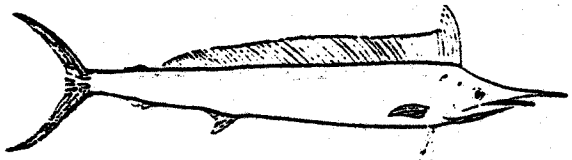
Blue marlin



Sailfish



Broadbill swordfish



Shortbill spearfish

5.1.2 Incidental Species in the Fishery

Mahimahi, or dolphinfish (Coryphaena hippurus and C. equiselis); ono, or wahoo (Acanthocybium solandri); and oceanic sharks are taken incidental to domestic and foreign fishing for billfish and tuna in the FCZ. These species also are included in the management unit under the PMP. They are not included in the management unit for this FMP for several reasons.

1. The Council does not believe there is sufficient information at this time to satisfy FCMA requirements relative to these species. Estimates of MSY cannot be derived, stock structure and the condition of stocks are unknown, and catches and catch values have not been determined. The foreign fisheries do not record the volume of incidental catch in aggregate or by species, and domestic recreational and commercial catch records are incomplete. It will take time to get reasonably accurate data on these aspects. The Council proposes that better catch information be reported by foreign and domestic fishermen for these species.

2. In the absence of good catch and values information, analyses cannot be made of the potential impacts of alternative management strategies in terms of mahimahi, ono, or shark catches. The Council has identified research needs to facilitate such analyses when more data become available.

3. The conservation and management measures for billfish fisheries are likely to provide some protection against overfishing of

these incidental species in the FCZ. Conservation and management measures for these other species do not appear to be as critically needed at this time. The Billfish FMP is needed and should not be delayed. If and when sufficient information is available, the Council will develop an appropriate amendment to the Billfish FMP or will develop a separate FMP for mahimahi and ono.

5.1.3 Ecologically Related Species

Billfish generally occupy the same epipelagic habitat as the highly migratory species of tuna. Billfish can also occur with the oceanic sharks, mahimahi, and, to a lesser extent, with wahoo. All of these species form a complex of pelagic predators.

The young of these species are prey for all predators that inhabit the upper surface layer of tropical and subtropical oceans. The adults of these species are opportunistic apex predators. Although there are differences in food intake, such as the ability of large marlins to ingest larger specimens than the other predators can, these predatory fish essentially compete for the same food.

Many species of fish and squid are common to the diets of the members of this predatory complex. At times, tuna species may constitute more than 85% of the blue marlin food. Although there are commonalities in the occurrences of the pelagic predators, there is no conclusive evidence of any direct associations and relationships among these pelagic finfish species.

5.1.4 Life History

5.1.4.1 Fecundity

Billfish are all highly fecund, pelagic spawners, producing large numbers of eggs. The number of eggs per spawn are estimated to range from a low of 1.8 million for sailfish to a high of 29 million for striped marlin (Table A-1 of Appendix A). Fertilization is external. Fertilized eggs hatch quickly and the larvae subsist for only a few days on the nutrients stored in the yolk sack. Larvae then survive by foraging on planktonic organisms. The larval survival rate has not been measured but is assumed to be low. It takes from three to seven years for billfish to reach sexual maturity. Table A-2 of Appendix A provides estimates of age and size of first spawning for Pacific billfish species.

5.1.4.2 Areas and Seasons of Spawning

Knowledge of areas and seasons of spawning for billfish is sketchy. Areas and seasons of spawning are briefly summarized for each of the management unit species. This does not preclude the possibility of spawning in other areas or seasons not mentioned below:

1. Blue marlin. Pacific blue marlin appear to spawn throughout the year in tropical and subtropical waters, 10° to 20° on either side of the equator. In higher latitudes, up to 30° on either side of the equator, blue

marlin spawn during the northern and southern hemispheres' respective summer months. The highest spawning densities generally occur in the western Pacific, with the density decreasing eastward (Strasburg, 1970; Matsumoto and Kazama, 1974; Rivas, 1975). Larvae are most commonly found in surface waters of 26-29°C (Howard and Ueyanagi, 1965; Matsumoto and Kazama, 1974; Ueyanagi, 1964; Jones and Kumaran, 1964).

2. Striped marlin. In both the northern and southern hemisphere, spawning takes place in early summer months of each hemisphere respectively (Howard and Ueyanagi, 1965; Kume and Joseph, 1969).

3. Black marlin. Spawning takes place in October and November in the northwest Coral Sea (Ueyanagi, 1960), and is believed to take place in other areas inhabited by the species.

4. Broadbill swordfish. Spawning occurs throughout the year in equatorial western Pacific (Nishikawa and Ueyanagi, 1974) and eastern Pacific (Kume and Joseph, 1969) waters. At higher latitudes, spawning takes place in spring and summer (Matsumoto and Kazama, 1974; Uchiyama and Shomura, 1974).

5. Shortbill spearfish. Spawning season is unknown. Spawning probably occurs in the western north Pacific and eastern south Pacific (Figure A-1 of Appendix A).

6. Sailfish. Spawning occurs throughout the year in tropical waters of the western Pacific near coastal areas (Figure A-2 of Appendix A). In the north Pacific at high latitudes, spawning takes place in summer (Ueyanagi, 1964; Eldridge and Wares, 1974).

5.1.4.3 Age and Growth

Length-weight relationships for Pacific billfish have been determined by various investigators; they are summarized in Table A-2 of Appendix A. Results of growth studies are presented in Table A-4 of Appendix A. Age estimates are suspect since age determinations for billfish species are difficult to make. Nevertheless, the best estimates of billfish size (length and weight) with age are given in Appendix A.

5.1.5 Distribution, Stock Structure, and Probable Condition of Pacific Billfish

5.1.5.1 Distribution

Billfish are widely distributed throughout the tropical and subtropical oceans. Some billfish species are pantropical in that they occur in the Atlantic, Indian, as well as the Pacific Ocean (Figures B-1 through B-6 of Appendix B). Some billfish are generally regarded as being as highly migratory as some of the pelagic tunas, though there may be considerable variation among billfish species in

the degree of wandering and in the degree of localized concentrations between stocks at certain times.

There is currently very little evidence (e.g., recapture of tagged individuals) of billfish migrations across the Pacific. Migrations are hypothesized largely on the basis of shifting abundance patterns of the fish as derived from foreign longline catch data.

Blue marlin distribution varies seasonally. A high concentration of blue marlin is found in the western and central south Pacific during December-March, and another in the central north Pacific during May-October. During April-November a high density of blue marlin is found in the equatorial region between lat. 10°N and 10°S (Rivas, 1975). In the eastern Pacific, blue marlin have been observed in relatively heavy concentrations west of long. 100°W between lat. 20°S and 13°N (Kume and Joseph, 1969), but they are generally not an important item in eastern Pacific fisheries.

Striped marlin are distributed in the Pacific in a U-shaped band (Figure B-4 of Appendix B) with the base along the Central American coast (Nakamura, 1974). The open ends of the horseshoe pattern extend to Asia in the north Pacific and to Australia in the south Pacific. In the eastern Pacific, striped marlin range from Chile to southern California with major areas of concentration off Mexico. In southern California, striped marlin appear mainly between

August and October. Fish tagged off southern California and Mexico have been captured on longline gear in the vicinity of tagging off Baja, California and out to about 900 miles south and 200 miles southwest of the Hawaiian Islands (Squire, 1974). In Hawaii, striped marlin are taken in greatest numbers from fall through spring.

Black marlin are most abundant in the western and southwestern Pacific around Taiwan and northwest Australia and in the East China, Arafura, Sulu, Celebes, and Coral Seas. Catch rates in the tuna longline fisheries show a very low population density throughout the open ocean except for certain coastal areas. In the eastern Pacific black marlin are found predominantly off Panama and Ecuador (Nakamura, 1975). They are occasionally taken around the Hawaiian Islands and off Guam, and are more frequently taken in American Samoa waters.

Swordfish occur mainly from California to Chile in the eastern Pacific, throughout the central Pacific and from Japan to Australia and New Zealand in the western Pacific. In California swordfish are most abundant in the summer and early fall. Swordfish taken in the California harpoon fishery are suspected to be members of the same stocks fished by foreign longliners further south in the eastern Pacific, since the harpoon fishery sometimes lands swordfish bearing longline hooks. In Hawaii, swordfish are usually most

plentiful during the spring months. Most of them are taken by commercial longliners, though sport-caught fish can be taken on live, whole, and cut bait while drift fishing at night.

Shortbill spearfish are found throughout the tropical and subtropical Pacific. They generally appear in offshore areas beyond the FCZ and are not abundant close to shore.

Sailfish are found throughout the tropical and subtropical Pacific. In the western Pacific the highest concentrations are found around New Guinea, the Caroline Islands, the Solomons, and in the Banda, Timor, and East China Seas (Koto et al., 1959). In the eastern Pacific sailfish are concentrated near the coast from the Gulf of California to northern Peru (Kume and Joseph, 1969). Some sailfish are taken around Hawaii by sport and commercial fishermen, and by recreational fishermen in Guam and American Samoa.

5.1.5.2 Stock Structure

Although information on stock structure is of primary importance in formulating a management plan for any species, there are virtually no hard data on stock structure for any Pacific billfish species at present. Instead, prevailing views of stock structure must be based on: distribution of adults derived from catch data and distribution of

larvae, analysis of life history characteristics, assessment of morphometric characteristics of individuals from different localities, searches for locality-specific parasites which serve as biological markers of populations, mark-recapture studies of tagged individuals, and analyses of genetic similarities and differences of individuals captured from different areas.

Foreign records of longline catch and effort are the only presently available data sources for attempting to define the geographical range of the billfish stocks comprising the management unit. Preliminary conclusions on possible stock structures of Pacific billfish populations were made by the participants of the Billfish Stock Assessment Workshop (Shomura, ed. 1980). Very briefly, they are summarized as follows:

Blue marlin:	An equatorally-centered Pacific-wide stock or separate north and south Pacific stocks with possible intermixing across the equator.
Striped marlin:	One Pacific-wide stock or separate north and south Pacific stock with intermixing in the eastern Pacific.
Black marlin:	Western and eastern Pacific stocks or three stocks (northwest Pacific, southwest Pacific and eastern Pacific).
Swordfish:	A Pacific-wide stock or possibly three separate stocks (northwestern Pacific, south Pacific and eastern Pacific).

Shortbill spearfish: North and south Pacific stocks.

Sailfish: Eastern and western Pacific stocks.

The best currently available scientific information seems to indicate that billfish species can only be managed for biological reasons as migratory species with a stock structure covering wide areas of the Pacific. Present information appears to suggest that none of these species is sufficiently localized at all stages of its life cycle to be managed as a stock specific to the FCZ of Hawaii, American Samoa, or Guam.

A single Pacific-wide stock of blue marlin has been assumed by the participants of the Stock Assessment Workshop in their production model analysis and by this FMP. There has not yet been confirmation of this assumed stock structure. Electrophoretic studies for Pacific blue and striped marlin are being undertaken by Shaklee and Brill (1980), with Council support, to determine whether or not multiple subpopulations or stocks of Pacific blue and striped marlin exist, and to determine the genetic characteristics and geographic boundaries of such stocks if different stocks do indeed exist.

The possibility of distinct stocks or subpopulations implies both genetic divergence and reproductive isolation. Direct measures of genetic similarity and differences to test for stock heterogenecity of blue and striped

marlin throughout the Pacific range of the species are clearly necessary for detecting and defining the geographic limits of such stocks.

5.1.5.3 Probable Condition of Pacific Billfish Stocks

Present Condition

The most recent report available on the condition of the Pacific blue marlin stock considers it to be overfished at present. Yuen and Miyake (1978) reported that the present longline fishing effort is about twice that suitable for maximum sustainable yield. Because the catch per unit effort of Pacific blue marlin has steadily declined over the past 10 years, in spite of a fairly constant level of effort, Yuen and Miyake (1978) reported "...that continued fishing at high levels will continue to reduce the abundance of the stock and a recruitment failure will become a distinct possibility."

The level of fishing effort for the other species of billfish is judged to be generally at or somewhat below what is necessary to take the MSY, and stocks are believed to be generally healthy. There is some evidence, however, that striped marlin populations, on an ocean-wide basis, may be starting to show a general decline as is the case with blue marlin (Section 9.3).

Estimate of Future Stock Condition

The billfish species covered by the management unit are migratory and transit the U.S. FCZ seasonally. At any given time, the largest part of the population(s) of any of these species occurs outside of the U.S. FCZ, and the vast majority of the fishing effort for any of these species also occurs outside of the FCZ. As a consequence, any management regulations for these species affecting fishing only in the U.S. FCZ should have virtually no detectable effect on the populations over their complete range.

The workshop analysis of the Pacific blue marlin stock indicated that this stock has been overfished since the early 1960s and that continued fishing at high levels could further reduce the abundance of the stock. For striped marlin, in a Pacific-wide perspective, the analysis indicated that the stock could, perhaps, provide increased yields by imposing a modest increase in fishing effort. Although the data did not allow a production model analysis for black marlin, the substantial decline in catch rates from the early 1950s to 1975 suggests that a very large increase in total catch over recent levels is probably not sustainable in the long-run. Swordfish stocks in the Pacific appear to be capable of sustaining increased yields with increased effort. For sailfish, the analysis of catch rates for the western Pacific stock suggested that any increase in effort probably

will not result in a substantial increase in catch. For the eastern Pacific stock of sailfish it is possible that an increase in effort will result in a slight increase in catch. Finally, any increase in effort should result in an increase in the catch of shortbill spearfish.

From a more localized perspective, domestic billfish catches in the FCZ could be reflective of the general condition of the stocks throughout their entire range or serve as indicators of their annual availability in local waters. Domestic catches can be expected to increase as the level of participation continues to increase. Domestic catches are influenced by seasonal and annual fluctuation in billfish availability in local waters attributable to environmental factors and the availability of prey.

At present, domestic fishers exploit only the part of the resource which migrates into the near vicinity of the islands. Measures proposed in this FMP are not expected to have any significant measurable effect on the future conditions of the stocks throughout their range. The risk of domestic overfishing of billfish under this FMP will be extremely low.

5.1.6 Maximum Sustainable Yield (MSY)

There are special problems in attempting to define MSY for billfish in the Pacific Ocean. First, very few data are available on

growth rates, natural mortality, reproduction, and other determinants of population dynamics. Second, most billfish are caught in association with tuna fishing by longline gear, and changes in the set up or deployment of gear, in fishing strategy, and in availability and vulnerability of billfish to changes in fishing patterns may result in changes in CPUE rates. Third, certain data on total catch are not available, for example, the total weight of billfish taken by foreign inshore or coastal fisheries on gear other than longline. Fourth, there is very limited, direct evidence concerning stock distribution. Fox (1975) discusses several other critical assumptions of the production model, suggesting that their application to billfish stocks must be considered as extremely weak and tentative.

On the basis of all the data available, the Stock Assessment Workshop made Pacific-wide estimates of MSYs for blue marlin, striped marlin, and swordfish. The lack of accurate and sufficiently detailed data on effort, catches, and other determinants of population dynamics for Pacific black marlin, shortbill spearfish, and sailfish precluded the use of fishery production models for estimating the MSY for these species. The Council concludes that the MSY estimates for black marlin, shortbill spearfish and sailfish as presented in the PMP are the best information available. Table 5.1 presents ocean-wide estimates of MSYs for all Pacific billfish species. A summary of information used to determine the MSY for each species is presented in Appendix C.

TABLE 5.1

PACIFIC-WIDE ESTIMATES OF MAXIMUM SUSTAINABLE YIELD (MSY) FOR BILLFISH

Species	MSY and Optimum Effort	Probable Stock Condition
Blue Marlin	22,000 MT1/	Substantially Overfished
Striped Marlin	24,000 MT1/	Fished At Capacity
Black Marlin	1,700 MT2/	Fished Near Capacity
Swordfish	20,000 MT1/	Good
Shortbill Spearfish	8,200 MT (combined)2/	Good
Sailfish		

SOURCES: 1/ Shomura, R.S. 1980

2/ PMP

5.2 Ecological Relationships

5.2.1 Other Finfish

Besides food chain relationships, there are no known critical ecological connections between billfish and other pelagic finfish. Actions in the FCZ under this plan are unlikely to result in any changes in the predator-prey relationships in this complex. Relative to the oceanwide distribution of these species, the FCZ is a small area, and the amount of fish taken is correspondingly small. The FMP should result in partial shifts in harvest from foreign to domestic interests; however, the total harvest amounts will not be substantially changed in relation to stock sizes and their ocean-wide distribution.

5.2.2 Marine Mammals and Endangered and Threatened Species

Table 5.2 lists marine mammals and endangered and threatened species which are resident in or are occasionally observed in the FCZ. There is no information indicating a direct relationship between the billfish species and the cetaceans or turtles listed or albatross. Sea turtles have been reported as being taken on longline gear on occasions (D.E. Gates, pers. comm., Jan. 13, 1981). There have been reports of porpoise taking bait and hooked fish off the lines of domestic trollers and deep-sea handline fishermen (R.T.B. Iversen, pers. comm., May 23, 1975). There is no documentation of incidental take of marine mammals in the foreign longline or baitboat fisheries.

TABLE 5.2 MARINE MAMMALS AND ENDANGERED AND THREATENED SPECIES RECORDED IN THE FCZ OF THE WESTERN PACIFIC REGION

Scientific Name	Common Name
*Megaptera novaengliae	(humpback whale)
Balaenoptera edeni	(Bryde's whale)
*B. physalus	(fin whale)
*Physeter catodon	(sperm whale)
Orcinus orca	(killer whale)
Pseudorca crassidens	(false killer whale)
Steno bredanensis	(rough-toothed dolphin)
Stenella longirostris	(Hawaiian spinner dolphin)
S. attenuata	(spotted dolphin)
S. caeruleoalba	(striped dolphin)
Tursiops truncatus	(bottlenosed dolphin)
Feresa attenuata	(pygmy killer whale)
Kogia sp.	(dwarf and pygmy sperm whale)
Peponocephala electra	(melon-headed whale)
Globicephala macrorhynchus	(short-finned pilot whale)
Grampus griseus	(Risso's dolphin)
Ziphius cavirostris	(goosebeak whale)
Mesoplodon densirostris	(densebeak whale)
*Monachus schauinslandi	(Hawaiian monk seal)
+Chelonia mydas	(green turtle)[1/]
*Eretmochelys imbricata	(hawksbill turtle)[1/]
*Dermochelys coriacea	(leatherback turtle)[1/]
*Diomedea albatrus	(albatross)

*endangered species + threatened species [1/](Joint NMFS-FWS jurisdiction)

No areas have been designated as "critical habitat" for endangered species in the FCZ covered by this plan.

5.3 Habitat of the Management Unit

5.3.1 Present Habitat Conditions

A general description of the habitat occupied by billfish is presented in Appendix D. Billfish are widely distributed throughout the tropical and, in some cases, the temperate Pacific Ocean. The range of distribution generally extends to between 40-45°N. latitude and 40°S. latitude (Shomura, 1980). Habitat conditions in the central and western Pacific Ocean are generally of high quality. There are few sources of pollution, and there is no information to suggest that billfish populations have been affected in any way by pollution or habitat modification.

5.3.2 Habitat Protection

There are many Federal and State laws and regulations to protect habitat conditions in FCZ areas under U.S. jurisdiction and to control U.S. vessels' waste discharges on the high seas. There are fewer such controls on foreign vessels on the high seas. However, within the FCZ, foreign vessels must conform with U.S. regulations governing waste discharges.

5.3.3 Probable Future Habitat Conditions in the Absence of a Plan

Normal fishing activities within the FCZ and on the high seas

from foreign vessels are likely to occur whether or not this FMP is in place. Fishing activity will continue to be widely separated as the foreign vessels fish throughout the Pacific. Insignificant environmental "effects" due to domestic fishing will occur almost exclusively in the FCZ. Domestic fishing is increasing in the Northwestern Hawaiian Islands (NWHI), and thus the chances of oil spills, wrecks, and entry onto HINWR islands will increase. This could be more than offset by decreased activity by foreign longline vessels in the FCZ. In general, habitat conditions throughout the FCZ are expected to remain favorable for billfish well into the future with or without the PMP or FMP.

5.4 Domestic Fisheries

5.4.1 User Groups

The primary domestic users of billfish in the Western Pacific Region are longline fishermen, commercial troll fishermen, charter boat operators and their customers, and recreational/subsistence trollers who may sell a part or all of their catch to defray trip expenses.

5.4.1.1 Domestic Longliners

5.4.1.1.1 Description of Vessels, Gear, and Species Landed

In 1980 there were 22 longline vessels operating in Hawaii - 19 based at Honolulu and 3 at the Big Island of Hawaii. Most of these vessels are Hawaii-style wooden sampan-type boats, generally ranging 30-40 feet (9-12m) in length. Several large, 85-95 foot (26-30m) vessels are also

engaged in longline fishing.

The Hawaii longline fleet has undergone severe attrition over the past 30 years (Table 5.3). The number of longliners has presently stabilized at around 20 after a steady decline from 76 boats in 1950. Five new vessels have been added to the fleet since 1976.

The smaller sampans generally fish within several tens of miles of the main Hawaiian Islands. The larger vessels are capable of longer trips to more distant offshore areas. On occasion, they may range offshore more than several hundred miles. The domestic longline fleet made around 470 trips in 1976. The length of trip varies from a few days for the smaller vessels to about two weeks for the larger longliners when they make trips to more distant grounds.

The smaller boats have crews of two to three men and deploy 150 to 200 hooks per set. The large vessels use crews of around 9 fishermen and set 600 to 1000 hooks. The larger vessels have automatic line coilers that greatly reduce manpower requirements. The fleet as a whole employs about 72 fishermen. The market value of the smaller longline vessels ranged between $20,000 and $50,000 in 1976.

Both classes of vessels use floating gear. Each

TABLE 5.3

NUMBER OF DOMESTIC LONGLINE VESSELS OPERATING IN HAWAII, BY ISLAND, 1948-1977

Year	Oahu	Hawaii	Kauai	Total
1948	27	30	2	59
1949	29	42	2	73
1950	30	42	4	76
1951	31	32	4	67
1952	31	21	4	56
1953	35	20	3	58
1954	31	20	3	54
1955	33	17	2	52
1956	33	16	2	51
1957	33	14	2	49
1958	31	12	1	44
1959	27	12	2	41
1960	27	10	1	38
1961	25	9	2	36
1962	25	9	1	35
1963	24	7	1	32
1964	24	7	-	31
1965	24	6	-	30
1966	23	5	-	28
1967	21	5	-	26
1968	19	3	-	22
1969	19	4	-	23
1970	20	4	-	24
1971	20	3	-	23
1972	19	4	-	23
1973	17	2	-	19
1974	16	2	-	18
1975	15	2	-	17
1976	15	2	-	17
1977	15	3	-	18
1978	16	4	-	20
1979	16	2	-	18
1980	19	3	-	22

SOURCE: State of Hawaii, Department of Land and Natural Resources, Division of Fish and Game, umpublished records

unit of longline gear consists of a float, a floatline attached to a main line including 6 to 10 branch lines, and hooks spaced at regular intervals. The lengths of the floatlines plus the branchlines, combined with the considerable sag in the mainline between floats, are such that baited hooks fish at depths of 150 to 300 feet (34 to 90m) below the surface. The fishing depth can be adjusted somewhat by shortening or lengthening the floatline to suit fishing conditions in different areas and seasons.

The main species in the catch of Hawaii longliners are yellowfin and bigeye tuna, both referred to generically in Hawaii as ahi. About one-quarter of their catch (weight) is billfish (Table 5.4), but the ratio of billfish catch to tuna catch varies widely each year. The fishery also regularly catches sharks, albacore tuna, and mahimahi and wahoo on occasion; and infrequently such miscellaneous species as the moonfish and oilfish.

If the reported landings of all of the species taken by the domestic longline fishery are added together, the total becomes the second largest category in the reported Hawaii commercial catch statistics after the skipjack tuna (aku) fishery, and in some years it amounts to about half as much as the skipjack tuna catch.

The areas off the Waianae Coast and the north shore

TABLE 5.4 CATCH, SALES, REVENUE, AND AVERAGE SALES REVENUE BY SPECIES FOR DOMESTIC LONGLINERS IN HAWAII, 1976

Species	Catch (kg)	Quantity Sold (kg)	Revenue From Sales ($)	Average Revenue ($/kg Sold)
Blue Marlin	7,598	7,598	12,089	1.59
Striped Marlin	33,686	33,686	81,116	2.41
Other Billfish*	3,842	3,842	5,980	1.56
Total Billfish	45,126	45,126	99,1885	2.20
Ahi (large tunas)	129,503	129,503	384,502	2.97
Aku (skipjack tuna)	13	13	22	1.69
Total Tunas	129,516	129,516	384,524	2.97
Ono (wahoo)	3,418	3,418	6,409	1.88
Mahimahi (dolphin)	7,466	7,466	30,003	4.02
Total Ono & Mahi	10,884	10,884	36,412	3.35
Grand Total	185,526	185,526	520,121	2.80

SOURCE: Data from Table 6, Cooper and Adams (1978)

* Includes 190 kg of Black Marlin

of Oahu are the most heavily fished by the fleet. Most fishing occurs within 50 miles of the main Hawaiian Islands, although there are occasional trips to distant grounds by the larger boats. A distant-water longline feasibility survey (in latitudes where catch rates have been found to be somewhat superior to catch rates in Hawaii latitudes) has been contracted to a local vessel subsidized by the State of Hawaii and the Pacific Tuna Development Foundation. The survey results were inconclusive but encouraging and proposals for additional cruises are being planned. Three vessels engage in some longline fishing around Guam (draft Guam Fisheries Development and Management Plan, September, 1980). There is no known domestic longline fishing by American Samoa vessels.

5.4.1.1.2 Catch and Revenues

Domestic longliners reported landing and selling about 45,000 kg of billfish during 1976 earning nearly $100,000 from billfish sales. The longline catch for all species was reported to be 186,000 kg which generated $520,000 in sales revenue. Table 5.4 provides reported data on catch and sales composition by species for domestic longliners. Large tunas dominate the catch and sales figures for domestic longliners but to a smaller extent compared to commercial trollers.

5.4.1.1.3 Probable Future Condition

The fishery as presently largely structured and conducted, is subject to several basic limitations. The majority of boats in the longline fleet continue to fish strictly for the fresh sashimi market. The fishery produces a modest tonnage of fish in relation to the investment and effort that it requires. In order to return "living wages" to fishermen, the catch must be sold for prices much higher than canneries normally pay for tuna delivered by the more productive baitboats and purse seiners. This means that there must be a market for excellent quality fish to be sold for such local preparations as sashimi and sushi, and the by-catch of billfish and other large pelagic species must command a fairly high price as table-fish. The domestic fleet has been suffering from escalating fuel costs since 1970 relative to the less rapidly rising prices for fresh ahi. The less efficient operators in the fleet have not replaced or maintained capital as equipment and hulls simply wear out. The more efficient firms have experienced a rate of return high enough to warrant replacement investment; and new entry in the fishery has occurred.

On the positive side, the demand for fresh ahi has remained strong, even at high retail prices ($5/lb. and up) now charged. The taste for this delicacy is shared by Hawaii consumers of all ethnic backgrounds. Undoubtedly, the market

has been strengthened by the large numbers of Japanese tourists who regularly visit Hawaii and who are used to paying sashimi prices as high or higher at home than in restaurants and hotels in Hawaii. The outlook for improving the conditions in the local longline fleet appears to be bright considering the increasing volume of locally caught ahi being air-freighted to markets in Japan and the mainland U.S. Possibilities remain for improvement of the catch rate, installation of freezers that can deliver sashimi-quality fish, cultivation of still broader markets, greater mechanization of the fishing operation, and development of practical methods for locating sub-surface concentrations of bigeye and yellowfin tuna, swordfish and marlins.

The Council anticipates that domestic longline fishery will expand and extend its operations up the chain of the NWHI. The Hawaii Fisheries Development Plan presents a "Pro Forma Financial Statement" for a new 80-foot longliners; with the data presented, an estimated break-even monthly revenue level of about $32,200 is suggested. With an ex-vessel price of $.70 per pound for frozen ahi, the break-even catch rate would be 46,000 pounds per month, or 2,300 pounds per day on a 20-day trip. If the average ahi is 75 pounds, the daily catch would have to be about 30 ahi per day.

The average ahi catch per day for foreign longliners in the NWHI was 34 ahi per day, using 50-60 mile

longlines, which are considerably longer than longlines used by domestic vessels. The catch of striped marlin and swordfish may well be critical to making new investments in the domestic longline fishery profitable. Striped marlin and swordfish have made up as much as 25% of domestic longline landings, and almost 10% of foreign longline landings in the NWHI. Domestic expansion of the longline fishery will require some assurance that striped marlin and swordfish will remain available in the NWHI.

5.4.1.2 Commercial Trollers

5.4.1.2.1 Description of Vessels, Gear, and Species Landed

There were about 160 commercial trolling vessels operating in Hawaii during 1976. About 40 of these vessels were located in Kailua-Kona, Hawaii. A 1976 survey of the Kailua-Kona vessels conducted by Research Associates, Inc. for the National Marine Fisheries Service showed that about 80% of commercial troll vessels were 18-20 feet in length with an average market value of $5,190 for vessel and gear. Minimum value was $2,500 and maximum value was $12,000. About 75% of the commercial trolling vessels were trailered.

Three types of vessels are employed in the Hawaiian commercial troll fleet: (1) small outboard motorboats and canoes 15-20 feet long (4.5-6.5m); (2) small inboard/outboard or inboard gasoline-powered motorboats 18-25 feet long

(5.5-8m); and (3) large diesel powered trollers up to 45 feet long (13.5m). Some larger West Coast-style trollers are based in Hawaii, but these mostly fish for albacore north and west of the FCZ and have not, to date, expended much effort inside the FCZ.

The smaller trollers use one or two handlines, the larger boats two to six. Both artificial and natural bait are used. Some commercial troll vessels try to avoid catching billfish, seeking yellowfin tuna instead as the primary target with secondary catches of mahimahi and wahoo.

In American Samoa, two 24-foot inboard/outboard (7.5m) dories occasionally troll for these species, and approximately four 14-ft. (4.4m) aluminum outboard skiffs troll on occasion; ten 27-foot (9m) outboard-powered aluminum catamarans (alias) also troll. All these boats are equipped with jig poles and fish two to seven lines using artificial lures. These boats sometime take billfish, but more frequently they take mahimahi and other pelagic species incidental to their target species - skipjack and other small tuna. Only one vessel with an estimated market value of $35,000 regularly lands billfish.

The trollers operating in Guam are chiefly outboard-powered skiffs equipped with sportgear or hand lines. A few larger inboard gasoline and diesel powered

boats are also engaged in commercial trolling. Artificial lures are used almost exclusively. Five troll vessels regularly land billfish.

5.4.1.2.2 Catch and Revenues

In 1976, commercial trollers in Hawaii landed an estimated 82,000 kg of billfish out of an estimated total catch of 1,327,000 kg for all species combined. About 77,000 kg of billfish were sold, generating about $55,000 in sales revenue. Table 5.5 lists the commercial trollers' catch by species. Large tuna sales generated 45 times more revenue for commercial trollers than did billfish sales.

Approximately 4,000 kg of billfish were landed by domestic fishermen in American Samoa during 1978 (Office of Marine Resources (OMR)). About one-half of this amount was sailfish/spearfish; the remaining half consisted mostly of blue marlin. There are no government records kept on the disposition of the catch. Some billfish are divided among villagers for family consumption, and some are sold directly to fresh fish markets or to restaurants for fish and chips at approximately $1.65 per kg (75¢ per pound, ex-vessel). the market value of 1978 domestic billfish catches made in American Samoa was about $6,600. Gross income from fish sales for 1978 for all locally caught species was estimated to be $43,000 (OMR).

TABLE 5.5 CATCH, SALES, REVENUE, AND AVERAGE SALES REVENUE BY SPECIES FOR COMMERCIAL TROLLERS IN HAWAII, 1976

Species	Catch (kg)	Quantity Sold (kg)	Revenue From Sales ($)	Average Revenue ($/kg Sold)
Blue Marlin*	76,916	72,716	50,324	0.69
Striped Marlin	1,092	1,092	1,632	1.49
Other Billfish	4,024	3,244	3,064	0.94
Total Billfish	82,032	77,052	55,020	0.71
Ahi (large tunas)	1,144,576	1,138,084	2,487,880	2.19
Aku (skipjack tuna)	10,164	4,644	7,880	1.70
Total Tunas	1,154,740	1,142,728	2,495,760	2.18
Ono (wahoo)	62,344	61,060	115,780	1.90
Mahimahi (dolphin)	27,784	26,036	85,760	3.29
Total Ono & Mahi	90,128	87,096	201,540	2.31
Grand Total	1,326,900	1,306,876	2,752,320	2.11

SOURCE: Data from Table 4, Cooper and Adams (1978)

* Includes Black Marlin

An estimated 4,000 kg of billfish were landed by domestic fishermen in Guam during 1978 (Guam Division of Aquatic and Wildlife Resources). About 5,000 kg of billfish (mostly blue marlin) were landed during 1979. At $1.25 per pound ($2.75/kg), the total ex-vessel market value of Guam billfish landings has ranged from $12,000 to about $15,000. Recent reports indicate that around 7-8,000 kg of billfish were landed by domestic fishermen in Guam (Guam Fishermen's Coop., pers. comm., March 1981).

5.4.1.2.3. Employment

About one-half of the commercial trollers operate with a single fisherman. The remaining vessels are crewed by two fishermen. Thus, about 240 fishermen are employed on the 160 commercial trolling vessels in Hawaii. The commercial trolling fleet took an estimated total of 41,000 day fishing trips in Hawaii in 1976 (Research Associates, Inc., 1977).

In American Samoa, fisheries expansion requires development of small boat fishery capabilities now limited by the demise of the dory program. At present there are about 17 powered vessels conducting either part-time or full-time commercial fishing. The Office of Marine Resources is working to encourage local fishing for the local market through boatbuilding and fishery training programs. In 1977, the local commercial fleet of around 20 small boats landed about 100 tons of bottomfish (snappers, jacks, groupers) and

about 50 tons of pelagic fish -- mostly skipjack (atu) and yellowfin (asi) tunas, dolphinfish (masi masi) and other pelagics including some billfish -- for local sale or consumption (Kent, 1980). Employment figures are not available but there are probably around 35 to 50 people engaged in full-time/part-time commercial fishing. The proportion of employment attributable to billfish fishing is unknown but is probably insignificant.

In Guam, employment statistics are not kept in the needed detail to allow summary of employment associated with harvest, wholesale, and retail fishing commerce. There are also no comprehensive data on commercial fish landings and sales. Therefore, the importance of fisheries, whether for employment, food, or recreation, must be subjectively determined based on opinions of knowledgeable people or surmised from comparison with Hawaii or other island economies. It is thought that around 400 recreational/commercial vessels are engaged in different sorts of fishing (draft Guam Fishery Development and Management Plan, 1980). It is unknown what type of fishing these vessels engage in (offshore trolling, bottom fishing, and diving), the frequency of fishing, and disposition of the catch. Given these uncertainties, it is probably best not to speculate on "employment" in the pelagic fisheries sector.

5.4.1.2.4 Probable Future Condition

In Hawaii, the commercial troll fishery has shown substantial growth in recent years as measured by commercial catch statistics compiled by the Hawaii Division of Fish and Game. The target species is principally yellowfin tuna. Further expansion is comparatively easy, since commercial trolling requires only small vessels and few hands. However, the fishery has been troubled by escalating fuel prices and by a problem with the quality of the fish it delivers to the market. Some of the ahi have discolored flesh, a condition known in the trade as "burnt tuna", and such fish cannot be sold for sashimi prices.

Expansion in the commercial troll fishery has been brought on by high earnings in the fleet. In 1976, the 40 commercial trollers in the Kailua-Kona area had gross sales totalling $688,000. Major expense items totalled $283,000. The rate of return in the trolling fleet has been estimated to be well above the average in other segments of the economy. (Cooper and Adams, 1978).

The Hawaii Fisheries Development Plan notes that the state of the economy, in large part, will determine the rate of growth in the commercial troll fisheries. The Plan emphasizes the need to increase the productivity of full and part time commercial troll fishermen by increasing their catch rates, by improving the quality of their catches, and

by reducing operating costs. As an initial response to the Plan, the 1981 State Legislature adopted a law providing for a rebate on State and County fuel taxes for fishermen who earn more than 50% of their income from fishing. The State fuel tax is 8.5 cents per gallon, County fuel taxes vary from 4.5 to 6 cents per gallon. These tax savings are expected to result in significant reductions in operating costs since fuel purchases are the single largest cost component in the troll fisheries. Improvements in catch rates for domestic trollers operating in the waters of the main Hawaiian Islands would be possible as a result of implementing the closures to foreign longline fishermen recommended by this FMP.

The success of the newly developing troll fishery for albacore tuna north and west of the Hawaiian Islands FCZ will apparently be dependent on a reliable resupply, repair, and fish transshipment base or vessel near the fishing grounds. However, in the period between albacore seasons, these vessels may engage in trolling for skipjack and yellowfin tuna and billfish in the FCZ of the Northwestern Hawaiian Islands (NWHI). Assuring a larger availability of billfish and tunas in the FCZ of the NWHI while minimizing gear conflicts with foreign longliners should be beneficial.

Trolling is becoming more important in Guam as more vessels are going farther from shore in search of billfish,

tuna, and other species. Initial catch rates will have to be high to provide incentives for further growth. To the extent possible, the FCZ around Guam should be reserved for domestic vessels to prevent gear conflicts and provide the greatest possible assurance of high catch rates for the developing fishery.

5.4.1.3 Charter Sport Fishing Boats

5.4.1.3.1 Description of Vessels, Gear, and Species Landed

There were an estimated 102 charter sport fishing boats operating in Hawaii in 1976. These boats range from about 20 to 56 feet (6 to 17m) in length, averaging 40 feet, have an inboard diesel engine and accommodations for crew plus up to six passengers. A number of the older charter vessels are of a type called "haole sampans", with wooden hulls of a typical sampan form but interior arrangements of conventional motor cruisers. An increasing number of the newer boats are mostly standard fiberglass sportfishing types brought in from mainland builders. Big game sportfishing rods and reels are used with two to five lines trolled at any one time. Both natural (live aku and dead squid or fish) and artificial baits are used. Boats generally carry ice to prevent spoilage of the catch.

The number of active charter fishing vessels in American Samoa ranges from 1 to 3. A half a dozen or perhaps

more, charter boats are available for hire in Guam. Some charter boat captains in Guam believe that the number of regular hire charter boats would increase if the limitations imposed by the Jones Act were removed. The Jones Act prohibits the use of foreign built hulls in coast-wide trade. Charter fishing is a mercantile activity, thus it falls within the definition of coast-wide trade (taking passengers for hire).

The principal target species for most charter boats are billfish but tunas provided the greatest revenue from fish sales for the charter fleet in 1976. Many charterboat customers specify that they prefer to catch a billfish.

5.4.1.3.2 Catch and Revenues

Table 5.6 presents estimates of catches and sales for the Hawaii charterboat industry during 1976. About 63% (by weight) of the charterboat catch is billfish. The fleet landed an estimated 367,000 kg of billfish and sold 287,000 kg for $108,000. Average sales revenue was estimated to be $0.38 per kg. This was the lowest "price" received by any segment of the fleet taking billfish. This is undoubtedly due to the "soft" consumer demand for large billfish. Large billfish are not normally iced upon boating.

TABLE 5.6 CATCH, SALES, REVENUE, AND AVERAGE SALES REVENUE BY SPECIES FOR CHARTER FISHING VESSELS IN HAWAII, 1976

Species	Catch (kg)	Quantity Sold (kg)	Revenue From Sales ($)	Average Revenue ($/kg Sold)
Blue Marlin*	342,054	266,621	98,504	0.37
Striped Marlin	18,180	15,504	6,117	0.39
Other Billfish	7,099	4,451	3,213	0.72
Total Billfish	367,333	286,576	107,834	0.38
Ahi (large tunas)	142,140	113,271	176,565	1.56
Aku (skipjack tuna)	42,201	1,312	1,955	1.49
Total Tunas	184,341	114,583	178,520	1.56
Ono (wahoo)	47,685	35,516	77,010	2.17
Mahimahi (dolphin)	30,304	18,816	52,006	2.76
Total Ono & Mahi	77,989	54,332	129,016	2.37
Grand Total	629,663	455,491	415,370	0.91

SOURCE: Data from Table 4, Cooper and Adams (1978)

* Includes Black Marlin

5.4.1.3.3 Employment

In 1976 the fishing charterboat industry in Hawaii directly employed some 230 full-time workers and 82 part-time workers. These estimates do not include the 56 self-employed owner operators of charterboats. Wages paid to charter vessel "employees" on a state-wide basis in 1976 were estimated at $1,334,000. A few jobs are associated with charterboat booking agents which can be directly attributed to the industry.

5.4.1.3.4 Probable Future Condition

The market value of the "average" charter boat was estimated at $81,000 for the Kailua-Kona area in 1976. The minimum value was $28,000 and the maximum value was $225,000. On a statewide basis, the value of depreciable capital (charter boats) plus a contingency and working capital fund was estimated to be close to $4 million in 1976.

Revenues accruing to the Kailua-Kona charter boat industry come from charter fees, sale of fish, and commissions from the mounting of trophy fish. These were estimated to be $864,000, $122,000 and $17,000, respectively in 1976. Deducting operating costs and taxes yields a net profit of $187,000. Based on total assets of $2,205,000 for the entire Kailua-Kona fleet, the average rate of return on

TABLE 5.7 ANNUAL RATES OF RETURN AFTER TAXES OF TOTAL ASSETS FOR CORPORATIONS IN MANUFACTURING INDUSTRIES BY SELECTED INDUSTRY GROUPS AND ASSET SIZES, QUARTERLY, 1976

Industry/Asset Size	1976 Quarter (Percent)			
	1	2	3	4
All Manufacturing				
All Asset Sizes	7.15	8.49	7.35	7.05
Under $1 Million	7.24	10.54	9.33	3.89
$1 - $5 Million	6.57	11.52	8.69	5.81
Nondurable Goods				
All Asset Sizes	7.84	8.56	7.90	7.09
Under $5 Million	7.71	11.07	8.83	4.87
Durable Goods				
All Asset Sizes	6.46	8.42	6.79	7.00
Under $5 Million	6.20	11.16	9.04	5.11

SOURCE: Federal Trade Commission, Quarterly Finacial Report for Manufacturing, Mining and Trade Corporatons, First Quarter, 1977.

total assets for the fleet was 8.51% in 1976. Overall, the rate of return for the Hawaii charterboat industry is slightly greater than that for selected industries shown in Table 5.7.

A survey of charterboat owners and operators in the Kailua-Kona fishery estimated that 4,274 charter trips were taken in that area in 1977 (Research Associates, Inc., 1977). The total number of sportfishing trips for the entire State of Hawaii was put at around 12,500, carrying about 47,000 passengers. Preliminary data from the NMFS recreational fisheries survey indicate that there were 91,000 party/charter vessel passenger trips in Hawaii in 1979 (NMFS print-out, 3/25/81), suggesting a near doubling of participation in the charter sportfishing business over a 3 year period.

The seasonal variation in the demand for charter fishing corresponds to the seasonal variations of the Hawaii tourist industry which also coincides to the summer-centered peak availability of billfish in Hawaii waters. A typical tourist charterboat customer allocates his time visiting the various island attractions in much the same manner as the typical Hawaii visitor. Their direct expenditures for charterboat fishing are modest relative to their total expenditures for the Hawaii visit. A growing number of visitors, however, are repeat charterboat customers whose principal

reason for visiting Hawaii is to engage in big game sport fishing. The phenomenal growth in tournament fishing since 1976 (Appendix V) attests to the change in the type of charterboat customer, in charter fishing induced expenditures in the local economy, and in the change of motivations for many visitors coming to Hawaii. A growing number of residents are also hiring the services of charter boats in Hawaii.

The Council is proposing an economic study of the charter boat fishing sector for 1982 to update the survey taken in 1976.

5.4.1.4 Recreational/Commercial/Subsistence Trollers

5.4.1.4.1 Description of Vessels, Gear, and Species Landed

In the troll fishery for pelagic species, there is a blend of recreational, commercial, and subsistence motivations for fishing. This makes it difficult, if not impossible, to know exactly what part of the total fleet effort to identify as being primarily engaged in recreational and/or subsistence trolling as opposed to commercial trolling. Fishermen in Hawaii may often sell all or a portion of their catches to help meet trip expenses (Hawaii Fishing News, December 1980). Apparently there also are fishermen who sell fish that are surplus to their needs but do not obtain a commercial fishing license or report their catches. Others, more conscientious or perhaps more

optimistic, spend $10 to obtain a Hawaii commercial fishing license in anticipation of catching fish in excess of their personal needs, but in fact deliver little to the market.

The private "recreational" fleet (i.e., non-charter, non-fulltime commercial trollers) in Hawaii was made up of around 1,500 vessels in 1976 (Table E-2, Appendix E). These are chiefly small, trailerable, 14-33 feet (4 to 10m) boats of the so-called "mosquito fleet" with outboard motors of gasoline inboard/outboard drive. The larger vessels which are moored make up about 7% of the fleet. The average market value per "recreational" troll vessel in 1976 was estimated to be $5,300 (Research Associates, Inc., 1977). Typically, two to four sportfishing rods and reels are used with artificial and natural bait.

Private "recreational/commercial" troll boats are used primarily for weekend trips. A sizeable proportion of the total catch made by these fishermen is sold to fish dealers (Table 5.8) who move the fish to commercial markets in Hawaii, other states in the U.S., and to foreign countries. Troll caught billfish are either sold, given away to family and friends, or retained for personal consumption in Guam, American Samoa, and Hawaii. A few fish are mounted as trophies. None is wasted. Fish may or may not be iced upon boating.

TABLE 5.8 CATCH, SALES, REVENUE, AND AVERAGE SALES REVENUE BY SPECIES FOR THE NON-CHARTER RECREATIONAL FLEET IN HAWAII, 1976

Species	Catch (kg)	Quantity Sold (kg)	Revenue From Sales ($)	Average Revenue ($/kg Sold)
Blue Marlin*	217,020	120,200	79,652	0.66
Striped Marlin	8,876	3,564	1,732	0.49
Other Billfish	11,924	2,588	4,144	1.60
Total Billfish	237,820	126,352	85,528	0.68
Ahi (large tunas)	510,748	384,316	765,444	1.99
Aku (skipjack tuna)	69,004	12,200	17,512	1.44
Total Tunas	579,752	396,516	782,956	1.97
Ono (wahoo)	175,192	74,980	141,412	1.88
Mahimahi (dolphin)	39,544	20,488	52,632	2.57
Total Ono & Mahi	214,736	95,468	194,044	2.03
Grand Total	1,032,308	618,336	1,062,528	1.72

SOURCE: Data from Table 4, Cooper and Adams (1978)

* Includes Black Marlin

It is presently impossible to determine the number and type of fishing vessels in Guam. There are some 1,000 vessels listed in the registration files at the Guam Department of Public Safety of which an unknown number are operational craft used in subsistence, recreational, or commercial activities (Guam, Department of Commerce, 1980 unpublished). It is probably a conservative assumption that at least 400 vessels participate in fishing in one form or another, some frequently, others on rarer occasion. The number of these vessels engaged in recreational trolling for billfish and other pelagic species is unknown at this time, but it may be fairly large. The recreational fishing vessel segment is believed to be growing rapidly but growth figures are not available to substantiate this belief. At best, inferences on fishing participation can be gleaned from creel census studies undertaken on a random basis at various locations throughout the island conducted by the Division of Aquatic and Wildlife Resources. Estimates based on these surveys indicate that 35,536 individuals spent 190,642 hours harvesting 424,456 pounds of fish during FY 1979. Some 68 percent of the catch resulted from bottomfishing, diving, and offshore trolling. The rest of the catch came from a variety of inshore activities including netting, diving and hook and line fishing.

There is probably very little "pure", private recreational trolling around American Samoa. Whatever level

of trolling takes place, most of it is for local sale or subsistence purposes.

5.4.1.4.2 Catch and Revenue

The recreational fleet in Hawaii engaged in about 130,000 passenger day trips during 1976. This estimate was developed from survey questionnaires completed by Kailua-Kona fishermen which was expanded to the entire State. This assumes that trollers in the rest of the State were as active as those surveyed in Kailua-Kona, Hawaii.

Preliminary NMFS recreational fisheries survey data indicate an estimated 462,000 fishing trips were taken on private/rental boats in 1979, with a total catch exceeding 1800 m.t. in the FCZ (survey print-out, 3/25/81).

Table 5.8 gives estimates of catches and sales for 1976. It was estimated that the non-charter recreational fleet in Hawaii sold about 60% of its catch. Average sales revenue for recreationally caught billfish was $.68 per kg in 1976.

5.4.1.4.3 Employment

Non-charter recreational fishing does not directly employ workers, although there is clearly an indirect employment effect generated by purchase of fishing gear, gasoline and the like. The magnitude of indirect employment

TABLE 5.9

1976 CATCHES (MT) BY DOMESTIC TROLLERS AND LONGLINERS IN THE US FCZ OF THE HAWAIIAN ISLANDS

Species	A Charter Sportfishing Trollers 1/	B Non-Charter Recreational Commercial Trollers 1/	C Commercial Trollers 1/	D Domestic Longliners 2/	E=(A+B+C+D) Total 2/
Blue Marlin	342	217	77	8	644
Striped Marlin	18	9	1	34	62
Other Billfish	7	12	4	4	27
Total Billfish	367	238	82	45	732
Ahi (Yellowfin, Bigeye & Albacore)	142	511	1,145	130	1,927
Aku (Skipjack)	42	69	10	*	121
Total Tunas	184	580	1,155	130	2,048
TOTAL CATCHES OF BILLFISH & TUNA	552	818	1,237	175	2,781

1/ Data from Table 4, Cooper and Adams (1978)
2/ Data from Table 6, Cooper and Adams (1978)
(Kg rounded to MT)

generated by recreational fishing has not been estimated.

5.4.1.4.4 Probable Future Condition

An interesting aspect of troll fishing in Hawaii, Guam, and American Samoa is that large billfish (especially blue marlin) are the glamour catch in the recreational mode, but large tunas are the most profitable catch on the commercial side. Whatever part of the total trolling effort around Hawaii may be fairly identified as "commercial", it is clear that the troll catch greatly exceeds the catch of the longline fleet. The trollers in Hawaii now outproduce local longliners by about 15 times in the case of the billfish and tunas (Table 5.9). Striped marlin (which do not grow as large as the blue and black marlin in local waters) and broadbill swordfish are the billfish species preferred by the longliners and handline fishermen because of the higher price which they bring on the market. Blue marlin and large yellowfin tuna are the principal species taken on trolling gear. Swordfish are regularly taken on the domestic tuna longlines, but are very rarely taken on trolling gear. In general, trolling is practiced mostly in the recreational or semi-commercial fisheries, but it has recently become a commercial fishing method in its own right.

5.4.1.5 Handline Fisheries

Fishing with handlines in a drifting boat is a fairly common

form of fishing in Hawaii as in other Pacific islands. Handline fishermen catch every kind of fish including marlins, all species of tuna found in local waters, mahimahi and ono, and all other fish usually thought of as for trolling only. This type of fishing employs elementary simple gear (esentially a hook, line, and a weight) but it is very effective in catching tunas. The handline fisheries are conducted mostly from small boats largely for subsistence and recreational purposes. A more developed kind of tuna handline fishing, which is carried out commercially off Hilo and the Kona coast of the Island of Hawaii, is the night fishery locally known as "ika-shibi" fishing.

5.4.1.5.1 Night Handline Fishery

Night handline fishing for tunas in Hawaii has been described in detail by Yuen (1979). This fishery is very effective in catching bigeye, yellowfin, and albacore tuna. The effectiveness of this method is demonstrated by its catch rate which is approximately two fish per hook per night on the average. In comparison, catch rates of Hawaii longline vessels are on the order of 0.03 fish per hook per day (Otsu, 1954).

The night handline fishery was developed by fishermen on the Island of Hawaii. By 1976, the night handline fishing fleet had grown to 30-40 boats, most of which fish out of Hilo. The areas fished are characterized by a marked increase in slope of the bottom beyond the edge of the insular shelf, at depths of around 1,200 feet on the Hilo grounds

and 600 feet off the Kona Coast. It consists basically of catching squid on jigs or with gaffs under a light then using the squid as bait on handlines to catch ahi. The local name of the fishery comes from two Japanese words, "ika" meaning squid and "shibi" meaning ahi. On occasion, ika-shibi (squid-tuna) fishermen also catch marlins and, more frequently, swordfish. One firm (confidential data) has estimated that swordfish now make up 20% of total income from fish sales from the night handline fishing.

5.4.1.5.2 Day Handline Fishery

This fishery is mostly conducted off the Kona Coast and is made up of small and medium-sized boats, usually fishing two to three lines. The hooks are normally baited with opelu (mackeral scad) and are lowered to a depth of 75 to 100 feet. The composition of the catch is mostly yellowfin tuna, with bigeye tuna and marlins of secondary importance.

The name koa is applied to certain places in the deep sea where fish are known to congregate relatively close to shore. Thus the places where ahi are found on a regular basis in Hawaii are called ahi-koa. The ahi-koa handline fisheries have shown substantial growth in recent years. Entry to the fishery appears comparatively easy, since it requires only a small vessel, simple gear and few crew

members. However, expansion of the fishery would probably also require the discovery of additional ahi-koas in areas reasonably close to ports and markets. New ahi and aku koas may be created by deployment of anchored fish aggregation buoys. Wherever tunas are found to aggregate, marlin can be expected to be found nearby. Therefore, catches of marlin taken on handline gear can be expected to increase in the future.

5.4.1.6 Summary of Catches by Domestic User Groups Combined

The reported domestic commercial catch of billfish in Hawaii more than tripled in 5 years from 106MT in 1973 to 338MT in 1978 (Table 5.10). The absence of corresponding effort data makes catch trends difficult to interpret. Estimates of total catches in 1976 by species and by major billfish user groups combined for Hawaii are given in Table 5.11. The estimate of the total domestic billfish catch for 1976 exceeds the total reported commercial billfish catch for that year by a factor of nearly 4. The significance and size of the recreational billfish catch becomes apparent.

The reported commercial catch of blue marlin for Guam was between 4 and 5 MT in 1978-1979 and around 7-8 MT in 1980. The domestic catch of billfish in American Samoa in

1978 was approximately 4 MT. It is difficult to project billfish catch trends for Guam and American Samoa because records have been kept for only a short period of time. Fishing activity generally has been increasing in Guam and American Samoa in recent years.

5.4.2 Changes in Domestic Fishing

The level of domestic commercial fishing for billfish and tunas in the future is expected to continue to increase but at a rate that is difficult to predict with precision. The rate of increase in the commercial sector will depend on the rate of increase in vessel operating costs relative to the rate of increase in ex-vessel prices paid for tunas and billfish. So far, increases in fuel costs have not diminished commercial landings in Hawaii. Contrary to what could be expected, reported commercial billfish landings more than tripled between 1973 and 1978, growing by an annual average of nearly 30%, and jumping by 44% between 1977 and 1978 (Table 5.10).

During 1976, recreational catches outstripped commercial catches by a factor of nearly 5 times (Table 5.9). Recreational catches of billfish have probably increased at a faster rate than commercial catches but recreational catch figures for more recent years are not available, but preliminary 1979 NMFS recreational fisheries survey results indicate much higher catches of swordfish and related species by recreational fishing than were previously believed.

TABLE 5.10

REPORTED COMMERCIAL CATCHES (MT) OF BILLFISH IN HAWAII

1973 - 1977

Species	1973	1974	1975	1976	1977	1978
Swordfish	<1	<1	<1	2	19	14
Blue Marlin	38	57	48	87	166	244
Black Marlin	<1	<1	<1	3	4	<1
Striped Marlin	64	89	106	95	41	67
Sailfish & Spearfish	4	7	7	7	6	12
Total Billfish	106	153	161	194	234	338
Percent Change		44	5	20	21	44

SOURCE: Hawaii Division of Fish and Game tabulations of monthly catch reports into annual totals. These figures do not include unreported commercial catches nor catches of recreational fishermen.

TABLE 5.11 TOTAL CATCH, SALES, AND REVENUES BY SPECIES FOR THE TROLLING AND DOMESTIC LONGLINE FLEETS COMBINED IN HAWAII, 1976

Species	Catch (kg)	Quantity Sold (kg)	Revenue From Sales ($)	Average Revenue ($/kg Sold)
Blue Marlin	644	467	240,569	0.51
Striped Marlin	62	54	90,597	1.68
Other Billfish	27	14	16,401	1.16
Total Billfish	732	535	347,567	0.67
Ahi (large tunas)	1,927	1,765	3,814,391	2.16
Aku (skipjack tuna)	121	18	27,369	1.51
Total Tunas	2,048	1,783	3,841,760	2.15
Ono (wahoo)	289	175	340,611	1.95
Mahimahi (dolphin)	105	73	220,401	3.03
Total Ono & Mahi	394	248	561,012	2.26
Grand Total	3,174	2,566	4,750,339	1.85

SOURCE: Data from Table 4, Cooper and Adams (1978)

5.4.3 Processing

As described in previous sections, billfish are supplied to fresh fish markets by both commercial and recreational fleets in Hawaii, American Samoa and Guam. Table 5.11 summarizes the estimated total catch and sales by species in Hawaii for all fleets operating in Hawaii in 1976. Most of the billfish sold in 1976 (535MT) were consumed in Hawaii.

Small quantities of billfish are shipped to the West Coast for consumption as fresh fish. Most billfish sold in Hawaii are channeled through fish auctions in Honolulu and Hilo. Fishermen can sell directly through the auction, as in the case of some longline vessels, or sell to regional fish dealers, as in Kailua-Kona, who then sell through the auctions. Wholesalers or even retailers purchase the fish at the auctions and prepare it for retail sale to households. Small quantities of billfish are sold directly to restaurants.

The domestic catch of billfish, for the most part, is not processed except in the normal preparation of the product for the fresh fish market. Most local fishcake factories no longer use billfish as an ingredient in their products, but have changed to imported fish flesh. One fish cake factory continues to use billfish for about 10% of its production of fish cake and fish sausages.

5.4.4 User Group Interactions

There are occasional instances of competition between domestic fishery sectors. Domestic trolling vessels - commercial,

charter, and private - usually fish on approximately the same grounds at the same time. The success of fish aggregations devices may be generating crowding problems, especially on weekends. Domestic longline vessels, on the other hand, generally fish beyond the range of domestic trollers, and there have been no reports of gear conflicts.

There is no evidence to indicate that the Council needs to take action at this time to resolve domestic user group conflicts.

5.4.5 Social and Cultural Importance of the Fishery

The social significance and economic values of commercial and recreational fishing in Hawaii, Guam, and American Samoa have not been studies, but there have been studies elsewhere suggesting the ranges of values of recreational fishing. For example, one study (Frederick W. Bell et al., unpublished ms., cited in Sport Fishing Institute, et al., 1976) estimated that in 1974, U.S. salt water anglers spent 312,412,000 fishing days with an estimated market value of $2,556,500,000. An additional nonmarket value of $569,800,000 was derived. Total value was estimated at about $10 per day for all forms of recreational fishing combined ranging from simple pier fishing to big-game fishing. A survey of the south Atlantic, Gulf of Mexico, and Caribbean billfish fishery (Hamm and Slater, cited in South Atlantic Fishery Management Council, 1980), indicated the fishery generated total expenditures of between $89 and $100 million from May 1977 through April 1978. It was estimated that about 78,750 billfish were caught in that period, so expenditure per fish would be between $1,130 and $1,270. Expenditure per fish does not necessarily measure the social and economic value of the fishery but it does indicate the high value placed on billfish

fishing by participants.

The preliminary results of the 1979 NMFS recreational fisheries survey suggest similarly high expenditures per fish. Charter vessels in Hawaii charge around $300 or more for a full day of fishing. If 91,000 party/charter passenger trips were taken in 1979, with 4 passengers per vessel, then 22,750 vessel trips were taken with estimated expenditures of $6,825,000 on vessel fees alone. The average catch per trip on party-charter vessels was 0.5 fish; including billfish, wahoo, mahimahi, and tuna. The portion of total expenditures attributable to billfish is unknown but is significant.

Even higher expenditures per fish can be derived from major fishing tournaments. For example, it has been estimated that expenditures per blue marlin caught in the Hawaiian International Billfish Tournament in 1980 were almost $4,000. That tournament overall generates almost $4 million in expenditures in Kona each year (J. Sutherland, pers. communication), a large amount of which comes from foreign and mainland visitors. In 1981, 30 of the 68 teams participating were from foreign countries. It is evident that the tournament would not be viable if there were not a reasonable chance of catching blue marlin in a tournament. It seems logical to conclude that higher catch rates would generate additional investment in vessels and additional tourist and resident expenditures in the fishery.

In this context, it is worth noting that most of the 1973-77 foreign longlining effort around the main Hawaiian Islands has been

summer-oriented with relatively high incidental catch rates of blue marlin. Most of this foreign effort occurs in the late spring and early summer to the south of the main islands when blue marlin are believed to be shifting northward into the FCZ (Lovejoy, 1977). If that foreign effort were relocated, the potential impacts on catch rates at tournament time would be much more important than the simulation model's two percent (2%) domestic troller catch increase may imply.

To add to the general appeal of billfish fishing, Hawaii waters have earned a reputation for providing record-setting fishing opportunities: 7 of the 11 currently held world records for Pacific blue marlin were established in Hawaii.

Finally, fishing is a traditional activity in the insular areas, and billfish are primary target species for domestic sport fishermen; even if the expectation of hooking a billfish is low compared to other species, the anticipation of the "rare" event, nevertheless, is considerable. Fishers are satisfied if they catch mahimahi or tuna, but their level of satisfaction upon catching billfish is many times greater.

In summary, the social and cultural values associated with the billfish fishing are substantial. Quantification of these values is fraught with difficulties in competing approaches, methologies, and in standards for measuring values.

5.4.6 Fishery Development

The State of Hawaii and the Territories of Guam and American Samoa have established intentions to expand the size and range of their fisheries. The Governors (with the Governor of the CNMI) have formed the Pacific Basin Development Council to coordinate all economic development activities in the region. Fishery development has very high priority in the Council. The Hawaii Fishery Development Plan has been approved by the Governor of Hawaii and is being implemented by the Legislature, which established a Fisheries Coordinating Council and appropriated more than $500,000 in 1980 for fishery development projects. Guam and American Samoa have completed their draft fishery development plans, and both governments clearly view fisheries as having great economic potential. Billfish and other species in the pelagic complex will be primary target species. Domestic harvest capacity is expected to increase substantially in the future, and programs for fisheries infrastructure development are being planned and implemented in all areas.

5.5 Foreign Fisheries

Two types of major fisheries are conducted by foreign fleets in the U.S. FCZ of the Western Pacific Region: longlining and pole-and-line, live-bait fishing.

5.5.1 User Groups

5.5.1.1 Longliners--Description of Vessels, Gear and Species Landed

Pacific billfish are exploited by longline vessels of Japan, Taiwan and Korea. These vessels take billfish and other species in the process of catching tuna, their main target species. The Japanese developed longlining into a large-scale fishery after World War II, and their large modern longliners, equipped with advanced refrigeration systems, operate in all Pacific ocean areas where tuna occur. In recent years, the South Koreans and Taiwanese, following Japan's example and using old Japanese boats, have also developed major tuna longline fishing industries as well. While sashimi quality tuna are the prime targets of Japanese longliners, their by-catch of billfish is an important component of the catch (10% or more in the FCZ). Billfish command a fairly high price as table-fish or as raw material for fish sausages and fishcake. Japan has dominated the Pacific landings of billfish accounting for between 77 to nearly 90 percent of all billfish landed each year during 1965 through 1974 (Table 9.2).

Foreign longline vessels range in size from 60 to 120 ft. (18-36 m). The larger boats have ultra-low temperature freezer cargo holds and can make trips of several months duration. The gear is essentially a more sophisti-

cated scaled-up version of the domestic gear described in Section 5.4.1.1, but these vessels use 1500 to more than 2000 hooks per set (or per day).

The longline fishery uses buoyed set lines 50-60 miles in length. Hooks are baited with frozen or salted fish. They catch large bigeye and yellowfin tuna, lesser quantities of large albacore tuna, all of the billfish species which occur in the regions, sharks, dolphinfish and wahoo. Occasionally other miscellaneous pelagic fishes are also taken. This is essentially a fishery in which a passive type of fishing gear is deployed diffusely over a large area of ocean to catch fish which have a high value on the market. The fish probably are solitary or in loose aggregations of a few individuals, so that they are not vulnerable to more concentrated, intensive fishing methods.

5.5.1.2 Baitboats--Description of Vessels, Gear, and Species Landed

The tuna pole-and-line fishery, using chummed live bait to take the smaller tunas from schools at the surface of the ocean, is the most productive of the fisheries undertaken by foreign fleets in the U.S. FCZ of the Western Pacific Region. Baitboats take 2 times more tuna (in terms of weight) than do the foreign longliners. Although all kinds of tuna can be taken by the live-bait, pole-and-line method, the Japanese baitboat catch in the U.S. FCZ of the

Western Pacific Region is predominantly skipjack tuna (85%) and the fishery is generally referred to as the skipjack tuna fishery. Species of tuna other than skipjack occassionally appear in surface schools in U.S. FCZ waters of the Western Pacific Region. Small yellowfin, bigeye, and albacore tuna are at times fished by baitboats in the Western Pacific Region, but they make up a far smaller share of the catch than they do in live-bait, pole-and-line fisheries elsewhere, particularly in the eastern Pacific. While the main target of foreign baitboats in the Western Pacific Region is skipjack tuna, their catch at times also includes mahimahi. Small billfish are believed to be caught by foreign baitboats but very rarely.

The live-bait technique is very effective wherever schools of tuna can be found at the sea surface, provided there is a supply of suitable baitfish on board. Finding skipjack schools is entirely a matter of sighting by eye and depends in large part on sighting and evaluating the behavior of flocks of seabirds. Seabirds commonly gather where schools of tuna, feeding near the surface, drive baitfish, squid, or crustaceans on which they are preying up to where the birds can dive in and share in the forage. Schools of skipjack tuna are attracted to the fishing boat by scattering live baitfish in the water. They are caught on feathered lures with barbless hooks attached by short lengths of line to stout poles. Automatic fishing poles are used on more

than 80% of the Japanese skipjack tuna vessels of over 200 tons. Since smaller, coastal water vessels (less than 50 tons) do not have as much problems in recruiting fishermen, only about 40% of such vessels utilized automatic fishing poles (Maruyama, 1980).

Although there are reports that foreign pole-and-line boats on occasion obtain baitfish on the high seas by the use of underwater lights or floodlights, most bait used by the distant-water Japanese fleet is purchased from coastal fishermen in Japan and is transported to the fishing grounds.

5.5.2 Description of Fishing Effort

Estimates of foreign longline and baitboat effort expended in the FCZs of Hawaii, Guam, and American Samoa are presented in Table 5.12 for the years 1971 through 1977.

TABLE 5.12

FISHING EFFORT (VESSEL DAYS) BY FOREIGN LONGLINERS AND BAITBOATS IN THE US FCZ OF AMERICAN SAMOA, GUAM, AND HAWAII, 1971-77

LONGLINERS

FCZ	1971	1972	1973	1974	1975	1976	1977
Main Hawaiian Islands	550	362	592	1289	342	823	852
Northwestern Hawaiian Islands	1553	1697	963	433	828	1856	1508
HAWAII ARCHIPELAGO (TOTAL)	2103	2059	1555	1722	1170	2679	2360
GUAM	19	20	55	273	278	735	1199
AMERICAN SAMOA	769	462	887	1056	855	819	271**

BAITBOATS

FCZ	1971	1972	1973	1974	1975	1976	1977
Main Hawaiian Islands	*	*	*	1	3	51	52
Northwestern Hawaiian Islands	*	213	96	186	266	598	715
HAWAII ARCHIPELAGO (TOTAL)	*	213	96	187	269	649	767
GUAM	164	118	54	67	206	50	333
AMERICAN SAMOA	*	*	*	*	13	8	*

SOURCE: Data from Yong and Wetherall (1980)

* None
** Wetherall, pers. comm (12/9/80)

5.5.2.1 Hawaii

The major part of the effort expended by foreign fleets in the FCZ around Hawaii has been by Japanese vessels. Taiwanese longliners did a slight amount of fishing (about 50 vessel days) in 1972 and 1977. Foreign fishing effort estimates shown in Table 5.12 do not present a complete picture since no Korean statistics were included. Korean vessels are known to fish in areas of the FCZ, but Korean longline catch statistics have not yet been evaluated by the NMFS for collecting procedures and reliability. There have been minor catches in the Hawaii portion of the FCZ by Korean longline boats based in American Samoa.

With the single exception of 1974, Japanese longlining in the FCZ of the Northwestern Hawaiian Islands (NWHI) was about double their longline effort in the FCZ of the main Hawaiian Islands. The year-to-year fishing pattern of Japanese longline activity around the main Hawaiian Islands shows no real discernible trend. Foreign longline effort in Hawaii's entire FCZ has remained fairly stable averaging around 2,300 vessel days per year over the period 1971-1977.

Japanese baitboats have increased their activities in the Hawaii FCZ, nearly tripling their effort in 1976-1977 compared to earlier years. These live-bait boats, which carry their supplies of live anchovies all the way from

Japan, have been reported mainly as fishing for skipjack tuna mostly in the vicinity of the NWHI. Some bait fishing takes place due west of the main islands at a distance of several hundred miles.

5.5.2.2 Guam

The historical data available indicate that the only foreign vessels taking billfish in the FCZ around Guam are from the Japanese longline fleet. Beginning in 1974, the Japanese longline effort in this zone increased substantially and by 1977 the longline effort in the FCZ around Guam reached an estimated 1199 vessel-days, a large increase relative to earlier years. As noted earlier, however, Korean longlining patterns are undocumented. It is believed that substantial Korean longlining occurs around Guam. Blue marlin is by far the largest volume billfish species taken by foreign longliners.

Bait fishing in the FCZ of Guam by Japanese vessels has been a common occurrence since the 1960's when the Japanese "Southern Waters" fishing grounds were confined to the vicinity of the Mariana Archipelago. Beginning around 1968, the Japanese bait boat fleet expanded and began to fish in waters around the Caroline Islands. These fishing grounds gradually continued to expand and shifted eastward. By 1973, baitboats in the "Southern Waters" skipjack fleet reached the

waters off the Northwestern Hawaiian Islands.

5.5.2.3 Commonwealth of the Northern Mariana Islands

An annual average (1973-1977) of 71 metric tons of billfish were harvested on foreign longline gear in the FCZ of the CNMI. Compared to Guam (Table 5.20), the waters of the CNMI appear to be richer in striped marlin and swordfish, but significantly poorer in blue marlin when measured by levels of average foreign longline catches for each of the billfish species.

5.5.2.4 American Samoa

Vessels from the Republic of South Korea and Taiwan are the foreign vessels longlining in the FCZ around American Samoa. Estimated foreign effort has remained fairly stable averaging around 800 vessel days per year during the 1970's. A small amount of Japanese pole-and-line fishing for skipjack tuna was reported during 1975-1976 in the FCZ of American Samoa (South Pacific Commission, 1980).

5.5.2.5 U.S. Possessions

An average (1973-1977) of 226 MT of billfish were harvested annually on foreign longline gear in the FCZ of U.S. Possessions. Nearly 1,500 MT of the various species of tunas were simultaneously taken. This average level of foreign longline tuna catches compares closely to the average level

of tuna harvests made in the FCZ of the Northwestern Hawaiian Islands (1,407 MT).

Japanese bait boats harvested an estimated average annual catch of 2,324 MT of tunas (mostly skipjack) in the FCZ of the U.S. Possessions during 1973-1977, about one-half of the amount of skipjack taken by baitboats in the FCZ of the Commonwealth of the Northern Mariana Islands.

5.5.3 Description of Catches

5.5.3.1 Pacific Ocean Billfish Catch Trends

The Pacific catch of billfish (1952-1975) is given in Table 5.13.

The Pacific catch of blue marlin rose irregularly from 1952 reaching a peak of 31,300 MT in 1963 and declined irregularly thereafter.

FIGURE 5.2 Blue Marlin Catch in the Pacific, 1952-1975.
Source: Shomura (ed), 1980

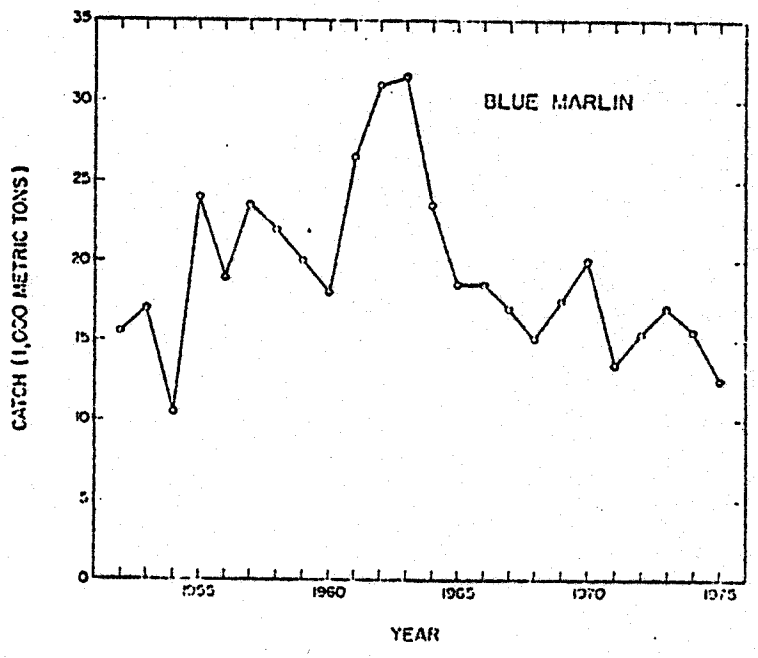


TABLE 5.13

TOTAL PACIFIC CATCH OF BILLFISH BY SPECIES, 1953-1975
(Metric Tons)

Year	Blue marlin	Striped marlin	Swordfish	Sailfish and spearfish	Black marlin	Total
1952	15,525	4,992	11,339	2,000	1,806	35,662
1953	17,250	3,789	11,689	3,300	3,188	39,216
1954	10,519	7,256	13,392	2,400	5,370	38,937
1955	24,190	7,075	16,485	3,300	5,379	56,429
1956	18,770	7,724	12,584	3,200	6,466	48,744
1957	23,500	7,150	16,243	2,800	6,376	56,069
1958	22,106	8,999	21,341	3,400	4,548	60,394
1959	20,275	8,986	19,663	3,400	3,081	55,405
1960	18,155	7,362	23,409	5,000	2,721	56,647
1961	26,581	10,084	24,286	4,800	3,170	68,921
1962	30,743	13,685	14,604	6,800	4,066	69,898
1963	31,344	16,944	14,133	7,900	3,180	73,501
1964	23,233	23,480	10,112	6,100	2,805	65,730
1965	18,885	24,017	12,949	12,800	4,039	72,690
1966	18,588	20,967	14,601	11,100	3,729	68,985
1967	17,233	22,050	15,649	11,800	2,836	69,568
1968	15,283	27,143	15,230	12,500	2,362	72,518
1969	17,427	21,706	18,934	12,800	2,546	73,413
1970	20,115	24,221	15,727	9,000	2,207	71,270
1971	13,342	24,264	11,037	8,100	2,674	59,417
1972	15,300	14,541	11,029	8,600	3,424	52,894
1973	17,285	15,407	13,791	8,700	3,720	58,903
1974	15,594	14,669	11,664	7,100	3,048	52,075
1975	12,546	16,279	13,376	5,500	2,796	50,497

SOURCE: Data are from Shomura, (ed), 1980

The Pacific-wide catch of striped marlin rose steadily from approximately 5,000 MT in 1952 to 24,000 MT in 1965. From 1965 to 1971 the catch fluctuated between 20,000 and 27,000 MT. In 1972 the catch abruptly dropped to 14,500 MT and remained between 14,000 and 16,000 MT through 1975.

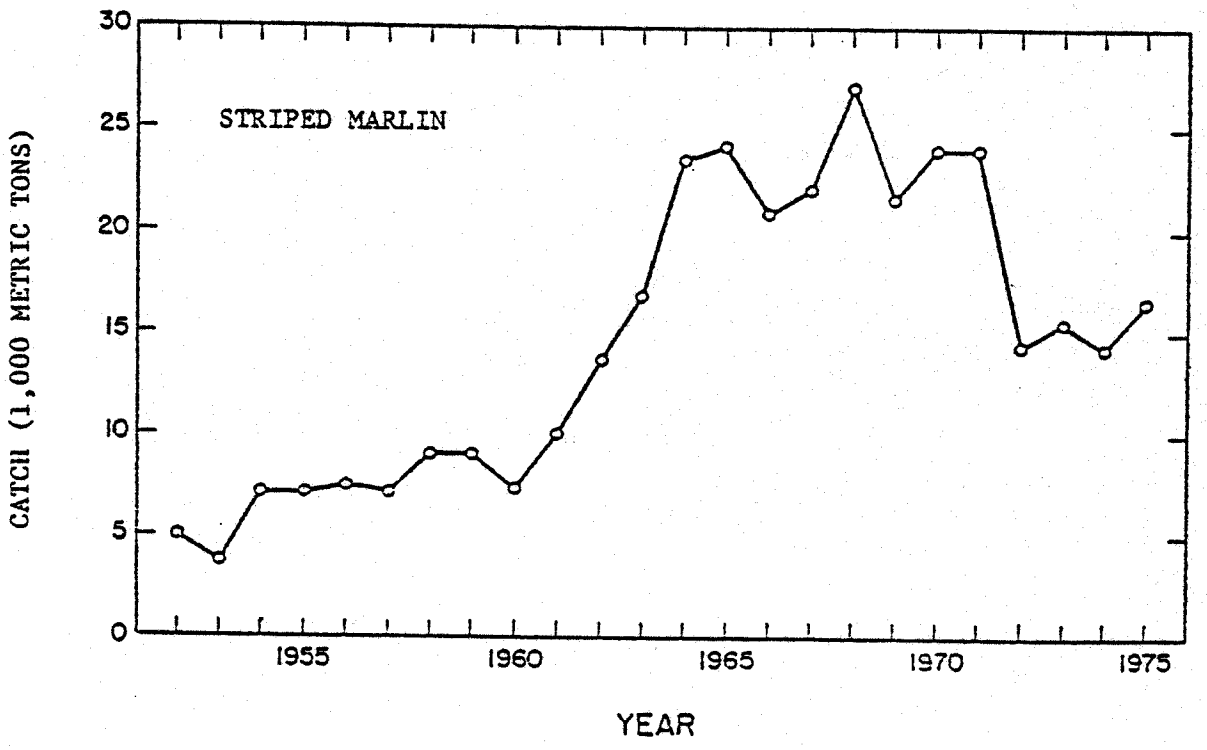


Figure 5.3. Catches of striped marlin in the Pacific, 1952-1975.

Source: Shomura (ed), 1980

The catch of black marlin in the Pacific rose to a peak of about 6,500 MT in 1956, then dipped to about 3,000 MT in 1959 and fluctuated between about 2,000 and 4,000 MT from 1960 to 1975.

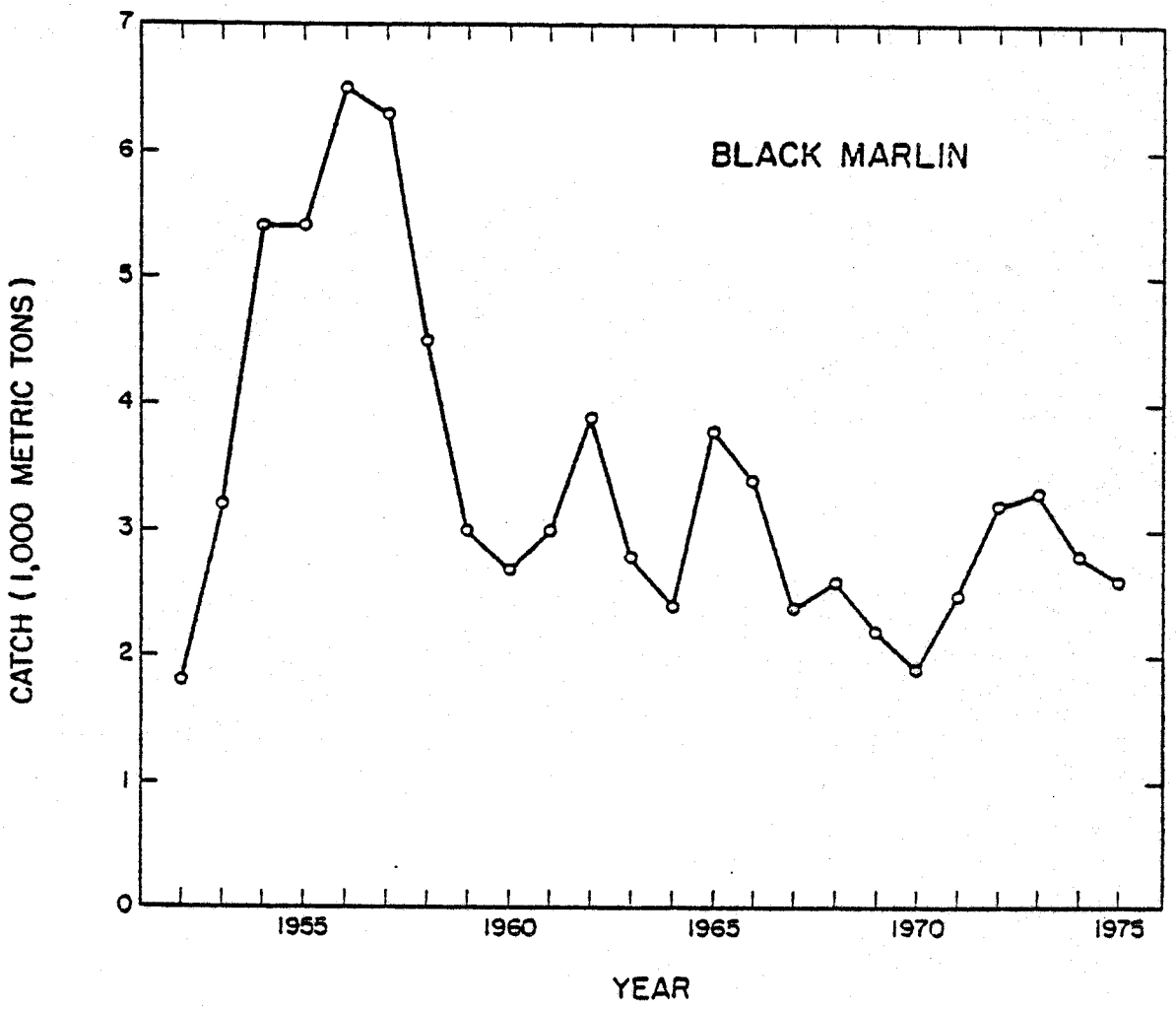


Figure 5.4. Total catch of black marlin in the Pacific, 1952-1975.

Source: Shomura (ed), 1980

The total annual Pacific catch of swordfish increased from 11,300 MT in 1952 to a record high of 24,300 MT in 1961. Since then the catch has fluctuated within a range of 10,100 to 18,900 MT, averaging 13,800 MT annually.

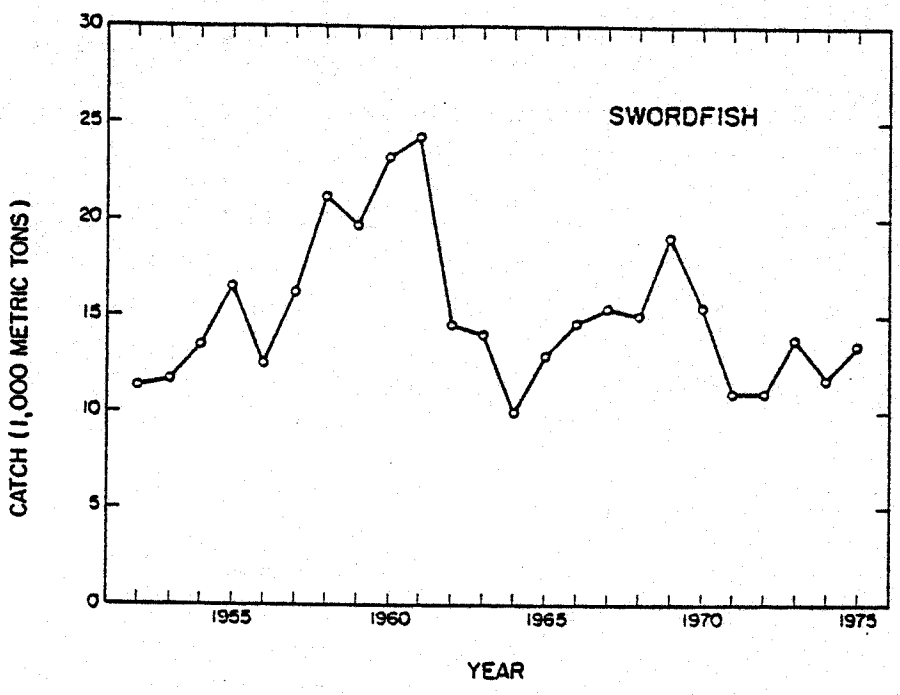


FIGURE 5.5 TOTAL CATCH OF SWORDFISH IN THE PACIFIC, 1952-1975.

SOURCE: Shomura (ed), 1980

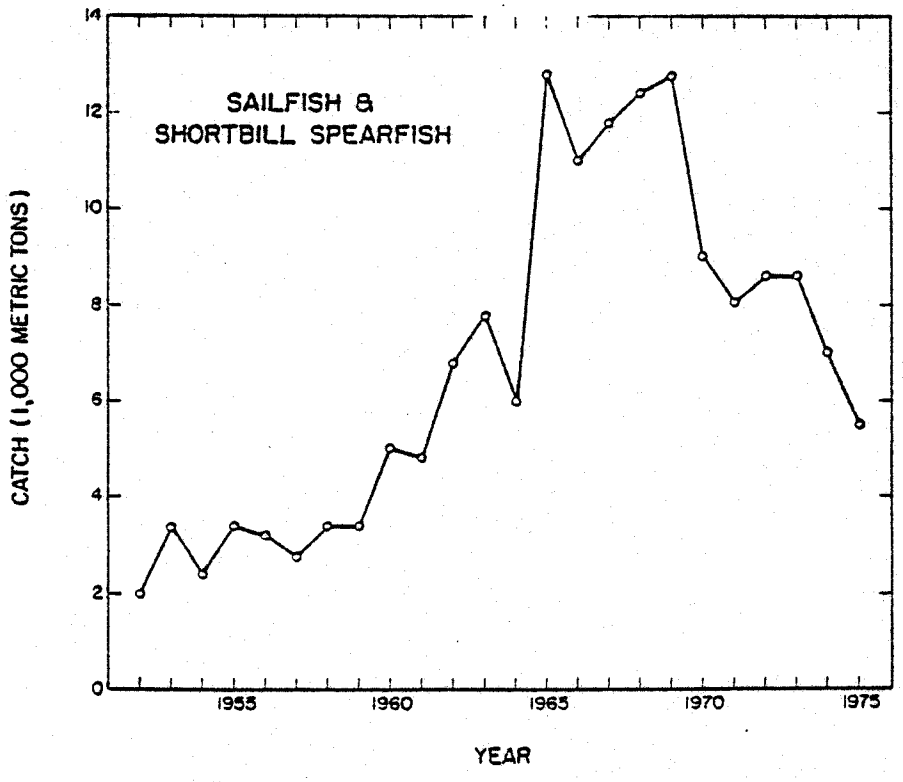


FIGURE 5.6 CATCHES OF SAILFISH AND SHORTBILL SPEARFISH IN THE PACIFIC, 1952-1975.

SOURCE: Shomura (ed), 1980

Before 1964 the annual Pacific landings of sailfish and shortbill spearfish amounted to less than 8,000 MT. A marked increase in catch to 12,800 MT was recorded in 1965. During the remainder of the 1960's the catches continued at around the 12,000 MT level and thereafter declined to about 5,5000 MT in 1975.

5.5.3.2 FCZ Catch Trends

Annual estimates of catches of billfish and tunas made by foreign longliners and baitboats in the FCZ of Hawaii, Guam, and American Samoa during the most recent 5-year period for which data are available (1973 through 1977) are shown in Tables 5.14 through 5.18.

5.5.3.2.1 Hawaii

The estimated annual foreign catch of billfish in the FCZ around Hawaii ranged from 162 to 497 MT during this period. The catch of blue marlin fluctuated between 20 and 83 MT; striped marlin, 78 and 168 MT; swordfish, 34 and 267 MT; and spearfish and sailfish, 13 and 45 MT. The annual catch of black marlin was 3 MT or less.

TABLE 5.14

FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, AND GUAM.

1973

	LONGLINE							BAITBOAT	TOTAL
HAWAII	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
Total foreign catch in FCZ	33	1	116	103	23	276	1728	952	2680
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	1	<1	8	5	<1	14	121	245	366
100 miles	4	<1	24	16	2	46	326	541	867
200 miles	18	1	78	89	10	196	980	952	1932
Main islands									
Foreign catch in FCZ within:									
50 miles	1	0	3	2	<1	6	24	0	24
100 miles	3	<1	7	3	1	14	84	0	84
200 miles	15	<1	38	14	13	80	748	0	748
AMERICAN SAMOA									
Foreign catch in FCZ within:									
50 miles	12	1	1	1	1	16	41	*	41
200 miles	106	10	21	12	6	155	496	*	496
GUAM									
*Foreign catch in FCZ within:									
50 miles	<1	0	<1	<1	<1	<1	3	85	88
200 miles	7	0	1	1	<1	9	44	234	278

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* None or data not available.

** Japanese only.

TABLE 5.15

FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA AND GUAM.

1974

	LONGLINE							BAITBOAT	TOTAL
HAWAII	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
Total foreign catch in FCZ	83	3	78	67	45	276	1720	2168	3888
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	<1	<1	1	4	<1	5	87	1190	1277
100 miles	3	<1	5	10	1	19	160	1707	1867
200 miles	24	1	20	45	7	97	498	2168	2666
Main islands									
Foreign catch in FCZ within:									
50 miles	2	<1	3	<1	1	6	30	0	30
100 miles	9	<1	13	3	7	32	190	0	190
200 miles	59	2	58	22	38	179	1222	0	1222
AMERICAN SAMOA									
Foreign catch in FCA within:									
50 miles	29	5	4	1	4	43	159	*	159
200 miles	89	14	18	4	9	134	498	*	498
GUAM									
Foreign catch in FCZ within:									
50 miles	1	0	<1	<1	<1	1	20	8	28
200 miles	27	<1	3	2	4	36	234	83	317

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* None or data not available.

** Japanese only.

TABLE 5.16

FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, AND GUAM.

1975

	LONGLINE							BAITBOAT	TOTAL
HAWAII	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
Total foreign catch in FCZ	20	1	93	34	14	162	1162	2258	3420
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	4	<1	18	4	2	28	346	955	1301
100 miles	6	1	46	9	4	66	574	1623	2197
200 miles	14	1	70	27	7	119	856	2258	3114
Main islands									
Foreign catch in FCZ within:									
50 miles	<1	<1	1	0	<1	1	17	0	17
100 miles	1	<1	3	<1	<1	4	39	0	39
200 miles	6	<1	23	7	7	43	306	0	306
AMERICAN SAMOA									
Foreign catch in FCZ within:									
50 miles	10	8	10	2	1	31	144	0	144
200 miles	38	28	31	7	6	110	562	65	562
GUAM									
Foreign catch in FCZ within:									
50 miles	3	0	<1	<1	0	3	14	68	82
200 miles	36	<1	<1	1	<1	37	202	1127	1329

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* Not available

** Japanese only.

TABLE 5.17

FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, AND GUAM

1976

	LONGLINE							BAITBOAT	TOTAL
	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
HAWAII									
Total foreign catch in FCZ	45	2	168	267	15	497	3395	4968	8363
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	5	<1	29	44	2	80	431	2483	2914
100 miles	12	<1	73	109	4	198	1101	4032	5133
200 miles	22	1	136	220	8	387	2399	4510	6909
Main islands									
Foreign catch in FCZ within:									
50 miles	5	<1	8	8	2	23	231	56	287
100 miles	10	1	16	18	3	48	458	245	703
200 miles	23	1	32	47	7	110	996	458	1454
AMERICAN SAMOA									
Foreign catch in FCZ within:									
50 miles	8	1	2	2	1	14	75	0	75
200 miles	56	13	11	9	16	105	575	50	575
GUAM									
Foreign catch in FCZ within:									
50 miles	9	<1	<1	2	<1	11	148	9	157
200 miles	58	1	2	10	2	73	922	110	1032

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* Not available.

** Japanese only.

TABLE 5.18

FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, AND GUAM.

1977

	LONGLINE							BAITBOAT	TOTAL
	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
HAWAII									
Total foreign catch in FCZ	63	3	144	82	13	305	3374	5892	9266
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	5	<1	23	11	1	40	384	2013	2397
100 miles	13	1	61	27	2	104	1038	3248	4286
200 miles	26	2	113	57	5	203	2304	5495	7799
Main islands									
Foreign catch in FCZ within:									
50 miles	7	<1	8	4	1	20	228	29	257
100 miles	15	1	15	9	3	43	460	154	614
200 miles	37	1	31	25	8	102	1070	397	1467
AMERICAN SAMOA									
Foreign catch in FCZ within:									
50 miles	3	1	1	0	0	5	17	*	17
200 miles	23	7	5	1	3	39	230	*	230
GUAM									
*Foreign catch in FCZ within:									
50 miles	14	1	<1	1	<1	16	314	94	408
200 miles	87	5	1	9	2	104	1989	2059	4048

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* None or data not available.

** Japanese only.

As would normally be expected, the pattern of foreign longline catch in the FCZ of Hawaii corresponds quite closely to the effort pattern. During 1973-1977, foreign longliners took an average of about 7½ times more tuna than billfish in the FCZ of the Hawaiian Islands. The foreign longline catch of billfish taken from the Northwestern Hawaiian Islands was 2.45 times higher (in terms of weight) than from the main Hawaiian Islands. The foreign longline catch of billfish and tuna combined in the Northwest Hawaiian Island waters was just about twice that of the main Hawaiian Islands.

Average baitboat catches of tuna during 1973-1977 were about 1½ times larger than average longline tuna catches in the Hawaii FCZ.

5.5.3.2.2 Guam

The foreign annual catch of billfish in the FCZ around Guam ranged widely from 9 to 104 MT. The catch of blue marlin ranged from 7 to 87 MT; striped marlin, <1 to 3 MT; swordfish, 1 to 10 MT; spearfish and sailfish, <1 to 4 MT; and black marlin, 0 to 5 MT. Between 5 and 20 times more tuna than billfish were taken on foreign longline gear in the FCZ around Guam during 1973 to 1977.

Slightly more tuna, on the average were taken by foreign baitboats (723 MT) than by foreign longliners (678 MT) during the 1973-1977 period.

5.5.3.2.3 Commonwealth of the Northern Mariana Islands

The average annual (1973-1977) level of foreign longline fishing in the FCZ of the CNMI was estimated to be 458 vessel days (Yong and Wetherall, 1980), which was slightly less than the average level of longlining in the FCZ of Guam for the same period (508 vessel days). On the other hand, pole-and-line fishing-by Japanese baitboats averaged 1,305 vessel days, nearly ten times the average level of baitboat fishing around Guam.

5.5.3.2.4 American Samoa

In the FCZ around American Samoa, the estimated foreign annual catch of billfish from 1973 to 1977 ranged from 105 to 155 MT. The catch of blue marlin ranged from 38 to 106 MT; striped marlin, 11 to 31 MT; swordfish, 4 to 12 MT; spearfish and sailfish, 6 to 16 MT; and black marlin, 13 to 28 MT. During this period 3 to 5 times more tuna than billfish were taken. Catches of skipjack tuna by Japanese baitboats in the American Samoa

FCZ were reported to be 65 MT in 1975 and 50 MT in 1976 (South Pacific Commission, 1980).

5.5.3.2.5 U.S. Possessions

Foreign longliners expended an average (1973-1977) of 1,684 vessel days fishing for tuna in the FCZ of the far flung U.S. possessions -- Wake, Johnston, Palmyra/Kingman, Jarvis, and Howland and Baker Islands (Figure 5.7). This was nearly as much as the average annual longline effort deployed in the FCZ of Hawaii (1,898 vessel days). Pole-and-line fishing by Japanese baitboats in the FCZ of U.S. Possessions averaged 381 vessel days, approaching the average level of foreign baitboat fishing in the FCZ surroundig the entire Hawaiian Archipelago.

5.5.4 Changes in Foreign Fishing

Manifestations of nationalism in the Pacific, world-wide fuel shortages, and rising operating costs are bringing about apparent changes in the strategies of distant-water fishing, changes in the fishing areas, and changes in the amount of effort expended. Rising operating costs are causing many Japanese longline vessels to seek high-value fish for their domestic raw fish market. As a result, the Japanese longline fleet has been gradually changing the fishing area from the tropics to the higher latitude areas which are more productive

for bigeye and bluefin tuna. Through preliminary discussions with several Japanese tuna industry representatives, the Council has learned that there may be possible cutbacks in the overall size of the Japanese longline fleet. Furthermore, fishing methods have been, and are, changing with gear being modified for deeper fishing (Suzuki and Warashina, 1977). These changes may result in marginal decreases in Japanese catch rates for the marlins, sailfish, and spearfish, which are more vulnerable to shallow gear fished in tropical waters. Suzuki and Warashina (1977) indicated that Japanese longliners began switching to deeper fishing longline gear in 1974 and that some vessels operating in the equatorial Pacific are now using this gear. However, decreased catch rates may be offset in part by increased average effort levels since the new longliners are larger and can apply higher levels of effort.

As the Japanese longline interests upgraded the longline fleet by building larger, modern longliners with flash-freezing facilities, Taiwanese and Korean interests bought the older Japanese boats. The Japanese put more and more emphasis on catching fish for the sashimi trade, while the bulk of the growing longline fleet from Taiwan and Korea continued to supply the canned tuna industry. This was done by offloading cannery-destined fish in the Pacific in places like Espiritu Santo (New Hebrides), American Samoa, Fiji, Singapore, and other areas. While longliners still fish primarily for raw material for canning, as is the case with the foreign longline fleet in American Samoa, the Japanese vessels have been replaced by smaller Taiwanese and Korean boats with crews inured to hard working conditions

for a lower wage.

The Japanese pole-and-line fishery for skipjack tuna has been going through a period of tremendous expansion. More and larger fishing vessels have joined the fleet (Maruyama, 1980). The fishing trips have been getting longer, necessitating the maintenance of catches in good condition over longer periods. Most freezing of skipjack tuna aboard ship is by the brine-freezing method, since large volumes of fish can be handled.

The skipjack tuna catch statistics for Japan indicate that while there have been year-to year fluctuations, the average for the last several years has been around 330,000 metric tons (MT). The 330,000 MT are produced as follows: 1) 122,000 MT by the coastal skipjack tuna vessels; 2) 10,000 MT by smaller nearshore pole-and-line vessels; 3) 22,000 MT by purse seine vessels; 5) 6,000 MT by various other fishing methods; and 6) 170,000 MT by distant-water skipjack tuna vessels (Ogawa, 1979).

The distant-water skipjack fleet is of interest to the Council. According to statistics of the Japan Fisheries Agency, there were 292 distant-water skipjack tuna vessels in 1976. More recent data compiled by the Federation of Japan Tuna Fisheries Co-operative Associations (Nikkatsuren) show 272 such vessels in the fleet. Of these, about 250 operate in the Pacific Ocean and the remaining 20 fish out of foreign bases. In addition to these vessels, there are 361 coastal vessels, about 3,000 smaller, near shore pole-and-line vessels,

and 68 large- and medium-sized purse seiners. Thus, skipjack tuna are being taken by these vessels which vary greatly in size, and the annual Japanese production of skipjack tuna is around 300,000-340,000 MT (Ogawa, 1979).

The establishment of exclusive fishing zones by Pacific island nations which do not exclude the tunas from their management authority, is resulting in shifts in fishing grounds for the foreign longline and baitboat fleets. In the long-run, more nations may develop their own fleets which may differ in efficiency than those of the long established distant-water fishing nations. This could result in data gathering and analysis problems unless some regional or international management body is established in the Pacific.

Finally, lack of fuel in some areas and high fuel costs in general may affect the distribution of effort in the Pacific and the composition of the catch, as well as vessel re-supply operations in American Samoa, Hawaii and Guam. Foreign longliners make Honolulu and Kahului (Maui) important points of supply for their operations in Hawaiian and equatorial waters. Foreign caught fish are the prime raw material sources for American canneries in Hawaii and American Samoa.

Table 5.19 presents average (1973-1977) catches of billfish and tunas taken by longliners and baitboats in the U.S. FCZ of Hawaii, Guam, and American Samoa. Table 5.20 presents a summary picture of fishing activity and catches of billfish and tunas (by species) taken by foreign longliners and baitboats in the U.S. FCZ of Hawaii, Guam, American Samoa, Northern Marianas, as well as in the U.S. FCZ of such

widely scattered island groups as Johnston, Wake, Howland and Baker, Palmyra and Jarvis (Figure 5.7).

There are some illuminating facts about foreign longlining that can be derived from Table 5.20.

1. The incidental catch rate for blue marlin is quite high in the FCZ around Guam (.08 mt/day), the main Hawaiian Islands (.04 mt/day), and American Samoa (.08 mt/day) compared to the incidental blue marlin catch rate around the NWHI (.02 mt/day);

2. Catch rates for striped marlin and swordfish are substantially higher around the NWHI (.15 mt/day) than around the main Hawaiian Islands (.08 mt/day), Guam (.01 mt/day) and American Samoa (.06 mt/day);

3. Catch rates for tuna are higher around the NWHI (1.26 mt/day) than around the main Hawaiian Islands (1.11 mt/day);

4. Billfish make up a higher proportion of the total foreign longline catch around American Samoa (19%) than around Hawaii (12%) or Guam (7%);

5. The average total catch rate (1.03 mt/day all species combined) in the FCZ around the CNMI and U.S. possessions is only slightly lower than average total catch rates in the FCZ around Hawaii, Guam, and American Samoa (1.2 mt/day);

6. Billfish are a relatively more important component of

total foreign longline catches around U.S. Possessions and the CNMI (13.4%) than around Hawaii, American Samoa, and Guam combined (12.1%), and considerably higher than around Hawaii and Guam combined (10.7%). The market value of billfish in Japan is comparable to the market value of tuna.

The significance of these facts is examined later under alternative management strategies (Section 7.0).

TABLE 5.19

AVERAGE FOREIGN CATCHES (METRIC TONS)
OF BILLFISH AND TUNA BY LONGLINERS AND BAITBOATS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, AND GUAM.

(1973-1977 AVERAGE)

	LONGLINE							BAITBOAT	TOTAL
	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORD-FISH	SPEARFISH & SAILFISH	TOTAL BILLFISH	TUNA	TUNA**	TUNA
HAWAII									
Total foreign catch in FCZ	49	2	120	111	22	303	2276	3248	5524
Northwestern Hawaiian Islands									
Foreign catch in FCZ within:									
50 miles	3	< 1	16	14	1	33	274	1377	1651
100 miles	8	< 1	42	34	3	87	640	2230	2870
200 miles	21	1	83	88	7	200	1407	3077	4484
Main islands									
Foreign catch in FCZ within:									
50 miles	3	< 1	5	3	1	11	106	17	123
100 miles	8	< 1	11	7	3	28	246	80	326
200 miles	28	1	36	23	15	103	868	171	1039
AMERICAN SAMOA									
Foreign catch in FCZ within:									
50 miles	12	3	4	1	1	21	87	*	87
200 miles	62	14	17	7	8	108	472	25	497
GUAM									
Foreign catch FCZ within:									
50 miles	6	< 1	< 1	1	< 1	6	100	53	153
200 miles	43	2	2	5	2	52	678	723	1401

SOURCE: Data from Yong and Wetherall (1980). Catches of < 1 MT are not included in the totals.

* Not available

** Japanese only.

TABLE 5.20

AVERAGE EFFORT (VESSEL DAYS) AND CATCH (METRIC TONS) OF BILLFISH AND TUNA SPECIES BY FOREIGN‡ LONGLINERS AND BAITBOATS** IN THE US FCZ OF HAWAII, AMERICAN SAMOA, GUAM, THE NORTHERN MARIANA ISLANDS, PACIFIC US ISLAND POSSESSIONS, AND THE PACIFIC OCEAN
(1973-1977 AVERAGE)

	SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)	AMERICAN SAMOA (3)	GUAM (4)	NORTHERN MARIANAS (5)	WAKE (6)	JOHNSTON (7)	PALMYRA KINGMAN (8)	JARVIS (9)	HOWLAND BAKER (10)	WESTERN PACIFIC US FCZ (1)+(2)+(3)+...+(10)	PACIFIC OCEAN θ
LONGLINERS	BLUE MARLIN	28	21	49	62	43	27	16	36	34	4	25	296	14,600
	STRIPED MARLIN	36	83	119	17	2	21	7	11	16	*	1	194	14,500
	SWORDFISH	23	88	111	7	5	21	7	8	17	2	5	183	14,800
	BLACK MARLIN	1	1	2	14	2	1	*	*	2	*	1	22	3,100
	SPEARFISH & SAILFISH	15	7	22	8	2	1	23	4	4	1	2	67	9,500
	(A) ALL BILLFISH	103	200	303	108	54	71	53	59	73	7	34	762	56,500
	ALBACORE TUNA	103	438	541	353	54	82	161	25	*	2	5	1,223	47,000
	YELLOWFIN TUNA	206	212	418	120	436	230	33	84	93	31	256	1,701	85,700
	BIGEYE TUNA	558	754	1,312	60	188	116	44	309	227	40	177	2,473	112,600
	BLUEFIN TUNA	0	2	2	*	*	*	*	*	0	*	*	2	***
	SKIPJACK TUNA	1	1	2	*	*	*	1	*	1	*	*	4	***
	(B) ALL TUNA	868	1,407	2,275	533	678	428	239	418	321	73	438	5,403	245,300
	EFFORT	780	1,118	1,898	904	508	458	256	423	489	87	429	5,452	
BAITBOATS**	ALBACORE TUNA	0	28	28	0	0	4	0	0	0	0	0	32	62,500
	YELLOWFIN TUNA	16	140	156	0	13	301	2	2	8	0	1	483	6,800
	BIGEYE TUNA	36	231	267	0	*	4	1	1	8	0	0	281	2,800
	BLUEFIN TUNA	0	5	5	0	*	2	0	0	0	0	0	7	***
	SKIPJACK TUNA	119	2,674	2,793	25	709	4,674	1,211	219	587	2	282	10,502	481,600
	(C) ALL TUNA	171	3,078	3,249	25	722	4,985	1,214	222	603	2	283	11,305	553,700
	EFFORT	21	372	393	4	142	1,305	246	33	67	<1	34	2,224	
LONGLINERS & BAITBOATS	TOTAL TUNA (B) + (C)	1,039	4,485	5,524	558	1,400	5,413	1,453	640	924	75	721	16,708	799,000
	GRAND TOTAL (A)+(B)+(C)	1,142	4,685	5,827	666	1,454	5,484	1,506	699	997	82	755	17,495	855,500

* < 1 MT

‡ Japanese, Taiwanese, Korean

** Japanese Only

*** Unavailable but minor catches relative to other species

θ Wetherall, pers. comm. 1/8/81

SOURCE: Data are from Yong and Wetherall (1980)

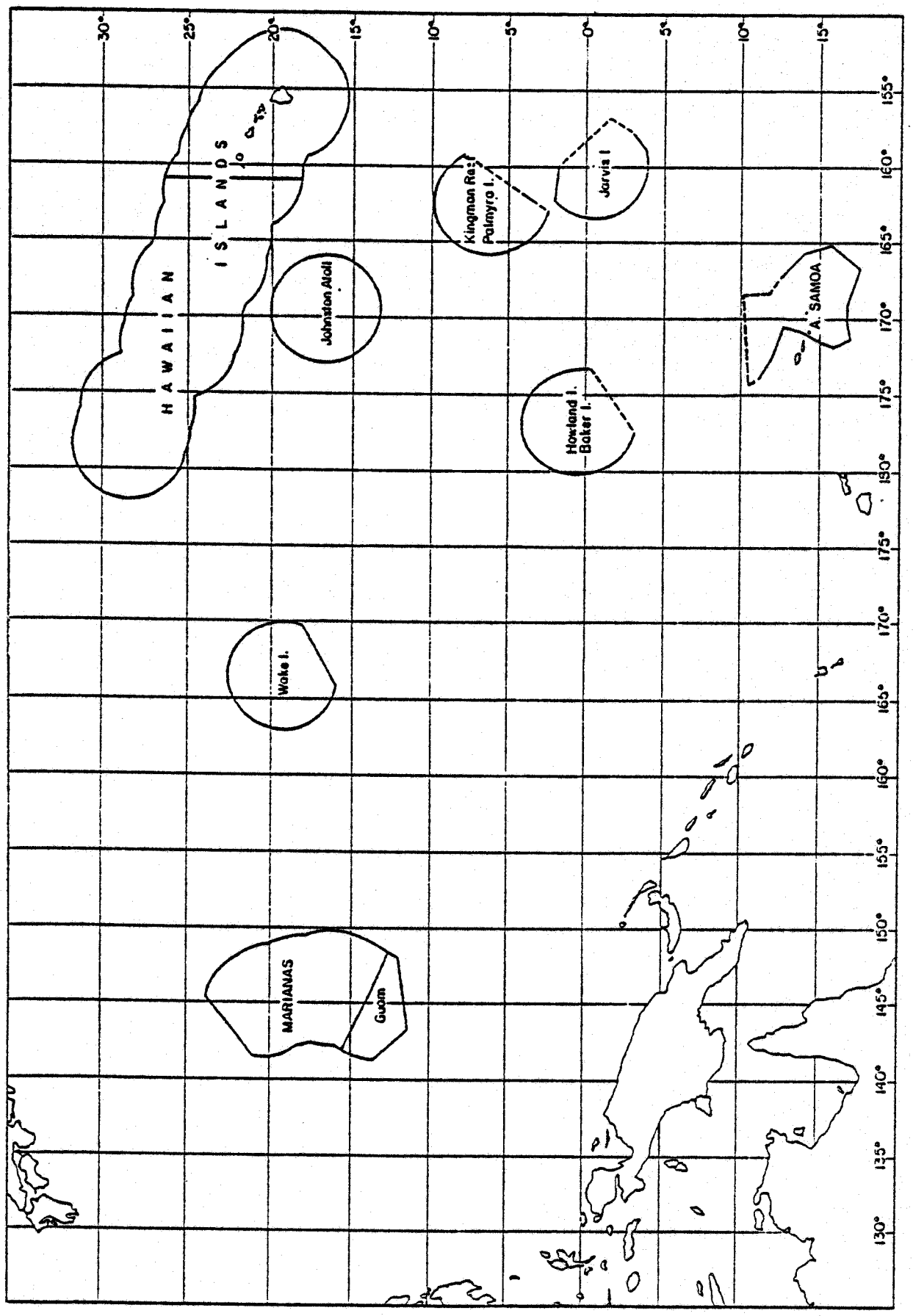


Figure 5.7 Approximate boundaries of the U.S. Fishery Conservation Zone around Hawaii, American Samoa, Guam, the Northern Mariana Islands, and U.S. possessions.

5.5.5 Other Fishing

Unlike some of the tunas, billfish generally do not aggregate in schools. Because of this behavioral characteristic, billfish are not intentionally harvested by baitboats or by purse seiners, the most prevalent surface fishing methods used for fishing tuna. Billfish however, are taken on infrequent occasion incidentally by purse seiners especially when sets are made around floating objects. Purse seining is not conducted in the U.S. FCZ of Hawaii, Guam, and American Samoa so far as is known.

A coastal drift-net fishery for billfish began operations off of Japan around 1972 (Suisan Sekai, 1978). This fishery is conducted by salmon drift-net vessels during the off season and by small tuna longline vessels unable to fish in distant waters. A big reason for the switch to drift-net fishing is that the method requires no expenditures for bait and the operation consumes much less fuel. In addition to taking billfish when they migrate in large numbers off of Japan from July through October, surface drift-nets also take skipjack and yellowfin tuna, dolphinfish, and sharks.

Some billfish, mostly swordfish and some marlin, are taken by harpoons.

Sportfishing billfish catches in the Pacific are hardly documented as compared to longline catches. There are a number of well known big game fishing centers in the Pacific Basin (e.g. Pinas Bay, Panama; Cairns, Australia; Cabo Blanco, Peru; Baja California, and

Acapulco, Mexico; Kona, Hawaii), but even in these major centers data on billfish catches are not routinely and systematically collected. In addition, there are literally hundreds of ports from which thousands of small, private sport and subsistence boats operate. If all of their billfish catches were known, the total would probably be impressive. To date, however, it is impossible to estimate accurately the number of boats and people involved in sport fishing for billfish, and most importantly, how many billfish of each species are caught. This is true not only for the Western Pacific Region under the jurisdiction of the Council, but for the entire Pacific Ocean as well.

5.5.6 Foreign User Group Interactions

There has been no documented conflict or competition in the FCZ between vessels from different foreign nations. In general, longliners and baitboats from Japan have been more active around Hawaii and the Marianas archipelago, including Guam. Vessels from Taiwan and South Korea have been most active around American Samoa, although the greater part of their fishing occurs beyond the FCZ. Small longline vessels from Korea apparently fish throughout the FCZ, but no data are available on the magnitude of their effort.

There also has been no documented conflict or competition between foreign gear types. This may reflect regulations imposed on Japanese vessels of different types to prevent gear conflicts. For example, Japanese regulations limit the number of purse seiners allowed to fish in "southern waters", i.e., waters south of 30°N. latitude. It appears that government action influences the patterns of foreign

fishing for longliners and baitboats as well.

5.6 Domestic and Foreign Fishery Interactions

5.6.1 Gear Conflicts

There are no clear documented cases of direct gear conflicts between domestic and foreign vessels in the FCZ. In part this reflects the fact that foreign and domestic vessels have generally fished in different areas during different seasons in the past. It may also be that such conflicts as have occurred have not been reported. Finally, it may be that domestic fishers, seeing foreign longline gear in the water, will move elsewhere to avoid entanglement and perhaps to fish in an unfished location. As domestic effort expands and extends to new areas, the risk of gear conflicts will grow in the absence of a FMP.

5.6.2 Catch and Effort Relationships

The only study of the relationship between domestic catch and foreign catch and effort is a simulation model for the Hawaii portion of the FCZ (Lovejoy, 1977). The model is an attempt to identify the direction and relative magnitude of changes in domestic commercial and recreational catches of billfish if foreign or domestic longline fishing were prohibited within certain portions of the FCZ around Hawaii. The model is necessarily simplified by a number of assumptions concerning migration patterns, catchability coefficients, and catch-effort relationships for different kinds of gear. The model concludes that foreign longlining in the FCZ does affect domestic commercial and

recreational catches in the FCZ around Hawaii. The model is discussed in more detail in Section 8.4.1.

Table 5.21 compares estimated 1976 catches of billfish and tunas made by foreign and domestic fishermen in the U.S. FCZ of the Hawaiian Islands. Domestic fishermen caught about 1½ times more billfish than Japanese longline fishermen, while Japanese fleets landed about 4 times more tuna than domestic trollers and longliners combined. Reliable figures on Korean fishing are not yet available.

5.6.3 Market and Trade Opportunities

There is no significant relationship between domestic billfish prices and revenues in Hawaii and foreign fishing in the FCZ around Hawaii. Foreign-caught billfish do not enter Hawaii markets to compete with U.S.-caught billfish. So far as is known, domestic vessels are able to satisfy the domestic market demand for billfish.

It is alleged, however, that foreign longline vessels "dump" their incidental billfish catches on the market in Guam. The market there is limited due to the relatively low population level, and availability of foreign caught fish results in sharp price drops to domestic producers. Domestic fishermen claim they are unable to compete under these conditions. The consumer presumably benefits to some degree if this is a common event and if low ex-vessel prices are passed on by wholesalers and retailers. Whether "dumping" in fact occurs, how much, and whether prices at the consumer level reflect sudden increases in supply, has not been confirmed.

It is uncertain there can be substantial U.S. export trade in billfish should this FMP be implemented. Local markets are presently able to handle all domestic landings. Foreign markets, however, are strong, with some ex-vessel billfish prices in Japan now exceeding the prices paid for large yellowfin tuna (Table 5.22). Foreign harvests have been sufficiently large and steady that there has been little incentive to date for developing an import market for U.S.-caught billfish. As the U.S. fishery develops, however, a portion of the billfish catch (especially striped marlin and swordfish) may enter world trade if the fish is properly handled.

TABLE 5.21

COMPARISON OF 1976 CATCHES (MT) BY DOMESTIC AND FOREIGN FISHERMEN IN THE US FCZ OF THE HAWAIIAN ISLANDS

Species	A Charter Sportfishing Trollers [1]	B Non-Charter Recreational Commercial Trollers [1]	C Commercial Trollers [1]	D Domestic Longliners [2]	E=(A+B+C+D) Total Domestic [2]	F Foreign Longliners [3]	G Foreign Baitboats [4]	H=(F+G) Total Foreign	I=(E+H) Total (Domestic & Foreign)
Blue Marlin	342	217	77	8	644	45	-	45	689
Striped Marlin	18	9	1	34	62	168	-	168	230
Other Billfish	7	12	4	4	27	284	-	284	311
Total Billfish	367	238	82	45	732	497	-	497	1,229
Ahi (Yellowfin, Bigeye & Albacore)	142	511	1,145	130	1,927	3,392	359	3,751	5,678
Aku (Skipjack)	42	69	10	*	121	2	4,609	4,611	4,732
Total Tunas	184	580	1,155	130	2,048	3,394	4,968	8,362	10,410
TOTAL CATCHES OF BILLFISH & TUNA	552	818	1,237	175	2,781	3,891	4,968	8,859	11,640

1/ Data from Table 4, Cooper and Adams (1978)
2/ Data from Table 6, Cooper and Adams (1978)
3/ Data from Table 17, Yong and Wetherall (1980)
4/ Data from Table 75, Yong and Wetherall (1980)

* < ½ MT

TABLE 5.22

AVERAGE EX-VESSEL PRICES[1/] FOR TUNA AND BILLFISH
LANDED AT YAIZU, JAPAN, FEBRUARY, 1980

Species[2/]	Yen/Kg	$1/MT	$1/Pound
Southern Bluefin	2,326	9,700	4.40
Bluefin	2,288	9,524	4.32
Bigeye	1,006	4,189	1.90
Swordfish	686	2,866	1.30
Striped Marlin	680	2,844	1.29
Blue Marlin	569	2,381	1.08
Yellowfin	517	2,161	0.98
Albacore	515	2,138	0.97
Black Marlin	419	1,742	0.79
Skipjack	351	1,455	0.66

1/ Based on 240 yen per 1 U.S. dollar for February, 1980

2/ Species listed in order of decreasing unit value

SOURCE: NMFS, Foreign Fishery Information Release No. 80-4, April 16, 1980

6.0 HISTORY OF MANAGEMENT AND RESEARCH

6.1 State and Territorial Management Measures

There are no State or Territorial restrictions on fishing for billfish in terms of seasons, gear restrictions, or other limitations on fishing practices. There are, however, certain licensing and reporting requirements. Hawaii regulations require a person to obtain a commercial fishing license prior to selling any fish caught; and commercially licensed fisherman must file a monthly catch report on all fish caught, whether or not sold, during each month. Recreational and subsistence fishermen are not required to obtain licenses nor to report their catches. Charterboat operators are essentially classified as commercial fishermen and are required to submit monthly catch reports since they generally sell all or most of the catch not kept by their customers.

Guam regulations establish that commercial fishermen must have licenses to sell their catch and must report their catches under that license. Recreational and subsistence fishermen are not required to obtain licenses or report catches. The Government of Guam is participating in a survey program to improve catch and effort data on recreational and subsistence fishing.

The Territory of American Samoa does not have any licensing requirements for commercial, subsistence or recreational fishermen. Voluntary catch reports and back-up interviews are relied on to obtain catch and effort data from commercial fishermen. The Office of Marine Resources participates in the national recreational fisheries survey program and uses creel censusing to obtain subsistence and recreational catch and effort data.

6.2 Preliminary Fishery Management Plan (PMP)

As noted previously, the National Marine Fisheries Service has implemented the PMP for Pacific Billfish, Oceanic Shark, Wahoo and Mahimahi. The PMP applies to foreign longline fishing in the FCZ around Hawaii, American Samoa, Guam, the Northern Mariana Islands, U. S. Possessions, and the mainland West Coast (except Alaska).

The PMP became effective on April 1, 1980 (Federal Register, Vol. 45, No. 46, March 6, 1980, pages 14581-14588). Any foreign vessel desiring to engage in longline fishing in the FCZ must possess a permit, whether or not billfish and associated species would be retained. The PMP established retention and non-retention zones for billfish within each fishing area (Table 6.1). National allocations for individual species of billfish must be taken outside the non-retention zones. All billfish caught by foreign vessels within the non-retention zone must be returned to the sea without removing the fish from the water. Billfish hooked in the non-retention zones are not counted against national allocations.

The TALFF (total allowable level of foreign fishing) for each species and area is shown in Table 6.2. A zero TALFF for any particular billfish species in an area means that a hooked fish of that species in that area must be returned to the sea by cutting the leader or line without removing the fish from the water. The "Reserve" component may be released to foreign fishermen only if domestic catches of that species do not exceed expectations. Once TALFF and the "Reserve" are taken for any particular species in an area, that species becomes a prohibited species and cannot be retained anywhere in the FCZ of that area.

TABLE 6.1

RETENTION AND NONRETENTION ZONES FOR BILLFISH WITHIN EACH FISHING AREA UNDER THE PMP

Regulatory Area	Billfish Retention Zones	Billfish Nonretention Zones
West Coast	None	Between 12 and 200 nautical miles
Guam and Northern Mariana Islands	(1) Beyond 50 nautical miles from Guam, Rota, Tinian, Aguijan, and Saipan, and (2) beyond 12 nautical miles of the remaining islands of the Northern Mariana Islands.	Between 12 and 50 nautical miles from Guam, Rota, Tinian, Aguijan, and Saipan.
Hawaii and Midway Islands	(1) Beyond 100 nautical miles from the islands of Hawaii, Kahoolawe, Kauai, Lanai, Maui, Molokai, Niihau, and Oahu, and (2) beyond 50 nautical miles from the remaining islands of the State of Hawaii and Midway Islands.	(1) Between 12 and 100 nautical miles from the islands of Hawaii, Kahoolawe, Kauai, Lanai, Maui, Molokai, Niihau, and Oahu, and (2) between 12 and 50 nautical miles from the remaining islands of the State of Hawaii and Midway Islands.
American Samoa	Beyond 12 nautical miles from American Samoa.	No nonretention zone.
U.S. Possessions	Beyond 12 nautical miles from any other possession of the United States in the Central and Western Pacific Ocean.	No nonretention zone.

TABLE 6.2

TALFF AND RESERVE FOR PACIFIC BILLFISH AND OCEANIC SHARKS BY FISHING AREAS UNDER THE PMP
(Metric Tons)

Species		(Fishing Areas) West Coast	Hawaii (Including Midway)	Guam and N. Marianas	American Samoa	Possessions
Swordfish	TALFF	0	78.9	3.5	2.4	28.1
	Reserve	0	8.8	0.4	0	0
Blue Marlin	TALFF	0	0	0	34.9	76.3
	Reserve	0	8.6	23.9	0	0
Black Marlin	TALFF	0	0	0.5	5.3	6.2
	Reserve	0	0	0.1	0	0
Striped Marlin	TALFF	0	139.8	4.2	7.8	46.6
	Reserve	0	15.5	0.5	0	0
Sailfish/Spearfish	TALFF	0	17.4	4.1	2.2	14.3
	Reserve	0	1.9	0.5	0	0
Sharks	TALFF	0	1000.5	21.9	101.6	651.4
	Reserve	0	111.1	0	0	0
Wahoo	TALFF	0	0	0	2.0	0
	Reserve	0	0	0	0	0
Mahimahi	TALFF	0	0	0	2.0	0
	Reserve	0	0	0	0	0

A total of 912 vessel permits were granted to foreign longliners to fish in the FCZ of the Western Pacific region during Calendar Year 1980. These are listed by nation in Table 6.3. No nations requested allocations for billfish, thus, all permit holders entering the FCZ to fish would have been fishing under full non-retention rules at all times. About an equal number of permit applications are expected for the Calendar Year 1981. Permit holders wishing to fish in the FCZ must first radio ahead to the NMFS. There have been four such requests. In each case the vessel was instructed to pick up an observer. All four vessels declined and decided not to fish in the FCZ. There has not been any foreign longlining in the FCZ to date under the regulations of the PMP.

TABLE 6.3. NUMBER OF FOREIGN VESSEL PERMITS IN THE FCZ OF THE WESTERN PACIFIC REGION UNDER THE PMP FOR 1980 AND 1981

	1980	1981
Japan	789	454
Taiwan	92	99
Korea	31	20
Total	912	573 (as of Jan. 19, 1981)

Permit applications are not area specific to the FCZs around Hawaii, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or U.S. island possessions. Rather, they are lumped together for the U.S. FCZ of the Pacific Ocean.

There was a flat permit fee of $200 per vessel during Calendar 1980. Beginning in January, 1981, the vessel fee was reduced to $50 per vessel

together with a 20% surcharge, which in total amounts to $60 per vessel. In addition, there is a poundage fee for those species for which there is a TALFF (Table 6.4). The poundage fee is a price that foreign longliners need to pay for the privilege of retaining these species. Tuna catches are not subject to fees because tuna are exempt from the FCMA. Poundage fees are not charged for non-retention fisheries (Table 6.4).

6.3 International Management

There are no treaties or conventions to which the U.S. is a party for international management of billfish in the FCZ of the Western Pacific Region.

There is at least one bilateral agreement under which the catch of billfish by longliners is being restricted. The Governments of Japan and Australia have reached an agreement whereby Japanese longline vessels will be prohibited from fishing in black marlin and tuna grounds north of Queensland (NMFS, Market News, November, 1980).

The Government of Mexico has unilaterally prohibited foreign vessels from setting longlines in its entire 200 miles economic zone in the Pacific. It is noteworthy that striped marlin catch rates off Mexico have increased considerably since the Mexican prohibition was put in effect (Southwest Fisheries Center, 1981).

6.4 Research

Discussions held in the early 1970s at a NMFS-sponsored workshop at the NMFS Tiburon Laboratory and at a special session of the 22nd Tuna Conference

TABLE 6.4 POUNDAGE FEES [$ PER METRIC TON (MT)] BY SPECIES

	1980	1981		
	All Areas	Hawaii	Guam	American Samoa
Blue Marlin	38.89	103.00	140.00	35.00
Striped Marlin	98.56	259.00	154.00	35.00
Black Marlin	38.89	103.00	140.00	35.00
Swordfish	106.26	224.00	154.00	45.00
Sailfish/Spearfish	38.89	103.00	140.00	35.00
Mahimahi	152.39	*	*	52.00
Wahoo	103.88	*	*	8.00
Sharks	28.88	8.00	8.00	4.00

* Cannot be retained; must be released by cutting leader.

Source: NMFS, 1981

identified the need for a symposium to bring together all the available information on billfish. The culmination of these discussions was an International Billfish Symposium, co-sponsored with the Hawaiian International Billfish Tournament, held at Kailua-Kona, Hawaii, during August 9-12, 1972 (Shomura and Williams, 1975). Papers presented at the symposium discussed the state of knowledge on billfish species identification, their life history, distribution and their fisheries. Discussion on these papers pointed out major gaps in the knowledge of billfish biology and population dynamics, particularly with regard to data on age and growth, mortality rates and stock structure. To fill some of the gaps identified at the symposium, the Southwest Fisheries Center of the NMFS and the Council sponsored a Pacific Billfish Stock Assessment Workshop in 1977 (Shomura, ed., 1980). Assessments of the various billfish stocks in the Pacific resulting from the workshop proceedings have been used extensively in the preparation of this FMP.

Additional research has been proposed and some has begun. The Pacific Gamefish Foundation, in cooperation with the Council, is undertaking a biochemical analysis of the population structure of Pacific blue and striped marlin. The intent is to find out if the Council is dealing with a small part of single stocks, or if there are separate stocks of blue and striped marlin. If the latter is true, there would be much greater potential for effective conservation and management for biological objectives through control of fishing in the FCZ, than if there is but one stock for each of the species in the Pacific.

In addition, the NMFS with cooperation from fishing clubs, tournament directors, and others has been taking length, weight, sex, and maturity measurements for billfish for many years. There have also been attempts to tag and release billfish to improve knowledge about distribution and migratory patterns.

The tagging efforts have had very limited success due to either low recapture rates, or to low tag return rates, or to a combination of the two factors.

Social and economic aspects of domestic fishing have not been researched extensively. Cooper and Adams (1978) analyzed data collected in a survey made for NMFS by Research Associates, Inc. Fishing vessel owners in Kailua-Kona were interviewed during 1976 concerning their fishing activity (catch, sales, revenue), and the results were extrapolated to derive estimates of total catch, sales, and revenue for various billfish fishery sectors in Hawaii. The results are now five years old; the economic estimates of various fisheries values (Section 5) are now probably undervalued and the study needs to be updated. The Council and NMFS are cooperating in developing an up-to-date inventory of all fishing vessels in Hawaii, Guam, American Samoa, and the CNMI to establish a sample "universe" for future surveys. The Council is also supporting field and household survey of marine recreational fishery participants in each of the Council's areas. These studies will identify changes in the local billfish and related-species fisheries since the Cooper and Adams study (1976 base year).

7.0 ALTERNATIVE MANAGEMENT STRATEGIES AND MEASURES

The INTRODUCTION (Section 4.0) to this FMP summarized the Council's reasons for concluding that the FMP is necessary and the factors which make development of a workable management program a complicated matter. This section will provide additional information on the manner in which the Council approached the management or decision-making process; that is, how the Council considered a number of alternatives in selecting those to be given detailed analysis and comparison in Section 8.0.

7.1 Basis for Council Action

7.1.1 Evaluation of the PMP

The first choice faced by the Council was whether or not to develop a FMP to supersede all or part of the PMP already in place. The first alternative considered was "no action", that is, retain the PMP. Section 6.2 indicates that the PMP allows an unlimited amount of foreign longlining in the FCZ; specifies limits on retention of different non-tuna species in the FCZ; establishes "non-retention" zones in which all billfish must be released, even if there is a portion of the foreign quota (allocations) remaining to be taken; specifies the manner of release for billfish; provides for a system of "reserves" to be made available for foreign fishing if domestic catches do not exceed estimated levels; and requires data reporting by foreign vessels. The PMP only applies to foreign vessels. It was assumed for purposes of analysis in preparing the PMP that foreign effort under the PMP would approach levels of fishing in the 1971-1975 period, with some shift out

of non-retention zones.

There has been no documented foreign longline fishing in the FCZ since the PMP went into effect on April 1, 1980. There have been no instances of foreign long-liners sighted operating in the FCZ on the patrol flights taken over the Guam, American Samoa and Hawaii portions of the FCZ. This appears to be due to the restrictions of the PMP. Foreign vessels, however, are still interested in having the option of fishing in the FCZ. In 1980, permits were issued to 789 Japanese, 92 Taiwanese, and 31 South Korean vessels. So far, almost 600 permits have been issued for 1981. No nation, however, has applied for allocations of billfish, suggesting that non-retention of billfish would be adopted throughout the FCZ.

The PMP, as indicated earlier, is not having its intended effect nor would it be effective in increasing domestic billfish catches if foreign fishing were to occur. First, inasmuch as no foreign longlining now is occurring in the FCZ, longliners have apparently taken the PMP to effectively deny them a reasonable opportunity to harvest tuna in the FCZ. Nominal permit fees are being paid for naught. Foreign catch and effort reports are not being added to the data base. Presumably, foreign longliners are fishing beyond the FCZ with no significant hardship.

If longlining were to occur at 1973-77 levels under a total non-retention policy (i.e., no allocations of billfish requested or made), longliners would likely catch historic levels of tuna, but the costs would be high. There would have to be advance reports of

billfish on board the vessels prior to entry into the FCZ. Provisions would have to be made for possible hold inspection to verify billfish on board prior to fishing in the FCZ, or after, or both. Longliners may have to make costly trips to a U.S. port to embark and disembark observers. Hooks and leaders would be lost in releasing billfish. Worst of all, approximately 300 mt. of billfish could be wasted, assuming average billfish catch levels and mortality rates (Tables 7.1 and 7.2) determined by the Honolulu Laboratory, NMFS (see Appendix T).

Similarly, high costs would accrue under the non-retention zones approach, assuming foreign longliners fished under appropriate allocations. Notification in advance of entry to the FCZ, embarking and disembarking observers, and provisions for hold inspections would still apply. Gear losses would be less since non-retention would not apply to all billfish species or all areas, only in the non-retention zones. Waste would also decrease since not all billfish would be discarded. However, about 54 mt. of blue marlin would be wasted around Hawaii and Guam, where blue marlin are most highly valued by sport fishermen.

U.S. administrative and enforcement costs would increase dramatically for effective enforcement of the PMP if foreign fishing occurs. With no fishing, surveillance flights could be sufficient to provide a reasonable assurance that violators would be spotted. If fishing occurs under full or partial non-retention requirements and quotas, at-sea observers and enforcement capability become critical to check on compliance and to collect detailed data. If 1973-77 effort

TABLE 7.1. CONDITION OF BILLFISH UPON LANDING

Species	PERCENT DEAD	
	Honolulu Laboratory Data	Far Seas Fisheries Research Laboratory Data
Swordfish	60.0	45.6
Striped Marlin	45.5	23.3
Blue Marlin	70.9	44.4
Black Marlin	74.3	45.9
Sailfish/Shortbill Spearfish	75.0	57.8

was applied under the PMP, an average of 3310 vessel days would have to be monitored per year around Hawaii, Guam and American Samoa alone. That is the equivalent of 9 vessels, each fishing 365 days in an area of 833,000 square miles. The cost of at-sea enforcement would be prohibitive.

The Council considered the "no action" alternative (i.e., continue the PMP) in relation to the objectives of the FMP and rejected the alternative for the following reasons:

1. Objectives 1-5 call for a transfer of billfish from foreign to domestic fisheries. The PMP allows unlimited foreign longlining in all parts of the FCZ, thus providing little or no assurance that billfish would not be caught or killed by foreign vessels if they chose to fish in the FCZ. The PMP would not provide for achievement of these objectives.

2. Objective 6 would require elimination of the non-retention approach. Longlining inevitably results in hooking billfish, and substantial numbers of those billfish are dead upon retrieval of the longline. "Release" of dead fish is wasteful but would be required by the PMP in non-retention zones, or when TALFF has been reached, or in the entire FCZ if no allocations have been made. Thus, the PMP would not achieve Objective 6.

TABLE 7.2

POTENTIAL "WASTE" OF BILLFISH

	Mortality Rate	Mortality (Metric Tons)		
		Hawaii	Guam	American Samoa
Blue Marlin	.71	34.8	30.5	51.1
Striped Marlin	.46	54.7	.9	9.2
Swordfish	.60	66.7	3.0	4.8
Black Marlin	.74	1.5	1.5	11.8
Sailfish/Spearfish	.75	16.5	1.5	3.8
Totals		174.2	47.4	80.7

NOTE: Assumes 1973-1977 average catch, by area, with mortality rates as determined by NMFS Honolulu Laboratory, and assuming no retention of billfish in the FCZ of Hawaii, Guam, and American Samoa.

3. Objective 7 requires clear delineation of zones in which domestic fishing may proceed without risk of conflict with foreign gear. The PMP would allow foreign longlining anywhere in the FCZ beyond 12 miles from shore, although the billfish non-retention requirements would apply. Gear conflicts would not be precluded in areas of concentrated domestic fishing, so Objective 7 would not be achieved.

4. The PMP places "minimal interference with foreign longlining" at an equal level as achievement of the other objectives. The PMP, however, appears to be having the effect of eliminating longlining in all areas of the FCZ. This is an unnecessary restriction and the Council proposes that a more liberal program be adopted consistent with Objective 8.

5. Both the FMP and the PMP are intended to improve the statistical base for better stock assessment. The PMP may result in greater improvement in the data base should there be greater foreign cooperation under the PMP than under the FMP. At present, however, the PMP is effectively stopping the flow of data for the FCZ by precluding longlining in effect. The FMP is intended to promote the exchange of data.

6. As with Objective 8, the Council's FMP proposes to achieve domestic fishery benefits pursuant to FCMA requirements as a primary objective. The importance of international cooperation is recognized and supported. The FMP gives high priority to the need to protect domestic fisheries while pursuing international cooperation.

The PMP does not provide as good a basis for such cooperation in the long term.

7. Finally, the PMP is far more complicated and difficult to enforce than this FMP would be. If in fact foreign fishing were to occur at historic levels, the NMFS and Coast Guard would face an inordinately complex and expensive task of monitoring entry and exit, inspecting vessels, and collecting data on foreign catches made in non-retention and retention zones. The Council believes that the PMP should be superseded by a simpler, more cost-effective FMP.

7.1.2 Amend the PMP

Amendment of the PMP could resolve only some of the weaknesses identified earlier. An amended PMP could establish area closures, eliminate the quotas and non-retention policy, and simplify some of the ancillary foreign reporting or observer requirements, similar to the proposals in this FMP. This approach, however, has significant weaknesses.

First, the current PMP should be replaced as soon as possible. Preparation and processing of a PMP amendment, even if based on this FMP, would involve duplicating much of the work already done by the Council, with no substantial change in the ultimate decision. A PMP amendment would be as significant a new regulatory action as this FMP so documentation requirements and procedural requirements (public hearings, etc.) are the same. Thus, the PMP amendment approach requires a long delay in implementation, additional cost of preparation and processing of the relevant documents, and no gain in the ultimate

decision relative to foreign fishing.

Second, a PMP amendment can not apply to domestic fisheries. It is true the Council at this time does not propose any controls or limitations on domestic fisheries. In the future, however, if any controls or limitations are needed, the FMP can be amended more quickly than a new FMP can be prepared and implemented. This would be especially true for amendments dealing with domestic fishery monitoring and reporting requirements, and is likely true for resolving potential conservation or user conflict problems should they occur. Thus, the flexibility to act rapidly to address domestic fishery problems is much greater with a FMP.

Third, in the Council's view, Congress did not intend that PMPs should remain in place when Councils were able to arrive at sound decisions through FMPs. Congress intended that Councils represent and speak for regional fishery interests and achieve optimum yield from regional fisheries. The PMP can and should be replaced by a Council FMP.

In summary, the Council has concluded that a FMP is clearly needed. The current PMP is not working; amending the PMP would involve unwarranted delays and cost with no improvement in ultimate management decisions; and an amended PMP would not provide a starting point for timely action to consider domestic fishery controls should they become needed.

7.2 Scope of the FMP

7.2.1 Foreign Fishing

7.2.1.1 Monitoring Only

The above discussion should serve to demonstrate that alternative management and conservation measures for the foreign billfish fishery are necessary to replace the PMP. It is clear that such measures must be more than essential monitoring of the foreign fishery through permit requirements, check-in/check-out procedures, or catch and effort reporting. Those monitoring measures are necessary, but they are far from being sufficient in themselves to achieve the objectives of the FMP. Under this option, there would be unlimited opportunity for foreign harvest of billfish, potential waste if billfish were not retained, and, most importantly, no demonstrable increase in the value of domestic fisheries. The risk of domestic and foreign gear conflicts would increase. The "monitoring only" approach for foreign fishing has therefore been rejected by the Council.

7.2.1.2 Control Foreign Effort

This alternative encompasses several options to manage the amount or timing or location of foreign fishing effort.

Area closures for the full year are the simplest option, and depending on the geographic extent of closures, could address most if not all the weaknesss of the PMP. If foreign longlining were prohibited in the FCZ, billfish that would have been taken by foreign vessels may be vulnerable to domestic effort. In 1976, the total

foreign billfish catch in the FCZ around Hawaii was almost 500 mt, while estimated domestic catch was 732 mt (Table 5.21). Thus, if domestic vessels had taken the foreign catch, domestic vessels' catches would have increased by 68%. The values associated with that increase would be very large. Objectives 1-5 would be achieved to a considerable extent with area closures. There would be no "waste" associated with release of dead billfish (Objective 6), and the risk of domestic foreign/gear conflicts would be eliminated (Objective 7). A prohibition of longlining would not prohibit other forms of tuna fishing such as bait-boat or pole-and-line fishing, which are much more selective for tuna (Objective 8). The cost of administering and enforcing a full closure is relatively low compared to the PMP.

If some longlining were to be permitted, less complete effort restrictions could be imposed. Seasonal restrictions could limit effort in months when incidental billfish catch rates are highest, or when total billfish catches are above average monthly rates. Partial area closures could be adopted for areas in which incidental catch rates are highest or in which domestic billfish fishing is concentrated. Limits could be imposed in terms of the absolute number of boats allowed into the FCZ, or the number of hooks allowed to be set, or the total number of effort days. Combinations of seasonal, area, or gear restrictions could be adopted.

Partial effort restrictions would provide for reduced satisfaction of Objectives 1-5, so long as the level of foreign billfish catch would ultimately be reduced and the availability of billfish for

domestic vessels were increased. If foreign vessels were not required to release billfish in remaining open fishing times and areas, there would be no waste of billfish (Objective 6). The risk of gear conflicts could be reduced substantially (Objective 7), and there would be less interference with longlining for tuna and absolutely no interference with bait-boat operations (Objective 8). The statistical data base might be improved, since foreign nations might be more inclined to cooperate provided that their vessels had some access to the FCZ (Objective 9). International cooperation on management of highly migratory species could conceivably be promoted, but with less immediate priority given to domestic interests (Objective 10). Partial area restrictions could be relatively inexpensive to enforce unless they were combined with effort limits which would require active monitoring to insure that those limits were being observed. Limits on the number of vessels would be less costly to enforce than limits on number of vessel days or other units of effort (e.g., hook days).

7.2.1.3 Control Foreign Catch

The Council also considered options to restrict the foreign catch of billfish. The most direct limit is quotas for different species. The first difficult step would be to determine appropriate species quotas; presumably, the limits should be above zero but less than average historic levels to promote a transfer of catch to domestic vessels, to prevent waste, and to provide an opportunity to fish for tuna. A second difficulty is to agree what should be done once a quota is reached for a specific species in a particular area: should further longlining be prohibited, or should a non-retention rule be instituted?

It could be necessary to establish quotas which can be taken only in certain areas, providing greater probability of transfer of fish and increased fishery values for domestic fisheries, and lower risk of domestic and foreign gear conflicts. The difficulties with this approach, as with the first, are determination of the appropriate quota by area and by species, and determination of appropriate measures (closure, non-retention) when a quota for any single species is reached. It may be possible to institute a "value transfer" measure, in which foreign longline vessels would pay to the U.S. a partial or a full ex-vessel value of all billfish caught in open areas/seasons. This might not result in the transfer of catch, but the U.S. would receive a measure of the economic value of the fish taken by foreign vessels.

Catch limits would generally be less useful than effort limitations in terms of meeting Council objectives. A quota approach in which an area is closed once any species quota is reached could have the same effect as a prohibition on longlining; if a quota were set at a low level for a species that was unusually abundant, such that the single species quota would be reached quickly, then further foreign fishing would be prohibited. Low quotas would tend to be more supportive of achieving catch transfer and increased domestic fishery value objectives (Objectives 1-5). Waste would be minimized (Objective 6), and gear conflicts would be precluded (Objective 7). There could be considerable interference with longline fishing but not with other forms of tuna fishing (Objective 8). The data base would be marginally improved (Objective 9), but greater international cooperation would not

be likely (Objective 10).

If quotas to foreign longliners were higher, and/or if non-retention for a species were imposed once that species' quota was reached, transfers to domestic fisheries and increased fishery values would be less likely to occur; waste would be more likely; gear conflicts would be more likely; the interference with longlining would be decreased; the data base could increase; and international cooperation might be promoted more effectively than with low quotas or effort restrictions.

A crucial element in the catch restriction approach would be the cost of effective monitoring of the foreign fishery. Catch restrictions can be meaningful only with accurate and timely foreign catch reports, and at-sea boardings and inspections to verify harvest levels made in the FCZ. To the extent catch restrictions are flexible (e.g., allowing non-retention once a quota is reached) such management approaches introduce larger monitoring and enforcement expenses, probably with a decreasing likelihood of catch transfers from foreign to domestic billfish interests.

7.2.1.4 Voluntary Controls

The FCMA prescribes certain statutory requirements for foreign fishing in the FCZ, including foreign fishing permits and fees. Other management measures, however, could be pursued through a voluntary approach as opposed to casting a management regime in the form of regulations. For example, foreign longline operators could voluntarily

abstain from fishing in certain areas, or could agree to limit the number of vessels or other measures of fishing effort in certain areas. Similarly, the NMFS could develop a mutually agreed upon observer program in cooperation with managers of foreign fleets. It might not be necessary to place observers on vessels from nations which voluntarily limit effort or provide timely data on catch and effort for their fishing activities.

The advantage of voluntary agreements is that they can provide flexibility in negotiating arrangements for international management of highly migratory species. Voluntary approaches to problem resolution foster mutual understanding of problems, objectives, and priorities. Voluntary agreements initially pertaining to billfish fishing in the FCZ can be the first step towards international agreements dealing with all highly migratory species throughout the central and western Pacific. A substantial portion of the compliance burden can be placed on the fishery participants themselves rather than on the Federal Government. A plan could provide that a pattern of willful violations of a voluntary agreement would trigger the imposition of mandatory measures with U.S. enforcement and penalties backed up by law.

On the other hand, voluntary agreements would be of limited value if they were not entered into by all nations participating in the fishery in a particular region. This is a difficult problem in the western Pacific since vessels from different tuna fishing associations of Japan, Korea and Taiwan are active in different geographic areas of the U.S. FCZ (with some overlap). A second problem is that there must

be assurance that individual violators of voluntary agreements would in fact have sanctions imposed on them by their representative organizations. Mandatory provisions in a FMP are backed by a reasonable certainty of prosecution if violations are discovered. This certainty decreases considerably with voluntary agreements. A third general problem is that an informal voluntary agreement would, by definition, be less stable or predictable than mandatory provisions having the force of U.S. law. Finally, the entry of new nations into a fishery would further complicate an already complicated situation.

It is uncertain whether voluntary agreements can be developed with the several fleets involved in longline fishing in the Council's area of fisheries plan development authority. The Council has begun discussions with Japanese tuna fishing interests, but no discussions have yet been conducted with Korean or Taiwanese fishing industry representatives or government officials. Voluntary agreements, however, are being considered as a possible mechanism for implementing some of the desired measures under this plan. If voluntary agreements were successfully negotiated and implemented, depending on their scope, there would not be an immediate need to implement the measures recommended by this FMP in the form of regulations.

7.2.1.5 Alternatives for Detailed Analysis

For the time being, the Council has concluded that time/area closures fishing access limits and effort limit combinations warrant further analysis and comparison in Section 8.0. The factors to be considered are as follows:

Probability of increased domestic billfish fishery values

Probability of dislocation of foreign longline vessels' operations

Possibility of reduced foreign longliners' catches[1/] in relation to nations' historical billfish and tuna tuna catches made in the FCZ of the Western Pacific Region

Possibility of reduced catches[1/] in relation to foreign nations' total FCZ catch of billfish and tuna in the Pacific Ocean

Enforcement and administrative problems

It is acknowledged that biological and ecological factors are not among the principal factors that can be considered. The Council has noted several times previously that biological and ecological factors are certainly important. However, conservation and management measures for the billfish fishery solely within the FCZ can have virtually no biological or ecological effects of significance throughout the believed range of billfish stocks. Controlling billfish mortality in the FCZ will not have a perceptible impact on billfish stocks or on related finfish species throughout their range. Elimination of the non-retention approach should have positive effects by eliminating the potential for waste. All options will probably have essentially the same biological and ecological effects. The major differences will be in the amount and distribution of benefits and costs to different domestic and foreign fishery sectors, and in the degree of administrative difficulty and enforceability.

1/ Assuming that effort displaced from the FCZ cannot be relocated elsewhere and catches from the FCZ cannot be replaced.

7.3.1 Domestic Fishing

The Council has considered the possibility that conservation and management measures may be needed for the domestic commercial, subsistence, or recreational fishery sectors. Briefly, the alternatives are as follows:

7.3.1.1 State and Territorial Management

State and Territorial regulations would stay in effect. There are currently no State or Territorial restrictions on domestic fishing for or landing of billfish taken in the FCZ or in State and Territorial waters around Hawaii, Guam and American Samoa. There are certain administrative requirements which must be satisfied; e.g., a commercial fishing license must be obtained if the catch is to be sold. Licensed commercial fishermen (including charter boat operators) must file monthly reports on all fish caught, whether or not they are sold. There are no restrictions on time, area, size, or gear type for billfish fishing by domestic vessels.

Compared to the PMP, this approach would be neutral in effect to Objectives 1-5; recreational and commercial fishermen would be free to fish for billfish just as they are under the PMP, which applies only to foreign vessels. Similary, this approach would be neutral with respect to waste of billfish taken on foreign longline gear (Objective 6); would have no impact on the potential risk of gear conflicts (Objective 7); would not add to or detract from interference with foreign tuna fishing in the FCZ (Objective 8); would add somewhat to the statistical base for future management decisions (Objective 9); and would be largely neutral with respect to promoting international

cooperation. The "no action" alternative would provide maximum freedom for domestic vessels (Objective 10). There would be no net change in State, Territorial, or Federal government expenses associated with the domestic billfish fisheries under this approach. In short, the "no action" alternative would maintain the status quo.

7.3.1.2 Monitor Only

A time series of catch, effort, and related data will eventually be needed for better determination of the status of stocks, the health of domestic fisheries, and the extent to which the objectives of FMP are being achieved. Information from Pacific Ocean fisheries will be needed to further assess and refine conclusions on stock conditions, assuming stock structures are as broad and pervasive as currently believed. Information on domestic fisheries and plan effectiveness, however, will be generated from monitoring domestic activities. The options before the Council include adding the weight of Federal authority to current State and Territorial reporting requirements; establishing comprehensive data reporting requirements for all domestic fishermen who fish for billfish, even if they do not succeed in catching billfish; and a variety of in-between alternatives.

The practicability and cost of data collection in relation to the importance of securing accurate data are significant considerations. The Council recognizes that a small number of commercial enterprises which have long submitted data are likely to keep doing so willingly; while a very large number of part-time commercial or subsistence fishermen or sports fishermen, some of whom occasionally

sell their catch, are less likely to submit detailed, accurate catch reports for all their fishing trips. Indeed, complete reporting could well overwhelm the existing data reporting systems with a flood of log-bookforms or catch reports. Further, the cost of enforcing universal data submission requirements could be prohibitive. The Council also is sensitive to the possible resentment or resistance of fishermen towards submitting what they may perceive as unnecessary detailed or "privileged" information (notwithstanding Federal prohibitions on and penalties for unauthorized release of confidential information).

The Council is aware that progress is being made in design of a regional Fishery Information Network (FIN) encompassing the Council's area, including the CNMI. It is presumed that catch, effort, and other data relevant to the FMP will be incorporated as a data file in the Network. At the same time, the Council and the Honolulu Laboratory, NMFS, are cooperating in establishing a "universe" of fishing vessel owners so that periodic sample surveys can be conducted to obtain needed specific sets of data, including data to evaluate the effectiveness of the FMP. The Northwest Region, NMFS, is funding a recreational fisheries socioeconomic data collection project which may provide a basis for similar or alternative data collection projects to determine the demand for and values of recreational billfish fishing in the Council's area.

In summary, the Council has concluded that it is premature to propose major adjustments in current State and Territorial data collection programs limited to billfish fisheries. Section 13.2 describes

the data collection programs to be incorporated under this FMP. These will be reviewed as progress is made in FIN planning.

7.3.1.3 Restrictions on Domestic Fishing

Figure 7.1 displays the types of controls that could be placed on domestic fisheries to address overfishing problems, user conflicts, waste, efficiency, or other management concerns.

The two general categories of restriction are regulation of domestic effort and regulation of domestic catch. Combinations of these measures could also be applied. The alternatives were considered for both commercial fishing and recreational fishing. In the former category, closed seasons would have no conservation benefits, would adversely affect domestic fishery catch and income levels, and would be expensive to enforce. If commercial landings were prohibited, much of the recreational fishery also would be curtailed since most marlin caught by the latter are sold. There is no evidence to indicate that release of billfish by domestic trollers and longliners during a closed season would be beneficial to anyone. In fact, as with foreign longline-caught fish, there would likely be high mortality rates and waste of released fish. A closed season thus would either mean sharp curtailment of all fishing for pelagic species, or waste, or both, with high enforcement costs. Consumer prices would likely increase sharply.

Area closures for commercial fishing would have similar effects. There would be no demonstrable conservation gain. There would be a curtailment of the bulk of pelagic species catch and subsequent sale. Prices would increase.

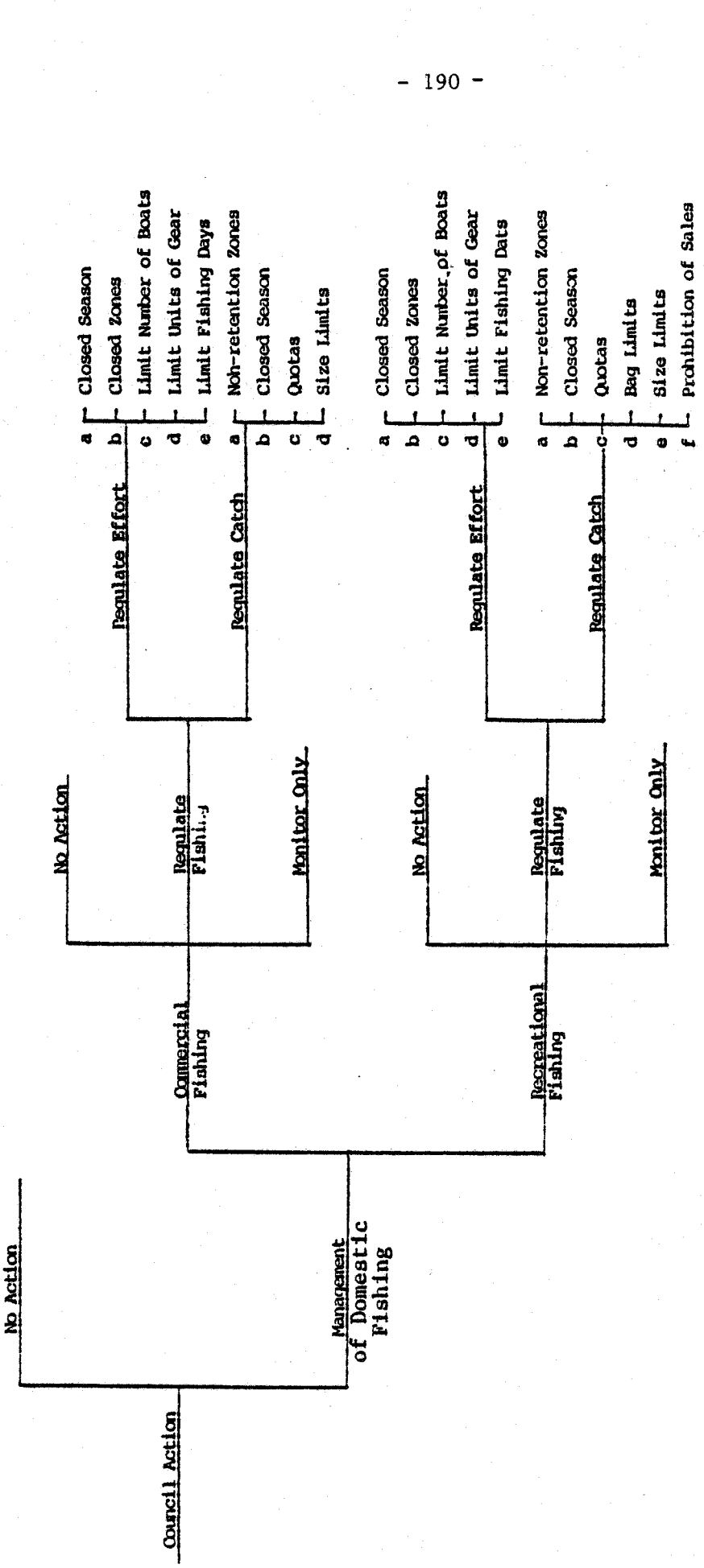


Figure 7.1: Management and Regulatory Options Open to the Council for Domestic Fishing

Limits on the number of boats, units of gear, or fishing days have been applied in many fisheries to address "common property" problems. They are inappropriate, however, to the billfish fisheries. There would be no conservation gains; there could be considerable waste of billfish if the constraint were applied only to vessels taking billfish and not other pelagic species; and they would be difficult to develop, administer, and enforce fairly.

Catch restrictions could be applied to commercial vessels. These would raise the same kinds of problems as numerical catch limits on foreign longliners. Establishing appropriate limits would be difficult in the mixed species fishery. Non-retention policies lead to waste, but limiting billfish landings either results in loss of all commercial pelagic species landings, or waste, or both, with high enforcement costs. Size limits would also incur high costs and waste. Hooked small marlin suffer injuries as much as large marlin. No conservation benefits are likely. Consumer prices would increase.

Similar restrictions were considered for recreational fishing. Closed seasons and closed zones would have no conservation benefits, would take away a substantial amount of value associated with recreational fishing, and would be very costly to enforce. Gear, vessel, and effort/day limits would be difficult to establish and administer fairly, would have no conservation benefits, and would subtract from the overall values associated with the fishery.

Catch limitations on recreational fisheries could be established, but without conservation benefits, and only at high cost.

Non-retention zones lead either to curtailment of fishing or waste of released dead fish. A closed season reduces overall fishing and fishery values with no conservation benefits. Quotas are difficult to establish fairly and are more difficult and costly to enforce, as are bag limits. Size limits also are likely to lead to waste or high enforcement costs. Prohibiting sale of recreationally-caught fish would lead to some waste (discard of fish) and possibly some reduciton in fishing activity. Many weekend fishermen obtain a commercial license. Curtailment of recreational fishing would lead most everyone to license themselves as commercial operators.

The Council has concluded from the available information that there are no conservation, economic or social gains which can be realized by Federal intervention in domestic billfish fisheries in the FCZ at this time. Levels of domestic catches of billfish do not pose a risk of overfishing of the stocks; the level of fishing mortality in the FCZ is low relative to the fishing mortality over the range of the species involved. It is irrational to establish domestic catch limits in the FCZ in the absence of demonstrable conservation effects so long as there were no international agreements establishing billfish conservation measures throughout their range. At the same time, there are no known user conflicts that require Federal response. Domestic fishermen have not expressed any concerns about the desire or need for domestic fishery restrictions. Domestic fisheries are undeveloped relative to the potentials of the FCZ as a whole. Domestic expansion of the fisheries is desirable, and is more likely to happen without regulation than with.

Consequently, the state management alternative is best for the domestic fisheries component. The FMP does, however, recommend improved monitoring programs.

8.0 COMPARISON OF IMPACTS OF ALTERNATIVE AREA/SEASON CLOSURES

The Council has decided to approach billfish fishery management in the U.S. FCZ of Hawaii, Guam, and American Samoa on social and economic grounds. As discussed previously, biological management of highly migratory billfish stocks is generally impossible within only the geographical limitations of the U.S. FCZ relative to the range of the species. The Council's approach is fully consistent with the definition of "optimum" in the FCMA:

> "The term 'optimum', with respect to the yield from a fishery, means the amount of fish --
> (A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and
> (B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor."

This avoids the perplexity and meaninglessness of establishing ficticious MSYs for a small portion of the stock(s) in the FCZ. Since conservation over the full range of the species is unachievable through this FMP, the goal that is most relevant and approachable under the policies and limitations of the FCMA as applied to billfish management is to "promote domestic commercial and recreational fishing" which is a policy of Congress as expressed in Sec. 2 of the FCMA. The objectives of the FMP are in accord with this Congressional policy. They can be achieved only by measures that increase the values of the domestic yield from the billfish fisheries.

Management of the fisheries for the purpose of promoting and increasing the values of the domestic fisheries for billfish must be done in a manner that

does not constitute the exercise of exclusive management authority over tuna fishing. Trying to maximize domestic fishery values while at the same time minimizing the effects on foreign longlining for tuna in the U.S. FCZ is an impossibility because foreign longlining takes both billfish and tunas.

It is clear that there are no options open to the Council, other than the unacceptable non-retention provisions, that would not affect foreign longlining for tuna. An October 1979 legal opinion (Appendix H) concluded that a billfish FMP may contain management measures which affect foreign longlining for tuna in the FCZ provided that the measures will (1) provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ, and (2) impose the least burden on such vessels necessary to conservation and management of the billfish covered by the plan. Improvement of the values of the domestic fisheries (Objectives 1-5) must be reconciled in terms of reasonableness of foreign fishing opportunity (Objective 8) for tunas with due recognition of enforcement and administrative costs. In short, gains to domestic fisheries need to be compared to the costs imposed on foreign fishers and enforcement costs under alternative sets of management measures. Conservation benefits to billfish, should there be any in the short term, would presumably benefit both domestic and foreign fishers in the long term.

There are no options open to the Council that would achieve the objectives of the plan without having an effect on foreign longlining in the FCZ. The Council has chosen to examine possible shifts in the pattern of foreign fishing that could arise from implementation of various area/season closures. To understand the relative significance of closures on foreign tuna fishing, one has to know something about the size, composition, and location of foreign longline catches made in the past in parts of the FCZ during certain times of

the year.

8.1 Management Focused on Dominant Billfish Species

In many mixed species fisheries of the world, a few species dominate catches and management programs are directed toward the dominant species. Certain species of marlin strongly dominate billfish catches made in the U.S. FCZ of Hawaii, Guam, and American Samoa.

8.1.1 Hawaii

Blue marlin and striped marlin dominate the commercial and recreational billfish catches of domestic fishermen in the Hawaiian Islands, together accounting for around 88-95% of total annual billfish landings. Black marlin, broadbill swordfish, shortbill spearfish, and sailfish make up fairly insignificant portions of the catch. Black marlin are not abundant in Hawaiian waters. As made evident by foreign longline catch data, swordfish are much more abundant but are rarely caught during the daylight hours on surface gear. Sailfish are rare. Spearfish are taken in somewhat larger numbers but the overall weight of spearfish landings is not large. Management focus will thus be directed at the blue and striped marlins for Hawaiian waters because of their dominant status in the Hawaiian fishery.

Blue Marlin. The blue marlin is presently the most important Hawaiian billfish from both the commercial and recreational viewpoint. It is a pantropical species occurring in the Atlantic, Indian and Pacific Oceans. In Hawaii, commercial catches of blue marlin are highest during summer (usually July to September) and lowest during

winter. The catch pattern for blue marlin is the opposite of the general longline catch pattern for striped marlin. It has been observed generally that there is a positive correlation between blue marlin and skipjack tuna catches. The annual abundance of blue marlin seem to be related to the annual abundance of one of their principal prey species, skipjack tuna. In Hawaiian waters, more than 85% (volume) of the diet of blue marlin is skipjack or other tuna-like fishes (State of Hawaii, Department of Land and Natural Resources, 1979).

The blue marlin is presently the major species in terms of total reported commercial billfish landings. Prices received are usually half of those received for smaller-sized striped marlin. Sport catches of blue marlin also peak in summer months.

Striped Marlin. The striped marlin ranked first in Hawaii commercial billfish landings during 1962-1976. Since then the blue marlin has become the dominant commercial species. The striped marlin and the swordfish are the highest priced species in this group. Auction prices are sometimes double those paid for blue marlin. In the area of the main Hawaiian Islands, striped marlin generally occur from fall through spring. The seasonal distribution for striped marlin caught on longline gear is the reverse of the distribution of blue marlin catches.

8.1.2 Guam

Eighty percent of all billfish caught (weight) by foreign

longliners operating in the U.S. FCZ of Guam during 1973-1977 was made up of blue marlin. Blue marlin also clearly dominates the landings of billfish made by domestic fishermen in Guam.

8.1.3 American Samoa

In American Samoa, blue marlin also dominate foreign longline billfish catches (Table 5.20) accounting for around 60 percent (weight) of all billfish landings. Likewise more than a half of the billfish landings made by domestic fishermen in American Samoa are blue marlin, while the remaining portion is mostly mixed sailfish/spearfish.

8.2 Seasonal Distribution Of Catches

8.2.1 Hawaii

Strasburg (1970) presented data on the monthly landings of blue marlin and striped marlin in the Hawaiian longline fishery from 1950 to 1963. For the period 1950 to 1960, Strasburg noted a reversed-nature in the landings of the two species in that striped marlin were caught in large numbers when the blue marlin catches were lowest, and vice versa. He noted that the landing peaks of the two species tended to coincide in 1961 and 1962. Monthly landings from 1963 to 1970, however, again showed a difference in peak landings for striped marlin and blue marlin (Figure 8.1). Blue marlin longline catches were highest in summer and lowest in winter, whereas striped marlin were more abundant in the winter than in the summer. The striped marlin

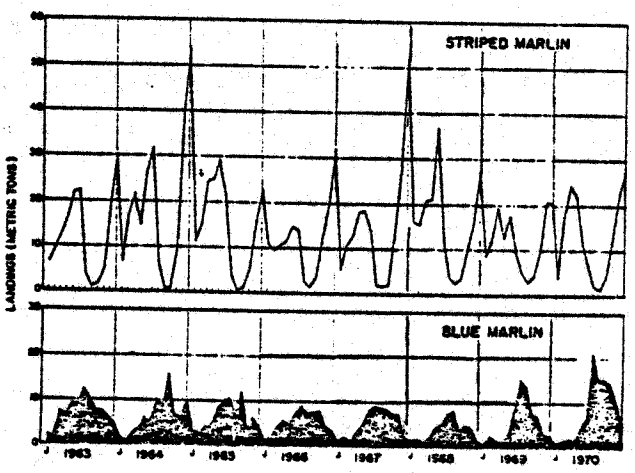


Figure 8.1 Monthly landings of blue marlin and striped marlin from 1963 to 1970 in Hawaii, by longliners.

SOURCE: Yoshida, H. (1972)

longline landings were also characterized by having more than one peak in a year, and by wide fluctuations from month to month. The biggest dip in the landings each year usually occurred in the summer.

Of equal interest to fishermen in Hawaii is a similar timing of the catches of yellowfin tuna and bigeye tuna in the Hawaiian longline fishery. The peak catches of yellowfin tuna are made during the summer while good catches of bigeye tuna are made during the winter and spring (June, 1950; Otsu, 1954; Shomura, 1959). This suggests that striped marlin and bigeye tuna are responding to a different set of environmental factors than the blue marlin and yellowfin tuna. Strasburg (1970) has suggested a relation to the food supply to explain the abundance of striped marlin and blue marlin around Hawaii. He noted that blue marlin fed largely on skipjack tuna, which were more abundant in the summer. This may account for the larger numbers of blue marlin during the summer (Yoshida, 1972).

In recent years, reported commercial catches for both blue and striped marlin have tended to coincide. Hawaii State Division of Fish and Game commercial monthly catch reports for all gear types combined show that commercial landings (averages 1973-1977) for both species were highest in summer (both peaking in August) and lowest during the spring months of March and April (Appendix I). The peaking of domestic striped marlin landings during the summer months can be partially explained by the recent rapid growth in troll fishing around the main Hawaiian Islands during the summer months. The volume of troll caught billfish now far outstrips the amount taken by domestic longliners (Table 5.9). In 1970, only 3.7% of the total reported commercial

catch for striped marlin was taken on troll gear. Ninety-five percent (95.7%) of the catch was on longlines. For 1978, the percent of troll caught striped marlin jumped to 26%, while the proportion caught on domestic longlines dropped to 71%.

For the purpose of this FMP, a billfish season is defined as the period, centered at the monthly mode, in which approximately 75% of the annual catch for each species is taken. Defined as such, the domestic billfish season in Hawaii is centered at August and includes the 7-month period, May through November (Appendix I). The domestic season is the same for both blue and striped marlin.

The season for blue marlin taken on foreign longline gear in Hawaiian waters (1973-1977 monthly averages) encompasses an 8-month period, March through October. Seventy-five percent of the annual foreign take of blue marlin in the FCZ around Hawaii is taken during this time.

The season for striped marlin taken on foreign longline gear in Hawaiian waters is an exact converse: October through February, a 5-month period. Compared to foreign blue marlin catches, striped marlin taken on foreign longline gear tend to show a more pronounced seasonality. Seventy-five percent of the striped marlin catches are bunched into a 5-month period.

8.2.2 Guam

In the FCZ around Guam, 73% of the annual catch of billfish (mostly blue marlin) made on foreign longlines is taken during the fall

and winter months, September through March. Eighty percent of the annual billfish catch made by domestic fishermen in Guam is made during a 5-month spring/summer period, April through August (Appendix J).

8.2.3. American Samoa

The billfish season for both domestic and foreign fishermen in American Samoan waters is the 5-month summer period, October through February, although billfish and other pelagics are available year round in the vicinity of Tutuila, American Samoa. Information developed by Sesepasara (1975) indicates that schools of skipjack and yellowfin tuna and blue marlin peak during the summer months of the southern hemisphere.

8.3 Geographic and Seasonal Focus of Catches

8.3.1 Hawaii

A distinction is commonly drawn between the "main islands" of the Hawaiian Islands chain, that is, the high islands from Hawaii to Kauai and Niihau; and the leeward islands, or as they are now officially designated, the Northwestern Hawaiian Islands (NWHI), from Nihoa to Kure Island (skipping over the Midway Islands, which are Federal territory; see Figure 8.2). This distinction is based not so much on natural factors of significance to pelagic fisheries as on the remoteness of the leeward islands from main population centers, their lack of human inhabitants (except for small Coast Guard and Navy contingents at Kure and Midway), the relatively lightly exploited condition of the

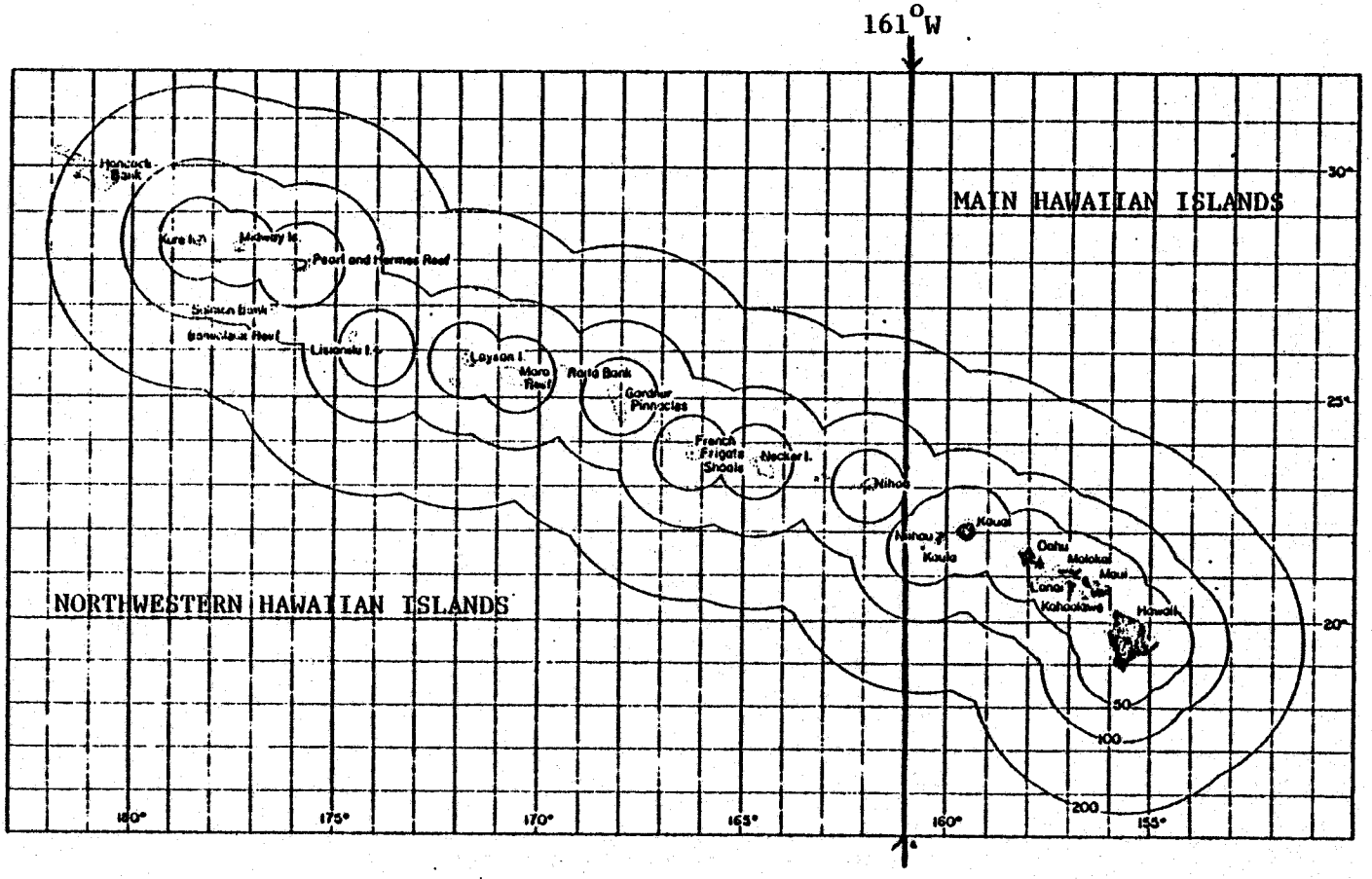


Figure 8.2 The 50-, 100-, and 200-mile zones around the main and Northwestern Hawaiian Islands

resources, and the fact that most of the islands are included in a Federal wildlife refuge.

A conspicuous differentiating feature within Hawaii's fishery environment is the relative accessibility of the two areas to domestic fishermen. Offshore banks and waters that are within easy reach of major population centers are subject to heavy domestic fishery pressure by commercial and sport fishermen all year but especially during the summer peak activity months. NWHI waters are subject to much lighter fishing pressure, especially in the winter, due to their distance from population centers and the greater frequency of storms and rough water conditions far from land.

The domestic pattern of fishing contrasts sharply with the observed pattern of foreign longlining. In terms of catch and effort statistics (1973-1977), the NWHI, on the average, produced about twice as much fish for the foreign longline fleet as did the main Hawaiian Islands. This is to be expected since the NWHI are nearer to the home ports of the foreign fleet and since the NWHI FCZ waters are significantly larger than the FCZ waters surrounding the main Hawaiian Islands.

On the average for the years 1973-1977, 76% of the annual foreign longline tuna catch but only 56% of the foreign longline billfish catch was taken during a 5-month winter period (October through February). Twice as much billfish (mostly striped marlin and swordfish) and more than 4 times as much tuna are caught by foreign longliners during these 5 winter months as compared to 5-month summer

period of April through August. Seventy-five percent of the winter month foreign longline catch (billfish and tunas combined) is taken from the NWHI portion of the FCZ. Striped marlin and swordfish account for over 90% of the NWHI winter billfish catch, while bigeye and albacore tuna dominate the winter month catch of tunas.

Unlike the winter fishery wherein most of the foreign catch is made in the NWHI FCZ, the waters surrounding the main Hawaiian Islands become the principal focus of foreign longlining during the summer months (Appendix L). The FCZ of the main Hawaiian Islands accounts for 86% of summer foreign longline tuna landings and 63% of the summer month foreign billfish catch. Thirty-four percent (34%) of the foreign summer month billfish catch is blue marlin, followed closely by swordfish (27%) and striped marlin (26%).

For the Hawaii Islands FCZ in total, only 17 percent of the average annual (1973-1977 data) foreign longline tuna catch is made during the spring/summer months (April through August). Twenty-seven (27) percent of the annual foreign longline billfish catch is made during this spring/summer period for the FCZ as a whole.

Other than a few billfish taken by the few domestic fishemen who transit through the waters of the NWHI FCZ, virtually all domestic billfish landings are made in waters within 100 miles of the main Hawaiian Islands.

In summary, there appears to be a marked seasonal variation in abundance among the billfish, with striped marlin generally occurring in greater numbers during the winter and blue marlin during

the summer months. The foreign longline fishery reaches its peak activity during the winter months in the NWHI. The foreign fishery diminishes in intensity during the summer months, but its focus shifts more towards the main Hawaiian Islands during the summer period (Appendix L). The domestic fishery is summer oriented. The seasonal variations in species composition is dependent upon the movements and local abundance of the fish. Both of these factors may be influenced by a number of environmental factors like sea surface temperatures and the relative availability of prey. It appears, in general, that striped marlin and bigeye tuna (winter fish) may be responding to a different set of environmental factors from the blue marlin and yellowfin tuna which are mostly summer fish.

8.3.2 Guam

Approximately 90 percent of the foreign longline catch of billfish and tunas in the U.S. FCZ of Guam is made beyond 50 miles from shore (Figure 8.3). The foreign catch of billfish in the FCZ around Guam in recent years accounts for 90% to 96% of the total annual billfish harvest in these waters. The rectangular area shown in Figure 8.3 12°30'N - 14°00'N and 144°10'E - 145°10'E encompasses Galvez and Rota Banks, Santa Rosa Reef and other productive fishing areas most frequented by Guam's domestic fishermen who pursue billfish and other species. The domestic fishery peaks in the summer months, April through August (Appendix K).

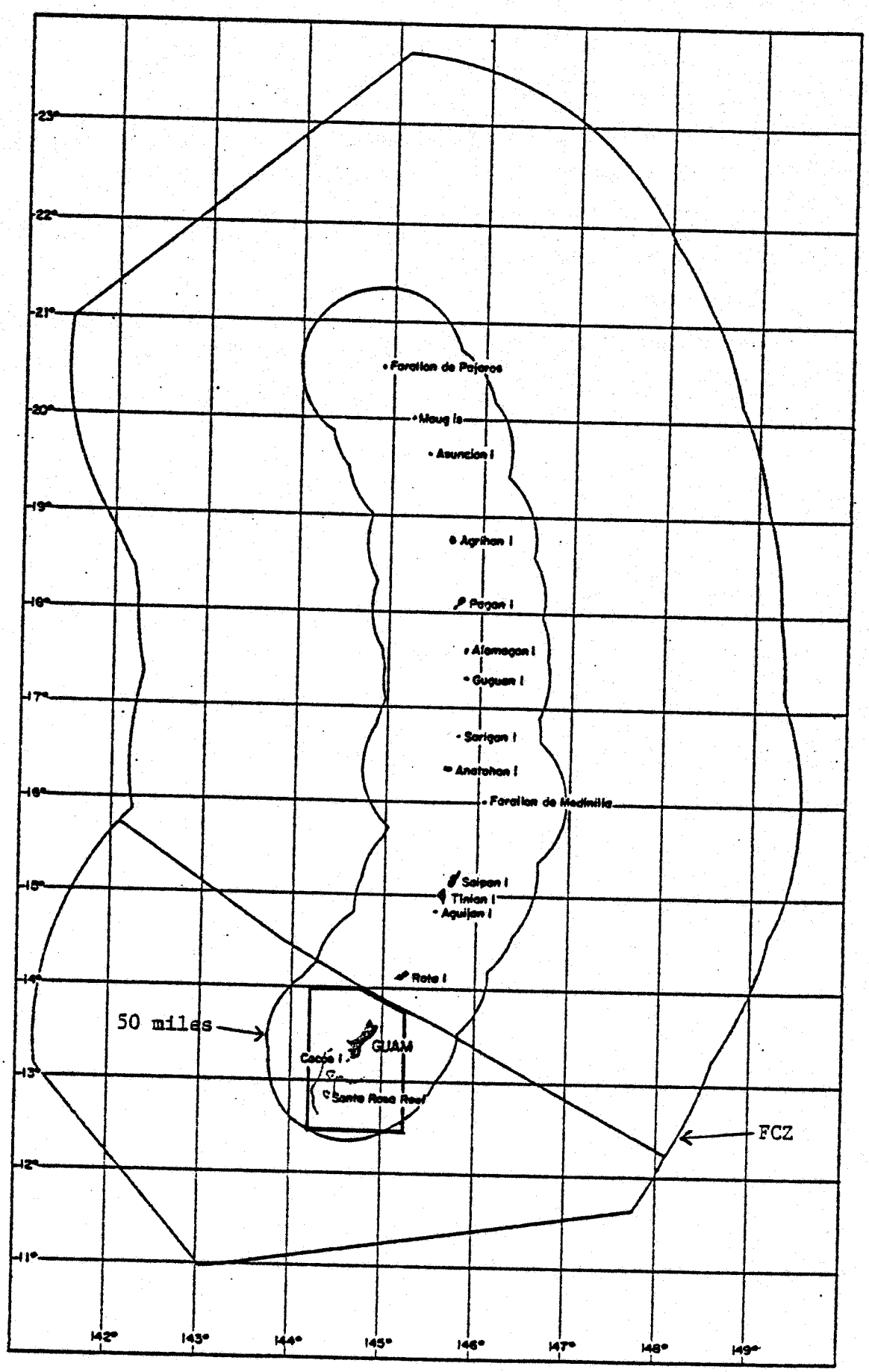


Figure 8.3 The 50-mile limits, the rectangular area enclosing banks, and the Fishery Conservation Zone around Guam and the Northern Mariana Islands.

8.3.3 American Samoa

Figure 8.4 portrays the U.S. FCZ surrounding American Samoa, the 50 mile limits around the principal islands of American Samoa, and the rectangular area bounded by 14° and 15°S latitude and 168° and 171°W longitude which encloses the principal bank areas most frequently fished by domestic fishermen. On the average, about 19 percent of total foreign longline landings are made within 50 miles from shore. An analysis of foreign catch data for 1973 through 1976 shows that the average annual effort in vessel days within the rectangular area was about 6% of the total foreign effort expended within the entire American Samoa FCZ. During the same period, 8.4% of all billfish and 7.7% of all tunas caught on foreign longlines came from the rectangular area. The domestic fishery peaks in the southern hemisphere summer months, October through February.

8.4 Area/Season Closures

It has been emphasized that management measures for billfish applied in the FCZ alone would have little or no measurable biological effect on the stocks of billfish in their entire range in the Pacific. Notwithstanding, the Council proposes that foreign fishing of billfish in the FCZ be managed in such a way that economic and social gains to domestic fishers are most likely.

8.4.1 Options for Hawaii

A complex simulation model using Hawaii as an example

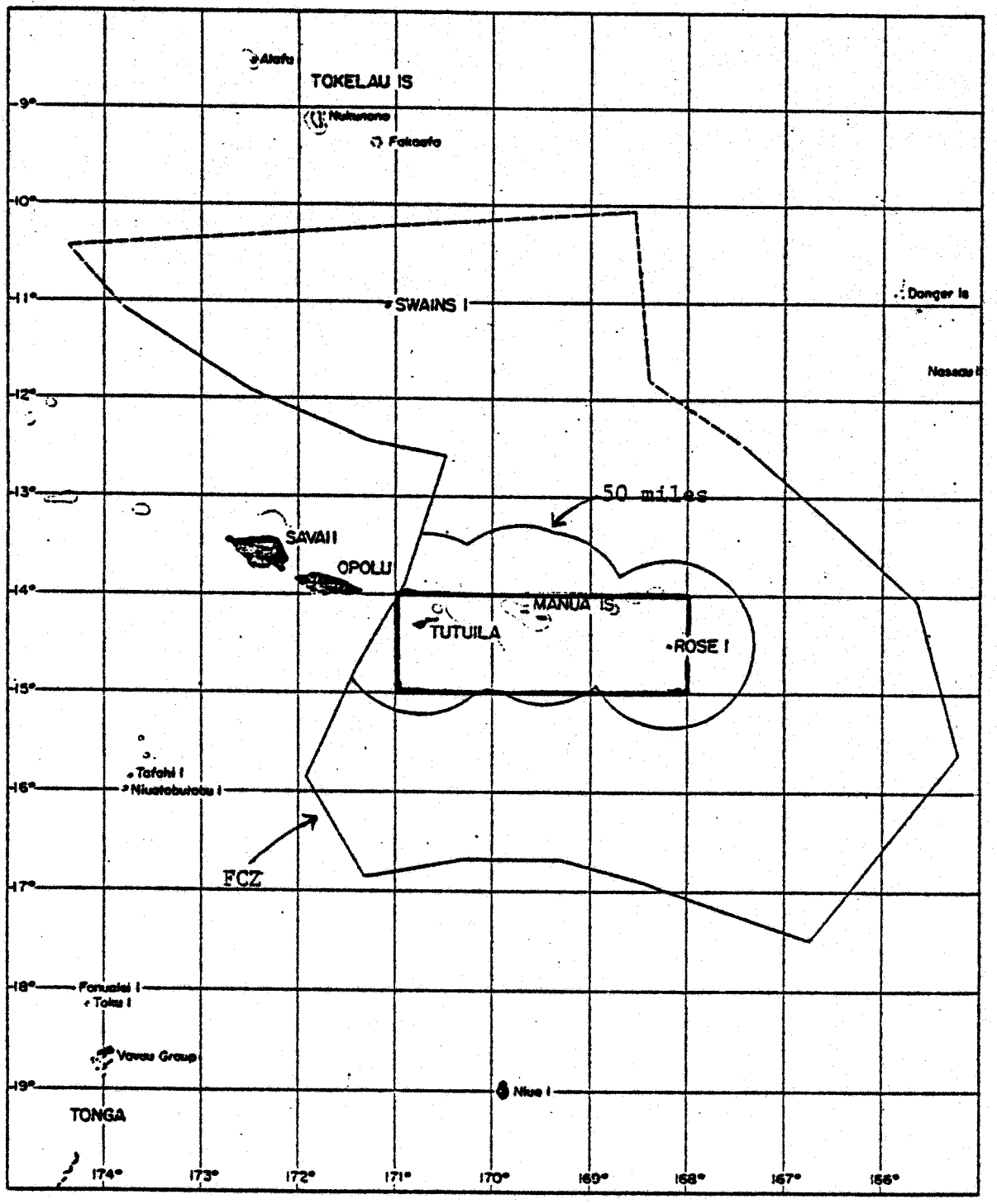


Figure 8.4 The 50-mile limits, the rectangular area enclosing banks and the Fishery Conservation Zone around American Samoa.

was constructed to estimate the effects of various closure areas on foreign fishing, on domestic fishing, and on the stocks themselves (Lovejoy, 1977). The following closure areas were among the options considered:

Area Closure 1:	foreign longlining prohibited within 50 miles of the main Hawaiian Islands
Area Closure 2:	foreign longlining prohibited within 100 miles of the main Hawaiian Islands
Area Closure 3:	foreign longlining prohibited within 200 miles of the Main Hawaiian Islands
Area Closure 4:	foreign longlining prohibited within 50 miles of the entire Hawaiian Archipelago
Area Closure 5:	foreign longlining prohibited within 100 miles of the entire Hawaiian Archipelago
Area Closure 6:	foreign longlining prohibited within 200 miles of the entire Hawaiian Archipelago

The results of the simulation model are shown in Table 8.1. An entry of 100 indicates no change is to be expected; i.e., the present base level or the status quo will be maintained. An entry of 90, for example, indicates that catches would be reduced to 90 percent of the base level. An entry of 102 means that the present situation can be expected to increase by 2% above the base level.

The model results indicate that the Pacific-wide populations and longline catches of blue marlin would remain unchanged as a result of any of the area closures considered for Hawaii. The effects of the closure areas on striped marlin in a Pacific-wide basis would be a drop of 1% in the annual foreign longline catch and a 1% rise in population levels. One of the most important conclusions of the Lovejoy analysis

TABLE 8.1

RELATIVE EFFECTS OF VARIOUS CLOSURES ON THE STOCKS AND CATCHES OF BLUE MARLIN AND STRIPED MARLIN IN THE PACIFIC

	Area Closure					
	1	2	3	4	5	6
Blue Marlin						
Pacific-wide						
Population (Jan)	100	100	100	100	100	100
Annual Longline Catch	100	100	100	100	100	100
Hawaii						
Annual Longline Catch (Foreign)	96	94	66	91	79	0
Annual Longline Catch (Domestic)	100.8	100.8	101.8	100.8	101.8	102
Annual Trolling Catch	100.8	100.8	101.8	100.8	101.8	102
Striped Marlin						
Pacific-wide						
Population (Jan)	100	101	101	101	101	101
Annual Longline Catch	99	99	99	99	99	99
Hawaii						
Annual Longline Catch (Foreign)	97	94	80	87	55	0
Annual Longline Catch (Domestic)	100	100	100	100	100	100
Annual Trolling Catch	101.6	101.6	103.6	101.6	103.6	107

Honolulu Laboratory, SWFC, NMFS

is that management measures applied solely to the FCZ are ineffective in conserving billfish stocks. This elevates the importance of achieving the objective of promoting international management (Objective 10).

Another conclusion which has a more pronounced local significance, and which has been a root of much confusion and disagreement, relates to the expected effects on domestic fishers. Under the closure option most favored by domestic fishermen (a complete ban on foreign longlining in the entire FCZ of the Hawaiian Archipelago), domestic longline catches of blue marlin would be expected to rise by 2%. Domestic troll catches would be expected to rise by 7% for striped marlin and 2% for blue marlin. (See Table 5.21 for comparison of foreign and domestic catches.) The model does not cover any other billfish species, does not cover tuna, and deals only with an average, "static" condition.

It is important that these potential effects be placed in perspective. First, as noted in Section 4.2.6, the Lovejoy model is helpful but certainly not definitive in describing the direction and magnitude of possible transfers of blue and striped marlin to recreational trollers and domestic longliners from foreign longliners. The magnitude of shift is especially subject to questions. The range of absolute shifts is not determinable because the model is "static" and deals only with averages. The Hawaii billfish fisheries, however, are dynamic and rapidly changing, and the values associated with the fisheries are large and growing. Averages based on 1973-77 foreign data or 1976-78 domestic fishery data may not be at all representative

of what actually is happening in the fishery. The magnitude and values of the domestic fisheries are most certainly understated. As suggested earlier, the significance of transfers will vary significantly depending on the time, place, and recipients of the transfers. Elimination of foreign longlining south of the main islands of Hawaii should generate higher blue marlin catches at the most important time to the most important users (i.e., summer and fall charter and troll vessels). Similarly, curtailing the foreign longline fishery in the NWHI within parts of the NWHI should generate increased domestic striped marlin and swordfish catches for new U.S. vessels in the NWHI as well as the main islands. The billfish catches may be critical to the economic viability of the new NWHI fishery.

According to the Lovejoy analysis, the smaller the closures selected, the smaller the likely transfer of catch and the lesser the increase in fishery values for the domestic fishery. Anything less than a closure of the full FCZ will lead to less than a maximization of domestic fishery values. Domestic vessels are generally dependent on the availability and vulnerability of billfish in the FCZ. Foreign longliners, on the other hand, operate throughout the Pacific, and are not dependent on the FCZ. They have already demonstrated their ability to relocate, suggesting that the costs of complying with the PMP are greater than the net marginal profit (if any) that would accrue from fishing in the FCZ. In this sense, the foregone catch from the FCZ by longliners as a result of area closures can be considered as small. Nonetheless, any closure less than the entire FCZ does provide an opportunity for foreign longlining and means less

dislocation/relocation of former effort levels from the FCZ.

In summary, the Lovejoy analysis provides only a partial base for assessing benefits and costs of different closure options. Domestic fishery enhancement is understated, while foreign catch "losses" are overstated.

8.4.1.1 Toward an Optimum Area/Season Closure

In an attempt to narrow the field and to help the Council identify the optimum areal-season closure, data on foreign billfish and tuna catches made within 50, 100, and 200 miles of the main Hawaiian Islands and the Northwest Hawaiian Islands were summarized by month and by species. The value of catches was estimated on the basis of equivalent ex-vessel prices for each of the species prevailing in Yaizu, Japan, in February 1980 (Table 5.22). The average monthly catches (1973-1977) and their corresponding values were then aggregated over various segments of the year (entire year, foreign striped marlin season, foreign blue marlin season, domestic marlin season).

The season for striped and blue marlin was defined as the period of the year, centered at the mode in the monthly catch data, in which approximately 75% of the average annual catch of each species is made. The domestic season was determined upon examining monthly distributions of domestic annual landings, while the foreign season for each

species was determined on the basis of foreign data. The seasons so defined and derived are as follows:

	Season	Months
1.	Entire Year	January through December
2.	Foreign Striped Marlin Season	October through February
3.	Foreign Blue Marlin Season	March through October
4.	Domestic Billfish Season	May through November

Commercial landing records of recent years (1973-1977) show that the domestic seasons for striped and blue marlin coincide (Appendix I).

There are good reasons for examining each of these seasons. The "entire year" was chosen because closing areas to foreign longlining all year would most improve the probability of larger domestic fishery values. The "foreign striped marlin season" was selected because the Lovejoy analysis indicated that the expected benefits to domestic trollers resulting from area closures to foreign fishermen would be larger for striped marlin than for blue marlin (Table 8.1). Also, the absolute amount of mortality brought upon billfish by foreign fishing in Hawaii's FCZ has been much higher for striped marlin than that for blue marlin in recent years (Table 5.19). The "foreign blue marlin season" was chosen because blue marlin is the undisputed king of Hawaii's billfish, and because blue marlin now dominate both commercial and recreational billfish catches of domestic

fishermen. The "domestic billfish season" was identified because that is when domestic participation in fishing for billfish is the highest. If the density of billfish available to domestic fishermen can be increased during peak periods of fishing activity, then the odds of actually achieving enlarged local billfish landings become that much better.

Summaries of estimated average foreign catches of billfish and tuna and their computed ex-vessel values in Japanese markets are shown for 50, 100, and 200 mile zones of the Main and Northwestern Hawaiian Islands, and their combinations, for each of the four different seasons (Tables 8.2 through 8.5). The purpose of this exercise is to compare the size and gross value, and thus the importance of the foreign fishery in the various parts of the FCZ during certain times of the year. This provides a basis for estimating the potential magnitude or degree of impact on foreign fishing that could possibly arise from area/season closure combinations. Both the size and value of the catches are generally related to the size of the area and the length of the time periods. The larger the area and/or the longer the period, generally the greater the catches and their value.

TABLE 8.2

AVERAGE CATCH (1973-77) AND EX-VESSEL VALUE (1980 PRICES)
OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS
IN THE VARIOUS SUBZONES OF THE US FCZ AROUND THE
MAIN HAWAIIAN ISLANDS AND THE NORTHWESTERN HAWAIIAN ISLANDS

SEASON: ENTIRE YEAR

MAIN HAWAIIAN ISLANDS

NORTHWESTERN HAWAIIAN ISLANDS

	0	50 miles	100 miles	200 miles
0	A = 0 B = 0 C = 0 D = 0 E = 0 F = 0	A = 11.0MT B = $28,349 C = 105.5MT D = $355,861 E = 116.5MT F = $384,210	A = 28.1MT B = $71,211 C = 246.3MT D = $831,830 E = 274.4MT F = $903,041	A = 102.6MT B = $251,805 C = 865.9MT D = $2,994,856 E = 968.5MT F = $3,246,661
50 miles	A = 33.2MT B = $91,159 C = 273.0MT D = $915,391 E = 306.2MT F = $1,006,550	A = 44.2MT B = $119,508 C = 378.5MT D = $1,271,252 E = 422.7MT F = $1,390,760	A = 61.3MT B = $162,370 C = 519.3MT D = $1,747,221 E = 580.6MT F = $1,909,591	A = 135.8MT B = $342,964 C = 1,138.9MT D = $3,910,247 E = 1,274.7MT F = $4,253,211
100 miles	A = 86.6MT B = $237,144 C = 637.7MT D = $2,143,078 E = 724.3MT F = $2,380,222	A = 97.6MT B = $265,493 C = 743.2MT D = $2,498,939 E = 840.8MT F = $2,764,432	A = 114.7MT B = $308,355 C = 884.0MT D = $2,974,908 E = 998.7MT F = $3,283,263	A = 189.2MT B = $488,949 C = 1,503.6MT D = $5,137.934 E = 1,692.8MT F = $5,626,883
200 miles	A = 200.1MT B = $544,832 C = 1,399.6MT D = $4,545,624 E = 1,599.7MT F = $5,090,456	A = 211.1MT B = $573,181 C = 1,505.1MT D = $4,901,485 E = 1,716.2MT F = $5,474,666	A = 228.2MT B = $616,043 C = 1,645.9MT D = $5,377,454 E = 1,874.1MT F = $5,993,497	A = 302.7MT B = $796,637 C = 2,265.5MT D = $7,540,480 E = 2,568.2MT F = $8,337,117

A = Catch of billfish
B = Exvessel value of billfish catch
C = Catch of tunas
D = Exvessel value of tuna catch
E = Total catch of billfish and tunas
F = Exvessel value of billfish and tuna catch

TABLE 8.3

AVERAGE CATCH (1973-77) AND EX-VESSEL VALUE (1980 PRICES) OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS IN THE VARIOUS SUBZONES OF THE US FCZ AROUND THE MAIN HAWAIIAN ISLANDS AND THE NORTHWESTERN HAWAIIAN ISLANDS

FOREIGN STRIPED MARLIN SEASON: OCTOBER THROUGH FEBRUARY

MAIN HAWAIIAN ISLANDS

NORTHWESTERN HAWAIIAN ISLANDS

	0	50 miles	100 miles	200 miles
0	A = 0 B = 0 C = 0 D = 0 E = 0 F = 0	A = 5.4MT B = $14,194 C = 64.5MT D = $195,997 E = 69.9MT F = $210,191	A = 13.9MT B = $35,765 C = 145.3MT D = $436,056 E = 159.2MT F = $471,821	A = 43.4MT B = $109,150 C = 450.3MT D = $1,335,697 E = 493.7MT F = $1,444,847
50 miles	A = 23.5MT B = $64,294 C = 255.0MT D = $854,100 E = 278.5MT F = $918,394	A = 28.9MT B = $78,488 C = 319.5MT D = $1,050,097 E = 348.4MT F = $1,128,585	A = 37.4MT B = $100,059 C = 400.3MT D = $1,290,156 E = 437.7MT F = $1,390,215	A = 66.9MT B = $173,444 C = 705.3MT D = $2,189,797 E = 772.2MT F = $2,363,241
100 miles	A = 59.3MT B = $162,419 C = 587.3MT D = $1,964,505 E = 646.6MT F = $2,126,924	A = 64.7MT B = $176,613 C = 651.8MT D = $2,160,502 E = 716.5MT F = $2,337,115	A = 73.2MT B = $198,184 C = 732.6MT D = $2,400,561 E = 805.8MT F = $2,598,745	A = 102.7MT B = $271,569 C = 1,037.6MT D = $3,300,202 E = 1,140.3MT F = $3,571,771
200 miles	A = 125.0MT B = $342,405 C = 1,263.8MT D = $4,116,050 E = 1,388.8MT F = $4,458,455	A = 130.4MT B = $356,599 C = 1,328.3MT D = $4,312,047 E = 1,458.7MT F = $4,668,646	A = 138.9MT B = $378,170 C = 1,409.1MT D = $4,552,106 E = 1,548.0MT F = $4,930,276	A = 168.4MT B = $451,555 C = 1,714.1MT D = $5,451,747 E = 1,882.5MT F = $5,903,302

A = Catch of billfish
B = Exvessel value of billfish catch
C = Catch of tunas
D = Exvessel value of tuna catch
E = Total catch of billfish and tunas
F = Exvessel value of billfish and tuna catch

TABLE 8.4

AVERAGE CATCH (1973-77) AND EX-VESSEL VALUE (1980 PRICES)
OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS
IN THE VARIOUS SUBZONES OF THE US FCZ AROUND THE
MAIN HAWAIIAN ISLANDS AND THE NORTHWESTERN HAWAIIAN ISLANDS

FOREIGN BLUE MARLIN SEASON: MARCH THROUGH OCTOBER

MAIN HAWAIIAN ISLANDS

NORTHWESTERN HAWAIIAN ISLANDS

	0	50 miles	100 miles	200 miles
0	A = 0 B = 0 C = 0 D = 0 E = 0 F = 0	A = 6.5MT B = $16,849 C = 52.0MT D = $198,719 E = 58.6MT F = $215,568	A = 16.8MT B = $41,966 C = 125.1MT D = $479,371 E = 141.9MT F = $521,337	A = 66.2MT B = $161,074 C = 476.3MT D = $1,875,068 E = 524.5MT F = $2,036,142
50 miles	A = 11.2MT B = $30,730 C = 48.2MT D = $171,563 E = 59.4MT F = $202,294	A = 17.7MT B = $47,579 C = 100.2MT D = $370,282 E = 118.9MT F = $417,861	A = 28.0MT B = $72,696 C = 173.3MT D = $650,934 E = 201.2MT F = $723,631	A = 77.3MT B = $191,804 C = 524.4MT D = $2,046,631 E = 582.7MT F = $2,238,435
100 miles	A = 30.4MT B = $83,232 C = 100.3MT D = $348,623 E = 130.7MT F = $431,855	A = 37.0MT B = $100,080 C = 152.3MT D = $547,342 E = 189.3MT F = $647,422	A = 47.2MT B = $125,198 C = 225.4MT D = $827,994 E = 272.6MT F = $953,191	A = 96.6MT B = $244,305 C = 576.6MT D = $2,223,691 E = 673.2MT F = $2,467,996
200 miles	A = 81.2MT B = $219,446 C = 218.2MT D = $730,713 E = 299.4MT F = $950,158	A = 87.7MT B = $236,294 C = 270.2MT D = $929,432 E = 360.0MT F = $1,165,726	A = 98.0MT B = $261,412 C = 343.3MT D = $1,210,084 E = 441.3MT F = $1,471,495	A = 147.4MT B = $380,520 C = 694.4MT D = $2,605,780 E = 841.9MT F = $2,986,300

A = Catch of billfish
B = Exvessel value of billfish catch
C = Catch of tunas
D = Exvessel value of tuna catch
E = Total catch of billfish and tunas
F = Exvessel value of billfish and tuna catch

TABLE 8.5

AVERAGE CATCH (1973-77) AND EX-VESSEL VALUE (1980 PRICES)
OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS
IN THE VARIOUS SUBZONES OF THE US FCZ AROUND THE
MAIN HAWAIIAN ISLANDS AND THE NORTHWESTERN HAWAIIAN ISLANDS

DOMESTIC BILLFISH SEASON: MAY THROUGH NOVEMBER

MAIN HAWAIIAN ISLANDS

NORTHWESTERN HAWAIIAN ISLANDS

	0	50 miles	100 miles	200 miles
0	A = 0 B = 0 C = 0 D = 0 E = 0 F = 0	A = 6.0MT B = $15,712 C = 48.4MT D = 185,768 E = 54.4MT F = $201,480	A = 15.7MT B = $40,259 C = 117.2MT D = $447,326 E = 132.9MT F = $487,585	A = 63.9MT B = $157,532 C = 441.0MT D = $1,720,039 E = 504.9MT F = $1,877,571
50 miles	A = 3.9MT B = $12,180 C = 73.6MT D = $267,404 E = 77.5MT F = $279,584	A = 9.9MT B = $27,892 C = 122.0MT D = $453,172 E = 131.9MT F = $481,064	A = 19.6MT B = $52,439 C = 190.8MT D = $714,730 E = 210.4MT F = $767,169	A = 67.8MT B = $169,712 C = 514.6MT D = $1,987,443 E = 582.4MT F = $2,157,155
100 miles	A = 13.4MT B = $35,387 C = 148.7MT D = $530,264 E = 162.1MT F = $565,591	A = 19.4MT B = $51,099 C = 197.1MT D = $715,972 E = 216.5MT F = $767,071	A = 29.1MT B = $75,646 C = 265.9MT D = $977,530 E = 295.0MT F = $1,053,176	A = 77.3MT B = $192,919 C = 589.7MT D = $2,250,243 E = 667.0MT F = $2,443,162
200 miles	A = 46.5MT B = $119,775 C = 301.7MT D = $1,036,460 E = 348.2MT F = $1,156,235	A = 52.5MT B = $135,487 C = 350.1MT D = $1,222,228 E = 438.6MT F = $1,357,715	A = 62.2MT B = $160,034 C = 418.9MT D = $1,483,786 E = 481.1MT F = $1,643,820	A = 110.4MT B = $277,307 C = 742.7MT D = $2,756,499 E = 853.1MT F = $3,033,806

A = Catch of billfish
B = Exvessel value of billfish catch
C = Catch of tunas
D = Exvessel value of tuna catch
E = Total catch of billfish and tunas
F = Exvessel value of billfish and tuna catch

These volumes and values can be thought of as being an upper-limit of possible gross "losses" of billfish and tuna to the foreign longline fleet. Obviously, net "losses" would be lower since the costs of fishing in the FCZ would not be incurred. The actual magnitude of expected "losses" would be softened if foreign longling were allowed to continue but only in open zones of the FCZ during another season. Total effort could be allowed to remain the same. It would simply be expended in a smaller area or during a shorter time period. Foreign vessels could be expected to make up the bulk of their forgone catch by fishing elsewhere in the U.S. FCZ of the Western Pacific Region or beyond the FCZ in international waters.

There are 15 area zone combination possibilities for each season. Coupled to four different seasons, the number of area/season closure combinations mushrooms to 60. The large number of possible combinations makes it quite difficult for anyone to select the single combination that provides the best reasonable balance between minimizing the impacts on foreign tuna fishing and maximizing the benefits to domestic fishermen. Some winnowing of options is needed.

Selecting area closures of 100 miles or less off the coasts of the main Hawaiian Islands would be contradictory to objective 4.5.7 of this plan (diminish the risk of foreign/domestic gear conflicts). Prohibiting foreign longlining in areas 50 miles or less surrounding the Main

Hawaiian Islands would also result in insignificant increases in domestic fishery values, assuming foreign fishing occurred in open areas. For these reasons, closures of 0 and 50 miles for the Main Hawaiian Islands have been eliminated from the set of acceptable options. In effect, we have eliminated the first two columns of Tables 8.2 through 8.5.

8.4.1.2 Rank Order of Options

The impacts on foreign fishing from the remaining 32 options can be brought into clearer focus by ranking each option by the expected magnitude of its effect. Since foreign catches in the FCZ of both tuna and billfish would be affected by area/season prohibitions, the common denominator for gauging the magnitude of possible effects is potential lost gross revenue. Table 8.6 presents a rank-ordering of options according to the relative magnitudes of possible dollar impacts on foreign longlining for tuna and billfish under these alternative sets of area/season combinations.

Three options recommended to the Council by the Billfish Advisory Sub-Panel (identified by Ψ) have been included in the rank ordering in Table 8.6. These are:

Option 2: 200 mile closure of the FCZ around the main Hawaiian Islands and the NWHI from May through December; 100 mile closure of the FCZ around the main and NWHI islands during the remainder of the year (January through April).

TABLE 8.6

RANK ORDER OF MANAGEMENT OPTIONS ACCORDING TO THE MAGNITUDES OF POSSIBLE IMPACTS ON FOREIGN LONGLINING FOR TUNA & BILLFISH UNDER ALTERNATIVE SETS OF AREA/SEASON COMBINATIONS

Rank Order	% of Total Annual Value of Billfish & Tuna ($8,337,117)	Size of Area Closure Between Main	Between NWHI	Season	Average (1973-77) Billfish Catch (MT)	Average (1973-77) Tuna Catch (MT)	Billfish Catch / Tuna Catch	% of Average Annual (1973-77) Foreign‡ Pacific Ocean Billfish Catch (56,500 MT)	% of Average Annual (1973-77) Foreign‡ Pacific Ocean Tuna Catch (245,300 MT)
1	100.0	200	200	Entire Year	302.7	2,265.5	.13	.53	.92
¥ 2	78.8	200 100	200 100	May/Dec Jan/Apr	225.9	1,959.7	.12	.39	.79
3	71.9	100	200	Entire Year	228.2	1,645.9	.14	.40	.67
* 4	70.8	200	200	Oct/Feb	168.4	1,714.1	.10	.29	.69
5	67.5	200	100	Entire Year	189.2	1,503.6	.13	.33	.61
¥ 6	63.7	200 100	200 100	March/Oct Entire Year	214.9	1,353.0	.16	.38	.55
* 7	59.1	100	200	Oct/Feb	138.9	1,409.1	.10	.24	.57
8	51.0	200	50	Entire Year	135.8	1,138.9	.12	.24	.46
¥ 9	45.7	200 --	-- 100	Entire Year May/Nov	116.0	1,014.6	.11	.20	.41
* 10	42.8	200	100	Oct/Feb	102.7	1,037.6	.10	.18	.42
11	39.4	100	100	Entire Year	114.7	884.0	.13	.20	.36
12	38.9	200	0	Entire Year	102.6	865.9	.12	.18	.35
13	36.4	200	200	May/Nov	110.4	742.7	.15	.19	.30
14	35.8	200	200	March/Oct	147.4	694.4	.21	.26	.28
* 15	31.2	100	100	Oct/Feb	73.2	732.6	.10	.12	.29
16	29.6	200	100	March/Oct	96.6	576.6	.17	.17	.23
17	29.3	200	100	May/Nov	77.3	589.7	.13	.13	.24
* 18	28.3	200	50	Oct/Feb	66.9	705.3	.09	.11	.28
19	26.8	200	50	March/Oct	77.3	524.4	.15	.13	.21
20	25.9	200	50	May/Nov	67.8	514.6	.13	.12	.20
Δ 21	24.4	200	0	March/Oct	66.2	476.3	.14	.11	.19
Δ 22	22.9	100	50	Entire Year	61.3	519.3	.12	.10	.21
Δ 23	22.5	200	0	May/Nov	63.9	441.0	.14	.11	.17
Δ 24	19.7	100	200	May/Nov	62.2	418.9	.15	.11	.17
Δ 25	17.6	100	200	March/Oct	98.0	343.3	.29	.17	.13
Δ* 26	17.3	200	0	Oct/Feb	43.4	450.3	.10	.07	.18
Δ* 27	16.7	100	50	Oct/Feb	37.4	400.3	.09	.06	.16
Δ 28	12.6	100	100	May/Nov	29.1	265.4	.11	.05	.10
Δ 29	11.4	100	100	March/Oct	47.2	225.4	.21	.08	.09
Δ 30	10.8	100	0	Entire Year	28.1	246.3	.11	.04	.10
Δ 31	9.2	100	50	May/Nov	19.6	190.8	.10	.03	.07
Δ 32	8.7	100	50	March/Oct	28.0	173.3	.16	.04	.07
Δ 33	6.3	100	0	March/Oct	16.8	125.1	.13	.02	.05
Δ 34	5.8	100	0	May/Nov	15.7	117.2	.13	.02	.04
Δ* 35	5.7	100	0	Oct/Feb	13.9	145.3	.10	.02	.05

‡ Japanese, Taiwanese, Korean

* Foreign striped marlin season (Oct/Feb) area options.

¥ Advisory Panel recommendations.

Option 6: 200 mile closure of the FCZ around the main Hawaiian Islands and the NWHI from March through October; 100 mile closure of the FCZ around the main and NWHI for the entire year.

Option 9: 200 mile closure of the FCZ around the main Hawaiian Islands (entire year), and 100 mile closure of the FCZ around the NWHI during the domestic billfish season (May through November).

Management measures intended solely to reduce FCZ foreign fishing mortalities on striped marlin and swordfish could be difficult to justify on biological grounds, but they are supportable on the grounds of effecting transfers to domestic vessels. Striped marlin and swordfish are more commonly caught in the NWHI and may make up a critical component of catch by new longline and troll vessels in the NWHI. However, options coupled to the foreign striped marlin season would not adequately reflect the growing, year-round importance of striped marlin and swordfish in the catch of domestic fishermen and those options have been eliminated (marked by an *). While important to domestic fishermen, especially to the longline and NWHI fleets, striped marlin are still of secondary rank compared to present levels of domestic catches of blue marlin.

The Lovejoy analysis indicated that a complete ban of foreign fishing in the entire FCZ around Hawaii could

result in a rise of 2% in the catch of blue marlin in the domestic longline fishery. In the domestic troll fisheries, the catch of blue marlin would rise by 2% and the striped marlin catch by 7%. Other combinations of smaller area and season closures would, of course, have proportionally smaller impacts on the domestic catch rates for these species. It seems reasonable to assume that any area/season closures that would affect the past pattern of foreign fishing in the FCZ of Hawaii by less than 25% cannot be expected to result in any detectable real improvements to domestic fishers in view of the Lovejoy study findings. The area/season options marked by an $\underline{\Delta}$ (options 21 through 35) are thus also eliminated from further consideration.

8.4.1.3 Alternative Area/Season Closure Options

The fifteen remaining options form the recommended sets of area/season closure alternatives that warrant further analysis. These are shown in Table 8.7. Thirteen of these options call for prohibiting foreign longlining within the entire 200 mile U.S. FCZ surrounding the main Hawaiian

TABLE 8.7

RECOMMENDED ALTERNATIVE AREA/SEASON CLOSURE OPTIONS FOR MANAGING FOREIGN‡ LONGLINE BILLFISH FISHING IN THE US FCZ OF THE HAWAII ARCHIPELAGO

Rank Order	% of Total Annual Value of Billfish and Tuna ($8,337,117)	Size of Area Closure Between Main	Size of Area Closure Between NWHI	Season	Average (1973-77) Billfish Catch (MT)	Average (1973-77) Tuna Catch (MT)	Billfish Catch / Tuna Catch	% of Average Annual (1973-77) Foreign‡ Catch of Billfish Made in the US FCZ of the Western Pacific Region* (779 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners in the US FCZ of the Western Pacific Region (5,430 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners and Baitboats in the US FCZ of the Western Pacific Region (16,683 MT)	% of Average Annual (1973-77) Foreign‡ Catch of Billfish in the Pacific Ocean (56,500 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners in the Pacific Ocean (245,300 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners and Baitboats in the Pacific Ocean (799,000 MT)
1	100.0	200	200	Entire Year	302.7	2,265.5	.13	38.8	41.9	13.6	.53	.92	.28
▼ 2	78.8	200 100	200 100	May/Dec Jan/Apr	225.9	1,959.7	.12	29.0	36.3	11.7	.39	.79	.24
3	71.9	100	200	Entire Year	228.2	1,645.9	.14	29.3	30.5	9.9	.40	.67	.20
5	67.5	200	100	Entire Year	189.2	1,503.6	.13	24.3	27.8	9.0	.33	.61	.18
▼ 6	63.7	200 100	200 100	March/Oct Entire Year	214.9	1,353.0	.16	27.6	25.0	8.1	.38	.55	.16
8	51.0	200	50	Entire Year	135.8	1,138.9	.12	17.4	21.1	6.8	.24	.46	.14
▼ 9	45.7	200 --	-- 100	Entire Year May/Nov	116.0	1,014.6	.11	14.9	18.8	6.1	.20	.41	.12
11	39.4	100	100	Entire Year	114.7	884.0	.13	14.7	16.4	5.3	.20	.36	.11
12	38.9	200	0	Entire Year	102.6	865.9	.12	13.2	16.0	5.2	.18	.35	.10
13	36.4	200	200	May/Nov	110.4	742.7	.15	14.2	13.7	4.5	.19	.30	.09
14	35.8	200	200	March/Oct	147.4	694.4	.21	18.9	12.9	4.2	.26	.28	.08
16	29.6	200	100	March/Oct	96.6	576.6	.17	12.4	10.7	3.5	.17	.23	.07
17	29.3	200	100	May/Nov	77.3	589.7	.13	9.9	10.9	3.5	.13	.24	.07
19	26.8	200	50	March/Oct	77.3	524.4	.15	9.9	9.7	3.1	.13	.21	.06
20	25.9	200	50	May/Nov	67.8	514.6	.13	8.7	9.5	3.1	.12	.20	.06

‡ Japanese, Korean, and Taiwanese

* The US FCZ of the Western Pacific Region includes the US FCZ of Hawaii, American Samoa, Guam, the Northern Marianas, and Wake, Johnston, Palmyra/Kingman, Jarvis, and Howard/Baker islands. In its entirety, the US FCZ of the Western Pacific Region totals 1,511,000 square miles. See Figure 5.7 for geographic perspective.

Islands either during the entire year or during the blue marlin seasons(s). Options 2, 9, 13, 17, and 20 are coupled to the 7-month, summer-centered, domestic billfish season which normally runs from May through November. Options 14, 16, and 19 are tied to the foreign blue marlin season which is also summer oriented and runs for eight months, March through October.

There are good reasons for examining either of these seasons. A closure of the FCZ to foreign longline fishing during the blue marlin season(s) appears to provide some degree of balance for achieving most of the objectives of this FMP while allowing a reasonable opportunity for foreign longline fishermen to catch tuna in the remaining months of the year. As indicated earlier, the Lovejoy model indicates that a ban on foreign longline fishing in the FCZ will increase the domestic annual catch of blue marlin and striped marlin. This is particularly important to segments of the domestic troll fishery which consider the blue marlin as the ultimate trophy fish. There is valid reason for this view since the largest blue marlin ever caught on rod and reel came from Hawaiian waters. This was an authenticated 1,805 lb. blue marlin taken by sport fishermen. There are anecdotal reports of individual fish taken on commercial gear that approach 2,500 lbs.

There are also other reasons for choosing the blue marlin season(s) as the time basis for managing foreign

longline fishing in the FCZ of the Hawaiian Islands. The domestic blue marlin season coincides perfectly with the domestic yellowfin tuna season in Hawaiian waters (Appendix I). This suggests that blue marlin and yellowfin tuna are responding to the same environmental conditions when migrating through the Hawaii area. If the blue marlin is the king of all sportsfish in Hawaii, then the large yellowfin tuna is surely the queen. And if the commercial market value of the catch were to be the factor deciding importance, then the queen would dethrone the king.

Also note that the data (Tables 8.3 and 8.4) show that more tuna (all species combined) are caught by foreign fishermen during the winter months (which is the off season for blue marlin). Therefore, a closure during the blue marlin season(s) would present a less of a hardship to foreign longliners. Finally, the billfish to tuna catch ratios (Table 8.6) are highest during the summer periods indicating that billfish (all species combined) are more abundant during the summer months in Hawaiian waters.

It can be readily computed from Table 5.20 that foreign longline catches made in the Hawaii portion of the U.S. FCZ constitute less than 40 percent of the foreign longline catch made in the U.S. FCZ of the Western Pacific Region as a whole. Thus even a total and absolute ban on foreign longlining in the FCZ of the Hawaiian Archipelago

would allow reasonable opportunity for the continuation of foreign longlining in U.S. waters since foreign fishing would still be permited in a large portion of the FCZ around American Samoa and foreign fishing would not be affected at all in the FCZ surrounding U.S. island possessions (Figure 5.7). Further, closing the Hawaiian Archipelago to foreign longlining would not represent an extreme situation; that is, longliners would be able to compensate for their gross "losses". It seems likely that foreign longliners would fish elsewhere in the U.S. FCZ of the Western Pacific Region or beyond the FCZ to make up for the fishing time lost in the closed areas. Therefore, net "losses" to foreign longliners would almost certainly be lower than those shown in Table 8.7. The alternative area/season closures shown in Table 8.7 do not represent all "opportunities lost" to foreign longliners since they would still be allowed to fish up to or even beyond average fishing effort levels of recent years in permitted areas during permitted times. The magnitude of the effort allowed in the FCZ could be held at a historical ceiling. It would, however, be rearranged both in space and in time.

The Council also notes that a total prohibition of foreign longlining in the U.S. FCZ of Hawaii would be a small interference (less than 15%) with all foreign fishing forms for tuna in the U.S. FCZ of the Western Pacific Region (Table 5.20). Large amounts of tuna are taken in the FCZ by bait

fishing, which would not be affected (Tables 5.19 and 5.20). Furthermore, a ban on foreign longlining in the FCZ of Hawaii would constitute a minor interference with foreign fishing for tuna when viewed in terms of fishing opportunities for foreign tuna fleets in a Pacific-wide perspective. Foreign catches of tuna made in the Hawaii FCZ constitute a small fraction of the total foreign tuna catch made by longliners and baitboats in the Pacific Ocean (Table 8.7). Foreign reliance on the U.S. FCZ of Hawaii for Pacific billfish catch is even less. In contrast, the estimated Hawaii catch by longliners and trollers in 1976 amounted to 732 MT of billfish and 2,000 MT of tunas. In 1976, the total reported commercial landings of all sea-caught fish in Hawaii were 6,252 MT (Hawaii State Division of Fish and Game, 1977). Thus, the catch of billfish made up 11.7% of the total reported commercial Hawaii landings. It is evident that the affected foreign longline catch in the FCZ would be relatively insignificant to foreign longline fleets, whereas billfish are clearly of major importance to domestic fishers.

8.4.1.4 Conclusion

In summary, the Council believes that an "optimal" areal-seasonal combination can be selected from among the remaining options for Hawaii which will best balance between competing legal interests. A balancing test is important for reviewing the acceptability of billfish management measures which have the effect of regulating tuna longline fishing.

Tuna regulation may be undertaken but only upon showing of necessity of management of fishery resources over which the U.S. has exclusive fishery management authority. The Council believes that there is ample necessity for managing the foreign take of billfish. There can be no doubt that under the FCMA, the U.S. can and should exercise exclusive management authority over billfish.

8.4.2 Options for Guam

The Council believes that area closures to foreign longlining in the FCZ around Guam are appropriate at this time and justifiable for the following reasons:

a) The FCZ around Guam is a small area, yet it is essentially Guam's only natural resource base for economic development. There is strong interest in fisheries development in Guam, but successful development requires successful fishing. This plan must provide as strong a safeguard as possible that Guam's fishermen will experience high enough catch rates in the FCZ to make expansion of the domestic fishery a viable proposition.

b) The dominant species in the foreign longline billfish catch around Guam is blue marlin, which is held in equally high regard in Guam as in Hawaii. Reducing foreign longlining mortality of blue marlin the FCZ around Guam would allow increased domestic effort and catch. Because domestic catches around Guam would be lower than recent billfish catches of marlin made by foreign longliners, there could be

an improvement in the biological condition of the stocks. The scientific literature reports that the highest spawning densities of blue marlin occur in the western Pacific, with density decreasing eastward.

c) Guamanian vessels historically have fished heavily in nearshore waters and at a number of offshore banks in the FCZ. These waters and a buffer zone must be reserved to protect harvesters of billfish. At only a couple of points is the FCZ boundary a full 200 nautical miles from shore. The boundary of the FCZ surrounding Guam is substantially less than 200 miles in most places.

d) Foreign longlining effort and catch in the FCZ around Guam increased five-fold from the 1965-75 average to the 1977 level. Comparable domestic fishery catch data are not available for this period; but it seems reasonable to expect that billfish density has at least periodically been reduced, and catch per unit effort and fishery values have not reached their potentials, due to foreign harvests. The Lovejoy model scenario of catch transfer ranges may even be larger for Guam than for Hawaii. The likelihood of interception for a given level of longlining is greater as the longlining gets closer to shore. Since the FCZ boundary is rarely 200 miles away, the relative smallness of the FCZ is more evident. Finally, as in Hawaii, the relative values associated with the fishery are high, even if the numbers of fish transferred are not necessarily large. Guam has a small economic base. Anything that adds to that base is significant to the local economy.

8.4.2.1 Framework for Comparison of Alternatives

There has been no equivalent (Lovejoy) simulation

model constructed for Guam as was done for Hawaii. Nonetheless, a qualitative evaluation of alternatives, and a quantitative comparison of possible gross "losses" to foreign longliners, can be presented on a general level. As with Hawaii the selection of management measures is based on an evaluation of their possible benefits to billfish conservation, possible benefits to the fisheries of Guam, and possible negative impacts on foreign longline fishermen.

Benefits to Billfish Conservation

The FCZ around Guam is but a very minute portion of the entire range of the billfish stocks which migrate through it. As a consequence, management measures applicable only within this area would have a miniscule, if any, measurable impact on the conservation of these wide ranging species. Nevertheless, management measures which limit increased foreign harvesting of blue marlin within Guam's FCZ could serve to benefit stock conservation to a limited extent:

1) The surface temperature of the waters around Guam are within the range of 26° to 29°C during the entire year. Blue marlin larvae are most commonly found within waters of this temperature range, suggesting that blue marlin spawning is most common in waters of this temperature (Appendix D). Thus, control over increased foreign blue marlin harvesting within the FCZ around Guam may partially help to protect these stocks of blue marlin during their

period of spawning.

2) Recognition of the need to control the increased harvesting of blue marlin through the enactment of measures which control harvesting in waters under U.S. jurisdiction may serve as a useful precedent for international efforts to manage billfish on a stock-wide basis and in coming to agreement on the relative national shares in the fishery.

3) The PMP may result in significant waste of billfish by requiring their release in non-retention zones and once TALFF is reached. Alternative management measures are needed to eliminate the potential for such waste.

Benefits to Domestic Fisheries

The values of Guam's fisheries will be increased by management measures controlling foreign billfish harvesting in the FCZ around Guam if:

1) The general availability of billfishes to domestic fishermen is increased, resulting in greater efficiency, increased investments in fishing enterprises, higher satisfaction from recreational fishing, and less dependence on fish imports;

2) The productivity of established fishing grounds is enhanced, and new grounds are identified through new

fishery operations due to high billfish catches; and

3) Present and potential gear conflicts between domestic and foreign fishermen are precluded.

Impacts on Foreign Fishermen

The only historical data available for a foreign fishery taking billfish in the FCZ around Guam is the Japanese longline tuna fishery. From 1965 to 1975, the Japanese annual longline effort in the FCZ around Guam averaged 161.1 vessel-days per year resulting in an average annual catch of 21.3 metric tons of billfish and 124.0 metric tons of tuna. In 1976, the Japanese longline effort and catch of billfish and tuna in the FCZ of Guam increased substantially and by 1977 the Japanese longline effort in the FCZ around Guam reached 1,199 vessel-days (Table 5.12). The catch of billfish rose correspondingly reaching 104 metric tons, and the catch of tuna reached 1989 metric tons (Table 5.18). This phenomenal increase in the Japanese longline effort and catch in the FCZ around Guam is significant departure from that nation's past fishing patterns around Guam. For this reason, the years from 1965 to 1975 are considered the base period representing Japan's fishing patterns in the U.S. FCZ of Guam. Because available Japanese data prior to 1971 and after 1975 are "...simply too coarse for an accurate, detailed spatial analysis of fishing activity within the FCZ" of Guam (Yong and Wetherall, 1980),

the data from the years 1971 to 1975 are used for most of this analysis.

The impacts of alternative area/season closures on foreign fishing are evaluated in terms of the extent to which the closures would reduce total foreign longline billfish and tuna catches in the U.S. FCZ of Guam below average levels achieved during the years 1971-1975.

Slightly more tuna, on the average, were taken by foreign skipjack boats than by foreign longliners in the U.S. FCZ of Guam (Sections 5.5.2.2 and 5.5.3.2.2).

8.4.2.2 Options Considered

The options considered for the management of foreign billfish fishing in the FCZ of Guam are the following:

1. Longline Exclusion Zone - Year Round

a. Entire FCZ around Guam closed to foreign longlining.

b. 100-mile zone around Guam closed to foreign longlining.

c. 50-mile zone around Guam closed to foreign longlining.

d. Rectangular area enclosing offshore banks between 12°30'N-14°00'N and 144°10'E-145°10'E closed to foreign longlining.

2. Seasonal Closures

a. Entire FCZ around Guam closed to foreign longlining during the foreign blue marlin season (September-March) -- (see Appendix J).

b. Entire FCZ around Guam closed to foreign longlining during the domestic blue marlin season (April - August) -- (see Appendix K).

c. 100-mile closure to foreign longlining during the foreign blue marlin season;

d. 100-mile closure to foreign longlining during the domestic blue marlin season.

e. 50-mile closure during the foreign blue marlin season.

f. 50-mile closure during the domestic blue marlin season.

g. Rectangular area enclosing offshore banks closed to foreign longlining during the foreign blue marlin season.

h. Rectangular area closed to foreign longlining during the domestic blue marlin season.

In view of the small catch of billfish being presently made by Guam fishermen and their desire to expand their harvesting of billfishes, catch, effort or area limitations on Guam's domestic billfish fishery in the FCZ are not considered desirable nor necessary at this time.

8.4.2.3 Rank Order of Options

The same methodology that was used for examining various area/season closure alternatives for Hawaii was used for comparing the size and value of the foreign fishery in the various parts of the U.S. FCZ of Guam during certain times of the year. Summaries of estimated average (1971-1975) catches of billfish and tuna taken by foreign longlining during different times of the year and their ex-vessel values in Japanese markets (February, 1980) are shown in Table 8.8 for the rectangular closure area and for the 50, 100, and 200 mile zones of off Guam. Table 8.9 is a rank-ordering of the area/season closure options according to the relative magnitudes of possible impacts on foreign longlining for both tuna and billfish on the basis of "lost" gross value of past average catches.

Two additional options recommended to the Council by the Billfish Advisory Sub-panel (identified by Ψ) have been included in the rank-ordering of Table 8.9. These are:

(a) Closure of 100 miles of the FCZ to foreign longlining for the entire year. Foreign longlining to be allowed

in the remaining portion of the FCZ but catch and effort be limited to not exceed the averages for the years 1971-1975.

(b) 100 miles of the FCZ permanently closed to foreign longlining combined with closing the entire 200-mile FCZ to foreign longlining during the domestic billfish season (April to August of each year).

As can be seen from Table 8.9 both the amount and gross value of the catches are related to the size of the area and the length of the time periods (seasons) chosen for analysis. The larger the closure area and/or the longer the closure period is to stay in effect, the greater the expectation of "lost" catches with high value. These volumes and values represent an upper bound of possible gross "losses" of billfish and tuna to foreign longliners. As in the Hawaii case, the net losses will be much smaller than the apparent gross losses.

8.4.2.4 Evaluation of Impacts

Table 8.9 presents a breakdown of the potential "loss" to the foreign longline fishery in the Pacific under the various area/season closure options. It is emphasized that this analysis presents the "worst-case" situation that assumes that foreign fishermen will not respond to longline restrictions by relocating their effort to and making equal catches in other Pacific areas. All of the management

measures (except for 1) would allow foreign fishermen to make up some or all their losses by redistributing their fishing effort in permissible fishing areas and times within the FCZ around Guam. In all cases foreign fishermen could make up their losses by redistributing approximately .03% of their total Pacific longlining effort into other Pacific areas outside the FCZ surrounding Guam.

TABLE 8.8

AVERAGE CATCH (1971-75) AND EX-VESSEL VALUE (1980) OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS IN THE VARIOUS SUBZONES OF THE US FCZ OF GUAM DURING VARIOUS TIMES (SEASONS) OF THE YEAR

FCZ SUB AREA	SEASONS OF YEAR	AVERAGE (1971-75) BILLFISH CATCH (MT)	EX-VESSEL VALUE OF AVERAGE BILLFISH CATCH $	AVERAGE (1971-75) TUNA CATCH (MT)	EX-VESSEL VALUE OF AVERAGE TUNA CATCH $
200	Entire Year	17.2	$ 40,486	100.0	$ 263,955
100	Entire Year	5.9	14,040	34.4	91,764
50	Entire Year	1.4	3,413	8.9	23,284
Rectangle*	Entire Year	0.6	1,522	4.7	12,433
200	Sept/March	13.1	30,769	80.8	213,276
100	Sept/March	3.7	8,929	24.5	62,421
50	Sept/March	0.9	2,124	5.4	13,151
Rectangle*	Sept/March	0.3	828	2.5	6,035
200	April/Aug	4.1	9,717	19.2	50,679
100	April/Aug	2.1	5,111	9.9	29,343
50	April/Aug	0.5	1,289	3.5	10,133
Rectangle*	April/Aug	0.3	694	2.2	6,398

* Between $12^{o}30'N - 14^{o}00'N$ and $144^{o}10'E - 145^{o}10'E$ (See Figure 8.3)

TABLE 8.9

RECOMMENDED ALTERNATIVE AREA/SEASON CLOSURE OPTIONS FOR MANAGING FOREIGN‡ LONGLINE BILLFISH FISHING IN THE US FCZ OF GUAM

Rank Order	% of Total Annual Value of Billfish and Tuna ($304,441)	Size of Area Closure	Season	Average (1971-75) Billfish Catch (MT)	Average (1971-75) Tuna Catch (MT)	Billfish Catch / Tuna Catch	% of Average Annual (1973-77) Foreign‡ Catch of Billfish Made in the US FCZ of the Western Pacific Region* (779 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners in the US FCZ of the Western Pacific Region (5,430 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners and Baitboats in the US FCZ of the Western Pacific Region (16,683 MT)	% of Average Annual (1973-77) Foreign‡ Catch of Billfish in the Pacific Ocean (56,500 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners in the Pacific (245,300 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign‡ Longliners and Baitboats in the Pacific Ocean (799,000 MT)
1	100.0	200	Entire Year	17.2	100.0	.17	2.21	1.84	.60	.030	.041	.0125
¥ 2	91.5	200 100	April/Aug Entire Year	15.3	90.7	.17	1.96	1.67	.54	.027	.037	.0114
3	80.3	200	Sept/March	13.1	80.8	.16	1.68	1.48	.48	.023	.033	.0101
¥ 4	34.7	100 (Effort in open zone not to exceed 1971-75 Average)	Entire Year	5.9	34.4	.17	.76	.68	.21	.010	.014	.0043
5	23.4	100	Sept/March	3.7	24.5	.15	.47	.45	.15	.007	.010	.0031
6	19.8	200	April/Aug	4.1	19.2	.21	.53	.35	.12	.007	.008	.0024
7	11.3	100	April/Aug	2.1	9.9	.21	.27	.18	.06	.004	.004	.0012
8	8.8	50	Entire Year	1.4	8.9	.16	.18	.16	.05	.002	.004	.0011
9	5.0	50	Sept/March	0.9	5.4	.17	.12	.10	.03	.002	.002	.0007
10	4.6	Rectangle	Entire Year	0.6	4.7	.13	.08	.09	.03	.001	.002	.0006
11	3.8	50	April/Aug	0.5	3.5	.14	.06	.06	.02	.001	.001	.0004
12	2.3	Rectangle	Sept/March	0.3	2.5	.12	.04	.05	.01	.001	.001	.0003
13	2.3	Rectangle	April/Aug	0.3	2.2	.14	.04	.04	.01	.001	.001	.0003

‡ Japanese

* The US FCZ of the Western Pacific Region includes the US FCZ of Hawaii, American Samoa, Guam, the Northern Marianas, and Wake, Johnston, Palmyra/Kingman, Jarvis, and Howard/Baker islands. In its entirety, the US FCZ of the Western Pacific Region totals 1,511,000 square miles. See Figure 5.7 for geographic perspective.

¥ Advisory Sub-Panel recommendations

It is further worth noting that the gross "loss" of tuna is expressed as a percent of the total foreign longline tuna catch. The actual "loss" to foreign tuna harvesting is less than this because other nations besides Japan harvest tunas on longline gear, tunas are harvested in all the oceans of the world, and other methods (purse seining, pole-and-line fishing) are used to harvest tunas.

The principal differences in the expected effects of these measures are as follows:

a. Options 1, 4, and 10 specifically protect established domestic fishing grounds by prohibiting foreign longlining all year in the bank areas frequented by domestic fishermen, whereas Options 12 and 13 do so only during a portion of a year.

b. Option 6 prohibits foreign longlining in the entire FCZ around Guam during the most productive domestic blue marlin season (April through August); this should act to increase the summer availability of blue marlin stocks to the domestic fishery.

c. Option 1 involves reducing the catch of foreign longliners by .03% of the total Pacific longline billfish catch and .04% of the total Pacific longline tuna catch. For all other options the reductions involved would be even smaller. Each of these options, except for option number 1, would allow this gross "loss" to be recovered by

relocation of foreign fishing within the FCZ around Guam where fishing is permitted during permitted times. Monitoring of permitted effort is most likely easier to carry out than monitoring catch.

d. Each of the recommended area/season alternatives would be less difificult to administer and enforce than the PMP measures. Option 10 would be the least difficult to enforce since the area "closed" (and thus needing fairly frequent surveillance) would be quite small (5,400 square miles).

An additional management measure which could be instituted in conjunction with the preferred area/season closure alternative selected from Table 8.9 is a poundage fee on billfish taken by foreign vessels in the FCZ around Guam in permitted areas during permitted times. The magnitude of the fee could be sufficient to recover the costs or providing adequate surveillance and enforcement of foreign fishing activities in the FCZ around Guam. Subject to legal constraints, a 50% level (same as for Hawaii) achieves this objective.

As for all parts of the FCZ, every foreign vessel fishing within the FCZ around Guam shall obtain a permit and maintain and submit such reports on its activities as may be required by the FMP.

8.4.3 Options for American Samoa

In the case of American Samoa, as with Hawaii and Guam, the Council is cognizant of the sensitive issue of de facto regulation of foreign longlining for tuna resulting from prohibitions of foreign billfish landings made in American waters. However, the Council believes that closures of some areas to foreign longline fishing in the FCZ of American Samoa are justifiable for the following reasons:

a. Almost all of American Samoa's current domestic fishing effort (that directed at billfish and other pelagics as well as for bottomfish) occurs within twelve miles of shore and/or in the vicinity of several offshore banks and pinnacles within a rectangle bounded by 15° and 14° S. latitude and 168° and 171° W. longitude (Figure 8.4). Billfish and other pelagic species will occur there in greater abundance if foreign longline fishing is prohibited in these areas. Domestic catch rates could then be expected to increase.

b. Fishery resources which are targets for future fisheries development in American Samoa such as deep bottomfish, lobster, shrimp and possibly precious coral are located entirely within the offshore bank areas and pinnacles. Pelagic species which currently support most of the domestic fishing in Samoa also tend to concentrate near islands and offshore banks where prey is more plentiful. Consequently, this is the area in which domestic effort will show the greatest increase in the future. Fishery development is not proceeding as rapidly in American Samoa as in other areas and domestic vessels are not expected to range far out from shore in the near future.

c. The likelihood of gear conflict between domestic and foreign fishermen would be almost eliminated if foreign fishing vessels were excluded from offshore bank areas.

d. Incidental catches of billfish (as well as masimasi, wahoo, barracuda, and other species) by foreign vessels directing their effort at tuna will be reduced because these species tend to be associated with offshore banks and reefs.

8.4.3.1 Options Considered

The size and value of the average (1973-1977) foreign longline catch made in the various parts of the U.S. FCZ around American Samoa are shown in Table 8.10. As can be readily seen from Table 8.10, the larger the area the larger the volume and value of the foreign catch.

8.4.3.2 Impacts of Alternative Area/Season Closures

Closing large areas to foreign longliners could have an inhibiting impact on the domestic economy of American Samoa which has two tuna canneries that receive a major portion of their fish from fleets of foreign longline vessels based in Pago Pago. These canneries are the largest private employers in American Samoa. Regulations that adversely affect the supplies of fish to the canneries could have detrimental social and economic effects in the level economy. The two canneries employ some 1,200 people.

TABLE 8.10

AVERAGE CATCH (1973-77) AND EX-VESSEL VALUE (1980) OF BILLFISH AND TUNA TAKEN BY FOREIGN LONGLINERS ON THE VARIOUS SUBZONES OF THE US FCZ OF AMERICAN SAMOA DURING VARIOUS TIMES (SEASONS) OF THE YEAR

FCZ SUB AREA	SEASON OF YEAR	AVERAGE (1973-77) BILLFISH CATCH (MT)	EX-VESSEL VALUE OF AVERAGE BILLFISH CATCH $	AVERAGE (1973-77) TUNA CATCH (MT)	EX-VESSEL VALUE OF AVERAGE TUNA CATCH $
200	Entire Year	109.1	251,741	472.7	1,127,735
100	Entire Year	45.9	105,849	193.1	448,392
50	Entire Year	21.5	49,575	87.7	203,546
Rectangle*	Entire Year	9.2	20,797	36.3	83,602

* Between 14°-15°S and 168°-171°W (See Figure 8.4)

Possible impacts on cannery supplies and on foreign longlining in the U.S. FCZ of American Samoa should not be viewed in isolation. American Samoa governmental policy also encourages the growth of domestic commercial and recreational fisheries. The social and economic benefits implicit on this development policy require that domestic fishing opportunities be enlarged in the FCZ around American Samoa.

8.4.3.3 Recommended Alternatives

Two alternatives stand out for meeting the objectives of this FMP and meeting the balancing test as laid out in the NOAA/NMFS legal opinion (Appendix H). These are:

(1) Foreign longline fishing be prohibited in the area between 14°S and 15°S latitude and 168°W and 171°W longitude (Figure 8.4) and within 12 nautical miles of any island of American Samoa.

(2) Foreign longlining be prohibited within 50 miles of any island of American Samoa.

Both of these area closures [(1) and (2)] would be for the entire year. No other area or time restrictions on foreign longline fishing are recommended in the U.S. FCZ surrounding American Samoa.

The 50 miles closure option is larger in area than the rectangular closure option (Figure 8.4). About 19% of the average foreign total catch of billfish and tuna

(1973-1977) was made within 50 miles from shore (Table 5.19).

The rectangular closure area shown (Figure 8.4) surrounds the banks fished by domestic fishermen in American Samoa. An analysis of the foreign catch data for the 1973-1976 period shows the average annual effort in vessel days within the closure areas was approximately 6% of the total effort expended within the entire American Samoa FCZ. But during the same period, 8.4% of all billfish and 7.7% of all tunas caught by foreign fishermen with the FCZ came from the rectangle, thus providing evidence that bank areas serve as focal points for pelagic fish populations while they are migrating through the FCZ.

Restrictions on foreign longlining are necessary for inshore waters around the islands of American Samoa and in the waters around certain banks in the FCZ to encourage the use of these waters by domestic fishermen free from possible conflict with foreign vessels. The areas involved are minor in comparison to the total area of the FCZ and the recommended area closures would have a negligible impact on foreign tuna fishing in the FCZ. This is in keeping with the Council's policy expressed in its October 16, 1979 Resolution concerning its recognition of Samoa's unique needs to simplify the operation of contract longline vessels based in American Samoa (Appendix O).

It should be noted that whatever foreign effort

were to be displaced as a result of implementing either option (1) or (2), actual losses would probably be much less than the figures shown on Table 8.10 because the area closures would not limit the foreign fleets from continued fishing effort outside the closure areas. Since the entire FCZ outside the closure area would be open for unrestricted fishing, the foreign fleet would be able to maintain at least 80% of their former catch levels within the FCZ.

The Council believes that the recommended set of management measures for American Samoa meets the balancing test as laid out in the NOAA/NMFS legal opinion (Appendix H).

Every foreign vessel wishing to fish within the FCZ of American Smoa would be required to obtain a permit and maintain and submit such reports on its activities as required by this FMP.

8.5 Summary

This chapter has analyzed in considerable detail a large range of alternative time/area closures for foreign longliners considered by the Council. This was done to meet the spirit and letter of "alternative examination requirements" of the National Environmental Policy Act of 1969 (NEPA) and associated regulations of the Council on Environmental Quality (CEQ); the Magnuson Fishery Management and Conservation Act (FCMA); the NOAA legal opinion (Appendix H) which concludes that a billfish management plan may contain management measures which affect foreign longline fishing for tuna in the FCZ; and the

Regulatory Flexibility Act, Executive Order 12291, and the associated NOAA Directive 21-24 which require assessment of beneficial and adverse effects of alternative actions especially with respect to possible economic impacts, especially for small businesses (e.g., local fishing enterprises).

The examined sets of alternative area/season closures for Hawaii, Guam, and American Samoa are part of a larger package of billfish conservation and management measures for the entire U.S. FCZ of the central and western Pacific. Access limitations to foreign longline fishing for billfish and tunas could be established either on a voluntary basis or by mandatory regulations. As indicated in Section 7.2.1.4, the Council has explored the possibility and workability of achieving voluntary agreements under which foreign longlining interests would limit their operations in some parts of the FCZ of the Western Pacific Region, but no agreements have yet been reached. Reviewers of this FMP should note that even if voluntary agreements can be reached, the FMP will be the controlling document with respect to permits, data reporting, and determinations of optimum yield (OY), domestic annual harvest (DAH), and the total allowable level of foreign fishing (TALFF). Whatever controls are eventually established for foreign longlining, there will not be and cannot be any limitations placed on foreign baitboat fishing or purse seining for tuna in the FCZ, unless the FCMA is amended by Congress.

9.0 PREFERRED ALTERNATIVE

The Council's area of jurisdiction is the FCZ seaward of Hawaii, Guam, and American Samoa. As noted in Section 4.2, however, it is necessary to examine billfish management from a broader geographic and economic context. First, billfish stocks range throughout the Pacific Ocean. Second, the foreign longliners that catch billfish in the U.S. FCZ fish throughout the entire Pacific. Third, most foreign catches of billfish are made in association with tuna fishing, and U.S. interests in tuna fishing are important in many other parts of the world as well as in the Council's area of authority. Fourth, the U.S. FCZ of the Pacific Ocean includes large areas off U.S. island possessions that are not presently under the Council's jurisdiction. Since billfish stocks and foreign fishing vessels are found in the Council's area and in other parts of the U.S. FCZ, meaningful and effective management under the FCMA requires consideration of the full FCZ. This plan includes recommendations by the Council for amendments to the PMP so that billfish management will uniformly cover the entire area of the U.S. fisheries authority in the Western Pacific Region.

The Western Pacific Regional Fishery Management Council proposes a composite package of conservation and management measures for the U.S. FCZ of the Western Pacific Region:

1. Area closures: The Council proposes that foreign longlining be prohibited in specific subareas of the U.S. FCZ to prevent incidental foreign take of billfish, to enhance the probability for increased domestic harvests and increased domestic fishery values in Hawaii, Guam, and American Samoa associated

with billfish and to prevent gear conflicts. Domestic catches of mahimahi, wahoo, and sharks may also increase. Foreign harvests of these species will cease in the closed areas, but foreign effort is expected to relocate from closed to open zones. Specific recommendations for area closures are presented by subarea in Sections 9.1 and 9.2.

2. Permits: Foreign longline vessels would be required to obtain permits to fish in the U.S. FCZ.

3. Observers: At the discretion of the Regional Director of the NMFS, observers may be placed on foreign longline vessels that are permitted to fish in subareas of the U.S. FCZ of the Western Pacific Region. The Council is aware that the costs of placing observers on foreign longline vessels is quite high. The Council strongly recommends that the NMFS develop and institute a mutually agreeable observer and reporting program with foreign longlining interests so that observer placement will not be prohibitively expensive and will not result in an indirect ban on foreign longline effort in the FCZ.

4. Effort plans and limits: The total allowable level of foreign fishing (TALFF), where foreign longlining would be allowed, is defined in non-numeric terms rather than as an amount of fish. The Council does not propose to establish quotas on foreign effort or catch of billfish at this time. This should simplify monitoring and enforcement of the fishery. The Council proposes that foreign longline vessels be required to file effort plans prior to obtaining permits.

5. Reporting: Foreign longline vessels would be required to record and report their effort and catches made in the U.S. FCZ. Reporting requirements are described in Section 13.2.1.

6. Permit Fees: The Council recommends that the NMFS consider setting fees based on effort levels rather than tonnage of billfish caught. Fees can be set to recover some portion of the value of the fish expected to be caught on an average vessel day, or the cost of enforcement, or both.

7. Incidental Catches: No limit on incidental catch of mahimahi, wahoo, or sharks is proposed in the areas where foreign longlining would be allowed. However, incidental catches would have to be reported.

There would continue to be no limits on catch or effort for baitboats. It is recommended that NMFS work with fishery agencies of foreign nations to insure that data on catch and effort will continue to be made available for monitoring this sector of the foreign fishery in the future.

9.1 Preferred Regime: Year Round Area Restrictions

The first preference (Option 1) of the Council is to restrict foreign longlining from approximately 30 percent of the Western Pacific FCZ (Table 9.1). Specifically, this option would limit foreign longliners from fishing: in the entire FCZ east of 161° West longitude around Hawaii all year; in the FCZ within 100 miles around the NWHI west of 161° West longitude all year (Figure 9.1); in the FCZ surrounding Guam all year; and in in a small rectangular portion of the FCZ around American Samoa all year (Figure 9.2).

This set of closures for foreign longline fishing would nearly maximize the probability of transfers of billfish catch from foreign to domestic harvesters and maximize the values associated with the domestic fishery. These limits would also promote the growth and development of domestic fisheries in

TABLE 9.1

RECOMMENDED AREA CLOSURES FOR FOREIGN LONGLINING IN THE WESTERN PACIFIC REGION.

UNITED STATES EXCLUSIVE FISHERIES JURISDICTION IN WESTERN PACIFIC REGION		SIZE OF RECOMMENDED AREA CLOSURE FOR FOREIGN LONGLINING	SIZE OF RECOMMENDED AREA CLOSURE RELATIVE TO THE TOTAL AREA OF THE WESTERN PACIFIC FCC (%)
HAWAIIAN ARCHIPELAGO	648,000 sq. miles	388,000 sq. miles	25.7 %
GUAM	60,000	60,000	4.0
AMERICAN SAMOA	75,000	10,800	0.7
NORTHERN MARIANA ISLANDS	251,000	***	***
HOWLAND AND BAKER ISLANDS	83,000	---	0.0
WAKE ISLAND	125,000	---	0.0
PALMYRA ISLAND AND KINGMAN REEF	83,000	---	0.0
JARVIS ISLAND	60,000	---	0.0
JOHNSTON ATOLL	125,000	---	0.0
	TOTAL 1,511,000 sq. miles	TOTAL 458,800 sq. miles	TOTAL 30.4%

*** NO RECOMMENDATION

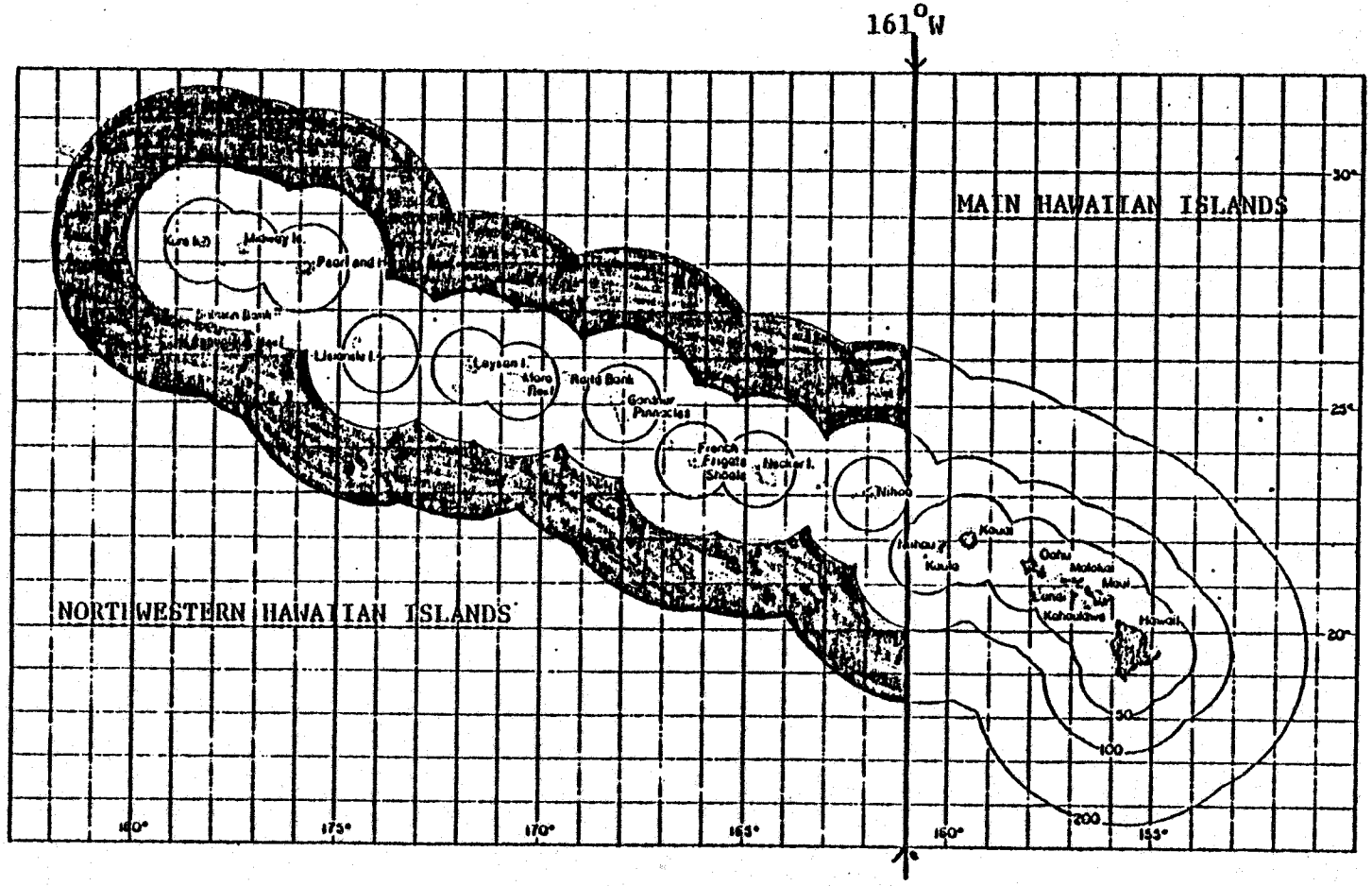


FIGURE 9.1 AREA (SHADED) OF PERMITTED FOREIGN LONGLINE FISHING YEAR ROUND IN THE US FCZ OF THE HAWAIIAN ARCHIPELAGO UNDER THE COUNCIL'S FIRST PREFERENCE.

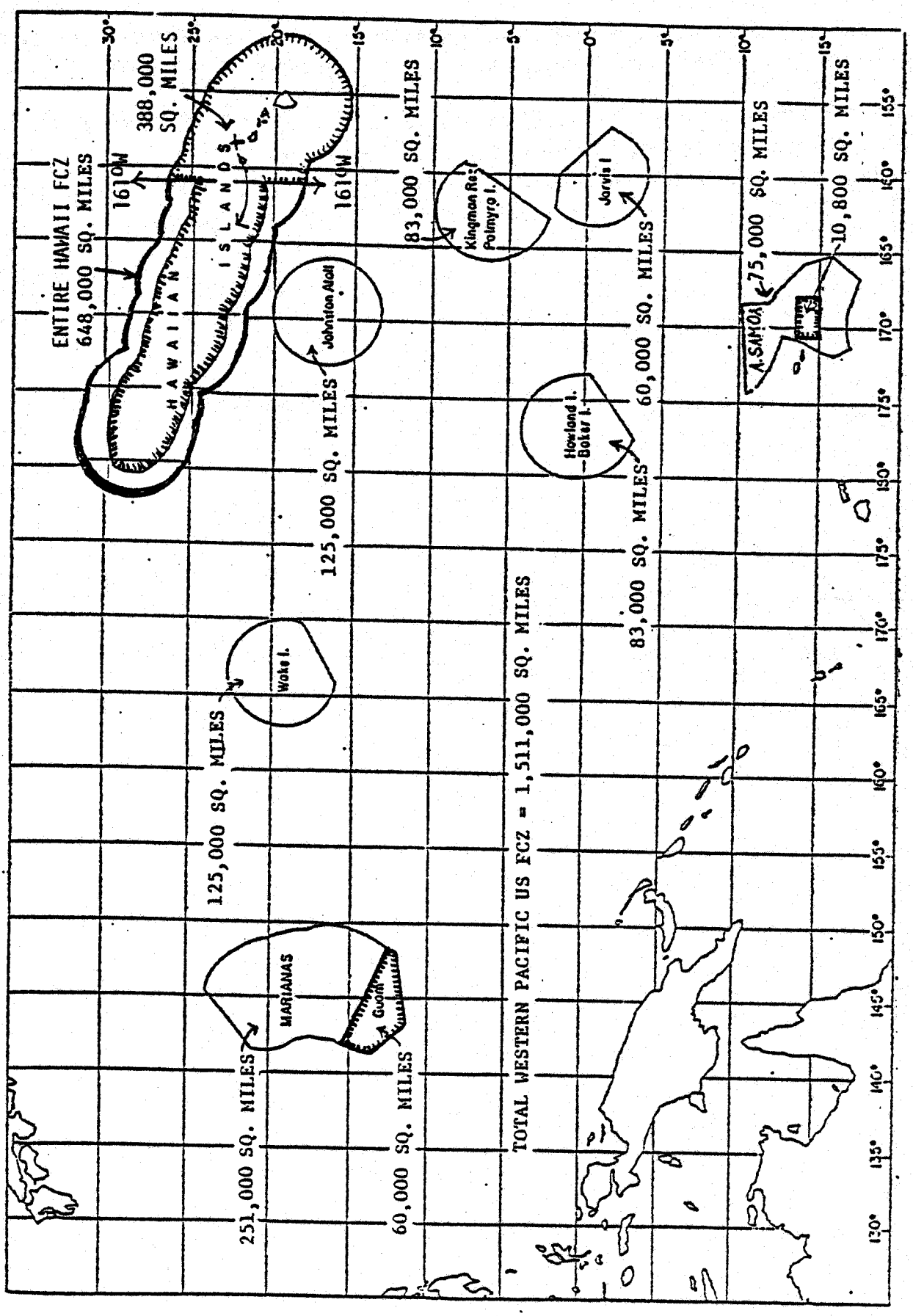


FIGURE 9.2 AREAS (STIPPLED) OF THE US FCZ OF HAWAII, GUAM, AND AMERICAN SAMOA RECOMMENDED TO BE CLOSED TO FOREIGN LONGLINE FISHING. (BOUNDARIES AND SIZES OF THE VARIOUS FISHERY CONSERVATION ZONES AS SHOWN IN THIS FIGURE ARE UNOFFICIAL AND ARE FOR ILLUSTRATIVE PURPOSES ONLY. DETAILED OFFICIAL COORDINATES FOR THE US FCZ HAVE BEEN PUBLISHED BY THE DEPARTMENT OF STATE.)

Guam, American Samoa, and Hawaii. Gear conflicts would be precluded in areas used by or potentially important to domestic fishermen. The limits would not interfere with selective tuna fishing methods and would provide reasonable opportunity for foreign longliners to catch tuna in open parts of the U.S. FCZ. Longliners would not be limited in terms of effort or catch. The opportunity for American Samoa-based longliners to fish for tuna in most of that subarea of the FCZ would also be maintained. Finally, the limits would constitute a relatively straightforward and simple enforcement regime, compared to the PMP.

While the primary justification for Option 1 lies in the enhancement of benefits to domestic fisheries from increased catches of billfish and tuna, there could also be some conservation benefits to billfish as well. By far, most of the billfish fishing mortality during the past several decades was brought about by foreign longline fishing (Table 9.2). Reducing the billfish mortality a bit through the recommended area closures should be immediately beneficial to billfish stocks. Further, the waste associated with non-retention would be eliminated.

There would be reasonable opportunity for foreign tuna fishing in the U.S. FCZ of the Western Pacific Region. Option 1 would alter the area of origin of the historical (1973-1977) average foreign catches of tuna made in the U.S. FCZ of the Western Pacific Region by 13.2 percent. The impacts in relation to total international tuna catches and effort are much smaller. Option 1 would alter the historical patterns of foreign longlining in the Pacific Ocean by less than 1 percent.

Each of the Council's preferences for area/season closures would add a 100-mile wide buffer zone around the NWHI Federal and State wildlife refuges.

TABLE 9.2

ANNUAL LANDINGS OF BILLFISH BY MAJOR HARVESTING NATIONS IN THE PACIFIC (THOUSANDS OF METRIC TONS)

Species/Country	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Swordfish										
Japan	16.1	18.4	15.8	16.2	16.8	16.1	10.4	10.4	11.1	10.2
United States	0.2	0.2	0.1	0.1	0.5	0.4	0.1	0.1	0.3	0.3
Chile	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.4	0.2
Peru	0.3	0.2	1.3	0.8	1.2	2.4	0.2	0.6	1.9	0.3
Others	0.3	0.8	0.8	0.9	1.1	1.3	1.2	1.3	1.4	1.1
Total	17.1	19.8	18.2	18.2	19.9	20.4	12.1	12.5	15.1	12.1
Sailfish										
Japan	10.6	6.8	7.1	8.0	8.8	6.3	6.1	7.2	6.5	5.9
Mexico	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	—
Others	2.2	3.1	3.3	4.0	4.0	2.8	2.0	1.4	2.2	1.5
Total	12.8	9.9	10.4	12.1	12.5	9.1	8.1	8.6	8.7	7.4
Black Marlin										
Others (mostly Japan)	0.6	1.0	1.0	1.2	0.9	1.1	1.4	2.1	2.1	1.5
Total	0.6	1.0	1.0	1.2	0.9	1.1	1.4	2.1	2.1	1.5
Blue Marlin										
Japan	16.1	16.2	13.1	11.6	12.1	13.8	8.6	10.5	11.0	9.5
Malaysia	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.3
United States	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Others	0.0	0.0	0.0	0.0	0.0	4.8	5.4	1.9	2.2	1.8
Total	16.4	16.5	13.5	11.8	12.3	18.8	14.2	12.6	13.5	11.7
Striped Marlin										
Japan	21.9	19.4	18.9	20.9	19.6	21.1	21.5	13.3	14.2	12.8
Others	4.1	5.1	3.5	4.6	5.0	4.7	4.8	0.9	1.0	0.7
Total	26.0	24.5	22.4	25.5	24.6	25.8	26.3	14.2	15.2	13.5
All Billfishes										
Japan	65.3	61.8	55.9	57.9	58.2	58.4	48.0	43.5	44.9	30.9
Others	7.6	9.9	9.6	10.9	12.3	16.0	14.1	6.5	9.7	6.3
Total	72.9	71.7	65.5	68.8	70.2	75.2	62.1	50.0	54.6	46.2
% Japan	89.6	86.2	85.3	84.2	82.9	77.7	77.3	87.0	82.2	86.4

SOURCE: DATA FROM FAO YEARBOOK OF FISHERY STATISTICS, 1974 and 1975.

9.1.1 Rationale

9.1.1.1 Hawaii

The overriding rationale for restricting foreign longline fishing in the FCZ around the main Hawaiian Islands is the high value of blue marlin found in these waters to Hawaii's principal billfish fishery sectors. Blue marlin are the mainstay of the domestic billfish fisheries. Blue marlin are believed to generally migrate along a north-south axis. They are relatively more abundant around the main islands and should be reserved for domestic fishing. Allowing foreign longlining results in mortality of blue marlin, whether by retention of incidentally caught fish or by death of released fish in the non-retention zones. The PMP non-retention provisions would not only lead to waste of fish but result in productivity losses to foreign vessels as well. Productive fishing time would be lost in releasing dead and injured fish, and expensive fishing tackle would be lost by the requirement to release the fish by cutting the leader. Foreign longlining that had normally occurred off the main Hawaiian islands could apparently relocate to NWHI waters with miniscule effects on their tuna catches. The foreign longliners' NWHI fishery could continue as it always has beyond 100 miles from shore (Figure 9.1).

Foreign longliners' annual effort and catch around the NWHI are usually 2-3 times as large as longliners' annual catch and effort around the main islands (Table 9.3 and Figure 9.3, 9.4, 9.5). The significance of the NWHI takes on an added dimension when the market

TABLE 9.3

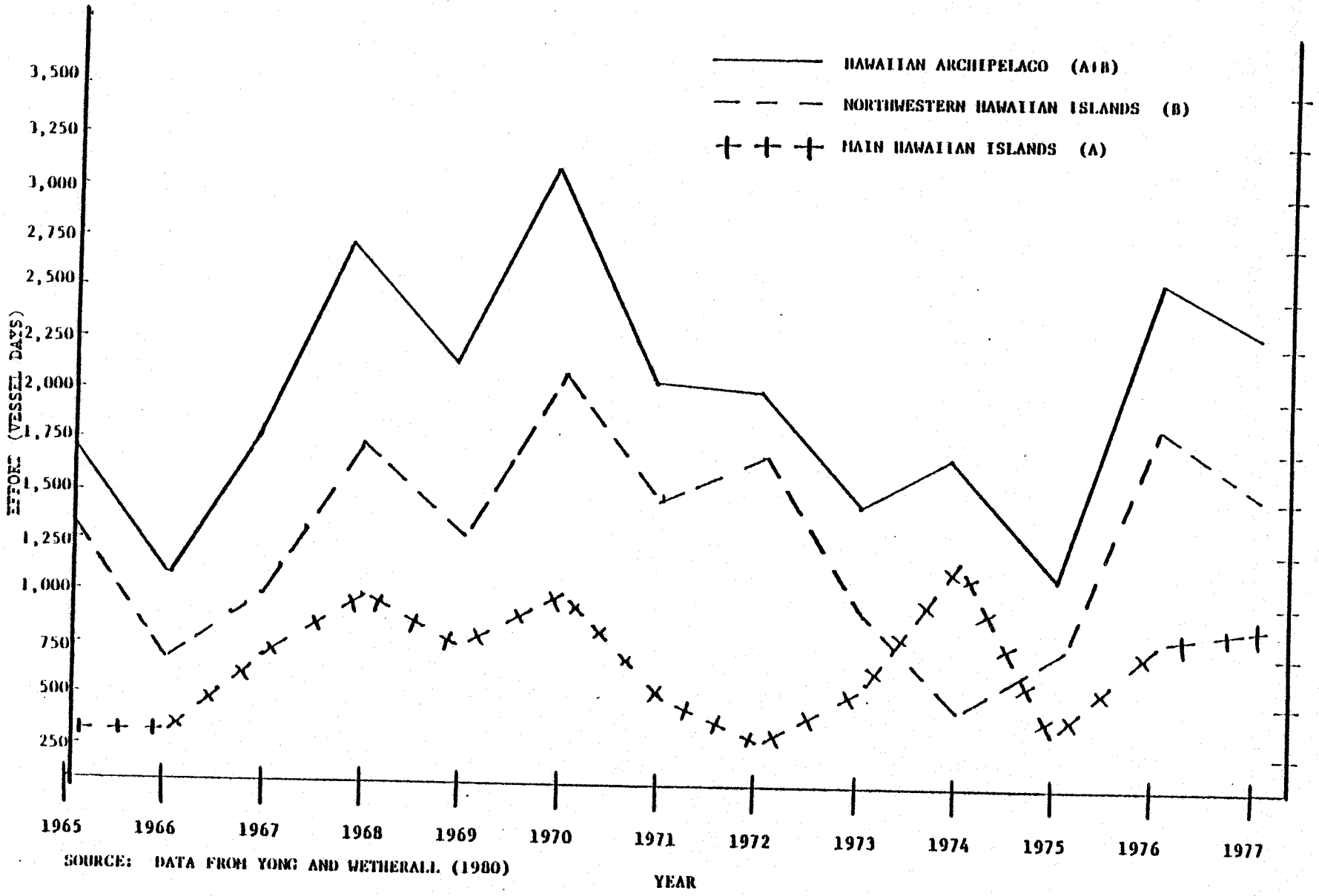
PERCENT (%) DISTRIBUTION OF FISHING EFFORT (VESSEL DAYS) BY FOREIGN LONGLINERS IN THE US FCZ OF THE MAIN HAWAIIAN ISLANDS AND THE NORTHWESTERN HAWAIIAN ISLANDS, 1971-77.

FCZ	1971	1972	1973	1974	1975	1976	1977
Main Hawaiian Islands	(26%) 550	(18%) 362	(38%) 592	(75%)1289	(29%) 342	(31%) 823	(36%) 852
Northwestern Hawaiian Islands	(74%)1553	(82%)1697	(62%) 963	(25%) 433	(71%) 828	(69%)1856	(64%)1508
HAWAII ARCHIPELAGO (TOTAL)	(100%)2103	(100%)2059	(100%)1555	(100%)1722	(100%)1170	(100%)2679	(100%)2360

SOURCE: Data from Yong and Wetherall (1980)

FIGURE 9.3

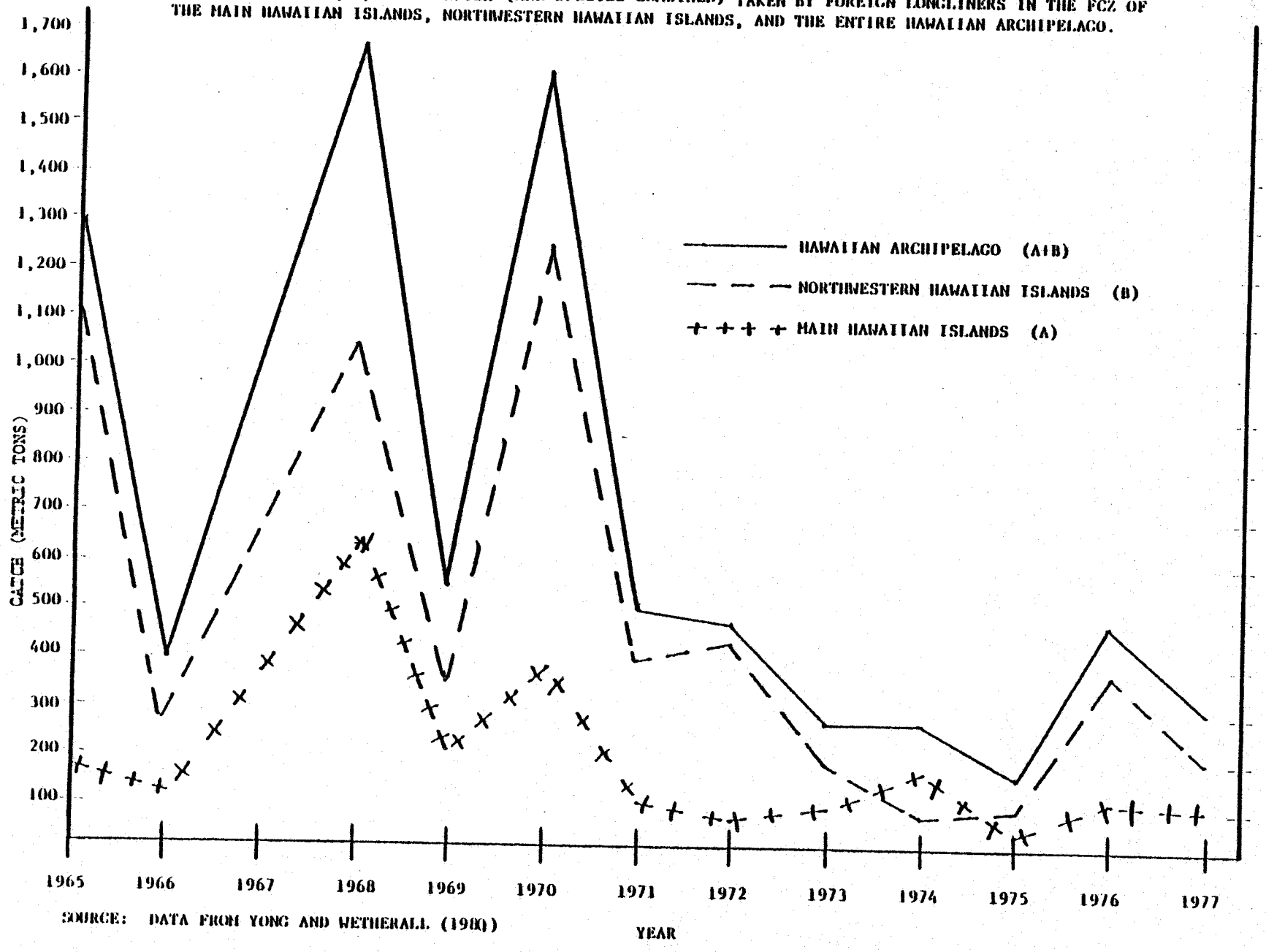
ESTIMATED EFFORT (VESSEL DAYS) EXPENDED BY FOREIGN LONGLINERS IN THE FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND THE ENTIRE HAWAIIAN ARCHIPELAGO.



SOURCE: DATA FROM YONG AND WETHERALL (1980)

FIGURE 9.4

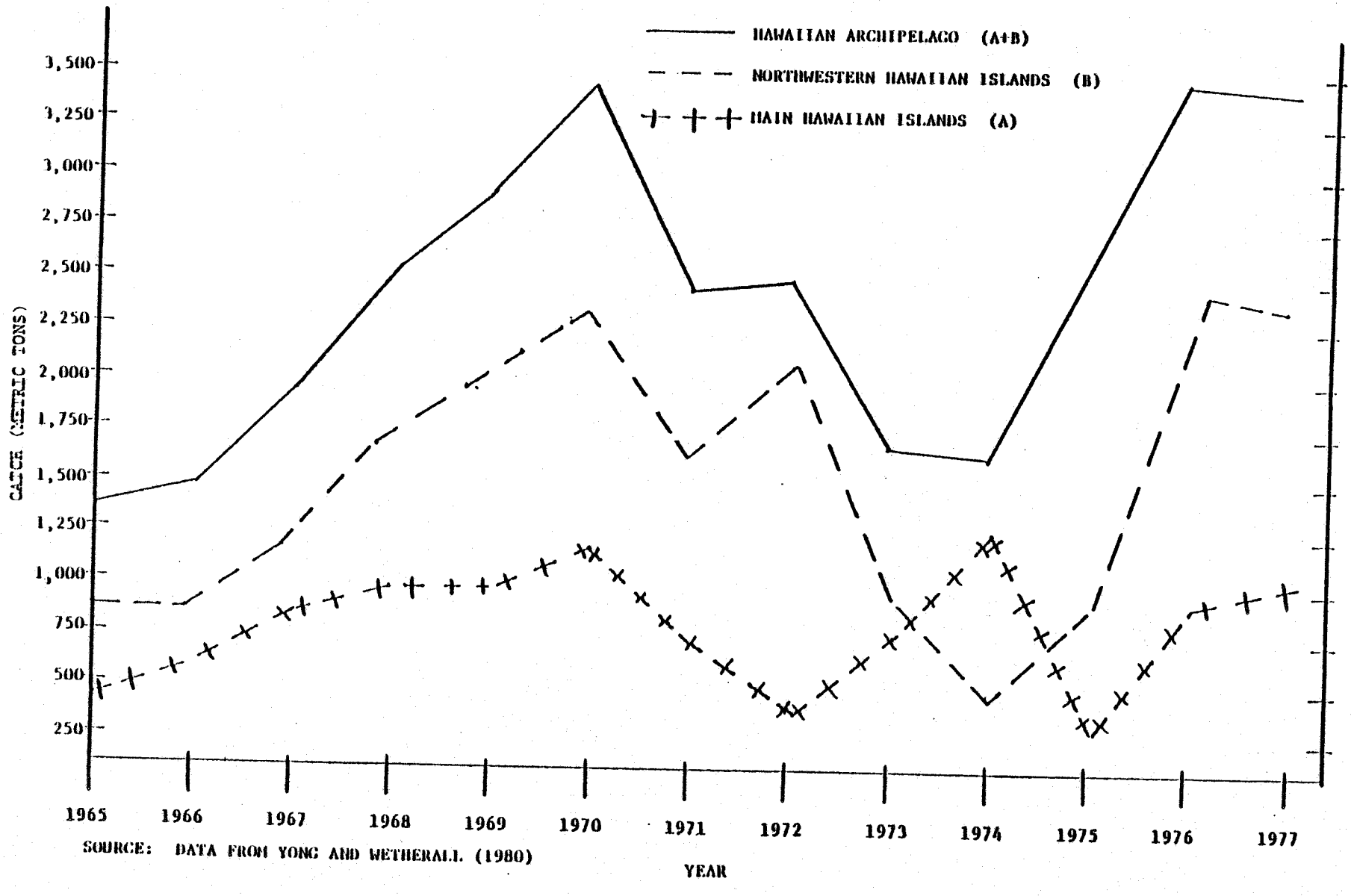
ESTIMATED CATCH (MT) OF BILLFISH (ALL SPECIES COMBINED) TAKEN BY FOREIGN LONGLINERS IN THE FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND THE ENTIRE HAWAIIAN ARCHIPELAGO.



SOURCE: DATA FROM YONG AND WETHERALL (1980)

FIGURE 9.5

ESTIMATED CATCH (MT) OF TUNAS (ALL SPECIES COMBINED) TAKEN BY FOREIGN LONGLINERS IN THE FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND THE ENTIRE HAWAIIAN ARCHIPELAGO.



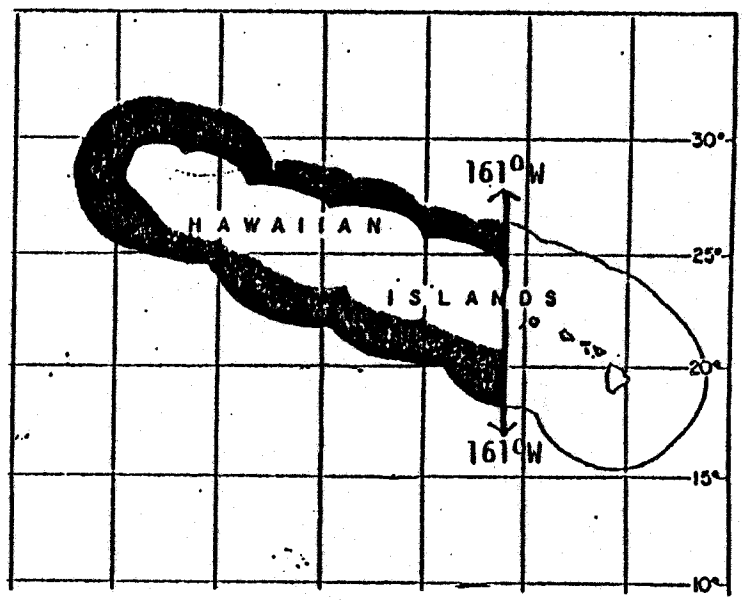
SOURCE: DATA FROM YONG AND WETHERALL (1980)

value of individual species is considered. Bigeye tuna, swordfish and striped marlin bring in relatively higher prices per pound than blue marlin in Japanese markets, while albacore and yellowfin prices are roughly comparable (Table 5.22). Because catches of the premium market species are higher in the NWHI, there seems to be a greater return from foreign fishing in that area. The NWHI are relatively nearer to Asian ports, and there could be a fuel-saving cost advantage associated with NWHI fishing. Absolute tonnage of tuna catches as well as tuna CPUE rates (all species combined) also are higher around the NWHI than the main islands.

The monthly distributions of albacore and bigeye tuna and striped marlin catches indicate that the foreign longline fishery in the NWHI has been principally conducted during the winter months. Almost all of the bigeye tuna taken in the waters of the NWHI are caught during September through March (Figure 9.6). No differences in relative densities are apparent for bigeye tuna and striped marlin as the distance from shore is increased (Table 9.5), although data are not fully conclusive.

The reason for limiting foreign longlining in the FCZ within 100 miles of the NWHI lies in the likely immediate and long-term benefits from increased domestic catches and improved catch rates of billfish and tunas. First, striped marlin are caught in large amounts by foreign longliners in the NWHI. Striped marlin are believed to migrate along a northwest-southeast axis. Limiting access to foreign

FIGURE 9.6 DISTRIBUTION OF AVERAGE (1973-77) MONTHLY CATCHES (mt & %) OF BIGEYE TUNA MADE BY JAPANESE LONGLINERS WITHIN 100 TO 200 MILES OFFSHORE (INSET) OF THE NORTHWESTERN HAWAIIAN ISLANDS



Metric Tons (mt)

89.4 mt (23.5%)
38.1 mt (10.0%)
12.8 mt (3.3%)
0.9 mt (0.2%)
3.6 mt (0.9%)
4.6 mt (1.2%)
2.5 mt (0.6%)
0.3 mt (0.0%)
13.4 mt (3.5%)
24.5 mt (6.4%)
38.5 mt (10.1%)

J F M A M J J A S O N D

MONTH

Metric Tons (mt)

longliners within 100 miles of the NWHI should increase domestic catch rates by precluding some interceptions of striped marlin by foreign vessels prior to arrival of striped marlin in local waters. Second, large numbers of swordfish are taken by foreign longliners in the NWHI. In time it can be anticipated that more domestic fishermen will learn how to catch this species as well. Third, there could be some gains in mahimahi and wahoo catches. Fourth, as the domestic NWHI fisheries expand, the striped marlin and swordfish catches may be crucial for their economic viability.

The largest gain to domestic fishermen in ex-vessel catch value is the prospective increases in tuna catch rates and levels of catches. It is evident that tuna resources in and around the Hawaiian archipelago are quite large. The average annual foreign longline tuna catch (1973-1977) was 2,265 metric tons, valued at more than $7.5 million in 1980 prices (Table 8.2). The migratory patterns of these tuna are not known, but it seems logical to conclude that a portion of the various tuna species not taken on foreign longline gear will be taken by domestic vessels, both in the NWHI and around the main Hawaiian islands.

Domestic fishermen have a strong interest in catching tuna. In 1976, tuna sales were about ten times larger than billfish sales in dollar value. If there were a 10% increase in domestic tuna catches, at 1980 prices, this could amount to roughly a one million dollar market gain to domestic fishermen. The increase in domestic catches would be greater and would accrue at a faster rate if the Hawaii Fishery Development Plan is successful in generating a rapid increase

in the NWHI fishery capacity, and if the availability and vulnerability of tuna stocks to U.S. fishermen increase as a result of the recommended limits on foreign longlining.

9.1.1.2 Guam

In Guam, a full closure of the FCZ is socially and economically justified by the clear need to improve the prospects of fishery development and self-sufficiency for the Territory. Coastal (tourism) and oceanic resources offer the only major potential for economic development. The FCZ around Guam is quite small in comparison to the FCZ around American Samoa, the Commonwealth of the Northern Marianas (CNMI), and especially Hawaii (Figure 9.2). Guam aspires to establish a competitive blue marlin sport fishery. This aspiration is more likely to be realized if the foreign take of blue marlin (87 MT in 1977) in the FCZ around Guam is curtailed. The domestic catch rate for blue marlin would likely be improved by removal of foreign longline catches.

Guam also would benefit by replacing some imports of fishery products with domestically-caught fishery products. Domestic fishermen are more likely to invest in boats and gear if there is a prospect of higher catch rates. Conversely, they are likely to be discouraged from investing so long as there's no prospect of controlling the apparent significant increases in foreign longlining effort around Guam in the 1971-1977 period (Table 5.12). Tuna catch rates for foreign longliners around Guam are nearly as high as the CPUE rates around the Hawaiian Islands (Table 9.4). It also appears that the FCZ around Guam has

TABLE 9.4

COMPARISON OF AVERAGE ANNUAL (1973-77) CATCH RATES (CPUE) FOR BILLFISH AND TUNA SPECIES TAKEN BY FOREIGN LONGLINERS IN THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AMERICAN SAMOA AND GUAM.

SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)	AMERICAN SAMOA (3)	GUAM (4)
BLUE MARLIN	.46	.24	.33	1.02	1.08
STRIPED MARLIN	1.64	2.63	2.24	.78	0.14
SWORDFISH	.35	.94	.70	.11	0.12
BLACK MARLIN	.02	.01	.02	.27	0.06
SPEARFISH & SAILFISH	1.16	.38	.70	.60	0.24
(A) ALL BILLFISH	3.62	4.20	3.98	2.78	1.64
ALBACORE TUNA	5.46	16.20	11.79	16.14	4.39
YELLOWFIN TUNA	5.45	3.92	4.55	2.74	17.73
BIGEYE TUNA	16.12	15.20	15.58	1.49	8.33
BLUEFIN TUNA	0.00	0.01	*	*	*
SKIPJACK TUNA	0.31	0.18	0.23	*	*
(B) ALL TUNA	27.34	35.50	32.15	20.37	30.46
TOTAL EFFORT (VESSEL DAYS)	780	1.118	1.898	904	508

* THE NUMBER OF FISH FOR CORRESPONDING CATCHES WERE DERIVED BY DIVIDING THE ESTIMATED WEIGHT OF THE TOTAL CATCH BY THE VALUES OF THE AVERAGE WEIGHT FOR EACH SPECIES CAUGHT BY DOMESTIC LONGLINERS. THE AVERAGE WEIGHT STATISTICS WERE PROVIDED BY THE UNITED FISHING AGENCY LTD. OF HONOLULU AND THE HAWAII DIVISION OF FISH AND GAME.

SOURCE: DATA ARE FROM YONG AND WETHERALL (1980).

sizeable amounts of wahoo and mahimahi which would become subject more to domestic rather than foreign harvest. A full closure of the FCZ around Guam will preclude future gear conflicts as the domestic fishery expands.

9.1.1.3 American Samoa

The rationale for the American Samoa area closure is clear and simple: it strikes a balance between the needs of domestic fishermen for protection of primary fishing grounds, and the need to minimize interference with fishing by foreign longline vessels based in American Samoa. The areas recommended for closure (between 14°S and 15°S latitude and 168°W and 171°W longitude and within 12 nautical miles of any island of American Samoa) are a very small portion (about 14%) of the American Samoa FCZ. The recommended limit would have a small impact on foreign tuna fishing in the FCZ. This is in keeping with the Council's policy expressed in its October 16, 1979 Resolution concerning its recognition of Samoa's unique needs to simplify the operation of contract longline vessels based in American Samoa (Appendix O).

This rectangle (Figures 8.4 and 9.2) encompasses nearshore waters and offshore banks commonly used by domestic vessels. Limiting fishing access for foreign longliners is necessary for inshore waters around the islands of American Samoa, including Rose Atoll, and in the waters around certain banks in the FCZ to encourage the use of these waters by domestic fishermen free from possible conflict with foreign vessels.

Foreign longliners would be permitted to fish relatively freely in the open areas. Domestic vessels rarely fish in waters which would remain open to foreign longliners. The FMP does not propose foreign fishing quotas or effort restrictions for open areas around American Samoa, so burdens on the foreign vessels would be minimal. The FMP would encourage foreign longliners to remain in American Samoa. Their deliveries of frozen tuna are critical to American canneries and to the economy of the Territory.

Every foreign longline vessel wishing to fish within the FCZ of American Samoa would be required to obtain a permit and maintain and submit such reports of its activities as required by this FMP. Observers may be placed on foreign longline vessels at the discretion of the Regional Director of the NMFS.

9.1.1.4 U.S. Possessions

The lifting of PMP quotas and non-retention requirements for the FCZ around U.S. Possessions is recommended by the Council to facilitate and encourage relocation of foreign longlining effort to these areas and to do away with unenforceable regulations. Freedom of foreign access to tuna, billfish, and associated species in these waters, with possibly increased catches of these species compared to historic levels, would not be detrimental to U.S. fishing interests and would serve to offset the limits proposed for Hawaii, Guam, and American Samoa.

9.1.1.5 Commonwealth of the Northern Mariana Islands (CNMI)

The Council makes no recommendations at this time concerning foreign longlining in the FCZ around the CNMI. The CNMI and NMFS should reach an agreement that will address this topic to achieve consistency to the extent possible and necessary for management in the Northern Mariana Islands FCZ and the adjacent FCZ around Guam.

9.2 Seasonal Limit Alternatives

9.2.1 Option 2

The second preference of the Council is to limit fishing access to foreign longliners in the entire FCZ around Hawaii from May through December; the FCZ out to 100 miles from shore around all the Hawaiian islands from January through April; and the area closures proposed for the Guam and American Samoa subareas in Option 1. Compared to the first option, this would open some more FCZ waters around Hawaii to foreign longliners but would restrict their fishing activities to the winter months (Figure 9.7). Protection to blue marlin would be provided to a lesser degree than in Option 1. The increase in the value of domestic fisheries would also be less than in Option 1. Foreign fishing could increase around the main islands in the winter

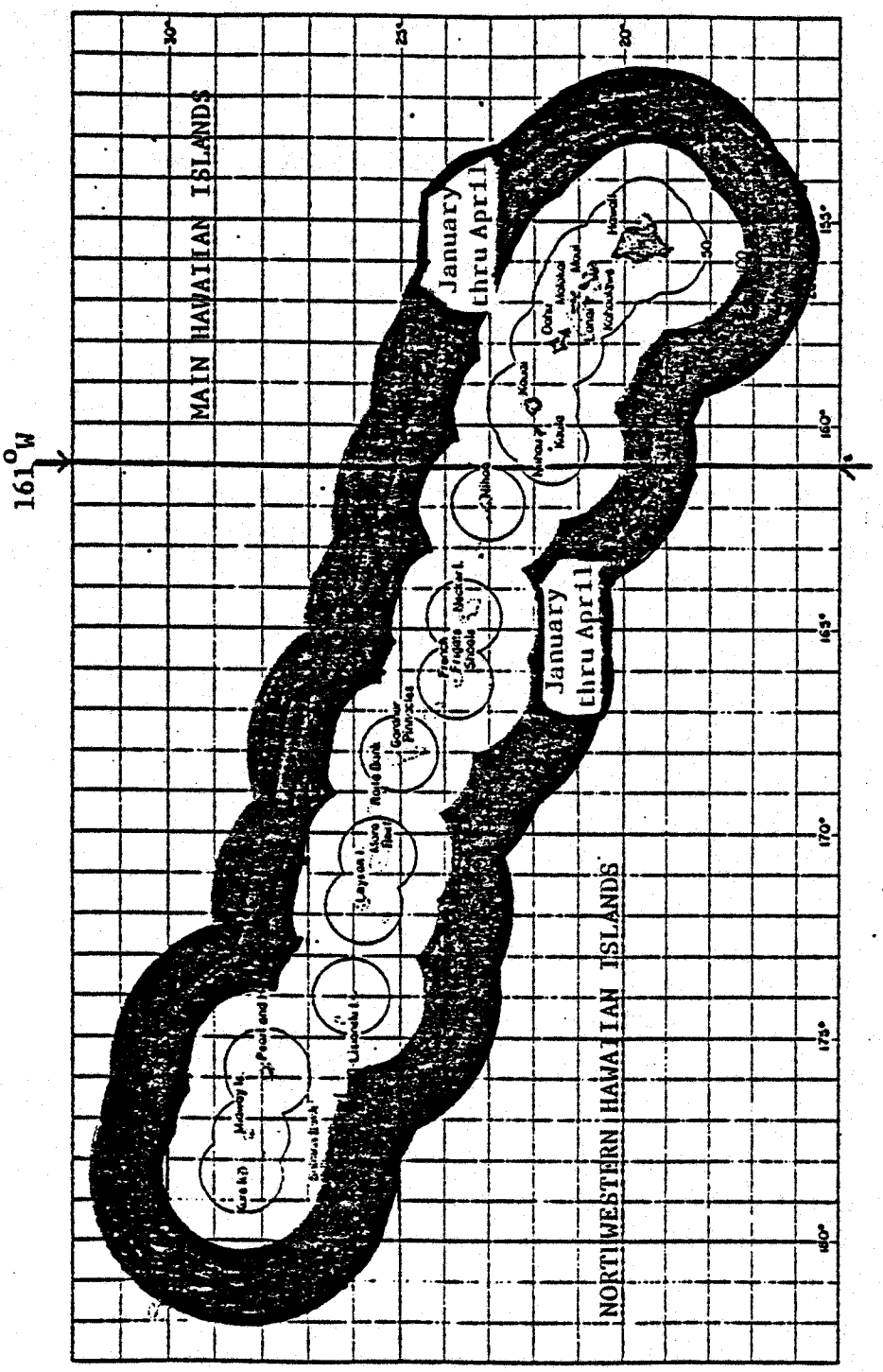


FIGURE 9.7 SEASON AND AREA (SHADED) OF PERMITTED FOREIGN LONGLINE FISHING UNDER THE COUNCIL'S SECOND PREFERENCE.

with larger blue marlin catches than would occur with the access limits around the main islands under the first option.

The winter fishery, mainly around the NWHI, has been more the more productive sector of the foreign longline fishery and could continue and possibly expand under this option. This foreign fishery catches relatively smaller amounts of blue marlin, but substantial numbers of striped marlin and swordfish and large numbers of tuna. Foreign longlining would be allowed in the larger part of the Hawaiian Islands FCZ during the most productive period of the fishery (Appendix L). Domestic fishermen could expect slightly higher catch rates for blue marlin. There would likely be some increase in domestic catches of other species as well. For example, black marlin and yellowfin tuna appear to be prone to capture closer to shore, so some transfer to domestic fishermen could be expected (Table 9.5). No differences in relative densities are apparent for striped marlin and bigeye tuna as the distance from shore is increased. These two species appear to be about equally abundant throughout the FCZ surrounding the main Hawaiian Islands. There appears to be, however, a far greater abundance of striped marlin in the NWHI than in the main Hawaiian Islands (Table 9.6). The opposite is true with respect to blue marlin as measured by the catch rates and catch levels of foreign longliners (Table 9.5 and 9.6).

Under this option, gear conflicts between domestic and

TABLE 9.5

AVERAGE (1973-77) FOREIGN LONGLINE CATCH RATES (CPUE) PER VESSEL PER DAY EXPRESSED IN METRIC TONS (MT) AND IN NUMBER (#) OF BILLFISH AND TUNAS IN THE 50, 100 AND 200 MILE SUBZONES OF THE US FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND THE HAWAIIAN ARCHIPELAGO AS A WHOLE.

SPECIES	MAIN HAWAIIAN ISLANDS						NORTHWESTERN HAWAIIAN ISLANDS						ENTIRE HAWAIIAN ISLANDS FCZ					
	50		100		200		50		100		200		50		100		200	
	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)
BLUE MARLIN	.033	.42	.036	.46	.036	.46	.013	.17	.015	.19	.019	.24	.019	.24	.021	.27	.026	.33
STRIPED MARLIN	.055	1.85	.050	1.77	.046	1.64	.070	2.48	.080	2.84	.074	2.63	.066	2.33	.071	2.52	.063	2.24
SWORDFISH	.033	.40	.032	.38	.029	.35	.061	.73	.065	.77	.079	.94	.053	.63	.055	.66	.058	.70
BLACK MARLIN	.011	.16	.005	.07	.001	.02	.004	.07	.002	.03	.001	.01	.006	.09	.003	.04	.001	.02
SPEARFISH & SAILFISH	.011	.66	.014	.82	.019	1.16	.004	.26	.006	.34	.006	.38	.006	.38	.008	.49	.012	.70
ALL BILLFISH	.143	3.58	.137	3.50	.131	3.62	.152	3.70	.168	4.18	.179	4.20	.150	3.67	.158	3.98	.160	3.98
ALBACORE	.112	4.63	.125	5.15	.132	5.46	.289	11.95	.306	12.62	.391	16.20	.239	9.87	.252	10.42	.285	11.79
YELLOWFIN	.356	7.35	.317	6.55	.264	5.45	.202	4.17	.199	4.12	.190	3.92	.246	5.08	.234	4.84	.220	4.55
BIGEYE	.697	15.69	.677	15.25	.716	16.12	.704	15.86	.713	16.05	.675	15.20	.702	15.81	.702	16.09	.691	15.58
BLUEFIN	.000	0.00	.000	0.00	.000	0.00	.001	*	.001	*	.001	0.01	.001	*	.001	*	.001	*
SKIPJACK	*	*	*	*	.001	0.31	*	*	.000	0.08	.001	0.18	*	*	*	*	.001	0.23
ALL TUNA	1.164	27.67	1.119	26.95	1.113	27.34	1.196	31.98	1.217	32.87	1.259	35.50	1.186	30.75	1.201	31.35	1.199	32.15
TOTAL EFFORT (VESSEL DAYS)	91		220		780		229		525		1,118		320		745		1,898	

* None or data not available.

SOURCE: Data from Yong and Wetherall (1980).

TABLE 9.6

AVERAGE (1973-77) FOREIGN LONGLINE CATCH IN METRIC TONS (MT) AND IN NUMBER (#) OF BILLFISH AND TUNAS MADE WITHIN 50, 100 AND 200 MILES OF THE US FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND IN THE HAWAIIAN ISLANDS FCZ AS A WHOLE.

SPECIES	MAIN HAWAIIAN ISLANDS						NORTHWESTERN HAWAIIAN ISLANDS						ENTIRE HAWAIIAN ISLANDS					
	50		100		200		50		100		200		50		100		200	
	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)	(MT)	(#)
BLUE MARLIN	3	38	8	102	28	358	3	38	8	102	21	269	6	76	16	204	49	627
STRIPED MARLIN	5	177	11	390	36	1,277	16	567	42	1,489	83	2,943	21	744	53	1,879	120	4,255
SWORDFISH	3	36	7	83	23	274	14	167	34	405	88	1,048	17	203	41	488	111	1,321
BLACK MARLIN	<1	15	<1	15	1	15	<1	15	<1	15	1	15	2	30	2	30	2	31
SPEARFISH & SAILFISH	1	60	3	181	15	903	1	60	3	181	7	422	2	120	6	312	22	1,325
ALL BILLFISH	13	326	30	771	103	2,827	35	847	88	2,192	200	4,697	48	1,173	118	2,963	304	7,559
ALBACORE	10	421	27	1,132	103	4,264	66	2,736	160	6,628	438	18,107	76	3,157	188	7,760	541	22,372
YELLOWFIN	32	669	70	1,442	206	4,252	46	955	105	2,161	212	4,380	79	1,624	174	3,603	418	8,636
BIGEYE	63	1,428	149	3,356	558	12,572	161	3,631	374	8,428	754	16,991	225	5,059	523	11,986	1,313	29,563
BLUEFIN	*	0	0	0	0	0	<1	1	<1	2	2	8	<1	1	<1	2	2	8
SKIPJACK	*	*	*	*	1	240	*	*	<1	40	1	200	<1	*	<1	*	2	440
ALL TUNA	106	2,518	246	5,930	868	21,328	274	7,323	640	17,259	1,407	39,686	380	9,841	895	23,351	2,276	61,019
TOTAL EFFORT (VESSEL DAYS)	91		220		780		229		525		1,118		320		745		1,898	

* None or data not available

SOURCE: Data from Yong and Wetherall (1980). Catches of <1 MT not included in the totals.

foreign fishermen would be precluded in the FCZ most of the year and in most fishing areas presently used by domestic fishermen. There would be less need for foreign longliners to relocate their effort; the summer main island longline fishery would be most affected. Guam and American Samoa fishery interests would gain in the same manner as under the first option. Fishery development would likely occur in Hawaii, but the pace might be slower if domestic catch rates are not high initially or if catch rates are somewhat lower than with the full, year-round closure to foreign longlining.

9.2.2 Option 3

The Council's third area/season closure preference is a slight variation of Option 2. Option 3 would allow foreign longline operations beyond 100 miles from shore of the Hawaiian Islands during November through February (Figure 9.8), the peak period of the foreign longline fishery (Appendix L). The Hawaii FCZ would be closed the rest of the year. Area restrictions for Guam and American Samoa would be the same as in Options 1 or 2.

The availability of blue marlin to domestic fishermen would be enhanced to about the same extent as in Option 2 since the species' relative abundance peaks during the summer months in Hawaii. Domestic blue marlin gains under Option 3 would likely be less than under the Council's first closure option since foreign longlining would be allowed beyond 100 miles from the main Hawaiian Islands during winter months. Correspondingly, the gains in the domestic fisheries' overall economic value would be less than in Option 1.

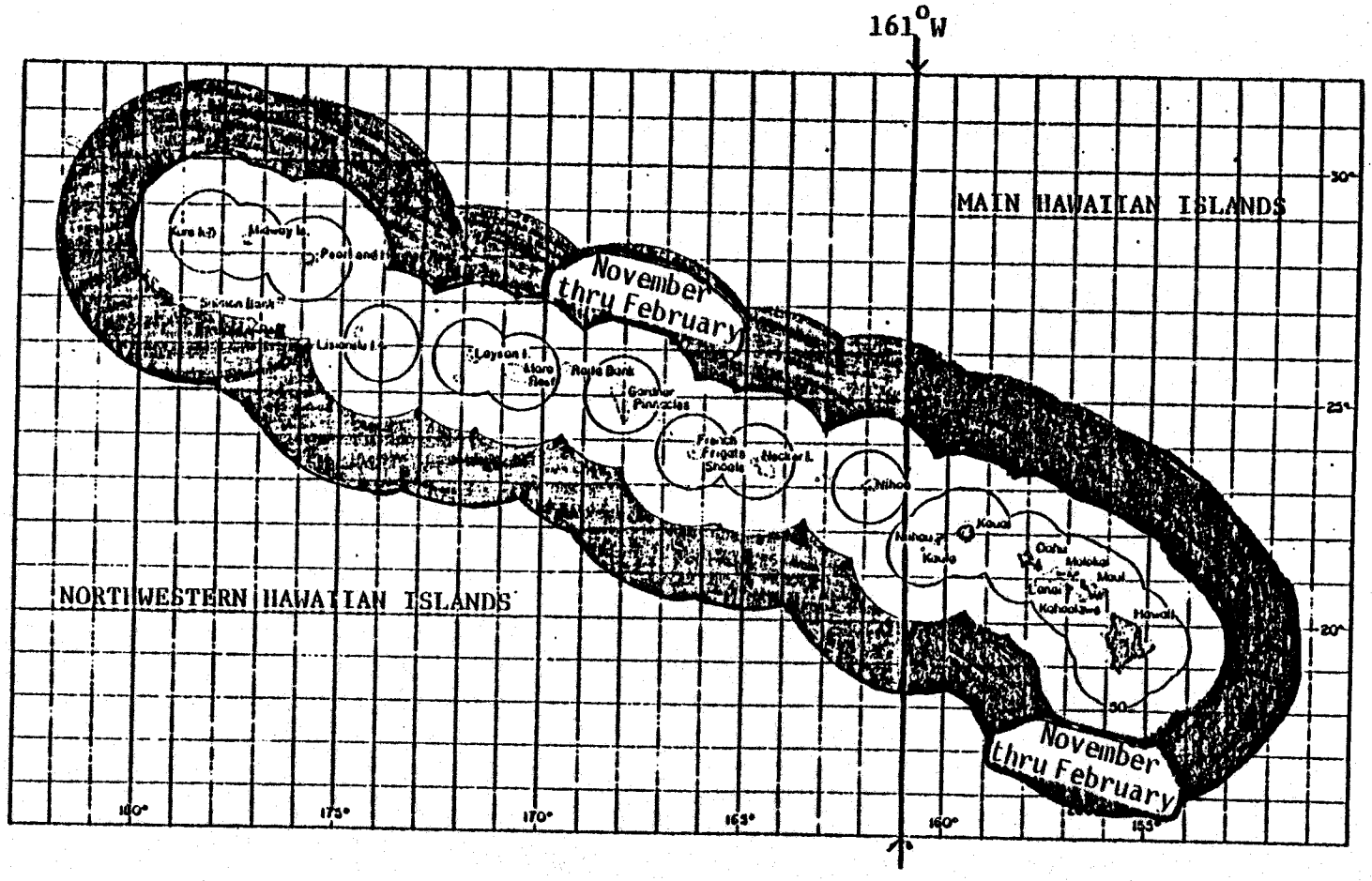


FIGURE 9.8 SEASON AND AREA (SHADED) OF PERMITTED FOREIGN LONGLINE FISHING UNDER THE COUNCIL'S THIRD PREFERENCE.

Increases in the domestic catch of striped marlin would likely be about the same as under the first option since some foreign longlining would be allowed during the winter months when the abundance of striped marlin apparently peaks in the FCZ of the Hawaiian Archipelago. Limiting access to the FCZ surrounding the NWHI out to 100 miles could still increase the local availability of striped marlin to domestic fishermen since striped marlin are assumed to migrate along the Hawaii chain of islands in a northwest to a southeast direction.

9.3 Qualitative and Quantitative Analysis of Closure Options

Several tables have been prepared to illustrate variations in catch and catch per unit effort (CPUE) rates in different parts of the FCZ considered for access limitations for foreign longline vessels. Table 9.7 shows comparative levels of foreign longlining catch (metric tons and equivalent total number of fish) and effort (vessel days) in the FCZs of each of the island groups of the Western Pacific Region. It is readily apparent that the species composition of the catch changes significantly by area of capture. Large catches of blue marlin occur off the main Hawaiian Islands, American Samoa and Guam. In contrast striped marlin and swordfish are the principal billfish species caught off the NWHI.

Table 9.8 presents comparative catch per unit effort figures in metric tons and numbers of fish, by species, of billfish and tuna, split between the main Hawaiian Islands and the NWHI. These catch rates indicate that the NWHI are relatively richer in billfish (all species combined) than the main Islands. The catch rates for striped marlin, swordfish, and albacore tuna are 60%, 169%, and

TABLE 9.7

CATCH OF BILLFISH AND TUNA SPECIES TAKEN BY FOREIGN LONGLINERS IN THE US FCZ OF HAWAII, AMERICAN SAMOA, GUAM, THE NORTHERN MARIANA ISLANDS, PACIFIC US ISLAND POSSESSIONS, AND THE PACIFIC OCEAN (1973-77 AVERAGE).

METRIC TONS

SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)	AMERICAN SAMOA (3)	GUAM (4)	NORTHERN MARIANAS (5)	WAKE (6)	JOHNSTON (7)	PALMYRA KINGMAN (8)	JARVIS (9)	HOWLAND BAKER (10)	WESTERN PACIFIC US FCZ (1)+(2)+(3)+...+(10)	PACIFIC OCEAN 0
BLUE MARLIN	20	35	49	22	43	27	16	36	34	4	25	306	84,600
STRIPED MARLIN	16	83	119	20	2	21	7	11	16	*	1	197	84,500
SWORDFISH	23	66	111	0	5	24	7	0	17	2	5	186	14,000
BLACK MARLIN	1	1	2	16	2	1	*	*	2	*	1	24	3,100
SPEARFISH & SAILFISH	11	7	22	9	2	1	23	4	4	1	2	68	9,500
(A) ALL BILLFISH	103	200	303	135	54	71	53	59	73	7	34	779	56,500
ALBACORE TUNA	103	438	541	353	54	82	161	25	*	2	5	1,223	67,000
YELLOWFIN TUNA	206	282	488	120	436	230	32	64	93	31	236	1,906	83,700
BIGEYE TUNA	550	754	1,312	60	888	116	44	309	227	40	177	3,473	112,600
BLUEFIN TUNA	0	2	2	*	*	*	*	*	0	*	*	2	***
SKIPJACK TUNA	1	1	2	*	*	*	1	*	1	*	*	4	***
(B) ALL TUNA	868	1,407	2,275	533	678	428	239	418	321	73	438	5,403	345,300
EFFORT	789	1,118	1,898	905	508	458	256	423	489	87	429	5,452	

NUMBER OF FISH oo

SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)	AMERICAN SAMOA (3)	GUAM (4)	NORTHERN MARIANAS (5)	WAKE (6)	JOHNSTON (7)	PALMYRA KINGMAN (8)	JARVIS (9)	HOWLAND BAKER (10)	WESTERN PACIFIC US FCZ (1)+(2)+(3)+...+(10)	PACIFIC OCEAN 0
BLUE MARLIN	358	269	627	921	550	345	205	460	435	51	320	3,913	186,700
STRIPED MARLIN	3,277	2,943	6,220	709	71	745	248	390	567	*	35	6,985	514,184
SWORDFISH	273	1,048	1,321	95	60	250	83	95	202	24	60	2,190	176,190
BLACK MARLIN	15	15	31	246	31	15	*	*	31	*	15	369	47,692
SPEARFISH & SAILFISH	904	422	1,325	542	120	60	1,386	241	241	60	120	4,096	572,289
(A) ALL BILLFISH	2,827	4,697	7,524	2,583	832	1,415	1,922	1,186	1,476	135	550	17,553	1,497,055
ALBACORE TUNA	4,256	18,099	22,355	14,587	2,231	3,388	6,653	1,033	*	83	206	50,537	1,942,149
YELLOWFIN TUNA	4,256	4,380	8,636	2,479	9,008	4,752	681	1,736	1,921	640	5,289	35,145	1,770,661
BIGEYE TUNA	12,568	16,982	29,550	1,351	4,234	2,613	991	6,959	5,111	901	3,986	55,698	2,576,016
BLUEFIN TUNA	0	10	10	*	*	*	*	*	0	*	*	10	***
SKIPJACK TUNA	200	200	400	*	*	*	200	*	200	*	*	800	***
(B) ALL TUNA	21,280	39,671	60,951	18,417	15,473	10,753	8,525	9,728	7,234	1,624	9,481	142,190	6,248,846
EFFORT	789	1,118	1,898	905	508	458	256	423	489	87	429	5,452	

* < 1 MT

| Japanese, Taiwanese, Korean

** Japanese Only

SOURCE: Data are from Yong and Wetherall (1980)

*** Unavailable but minor catches relative to other species

o Wetherall, pers. comm. 1/3/81

oo The number of fish for catches were derived by dividing the catch in metric tons by the values of average weight. The average weight statistics were provided by the United Fishing Agency Ltd. of Honolulu and the Hawaii Division of Fish and Game (Appendix B).

TABLE 9.8

AVERAGE (1973-77) CATCH RATES (CPUE) FOR BILLFISH AND TUNA SPECIES TAKEN BY FOREIGN LONGLINERS IN THE US FCZ OF THE MAIN HAWAIIAN ISLANDS, NORTHWESTERN HAWAIIAN ISLANDS, AND FOR THE HAWAIIAN ARCHIPELAGO AS A WHOLE.

METRIC TONS PER VESSEL PER DAY

SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)
BLUE MARLIN	.036	.019	.026
STRIPED MARLIN	.046	.074	.063
SWORDFISH	.029	.079	.058
BLACK MARLIN	.001	.001	.001
SPEARISH & SAILFISH	.019	.006	.012
(A) ALL BILLFISH	.132	.179	.160
ALBACORE TUNA	.132	.392	.285
YELLOWFIN TUNA	.264	.190	.220
BIGEYE TUNA	.715	.674	.691
BLUEFIN TUNA	.000	.002	.001
SKIPJACK TUNA	.001	.001	.001
(B) ALL TUNA	1.113	1.258	1.199
TOTAL EFFORT (VESSEL DAYS)	780	1.118	1.898

SOURCE: Data are from Yong and Wetherall (1980)

NUMBER OF FISH PER VESSEL PER DAY

SPECIES	MAIN HAWAIIAN ISLANDS (1)	NORTHWESTERN HAWAIIAN ISLANDS (2)	HAWAIIAN ARCHIPELAGO (1)+(2)
BLUE MARLIN	0.46	0.24	0.33
STRIPED MARLIN	1.64	2.63	2.22
SWORDFISH	0.35	0.94	0.70
BLACK MARLIN	0.02	0.01	0.02
SPEARFISH & SAILFISH	1.16	0.38	0.70
(A) ALL BILLFISH	3.62	4.20	3.96
ALBACORE TUNE	5.46	16.19	11.78
YELLOWFIN TUNA	5.46	3.92	4.55
BIGEYE TUNA	16.11	15.19	15.57
BLUEFIN TUNA	0.00	0.01	0.01
SKIPJACK TUNA	0.26	0.79	0.21
(B) ALL TUNA	27.28	35.48	32.11
TOTAL EFFORT (VESSEL DAYS)	780	1.118	1.898

197% higher respectively around the NWHI than around the main islands. On the other hand, the catch rates for blue marlin, yellowfin tuna, and sailfish and spearfish are about 100%, 40%, and 200% higher respectively around the main islands than around the NWHI. The catch rate for bigeye tuna is roughly the same in both areas. Mahimahi, wahoo, and other species are caught throughout the FCZ, but the relative catch rates for these species by area are unknown. Absolute tonnage of foreign tuna catches as well as most tuna species CPUE rates are also higher around the NWHI than the main islands.

The rate of billfish catch relative to tuna catch by foreign longliners has decreased substantially in recent years (Figure 9.9). In the late 1960's, the billfish:tuna catch ratio was less than 1:2. In the early 1970's, the ratio declined from about 1:4 to 1:10. That is longliners caught about 10 times as much tuna as billfish in 1977. A possible explanation for this shift in species composition is that deeper longlines are being set, which results in higher catches of tuna relative to billfish. Table 9.9 illustrates the types of shifts in species composition that can be associated with "deep" and "normal" longline deployment patterns. Table 9.9 shows the ratios of the average catch rates for deep-set longlines relative to the average catch rates for regularly-set longlines. A ratio of 1 means that either type of longline set would be equally effective in hooking the various species of billfish and tuna. Bigeye tuna are clearly more vulnerable to capture on deep-set longlines, while all other species of tuna and billfish are more vulnerable to hooking on shallower-set gear. Suzuki and Warashima (1977) reported that since around the latter part of 1974

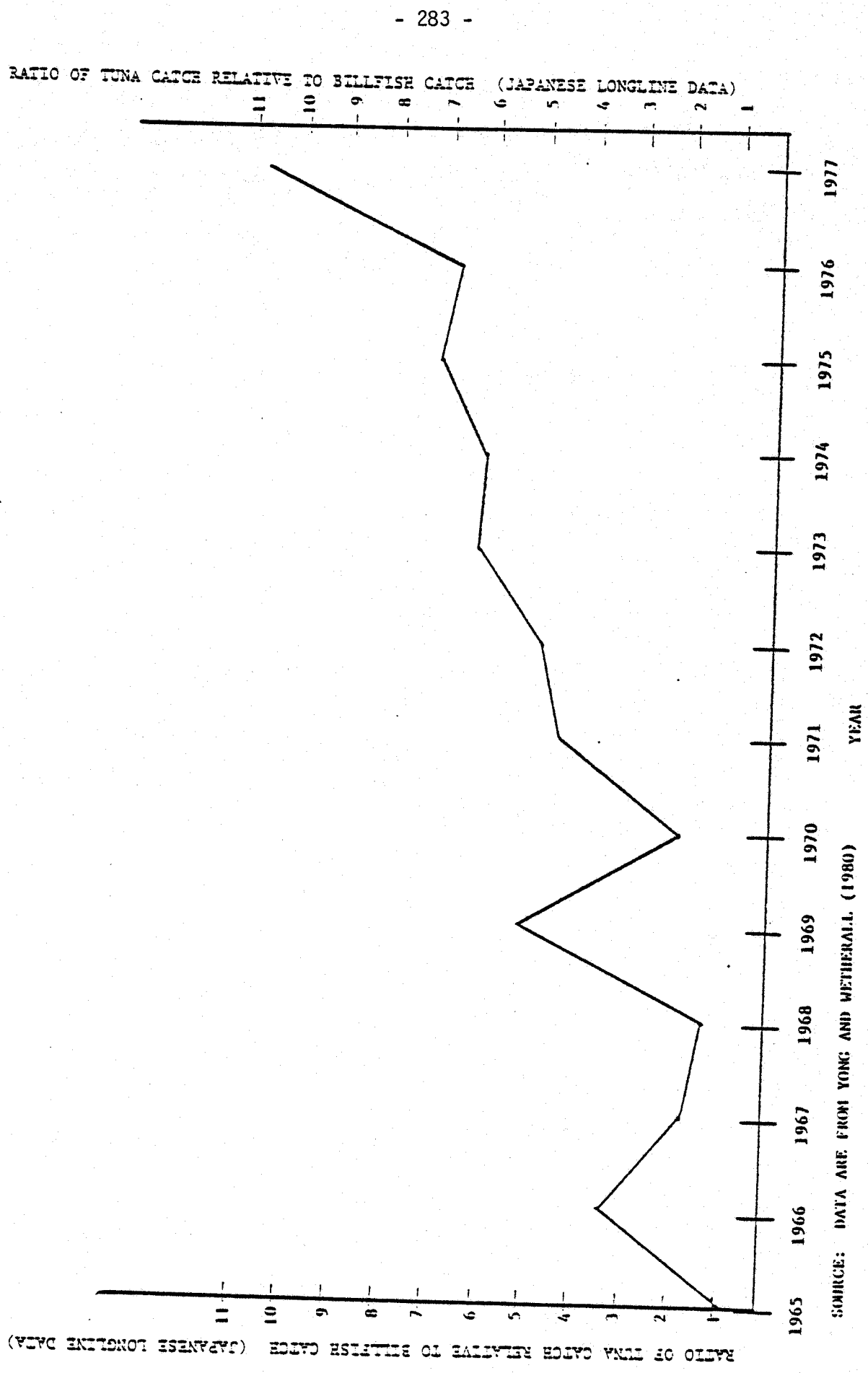


FIGURE 9.9

WEIGHT RATIO OF TUNA CATCH TO BILLFISH CATCH FOR FOREIGN LONGLINES IN THE US FCZ OF THE HAWAIIAN ARCHIPELAGO, 1965-77.

TABLE 9.9

RATIO OF AVERAGE CATCH RATE BY DEEP LONGLINE OVER AVERAGE CATCH RATE BY REGULAR LONGLINE FOR VARIOUS SPECIES OF TUNAS AND BILLFISHES TAKEN BY LONGLINE GEAR.*

SPECIES	DEEP/REGULAR
SAILFISH	0.07
STRIPED MARLIN	0.28
BLACK MARLIN	0.34
BLUE MARLIN	0.56
YELLOWFIN TUNA	0.73
BROADBILL SWORDFISH	0.79
ALBACORE	0.82
BIGEYE TUNA	1.79

* THE SMALLER THE RATIO, THE MORE "SURFACE DWELLING" A SPECIES IS.

SOURCE: Suzuki and Warashima, 1977

some small and medium sized foreign longline vessels, fishing in the central and western equatorial Pacific, began using deep-set longlines to catch bigeye tuna. The CPUE figures for bigeye tuna (Figure 9.10) caught around Hawaii have remained generally stable from 1965 through 1977. The depth of fishing gear alone does not provide a satisfactory full explanation for changes in the size of billfish catches relative to tuna catches (Figure 9.11).

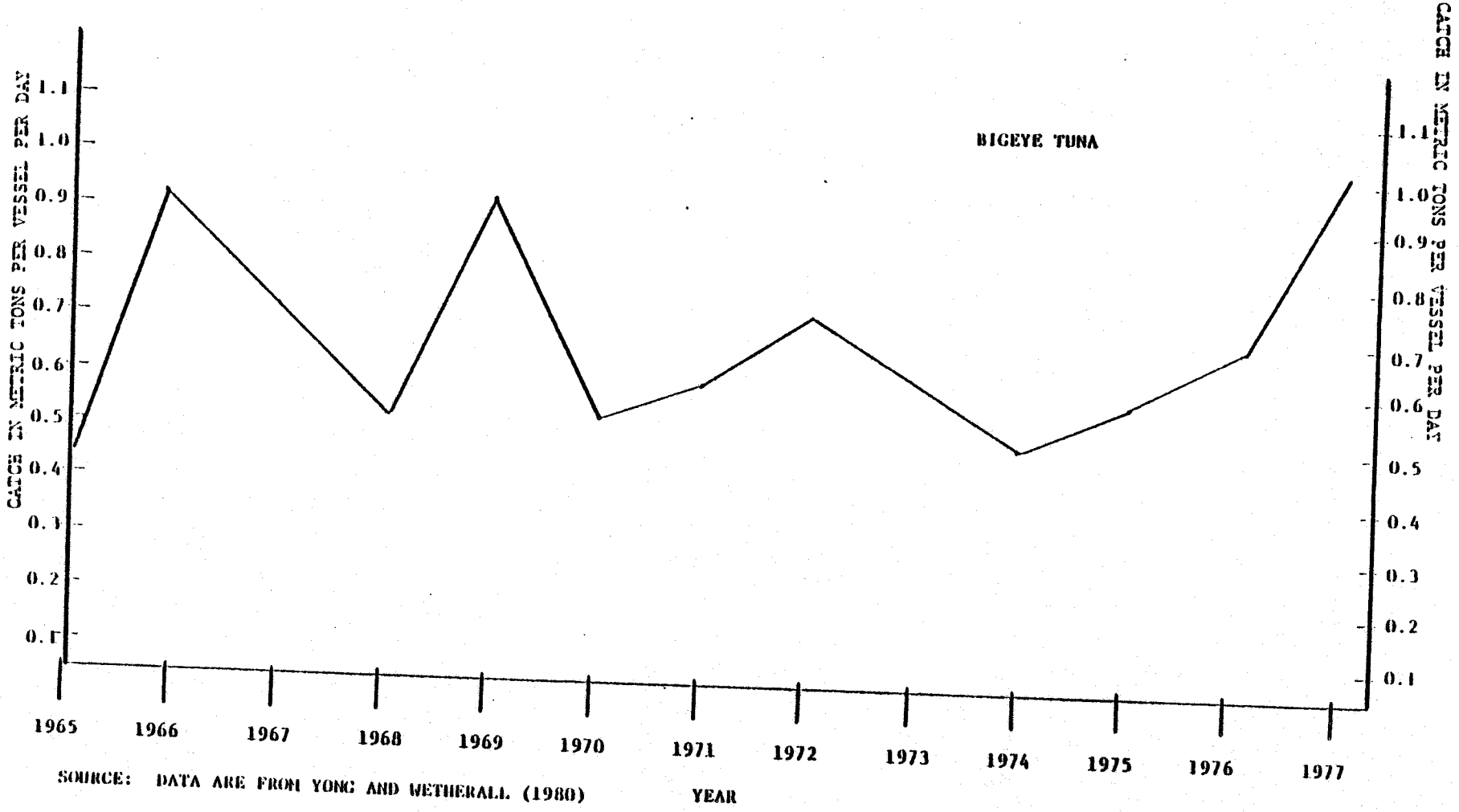
The divergence of tuna catch rates from billfish catch rates could reflect the increased scarcity of billfish throughout the Pacific. The International Billfish Stock Assessment Workshop concluded that blue marlin are overfished on an ocean-wide basis. Figure 9.12 compares catch rates for blue marlin caught by foreign vessels in the U.S. FCZ of Hawaii over a 13 year period. The declining catch rates are likely a local manifestation of the overfished status of blue marlin stocks on an ocean-wide basis.

The Billfish Stock Assessment Workshop concluded that striped marlin stocks on an ocean-wide basis may be in relatively good condition, but no hypotheses were established nor were any judgments made on possible localized striped marlin stock conditions. Figure 9.13 shows that the foreign longline CPUE for striped marlin in the FCZ around Hawaii declined over the 1965-1977 period, just as the CPUE for blue marlin during the same period.

Total striped marlin catches, on an ocean-wide basis, may be showing the same general decline, albeit a few year later, as ocean-wide catches of blue marlin (Table 5.13 and Figure 5.2). Bartoo and Ueyanagi (1978) concluded that

FIGURE 9.10

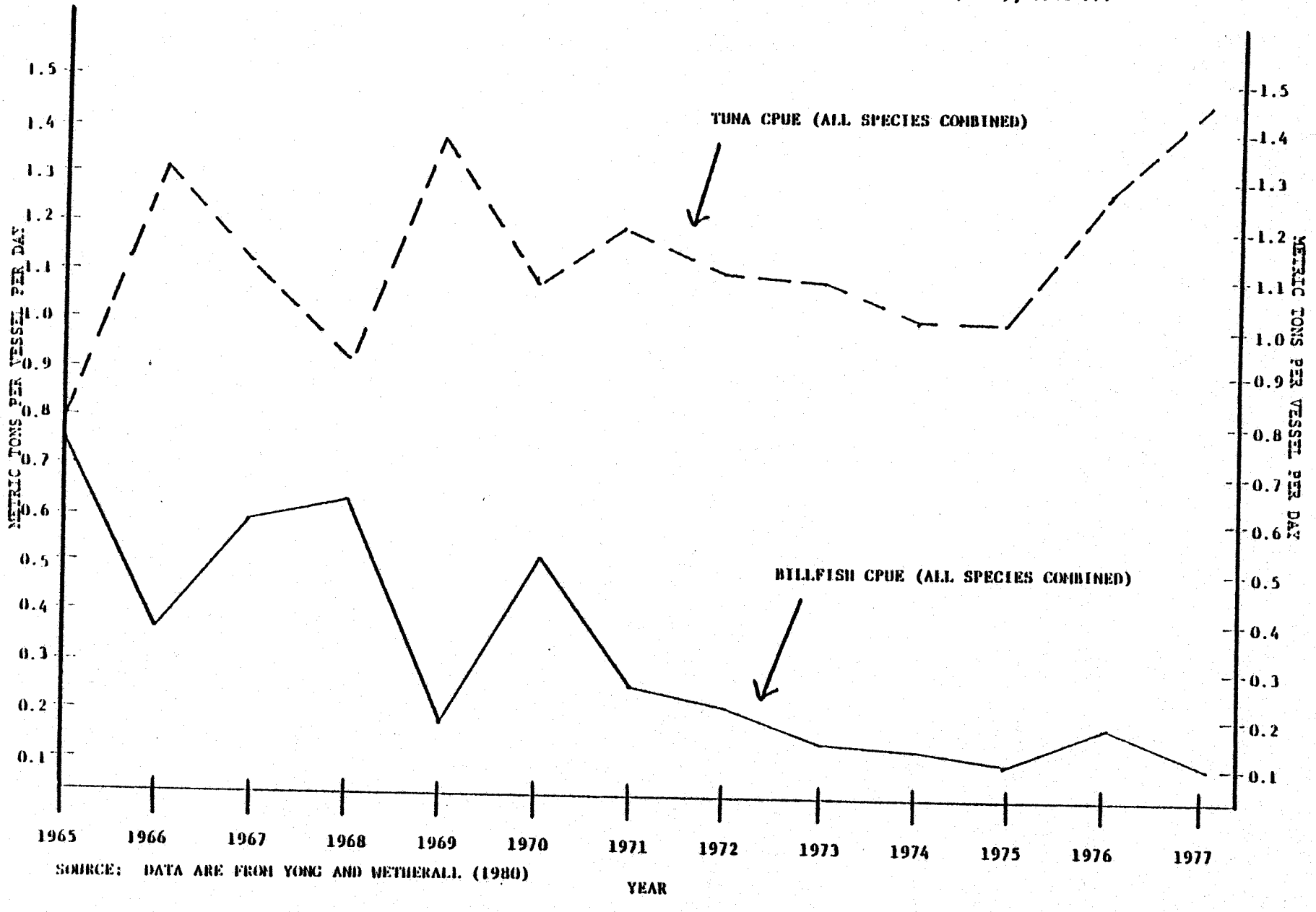
AVERAGE FOREIGN LONGLINE CATCH RATE (MT) FOR BIGEYE TUNA MADE IN THE US FCZ OF THE HAWAIIAN ARCHIPELAGO PER VESSEL PER DAY.



SOURCE: DATA ARE FROM YONG AND WETHERALL (1980)

FIGURE 9.11

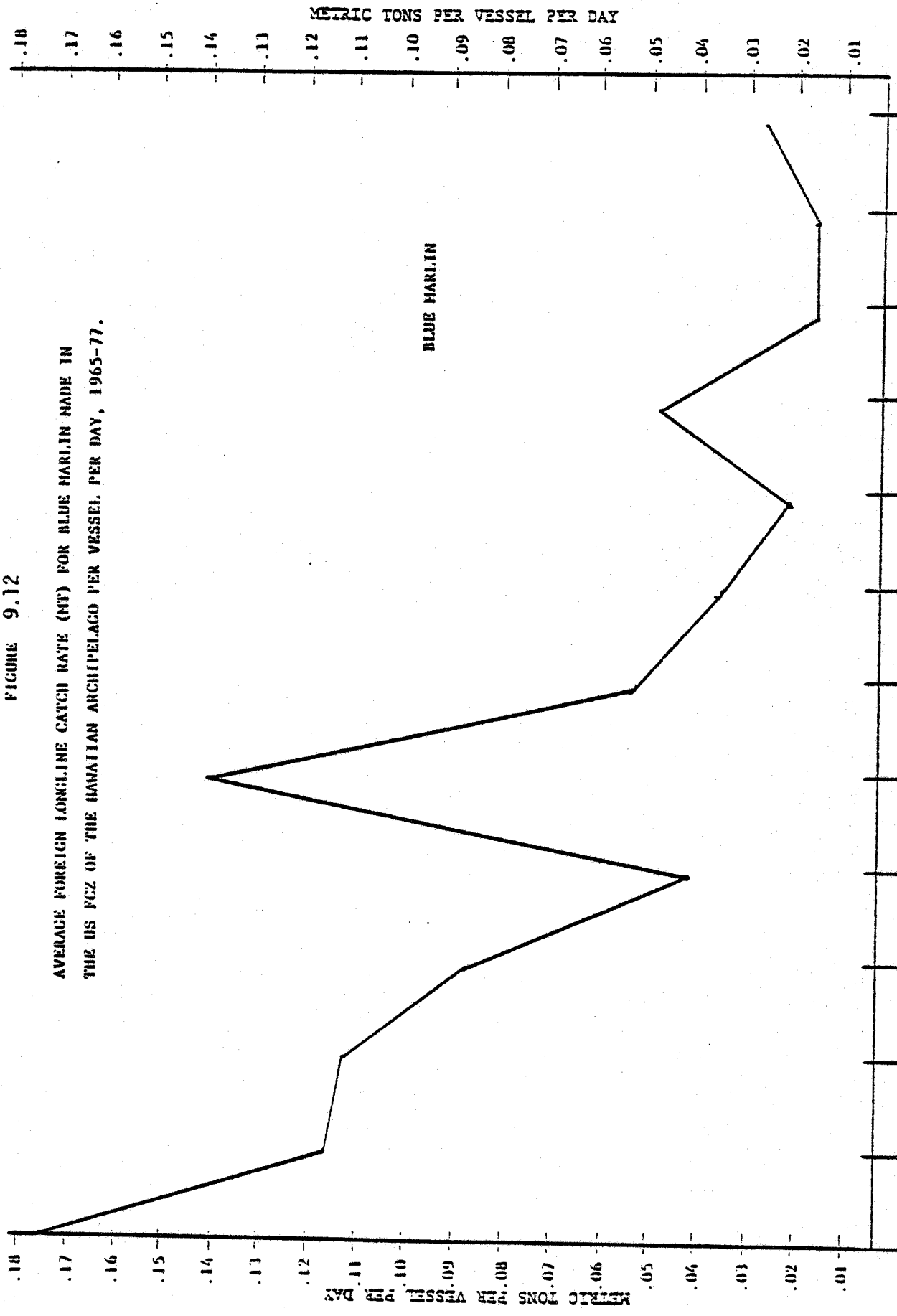
COMPARISON OF BILLFISH CATCH RATES (CPUE) TO TUNA CATCH RATES (CPUE), 1965-77.



SOURCE: DATA ARE FROM YONG AND WETHERALL (1980)

FIGURE 9.12

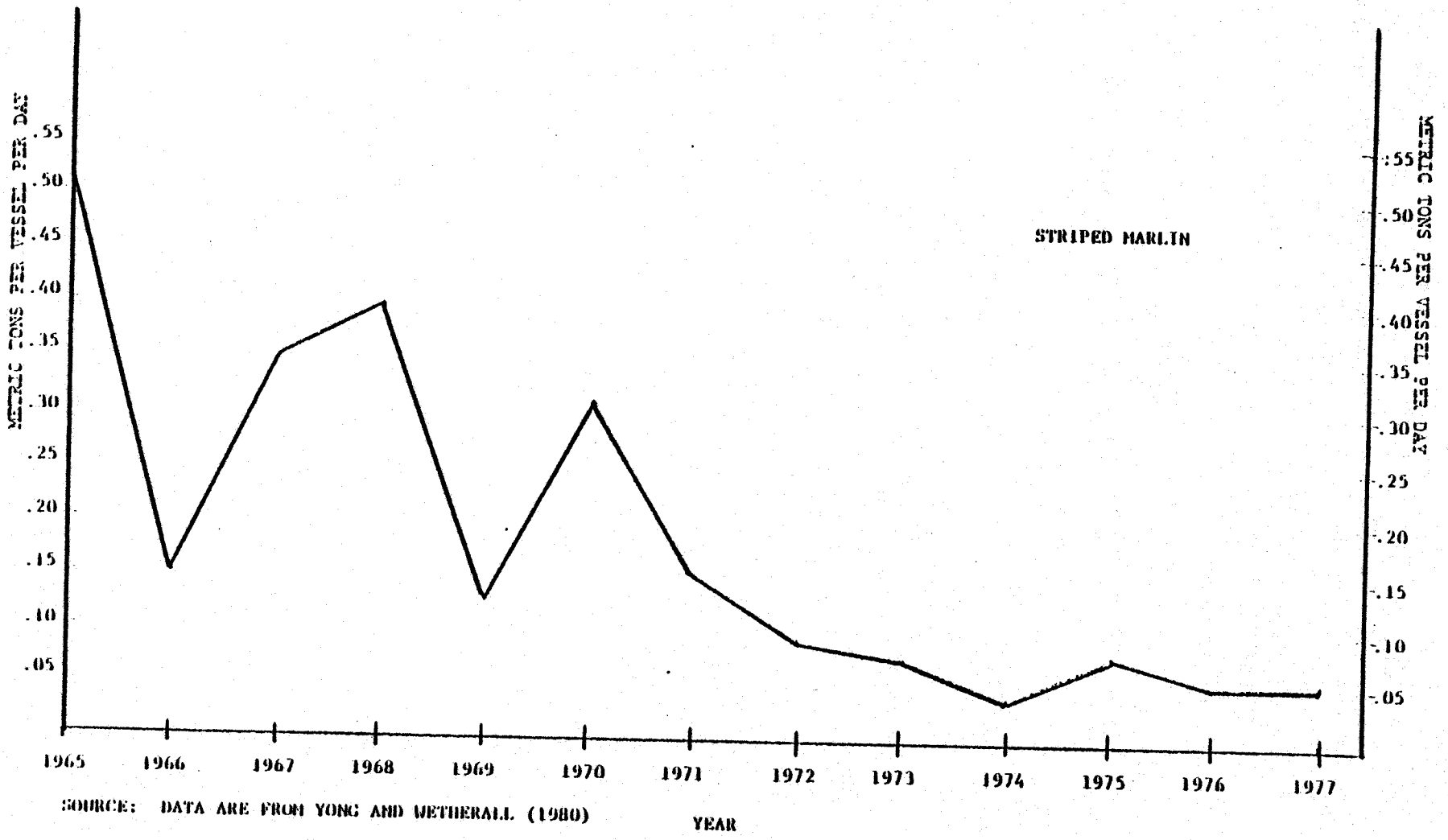
AVERAGE FOREIGN LONGLINE CATCH RATE (MT) FOR BLUE MARLIN MADE IN THE US FCZ OF THE HAWAIIAN ARCHIPELAGO PER VESSEL PER DAY, 1965-77.



SOURCE: DATA ARE FROM YORK AND METHERALL. (1980)

FIGURE 9.13

AVERAGE FOREIGN LONGLINE CATCH RATE (MT) FOR STRIPED MARLIN MADE IN THE US FCZ OF THE HAWAIIAN ARCHIPELAGO PER VESSEL PER DAY, 1965-77.



SOURCE: DATA ARE FROM YONG AND WETHERALL (1980)

"the catch rate of striped marlin for the entire Pacific fishery shows a long-term decline". The catch rate declined approximately by 50% from 1952 to 1975. Research should be undertaken to ascertain the condition of Pacific Ocean striped marlin populations as soon as possible.

Foreign fishing effort has generally remained fairly stable around American Samoa; but it apparently increased very sharply around Guam in the 1972-1977 period, from 20 vessel days in 1972 to almost 1200 vessel days in 1977 (Table 5.12 - Yong and Wetherall, 1980). Foreign longline effort in Hawaii's FCZ has remained fairly stable averaging around 2,300 vessel days per year over 1965-1977 (Figure 9.13), although there have been significant year-to-year fluctuations. Foreign longliners' catch, effort, and CPUE around U.S. Possessions did not change dramatically in the 1966-1977 period, except for a significant decline in blue marlin catches and catch rates, and a marked decline in striped marlin catch rates. Total tuna catches and tuna catch rates have been relatively stable; but there was a shift to larger bigeye tuna catches and smaller yellowfin tuna catches.

9.4 Conclusion

In conclusion, this draft FMP represents an improvement over the PMP in several major respects. The conservation and management measures proposed in the preferred management regime (Option 1) are intended to increase the values of domestic fisheries to achieve optimum utilization of billfish in the Western Pacific FCZ while providing a reasonable opportunity for foreign vessels to fish for tuna (Table 9.10). Domestic commercial, recreational, and subsistence fishermen could expect to realize larger catches, higher catch rates, and better fishery development prospects with the FMP than under the PMP. The waste associated with the non-retention approach would be eliminated while the possibility of gear conflicts will be precluded in the areas to be closed to foreign longlining. There will be a reasonable opportunity for foreign longliners to fish in the FCZ; in fact, overall foreign catch and effort could conceivably increase if foreign fishing effort relocates to open FCZ subareas. Foreign vessels would no longer be subject to quotas or non-retention requirements. NMFS can and should develop a mutually acceptable observer program with foreign fishing nations to minimize the burden posed by having to pick up and disembark observers at U.S. ports. The plan presents a relatively straightforward and easily complied with management regime. The cost-effectiveness of the FMP is much greater than that of the FMP. The alternatives considered (i.e., smaller time/area closures) would not achieve as large a probability of increased domestic fishery benefits.

The FMP also recognizes the need for and promotes the establishment of an international management program for all migratory species, as called for

TABLE 9.10

IMPACT OF ALTERNATIVE AREA/SEASON CLOSURES FOR MANAGING BILLFISH FISHING IN THE US FCZ OF THE WESTERN PACIFIC REGION ON HISTORICAL FOREIGN FISHING CATCHES OF TUNA.

Preference Rank Option	Hawaii (1) Size of Closure Between Main	NWHI	Season	Guam (2) Size of Area Closure	Season	American Samoa (3) Size of Area Closure	Season	Average (1973-77) Foreign Longline Billfish Catch (MT) Made in Closure Zones (1+2+3)	Average (1973-77) Foreign Longline Tuna Catch (MT) Made in Closure Zones (1+2+3)	Ratio of Billfish Catch To Tuna Catch	% of Average Annual (1973-77) Foreign Catch of Billfish Made in the US FCZ of the Western Pacific Region* (779 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign Longliners in the US FCZ of the Western Pacific Region (5,430 MT)	% of Average Annual (1973-77) Catch of Tunas Made by Foreign Longliners and Baitboats combined in the US FCZ of the Western Pacific Region (16,683 MT)	% of Average Annual (1973-77) Catch of Tunas Made By Foreign Longliners in the Pacific Ocean (245,300 MT)
1	200	100	Entire Year	FCZ	Entire Year	Small Rectangle	Entire Year	252	2,218	.11	33.2	40.8	13.2	0.9
2	200 100	200 100	May/Dec Jan/Apr	FCZ	Entire Year	Small Rectangle	Entire Year	289	2,674	.11	37.0	49.2	16.0	1.0
3	200 100	200 100	March/Oct Entire Year	FCZ	Entire Year	Small Rectangle	Entire Year	278	2,067	.13	35.6	38.0	12.3	0.8

* The US FCZ of the Western Pacific Region includes the US FCZ of Hawaii, American Samoa, Guam, the Northern Marianas, and Wake, Johnston, Palmyra/Kingman, Jarvis, and Howard/Baker Islands. In it's entirety, the US FCZ of the Western Pacific Region totals 1,511,000 square miles. See Figure 5.7 for geographic perspective.

under Article 64 of the Draft Convention of the Law of the Sea (Informal Text) which states:

> "The coastal State and other States whose nationals fish in the region for the highly migratory species listed in annex I (Appendix Q) shall co-operate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone. In regions where no appropriate international organization exists, the coastal State and other States whose nationals harvest these species in the region shall co-operate to establish such an organization and participate in its work." (United Nations, September 1980).

This FMP is a initial step towards that co-operation by protecting domestic interests and facilitating easier foreign access to tuna in the FCZ simultaneously.

10.0 OPTIMUM YIELD

The FCMA requires that each FMP contain a determination of optimum yield (OY) from the fishery. The FCMA defines OY as

> "the amount of fish (A) which will provide the greatest overall benefit to the nation with particular reference to food production and recreational opportunities; and (B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor." (Section 3(18)).

The FCMA envisioned that maximum sustainable yield (MSY), which is the greatest average catch of a species that can be made periodically into the future, would serve as a benchmark for determining OY. This apparently reflects Congress' concern that Councils should explicitly determine the biological limitations and the health of the stocks in making management decisions. In the context of this FMP, the Council notes this concern and has presented MSY estimates for billfish stocks throughout their range (see Section 5.1.5). The Council notes also that the level of fishing which has occurred and is likely to occur in the FCZ will not appreciably affect the overall condition of billfish stocks and will not pose a threat of biological overfishing. However, it has been reported (Smith, pers. comm.) that domestic catch per unit effort rates for billfish have dropped sharply around Guam in the past two years. If this is true, it may reflect natural variability in abundance, decreased abundance due to the large increase in foreign longlining since 1973-1974, or some other factor.

In any event, prevention of biological overfishing is not an achievable objective for this FMP, and MSY does not provide a useful benchmark for determining OY for the billfish fisheries in the FCZ.

OY can be defined in many different ways depending on the specific characteristics of each fishery. A numerical definition would generally be associated with a fishery in which a quota(s) is necessary to prevent overfishing or in which direct allocations of OY are to be made for different sectors of a fishery. A non-numerical definition will often be associated with a highly variable or unpredictable fishery in which a quota would neither be useful nor practical. The billfish fisheries fit into this latter category for several reasons.

1. There is no compelling biological or ecological reason to control the total level of catch of billfish in the FCZ because billfish stocks extend throughout the Pacific and the health of the stocks will not be affected in any significant way by controlling billfish catch in the FCZ alone.

2. The availability and vulnerability of billfish in the FCZ in any specific year will be highly variable and will not be affected by measures controlling fishing in the FCZ alone. Historic levels of catch during recent years do not provide a sound basis for determining numerical OYs or quotas.

3. Quotas would be extremely difficult and costly to monitor and enforce in the FCZ, given the vast areas involved; other types of restrictions (e.g., time/area closures) are much easier to enforce.

4. Species quotas are not very effective in mixed species or non-selective gear fisheries because they will generally lead to inefficient allocation of fishing resources or other problems such as waste from discards.

5. There are no economic or social objectives that warrant direct allocations of OY (or portions of OY) to specific domestic user groups; the Council promotes increased effort, catch and fishery values for all domestic fishery sectors.

A non-numerical definition of OY has the added advantage of providing the flexibility to address the different conditions and concerns of the separate geographic areas covered by the plan. For example, American Samoa's private sector economy is dominated by the two canneries in Pago Pago, and the canneries are dependent on continued delivery of tuna by foreign longliners. The definition of OY must be compatible with operations of American Samoa-based longliners. On the other hand, domestic fishing benefits are of paramount importance in Hawaii and Guam, and OY must be defined in terms which permit realization of those benefits.

In the Council's judgment, the following definition of OY is appropriate to the billfish fisheries:

> OY is that amount of billfish that will be caught by domestic and foreign vessels fishing in the FCZ in accordance with the measures contained in this plan.

The Council recognizes that it will be useful to present estimates of future catch levels as bases for evaluating the effectiveness of the FMP. Catches made in the past are, at best, only indicators of the magnitude of

catches which may occur in the future. The extent to which transfers of billfish from foreign to domestic vessels will occur is unknown, as is the extent to which foreign longline vessels will fish in the permitted areas under this plan. Further, there are natural fluctuations in billfish availability. External factors such as changes in fuel costs may affect both domestic and foreign fishing practices significantly. The Council cannot estimate with precision and reliability the amount of billfish which will actually be caught in the FCZ under this plan.

The Council has, nevertheless, provided estimates or "benchmarks" of what the harvests of billfish (all species combined) will be in 1982 in the FCZ of Hawaii, Guam, and American Samoa. Briefly summarized, the estimates of catch associated with the OY determinations are as follows:

FCZ	(A) Foreign Catch (MT)	(B) Domestic Catch (MT)	A + B OY (MT)
Hawaii	344[1]	915[4]	1,259
Guam	0[2]	10[5]	10
American Samoa	125[3]	5[6]	130

[1] Assumes 1973-77 average foreign longline effort (1898 days) from the entire Hawaii FCZ is applied in the 100-200 mile band of FCZ remaining open in the NWHI, and that 1973-77 average daily catch rates will be maintained. See Appendix T.

[2] No foreign fishing to be permitted.

[3] Average (1973-1977) catch (Table 5.20). Assumes that "displaced" effort and catches from the small rectangular closure zone will be made up in the much larger area of permitted foreign fishing.

[4] Twenty-five percent increase from the 1976 estimate of domestic catches (Table 5.9): 732MT + 183MT = 915MT. Reported commercial catches have increased dramatically, and recreational catches probably have also increased. Initial NMFS data show 1696 MT caught by recreational fishermen in 1979.

[5] Twenty-five percent increase in the 1980 estimate of domestic catch: 8MT + 2MT = 10MT. In 1981, in one tournament, almost 2.5 MT of blue marlin were caught.

[6] Ten percent increase in the 1978 estimate of domestic catch: 4MT + 1MT = 5MT.

TOURNAMENT AND CATEGORIES	NUMBER OF TEAMS	DAYS FISHING
(10) Kaneohe Yacht Club		
(11) Kawaihae Fishing Club		
(12) Keehi Sport Fishing Club		
(13) Koko Head Fishers		
(14) Kona Mauka Trollers		
(15) Kona Iki Trollers		
(16) Keahou Kona Yacht Club		
(17) Lahaina Yacht Club		
(18) Maalaea Boat & Fishing Club		
(19) Oahu Big Game Trollers		
(20) Molokai Yacht Club		
(21) Pearl Harbor Trollers		
(22) Pokai Bay Boat Club		
(24) Waialua Boat Club		
(25) Windward Fishing Club		

TOURNAMENT CATEGORIES	NUMBER OF TEAMS	DAYS FISHING
A. World-class tournaments		
(1) Hawaii International Billfish Tournament	70	5
(2) Hawaiian Billfish Tournament (companion to (1) -- qualifying test for mainland teams)	30	4
(3) Hawaiian Invitational Allison Tuna Tournament	45	5
B. Jackpot tournaments		
(1) Chuck Machado's Luau Jackpot Fishing Tournament	150	4
(2) Kona Gold Jackpot Fishing Tournament	200	3
(3) Lahaina Championship Jackpot Fishing Tournament	100	3
(4) Garden Isle Mokihana Bonanza Jackpot	35	2
(5) Haleiwa Hanapa'a Jackpot Fishing Tournament	75	3
(6) Lanai Rendezvous	50	2
(7) Pokai Bay Bonanza Jackpot	122	3
(8) Kona A'Lure Hawaiian Wahine Fishing Tournament	70	1
(9) Sauza Senoritas Fishing Tournament	40	2
(10) Golden Goddess Fishing Tournament	33	2
(11) Cocoribe Wahine Jackpot Fishing Tournament	35	1
(12) Spring Wahine Fishing Tournament	35	1
(13) Wee Guys' Annual Fishing Tournament	93	2
(14) Kona Ahi Tournament	45	2
(15) Annual Shop 31 Jackpot Fishing Tournament	20	2

HIBT SUMMARY TABLE

70 teams x 4.3 anglers/team = 300 anglers

Each angler spends an average of 9 days in Kona, 5 of which are spent in fishing.

Expenditures

Lodging

$60/day/room (double occupancy)	x	150 rooms (300 anglers)	x	9 days	=	$ 81,000

Food, Booze, Entertainment

$75/day	x	300 anglers	x	9 days	=	$202,500

Entry Fee

$295/angler	x	300 anglers	=	$ 88,500

Charter Fees

$1,825/vessel	x	30 vessels	=	$ 54,750

Operating Expenses (non-charter boats)

$100/day	x	30 boats	x	5 days	=	$ 15,000

TOTAL	$441,750

APPENDIX V

HAWAII OFFSHORE TOURNAMENTS

The growth of big-game tournament fishing in Hawaii has been astounding. In 1976,* there were three popularly recognized competitive tournaments. Now there are around twenty-five. In 1976 there were several organized fishing clubs; now there are about twenty-five. Tournament fishing for whatever motivation (world records, prestige, big cash prizes, equality of sexes, plain old fashioned fun) has come of age.

The following table presents an initial inventory of annual tournament events held in Hawaii. The information presented was culled from numerous reports in the 1980-81 issues of the Hawaii Fishing News: "The Voice of Hawaii's Sport Fisherman". The inventory is not complete, but it serves to illustrate the current level of participation (vessel days) in just tournament fishing. When completed, this inventory will be used as a base for deriving estimates of revenue generated in the local economy by tournament participants. The Hawaii International Billfish Tournament alone generates direct cash expenditures of over .4 million dollars for the Kona economy alone.

* Base year used in this FMP to describe levels of activity in the domestic billfish fisheries.

not caught by foreign longliners in the FCZ because of the FMP will nonetheless still not be caught by domestic fishermen) to 100% (all fish not caught by foreign longliners will be caught by domestic fishermen because of the FMP). Finally, the model looks only at blue and striped marlin harvested by recreational trollers, with fixed domestic effort levels. This is a limited study, though it was all that could be done with the data and time available in 1977.

As the only model of the fishery available to the Council, it is probably the "best available scientific evidence" to date. The model should be tested by examining other assumptions and parameters on which the model can be based, and any change in the results should be analyzed for their billfish management merit.

Persons wishing to obtain either or both of the reports referenced in this Appendix should send their requests to the Council.

tory stocks such as blue and striped marlin and that foreign longlining in the FCZ should not be expected to have significant deleterious effect on domestic recreational catches of billfish. Pacific-wide international management agreements are recommended. The model indicates that gains to recreational trollers from various area closures are evident if not highly significant statistically, and range up to 7% for striped marlin and 2% for blue marlin. These results are analyzed in the Billfish FMP (Section 8.4.1) and are related to the Council's primary management objectives.

ANALYSIS AND CONCLUSION

The Lovejoy model is the first systemmatic attempt to surmise blue and striped marlin migratory patterns and their relative densities in the FCZ of Hawaii. The confidence one can place on the model's quantitative predictions of impacts of alternative management options depends on the precision of the model's calibration, especially the migration coefficients, the assumption of constant commercial effort, and the estimated billfish density in recreational fishing compartments.

The model is not definitive since it has several limitations. The model is based primarily on available foreign longline catch and effort data within and near the Hawaii FCZ. If those data are incomplete or inaccurate, the model's quantitative transfer estimates will likely probably not be reliable. Several of the assumptions of the model have been challenged, and the model has not been subjected to a sensitivity analysis. In short, the model produces a single simulated set of outcomes. It is appropriate, however, to conclude that there is a broader set of possible transfers, ranging from zero (billfish

marlin per unit of longline effort, and using the assumed migration patterns, the model estimates the relative changes in the density of blue and striped marlin from one compartment to the next, or the fraction of fish in one compartment that moves into adjacent compartments during the month. The model, as such, estimates billfish transfer functions between compartments. The model is non-stochastic (i.e., it is deterministic) and the parameters are selected to "fit" the data.

The model thus "predicts" the number of marlin that would enter the compartments where recreational billfish fishing occurs -- the Waianae and Kona coasts, and other areas in Hawaii. The model provides estimates of the relative density of blue and striped marlin in the recreational areas under alternative management regimes and produces numerical estimates of the changes in the recreational troll catch of blue and striped marlin which would occur by closing portions of the FCZ -- within 50 miles, 100 miles, and 200 miles off the main Hawaiian islands and the entire Hawaiian islands archipelago -- to longline fishing. These estimates of impacts on recreational catches are the end result of the initial numbers of blue and striped marlin entering the FCZ as reduced by longlining in the compartments crossed by the fish on their way to the recreational fishing compartments.

INFERENCES AND IMPLICATIONS

The Lovejoy model suggests that the interaction between foreign longline fishing (tuna and marlin) and recreational troll fishing for blue and striped marlin is less than the annual and seasonal natural variations in recreational catches. The implications are that local management of billfish in the FCZ can only have a limited impact on local catches of trans-Pacific, migra-

marlin "mix" together in the Hawaiian islands, with the stocks from Mexico entering the southeast portion of the Hawaii FCZ and stocks from the North Pacific entering the northwest part. The model also assumes that the marlin only move from one compartment to an adjacent compartment, although this assumption is occasionally relaxed.

The relative abundance (relative numbers) of blue and striped marlin in any compartment at any time was calculated from monthly Japanese longline catch and effort data covering the period 1962-1974. The model sets base figures of Pacific-wide marlin stocks to create the overall bounds for the model: the Pacific-wide blue marlin stock is set at 2,004,242 fish and the striped marlin stocks are set at 1,084,710 fish. There were assumed to be 40,775 blue marlin and 95,893 striped marlin in the Hawaii FCZ at any point in time (these were averages, with considerable seasonal variation).

The coefficients for commercial and recreational levels of domestic effort and catch rates are postulations because full information on fishing patterns in the FCZ is not available. Commercial effort and catchability are essentially derived from Japanese longline data, which are used to produce a proportional "catchability coefficient" for domestic longliners. Complementary figures for the recreational troll fishery for billfish were derived by assuming that blue marlin catches are related to the size of the relevant compartment and that striped marlin catches are related to bottom topography, and by setting base figures for the total estimated recreational catch of marlin in Hawaii.

PROCEDURE

Using the monthly changes in the longline catch of blue and striped

Blue and striped marlin are migratory fish. In order to calculate the possible interaction between types of fishing, the migratory patterns of marlin were simulated through the Hawaii FCZ. To do this, the FCZ waters surrounding the Hawaiian islands were divided into compartments and the net amounts of blue and striped marlin movement from compartment to compartment was simulated.

Lovejoy's mathematical model (BFISH) is a complex simulation incorporating generalized behavioral characteristics of blue and striped marlin. Simulation was required because precise information on the migratory patterns of the marlin stocks in the Pacific Ocean is not available. Assumptions required to run the model covered:

relative abundance
absolute abundance
migratory direction
migratory timing
catchability
recruitment
natural mortality
seasonal variation

The model also required ad hoc adjustment in some coefficients to provide correspondence between simulated results and actual marlin catch data. The key assumptions are outlined in the following paragraphs.

The model assumes that blue marlin seasonally migrate across the Hawaiian islands chain in a north-south pattern and back, whereas striped marlin migrate along the chain in a northwest-southeast direction. The migratory pattern assumption for blue marlin is a variant of their travel along the Northeast/Southwest 26° C isotherm (water temperature contour) as postulated in the scientific literature. The postulated striped marlin migratory pattern is based on the idea that two relatively distinct populations of Pacific striped

APPENDIX U

DESCRIPTIVE SYNOPSIS OF THE LOVEJOY MODEL

PURPOSE

The purpose of the Lovejoy Model is to investigate the impact of longline fishing on the recreational troll fishery for blue and striped marlin in the FCZ of Hawaii. William S. Lovejoy created the mathematics and computer program for the model in June 1977 and applied the model to the Hawaiian fishery in November 1977.* The model is a view of the complex ecological and human interactions in the blue and striped marlin fisheries.

PREMISES

The essence of the Lovejoy model lies in indicating the degree of competition between user groups in a fishery. If commercial longline boats catch a certain number of blue and striped marlin from an area during the year, then the abundance (or density) of blue and striped marlin in that area is reduced by the amount of the longline catch. It follows that the reduction in density can result in reduced catch rates of these species for recreational troll fishers in that area. There is an interaction effect between the troll and longline fisheries.

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* --Ref: Lovejoy, W.S., "BFISH: a population dynamics and fishery management model", Southwest Fisheries Center (NMFS) Administrative Report No. 12H, 1977.

Lovejoy, W.S., "A BFISH Population Dynamics Analysis ... in the Hawaiian Fishery Conservation Zone", Western Pacific Fishery Management Council, 1977

	OPTIONS					
IMPACT CATEGORY	1.	2.	3.	4.	5.	6.
a) Domestic Fishery						
1. Billfish	Near Max.	Near Min.	Max. Gain	Small Gain	Moderate Gain	Small Gain
2. Tuna	Near Max.	Near Min.	Max. Gain	Small Gain	Moderate Gain	Small Gain
3. Other	Unknown	Unknown	Max. Gain	Unknown	Unknown	Unknown
b) Foreign Fishery						
1. Billfish	845 MT	803 MT	Zero catch	618 MT	0	618 MT
2. Tuna	5302 MT	5436 MT	Zero catch	5403 MT	5403 MT	5436 MT
3. Other	Unknown	Unknown	Zero catch	1779 MT	0	1779 MT
4. Gear Loss	None	None	None	Moderate	High	Moderate
5. Fees	$35,000+	$35,000+	$35,000+	$121,000+	$35,000+	$121,000+
c) Enforcement						
1. Mode	Air	Air	Air	Air, sea, observer	Air, sea, observer	Air, sea, observer
2. Feasibility	Adequate	Adequate	Adequate	Not with current resources	Not with current resources	Not with current resources
d) Billfish "Waste"	None	None	None	Ca. 113 MT	Ca. 482 MT	120 MT
e) Data Flow	Good	Good	None	Good	Good	Good
f) Gear Conflict	Very low	Low to Moderate	None	High	High	Low to Moderate

Option 6: Assume the PMP remains in effect, and 700 foreign longline vessels obtain permit to fish in the FCZ with allocations. Fishing, however, occurs only in the retention zones under the PMP; that is, longline effort relocates to areas where billfish can be retained subject to TALFF limitations.

Effects:

(a) Domestic fisheries - The maximum potential increase in billfish catch and in domestic fishery values would be quite low. Very small numbers of billfish and other non-tuna species would be released, and most of the released fish would be blue marlin. Up to 14 MT of blue marlin and 13 MT of swordfish would be subject to capture by domestic vessels in Hawaii; up to 12 MT of blue marlin could be transferred to Guam vessels; and up to 11 MT of blue marlin, 8 MT of striped marlin, and 3 MT of black marlin could be transferred to American Samoa vessels.

(b) Foreign longline fisheries - Longline fisheries would increase slightly their tuna catches (5436 MT), would retain the billfish TALFF (618 MT), and would retain the TALFFs for other non-tuna species (1779 MT). Actual gross billfish catch (821 MT) would be larger than the 1973-77 average (779 MT) since catch rates in retention zones are higher than in non-retention zones around Hawaii (unknown for other areas). Thus, a larger total amount of billfish would be released with losses of hooks, line, and time. Foreign effort would remain at 5452 vessel days. Foreign fees would be $35,000 for permits and $86,000 for billfish catch value, plus the costs of observer coverage. Fees on other non-tuna species are unknown.

(c) Enforcement requirements - U.S. Coast Guard and NMFS would be unable to actively enforce the PMP under these conditions with current resources. At-sea vessel patrols, observers, and vessel inspection would be needed. Hiring and training observers would be costly.

(d) Billfish "waste" - Approximately 120 MT of billfish would be wasted ((821 MT total catch -618 MT TALFF) x 60% average mortality rate=120 MT). Unknown amounts of other non-tuna species would be wasted.

(e) Flow of data - Foreign longline catch and effort data would be collected on a timely basis.

(f) Potential for gear conflicts - The risk of gear conflicts would initially be moderate but would increase if domestic vessels begin expanding their range of operations as expected.

Option 5: Assume the PMP remains in effect and 700 foreign longline vessels obtain permits and fish in the same patterns as 1973-77 levels. However, all longlining occurs without allocations, so non-retention applies everywhere for all billfish and other non-tuna species.

Effects:

(a) Domestic fisheries - There would be moderate potential for transfers of billfish to and increased values for domestic fisheries. Up to 125 MT, 37 MT and 16 MT of billfish would be subject to catch by domestic rather than foreign vessels around Hawaii, American Samoa, and Guam, respectively. There would likely be some survival and ultimate domestic catch of released mahimahi, wahoo, and sharks from foreign longliners. The increased fishery values would be large compared to option 2, but less than the proposed FMP.

(b) Foreign longline fisheries - The average catch of tuna (5403 MT) would be maintained. All billfish (779 MT) and other non-tuna species (unknown catch level) would be released with high costs of lost gear, line, and time. Foreign effort would be 5452 vessel days. Foreign permit fees would be about $35,000. No fees based on catch would be collected. Observer coverage (10% level) would cost about $54,500 plus embarkment and disembarkment cost (i.e., transit time or lost fishing time or transportation costs).

(c) Enforcement requirements - U.S. Coast Guard and NMFS would be unable to actively enforce the PMP regulations under these conditions with current resources. At-sea vessel patrols, observer coverage, and hold inspections would be needed. Hiring and training observers would be costly.

(d) Billfish "waste" - Approximately 482 MT of billfish and unknown amounts of other non-tuna species would be wasted.

(e) Flow of data - Detailed data on foreign longlining would be collected on a timely basis.

(f) Potential for gear conflicts - The risk of gear conflicts would be relatively high, since foreign longlining would occur throughout the FCZ, including waters close to shore.

Option 4: Assume the PMP remains in place without change and that 700 foreign longline vessels fish with permits under the PMP. Fishing patterns and catch rates are assumed to be identical to 1973-77 averages.

Effects:

(a) Domestic Fisheries - The maximum possible shift of billfish catches and of increased values to domestic fisheries would be quite small. Relatively small numbers of billfish would be released by longliners, and survival rates are low. There would be slight increases possible in blue marlin catch (up to 14 MT in Hawaii, 12 MT in Guam, and 11 MT in American Samoa), and lesser increases likely for other billfish species, including a slight increase (up to 13 MT) possible for swordfish around Hawaii and possible increases of 8 MT for striped marlin and 3 MT of black marlin to American Samoa vessels. The likelihood of substantial increases in domestic fishing values is low relative to current conditions or the FMP.

(b) Foreign longline fisheries - Large catches of billfish (total TALFF is 618 MT) tuna (5403 MT), and other species (total TALFF is 1779 MT) would be made and retained. Releases of billfish would total about 161 MT, with consequent losses (unquantifiable) of hooks, line, bait, and time. Foreign effort would be 5452 vessel days (1973-77 average). Foreign fees would be $35,000 for permits plus approximately $85,000 in fees based on catch (618 MT x $2,000/ton ex-vessel x .07=$86,520), not including fees on incidental wahoo, mahimahi, and shark catches and not including observer costs.

(c) Enforcement requirements - U.S. coast Guard and NMFS would be unable to actively enforce the PMP under these conditions with current resources. At-sea vessel patrols, observers, and inspections would be required. Ten percent observer coverage alone would cost about $54,500 (5452 vessel days x .10 coverage x $100/day observer cost), not including the time and cost of hiring and training oservers.

(d) Billfish "waste" - About 161 MT of billfish would be released at sea, most of which would be blue marlin with a 70.9% mortality rate. Thus, approximately 113 MT of billfish would be wasted. Unknown amounts of mahimahi, wahoo, sharks, and other species would also be wasted.

(e) Flows of data - Detailed data on foreign catch and effort in the FCZ would be collected on a relatively timely basis.

(f) Potential for gear conflicts - The chances for gear conflicts would be relatively high, since foreign longlining would occur throughout the FCZ, icluding in non-retention zones close to shore.

Option 3: Assume the PMP is kept in place without change and that 700 foreign longline vessels continue to obtain permits but do not use them to fish in the FCZ.

Effects:

(a) Domestic fisheries - Domestic fisheries achieve the maximum possible benefit from de facto closures of the FCZ. An additional 779 MT of billfish and 5403 MT of tuna, on average, are subject to harvest by U.S. fisheries in the FCZ (Table 5.20) each year, including 226 MT of billfish and 1489 MT of tuna around U.S. Possessions. The increased value of domestic fisheries cannot be quantified but would be enormous.

(b) Foreign fisheries - Foreign longline billfish catch in the FCZ would be zero (0) MT. Foreign longline tuna catch in the FCZ would be zero (0) MT. Average 1973-77 catches were 779 MT and 5403 MT of billfish and tuna respectively. Foreign fleets would pay approximately $35,000 (700 permits times $50 per permit) for permits.

(c) Enforcement requirements - U.S. Coast Guard and NMFS would be required to monitor the entire FCZ occasionally to check for illegal entry and fishing by foreign longliners. This is being done now, so there would be no added cost under this condition.

(d) Billfish "waste" - There would be zero (0) waste. All billfish caught by domestic vessels are retained and used.

(e) Flow of data - Detailed data on foreign longline fishing in the FCZ are not collected. Aggregate data of fishing elsewhere may be provided through routine communications between scientific organizations.

(f) Potential for gear conflicts - There is no potential for conflicts.

Option 2: Assume the FMP goes into effect with closures limited to the non-retention zones of the PMP; that 700 foreign longline vessels obtain permits and file effort plans; and that total average 1973-77 effort is applied in the open areas with no limits on total catch.

Effects:

(a) Domestic fisheries - There would be virtually no likelihood of increases in domestic catches and fishery values. Interception of blue and striped marlin headed for areas of domestic fishing pressure around the main islands of Hawaii would continue. There would be no increase in marlin availability around the main islands, Guam, or American Samoa; and the availability of billfish around the NWHI would decrease to domestic vessels.

(b) Foreign longline fisheries - Longliners' tuna catches (5436 MT) and billfish catches (803MT) would increase over 1973-77 levels due to minor changes in catch rates by distance from shore around the Hawaiian Islands. All catch would be kept; there would be no losses of hooks, lines, or time in releasing billfish. Other non-tuna species also would be retained without limits. Total effort would remain at 5452 vessel days. Foreign fees would be $35,000 for permits, plus the cost of a limited, mutually-agreed-to observer program.

(c) Enforcement requirements - Current resources should be sufficient to enforce this option. Aerial patrols and the limited observer program, with resource deployment based on effort plans, would generally provide adequate coverage for effective enforcement. At-sea vessel patrols and vessel inspections should not be needed.

(d) Billfish "waste" - There would be zero (0) waste.

(e) Flow of data - Foreign longline data would be collected on a timely basis.

(f) Potential for gear conflicts - The risk of gear conflicts would initially be low, but would increase if the domestic fisheries grow as expected.

Option 1: Assume the FMP goes into effect with closures proposed; that 700 foreign longline vessels obtain permits and file effort plans; and that total average 1973-77 effort levels are applied with relocation of effort to open areas. That is, effort historically applied in closed areas around Hawaii and American Samoa shifts to open areas around Hawaii and American Samoa, respectively; and effort historically applied around Guam shifts to open areas with catch rates equal to those in waters around the CNMI; and no limits on total catch.

Effects:

(a) Domestic fisheries - The potential for transfers of billfish to, and increases in the values of the domestic fishery is almost maximized. Interceptions of blue marlin in the FCZ headed for main Hawaiian Island fisheries are precluded. Interception of any blue marlin or other billfish in the Guam FCZ or in the American Samoa closure is precluded. Domestic access to striped marlin travelling along the NWHI chain and into main Hawaiian Island FCZ waters is reasonably protected. Some transfers of other billfish, other non-tuna species, and tuna are likely but cannot be quantified.

(b) Foreign longline fisheries - Longline vessels would have slightly lower catches of tuna (5302 MT) and larger catches of billfish (845 MT) overall than 1973-77 averages because of changes in catch per unit effort rates in closed and open areas. The foreign tuna and billfish catches around Hawaii would be higher than in 1973-77; tuna catches from Guam could not wholly be made up by fishing in waters with CNMI - equivalent catch rates, but billfish catches not made around Guam would be more than made up with this shift; and tuna and billfish catches around American Samoa's closure would not change materially. All catch would be retained, so there would be no loss of hooks, line, or time. Total foreign effort would remain at 5452 vessel days. Foreign fees would be $35,000 for permits, plus the cost of a limited, mutally-agreed-to observer program.

(c) Enforcement requirements - Aerial patrols and a limited observer program with deployment based on effort plans should be sufficient to monitor foreign activity in the FCZ. At-sea vessel patrols and vessel inspections should not be necessary. Current resources should be able to enforce the FMP.

(d) Billfish "waste" - There would be zero (0) waste.

(e) Flow of data - Foreign longline data would be collected on a timely basis.

(f) Potential for gear conflicts - The risk of gear conflicts is very low, even after the expected expansion of domestic fisheries.

APPENDIX T

COMPARISON OF CATCH AND EFFORT UNDER ALTERNATIVE STRATEGIES

This appendix is included to provide a comparison, in qualitative and quantitative terms, of the effects of alternative management measures and strategies, using different assumptions about domestic fishery catches and possible foreign longline fleet responses and subsequent catch rates. The general assumptions and data sources are as follows:

1. Detailed catch and effort data, by species of billfish and tuna, by distance from shore, were readily available for foreign longlining around Hawaii. It is assumed that if foreign effort shifts from one area to another around Hawaii, the 1973-77 average catch rate by species in the new area of fishing effort will be maintained.

2. Detailed catch and effort data, by species of billfish and tuna, by distance from shore, were not readily available for foreign longlining around American Samoa, Guam, the CNMI, or U.S. Possessions. It is assumed that if foreign longlining shifts from one area of the FCZ to another, the 1973-77 average catch rate for the whole FCZ will be maintained in the new fishing area (see Table 5.20).

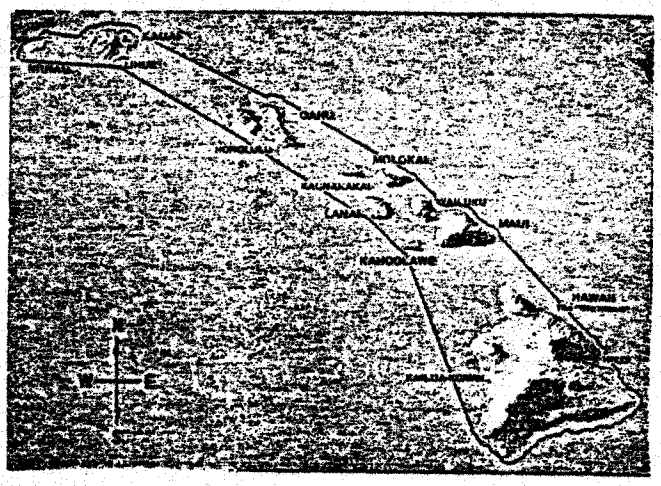
3. Detailed catch and effort rates for domestic fisheries are not available for any area.

4. In the Hawaii FCZ, blue marlin are assumed to travel on a south-north axis, while striped marlin are assumed to travel on a southeast-northwest axis. Migratory routes in other FCZ areas are unknown, and no assumptions are made.

5. In situations where foreign longlining is assumed to occur under allocations, the PMP allocations by species were applied (Table 6.2).

6. Where catches in excess of allocations and/or under non-retention rules in a management option would result in longliners' release of billfish, the mortality rates associated with Honolulu Laboratory fishing were applied to estimate "waste" (Table 7.1).

APPENDIX S



Facsimile map of State of Hawaii boundaries.

SOURCE: Pacific Business News, Feb. 21, 1977
Vol. 14, No. 48

APPENDIX R: JURISDICTIONAL POSITION OF THE STATE OF HAWAII

EXCERPT FROM LETTER dated March 30, 1981 from Hideto Kono, Director, Department of Planning and Economic Development, State of Hawaii, to Wadsworth Y.H. Yee, Chairman, Western Pacific Fishery Management Council.

"Thank you for your letter of March 23, 1981 in regard to the 'Final Fishery Management Plan for the Spiny Lobster Fisheries of the Western Pacific Region.'

"In your letter you request a statement on 'the current position of the State of Hawaii pertaining to jurisdictional and managerial programs developed for the spiny lobster resources.' The jurisdictional position of the State is that the State has jurisdiction over the channels between Hawaii's islands. There are a number of legal theories which, when applied to the facts, support this jurisdiction. These theories include: (1) historic custom and use; (2) U.S. Supreme Court and federal statutory definitions of State boundaries and inland waters; and (3) international definitions of mid-ocean archipelagos and rules for darawing straight baselines. Whichever theory is applied, the result is that the State has jurisdiction over the interisland channels. This jurisdiction can be described as those ocean areas inside straight baselines drawn between the headlands of the islands, plus the first three miles seaward of those baselines, known as the territorial sea. This jurisdiction has most recently been exercised over the harvesting of coral and the operation of OTEC-1 in channel waters.

"The determination of jurisdiction is a critical issue when State and federal plans are in conflict. However, as the final FMP notes at page 73, 'the State of Hawaii and the Council are cooperating in developing complementary management and conservation measures for the entire region so this FMP can be effective.' This is the key concept. If State and federal management and conservation measures can be made consistent or complementary, the question of the jurisdiction of each government loses its practical importance."

APPENDIX Q

ANNEX I [1]

Highly migratory species

1. Albacore tuna: Thunnus alalunga.

2. Bluefin tuna: Thunnus thynnus.

3. Bigeye tuna: Thunnus obesus.

4. Skipjack tuna: Katsuwonus pelamis.

5. Yellowfin tuna: Thunnus albacares.

6. Blackfin tuna: Thunnus atlanticus.

7. Little tuna: Euthynnus alletteratus; Euthynnus affinis.

8. Frigate mackerel: Auxis thazard; Auxis rochei.

9. Pomfrets: Family Bramidae.

10. Marlins: Tetrapturus angustirostris; Tetrapturus belone; Tetrapturus pfluegeri; Tetrapturus albidus; Tetrapturus audax; Tetrapturus georgei; Makaira mazara; Makaira indica; Makaira nigricans.

11. Sail-fishes: Istiophorus platypterus; Istiophorus albicans.

12. Swordfish: Xiphias gladius.

13. Sauries: Scomberesox saurus; Cololabis saira; Cololabis adocetus; Scomberesox saurus scombroides.

14. Dolphin: Coryphaena hippurus; Coryphaena equiselis.

15. Oceanic sharks: Hexanchus griseus; Cetorhinus maximus; Family Alopiidae; Rhincodon typus; Family Carcharhinidae; Family Sphyrnidae; Family Isurida.

16. Cetaceans: Family Physeteridae; Family Balaenopteridae; Family Balaenidae; Family Eschrichtiidae; Family Monodontidae; Family Ziphiidae; Family Delphinidae.

17. Southern bluefin tuna: Thunnus maccoyii.

1/ SOURCE: Draft Convention on the Law of the Sea (Informal Text);
Reproduced by Office of Law of the Sea Negotiations,
Department of State, September 2, 1980

APPENDIX P. ESTIMATED AVERAGE WEIGHTS (KG) USED IN COMPUTING THE NUMBER OF FISH IN FOREIGN LONGLINE CATCHES IN THE FCZ AROUND THE HAWAIIAN ISLANDS (1973-77).

YEAR	ALBACORE	YELLOWFIN TUNA	BIGEYE TUNA	BLUEFIN TUNA	SKIPJACK TUNA	BLUE MARLIN	BLACK MARLIN	STRIPED MARLIN	SWORDFISH	SAILFISH AND SPEARFISH
1965	25	49	46	200	6	89	65	29	84	16
1966	24	50	54	200	6	115	65	25	84	16
1967	24	51	50	200	5	102	65	28	84	16
1968	26	52	45	200	5	92	65	30	84	15
1969	25	50	47	200	4	90	65	30	84	16
1970	25	48	44	200	4	83	65	28	84	16
1971	25	47	43	200	5	97	65	30	84	16
1972	26	48	45	200	7	89	65	32	84	17
1973	23	49	48	200	6	70	65	26	84	18
1974	24	49	39	200	5	66	65	28	84	16
1975	23	45	43	200	4	77	65	28	84	17
1976	26	50	46	200	5	89	65	30	84	16
1977	25	49	46	200	5	89	65	29	84	16
AVERAGE WEIGHT 1973-77 (KG)	24	48	44	200	5	78	65	28	84	16
(LB)	53	107	98	441	11	172	143	62	185	37

SOURCE: Data supplied by Hawaii Division of Fish and Game and United Fishing Agency.

AND WHEREAS, the Western Pacific Fishery Management Council is concerned that the American Samoan fishermen using certain local fishing areas (banks) in the FCZ may be interferred with by the vessels and gear of foreign-flag longliners fishing in these same areas;

NOW, THEREFORE, BE IT RESOLVED by the Western Pacific Fishery Management Council that the NMFS close to foreign flag fishing vessels and their gears the important fishing grounds adjacent to American Samoa between 14° and 15° S. Lat. and 168° and 171° W. Long.

WADSWORTH W. H. YEE
CHAIRMAN

October 16, 1979
Pago Pago, American Samoa

APPENDIX O

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

1164 BISHOP STREET - ROOM 1608
HONOLULU, HAWAII 96813
TELEPHONE (808) 523-1368

RESOLUTION OF PACIFIC BILLFISH PMP AND AMERICAN SAMOA

WHEREAS, the Western Pacific Fishery Management Council is concerned that the imminent implementation of the Pacific Billfish PMP may adversely affect the economy of American Samoa by its impacts on the foreign tuna longliners based in and landing fish in American Samoa; and

WHEREAS, the Western Pacific Fishery Management Council realizes that the NMFS has been making continuing efforts to adequately consider the unique situation of American Samoa; and

WHEREAS, the Western Pacific Fishery Management Council considers additional measures to accommodate American Samoa's unique situation are still necessary and possible;

NOW, THEREFORE, the Western Pacific Fishery Management Council resolves that the NMFS should make the following changes to the regulations of the PMP to avoid jeopardizing the continued operations of the American Samoan-based foreign longline tuna fleets;

A. Not impose radio reporting requirements for those vessels not presently equipped with radio communication equipment;

B. Eliminate the poundage fee for allocated species which are landed in American Samoa (and thus benefit the local economy);

C. Eliminate or significantly reduce the permit fee because the vessels' activities benefit the American Samoa economy and thus in some ways provide economic benefits to American Samoa equivalent to a domestic (U. S. flag) fleet; and

D. Make whatever other reasonable accommodations are required to insure the continued viability of this fleet; including allocating the entire TALFF for billfish, mahimahi and wahoo for this portion of the FCZ to these vessels and their respective countries (Taiwan and South Korea) based upon their importance to American Samoa and their traditional fishery in this area.

DEPARTMENT OF LAND AND
NATURAL RESOURCES

DIVISION OF FISH AND GAME
STATE OF HAWAII

FISH CATCH REPORT

APPENDIX N

Name of Licensee ..... 2. Commercial Fishing License No. .... 7 [ ] - [ ][ ][ ]

Name of Boat ..... 4. HA No. [H][A] - [ ][ ][ ][ ] - [ ][ ] 5. Federal No. [ ][ ][ ][ ][ ][ ]

Month Fished ..... 7. Year Fished—19 [ ][ ]

Day Fished	9. Area Fished	10. Type of Fishing Gear Used	11. Species Caught	12. No. Caught	13. Lbs. Caught	14. Lbs. Sold	15. Value of Lbs. Sold	16. Port of Landing

See Instructions on Inside of Cover

The above report is true, correct, and complete to the best of knowledge and belief.

3 (Rev. 4-76)

17. Signature .....
Licensee or Authorized Agent

SEND THIS IN

APPENDIX M

DEPARTMENT OF LAND AND NATURAL RESOURCES

- 86 -

FLAGLINE CATCH REPORT

STATE OF HAWAII

Name of Permittee..... Fisherman's License No. ..... Month ..... 19.....

Name of Boat..... F.G. No..... No. of Baskets Used.....

Day of Landing	No. of Days at Sea	Area of Catch	Port of Landing	AHI (Yellowfin) 043			BIG EYE (Bigeye) 006			AHIPALAMA (Albacore Tombo) 004			STRIPED MARLIN 009			BLACK MARLIN 010			SHORT-NOSE MARLIN 007		
				No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value

Day of Landing	No. of Days at Sea	Area of Catch	Port of Landing	SILVER MARLIN 100			BROADBILL SWORDFISH 011			AU LEPE (Sailfish) 012			MAHIMAHI 013			ONO 014			OTHER (Give Name)*		
				No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	No. Caught	Lbs. Caught	Value	Species Caught	Lbs. Caught	Value

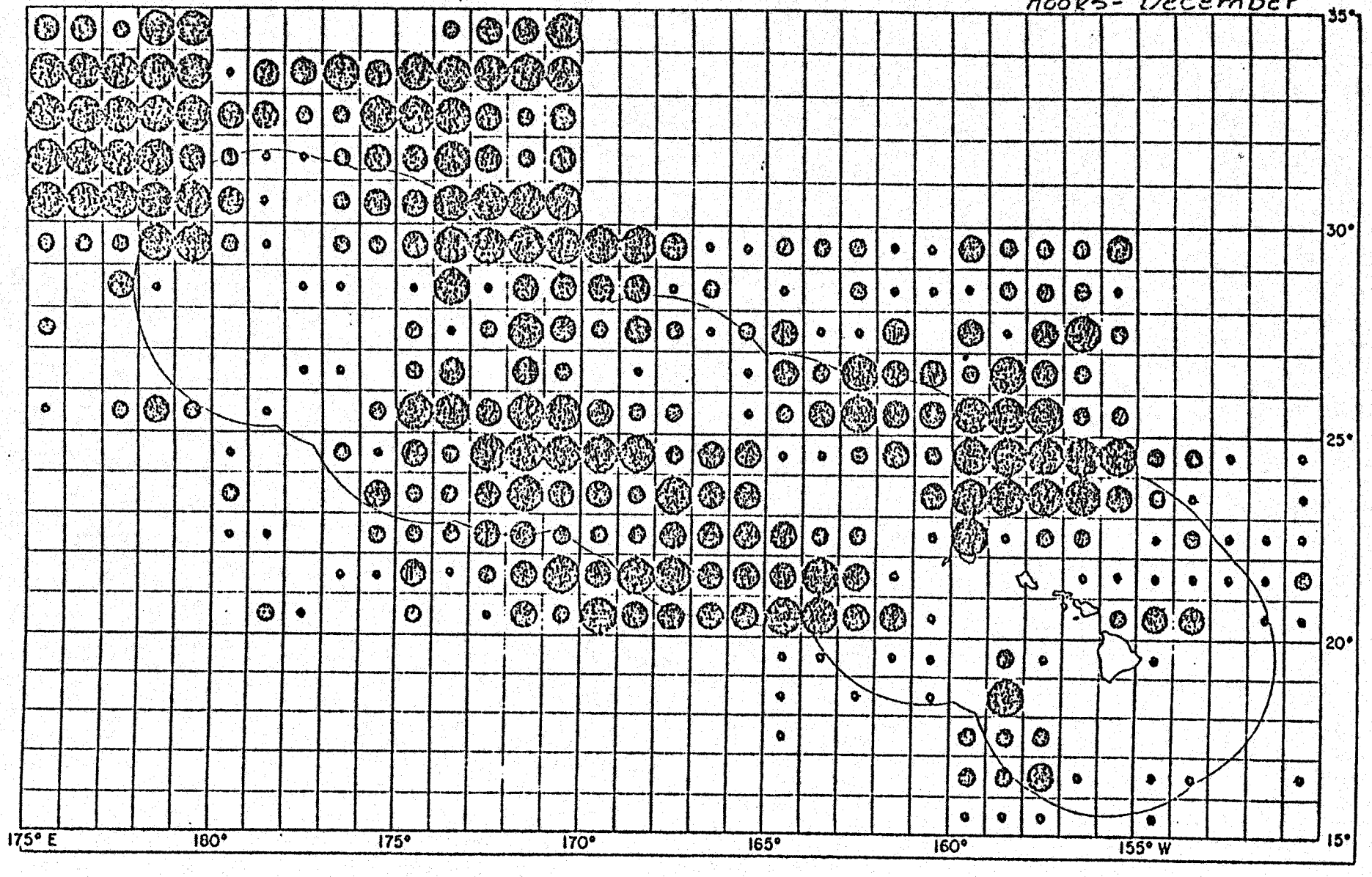
BAIT REPORT

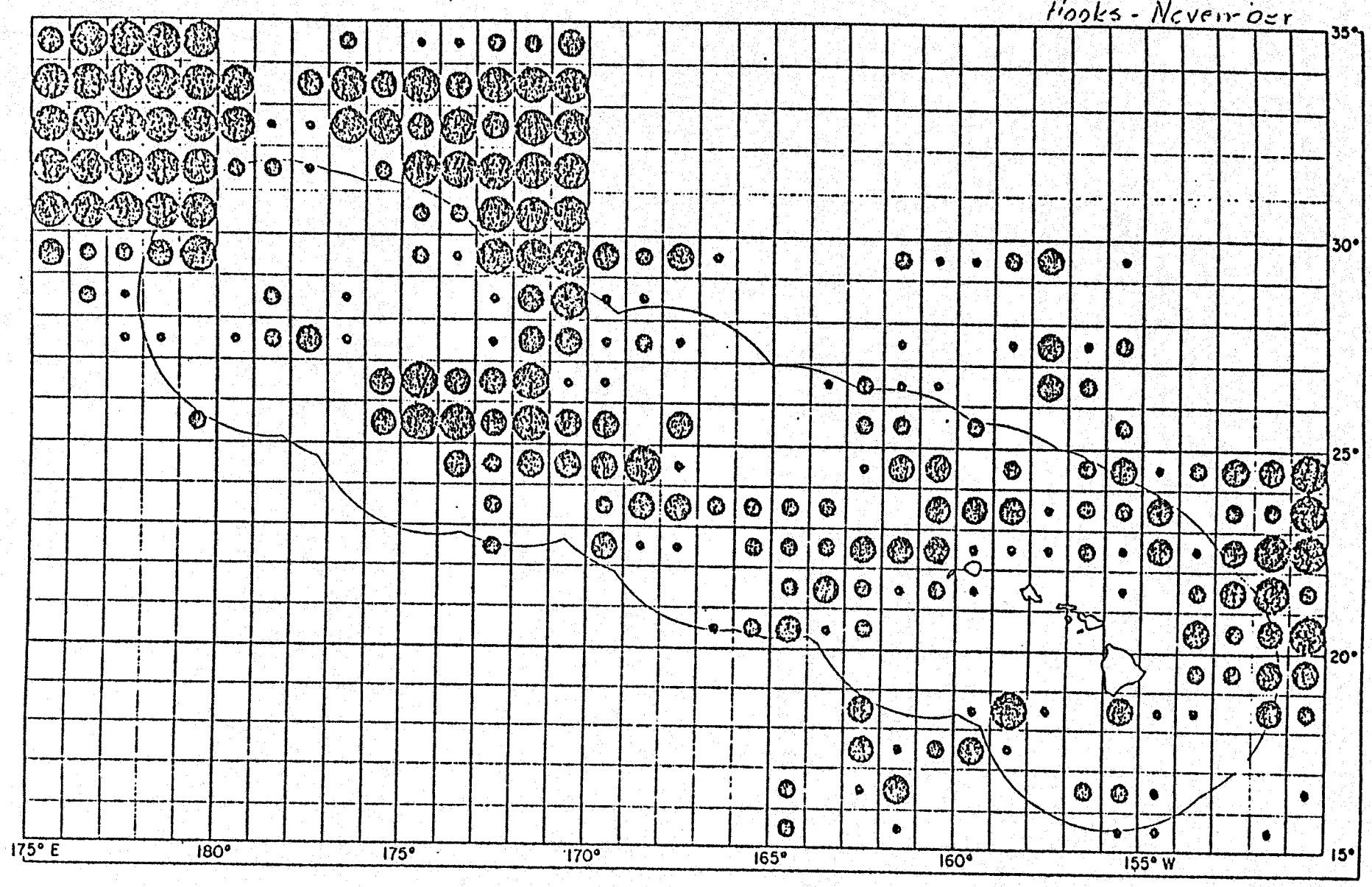
LOCAL BAIT							IMPORTED BAIT									
OPELU**			OTHERS				MACKEREL (Saba) 06		SMELT 07		SARDINE 04		HERRING 05		OTHER 02	
Date Caught	Pounds Caught	Locality Caught	Species Caught	Date	Lbs. Caught		Date	Lbs. Caught	Date	Lbs. Caught	Date	Lbs. Caught	Date	Lbs. Caught	Date	Lbs. Caught

The reports contained hereon are true, correct, and complete to the best of my knowledge and belief.

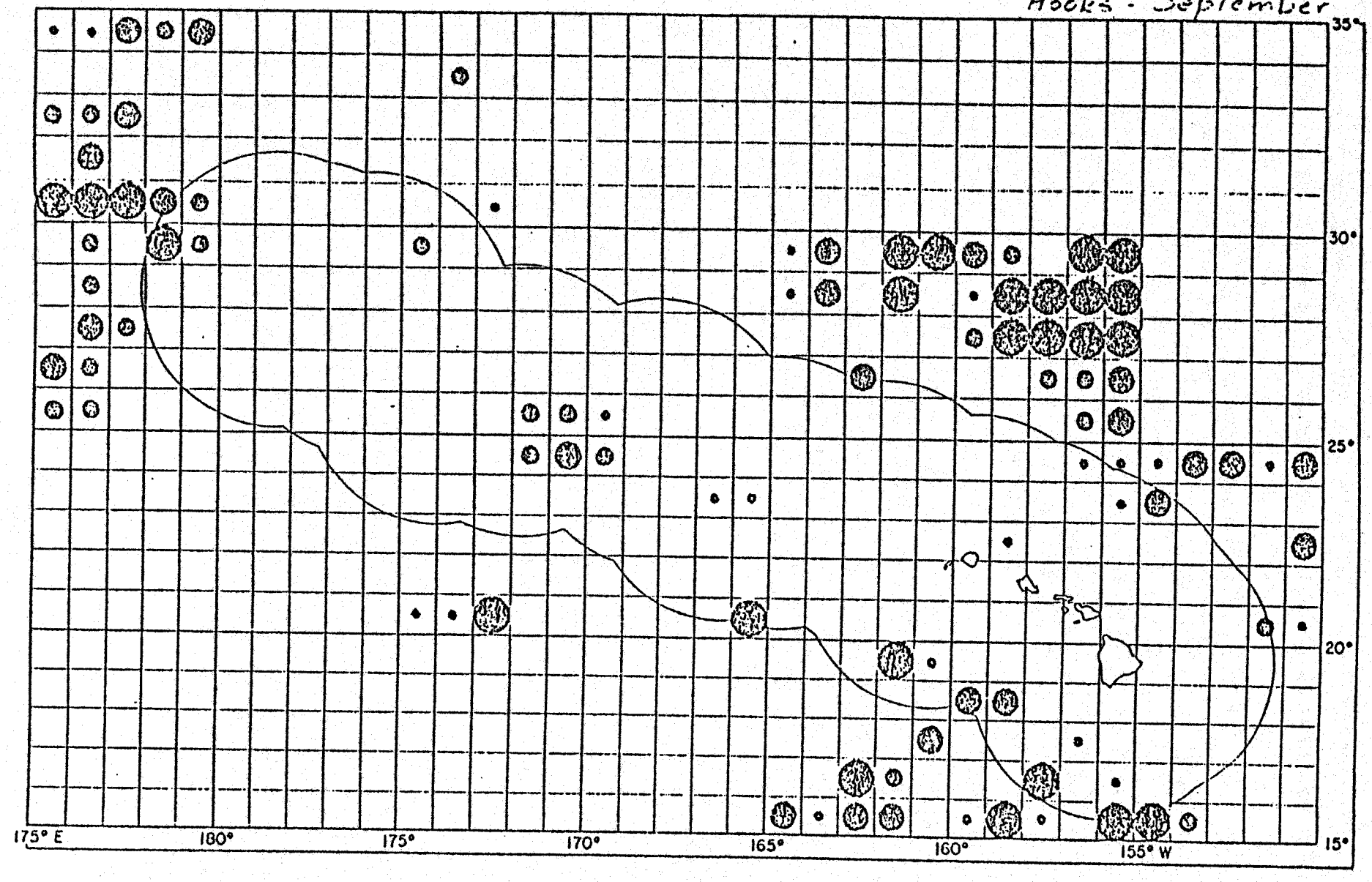
Signature .....
Permittee or Authorized Agent

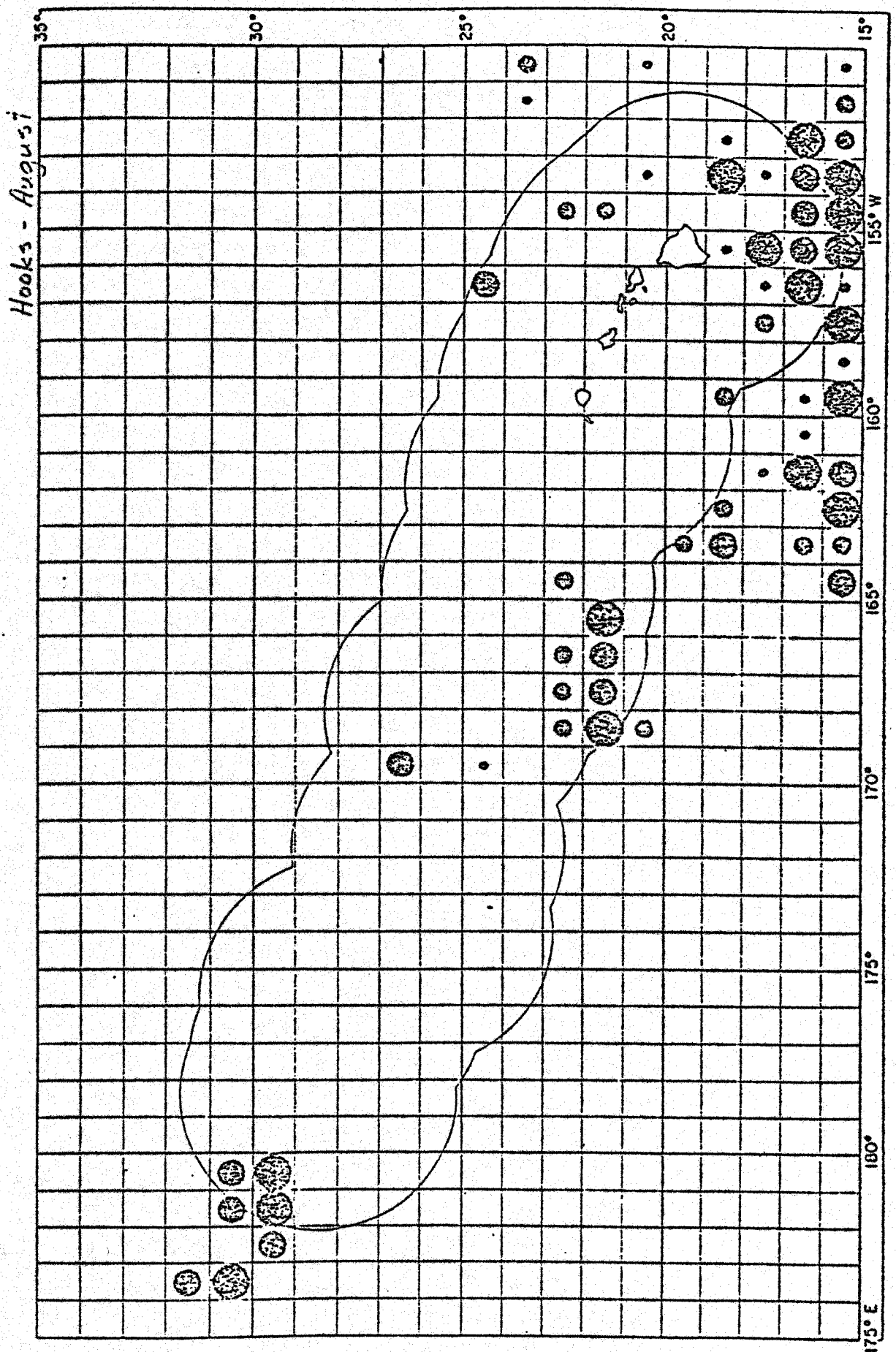
* If general species are taken on a trip, which was listed


Hooks- December
35°
30°
25°
20°
15°
175° E
180°
175°
170°
165°
160°
155° W

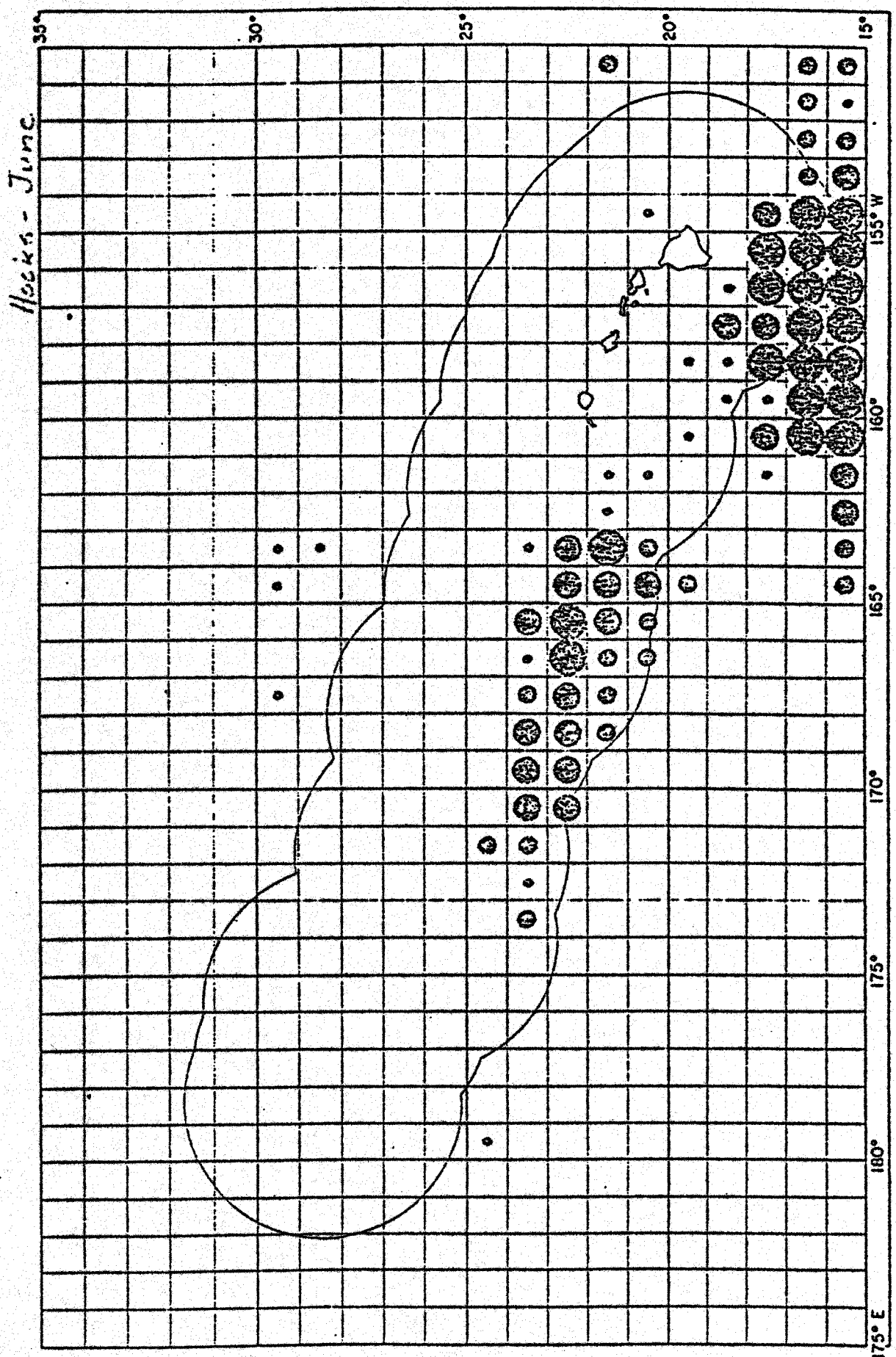

Hooks - November
35°
30°
25°
20°
15°
175° E
180°
175°
170°
165°
160°
155° W

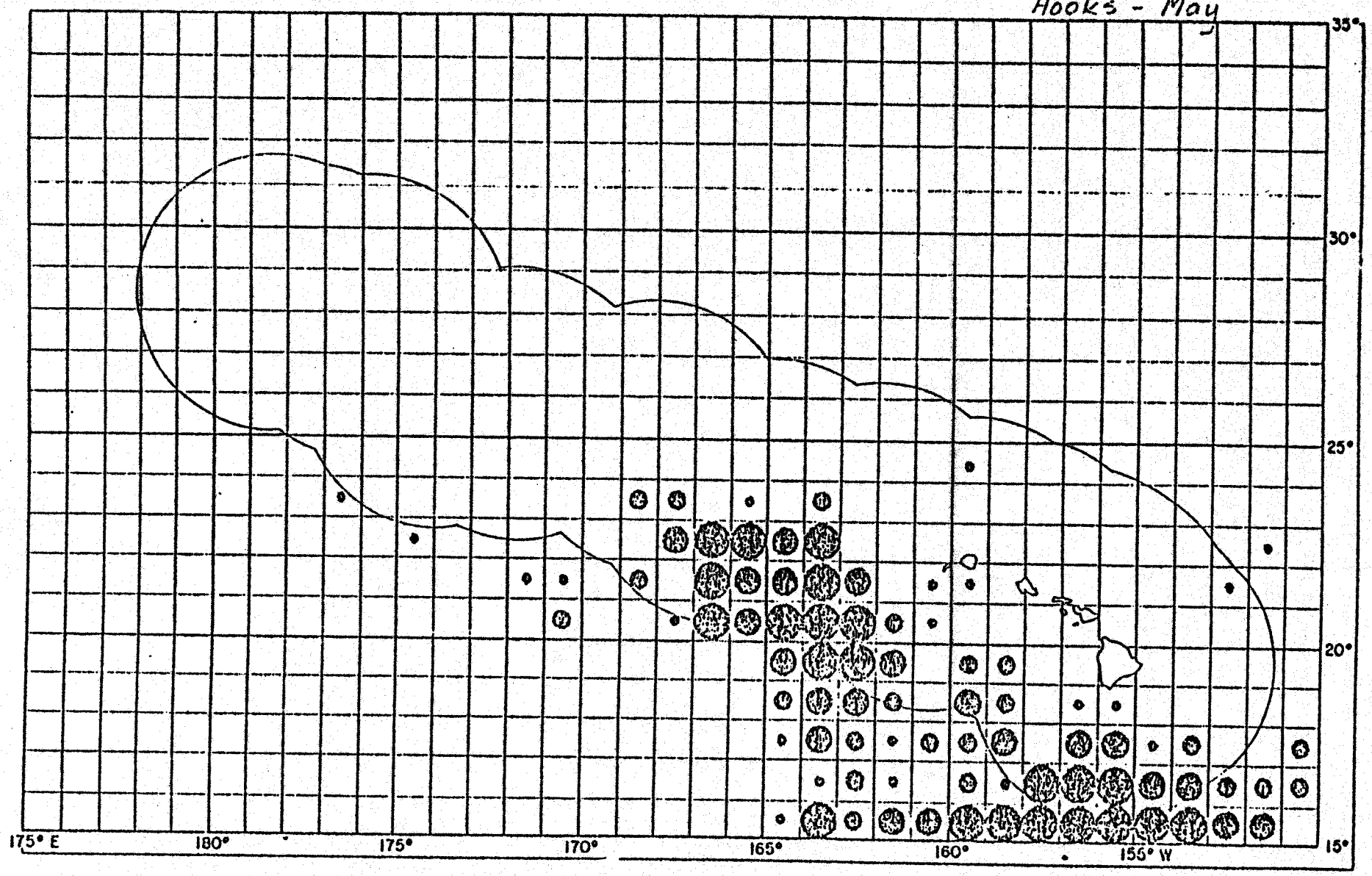
Hooks - October


Hooks - September
35°
30°
25°
20°
15°
175° E
180°
175°
170°
165°
160°
155° W

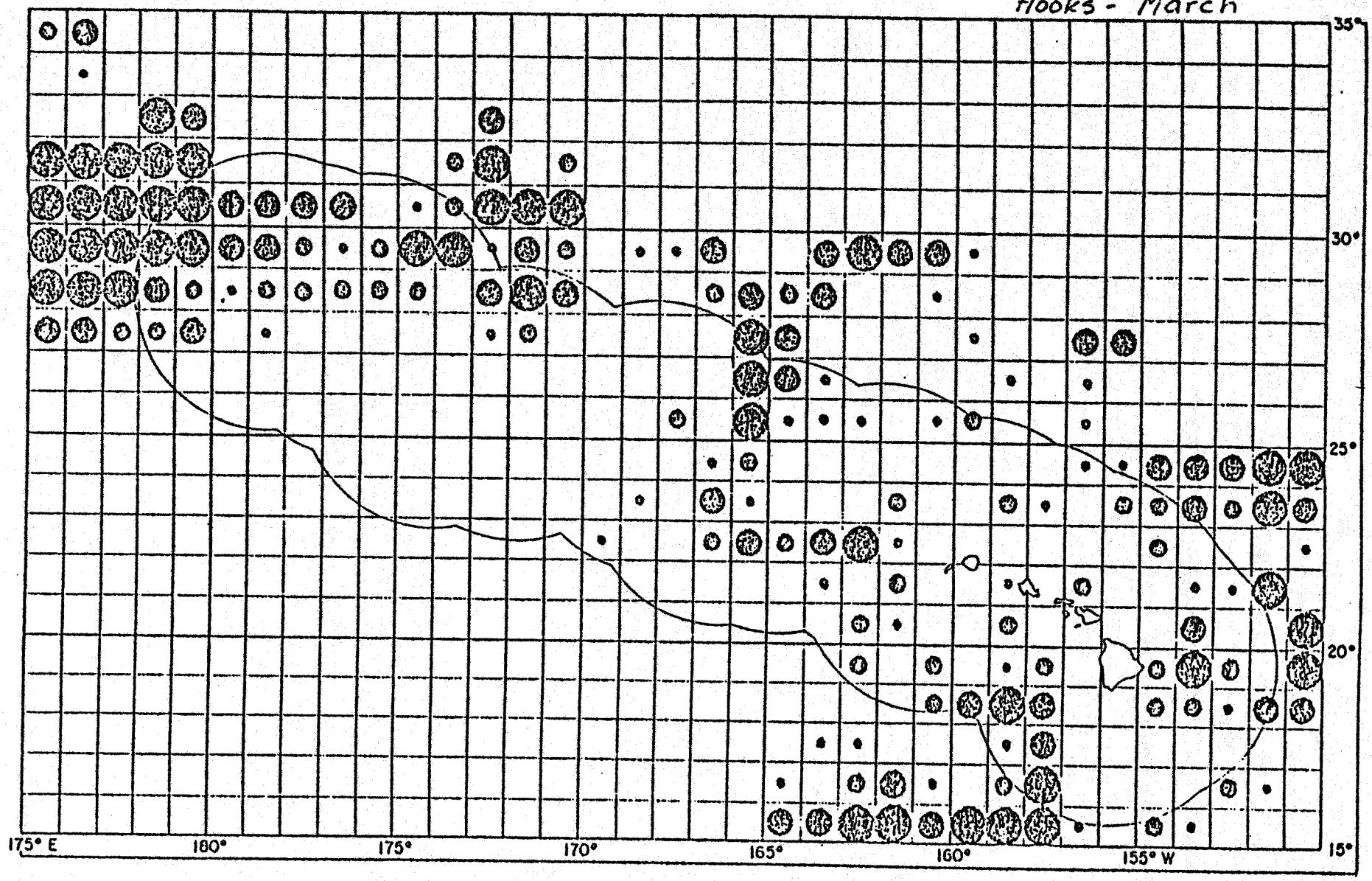

Hooks - August
35°
30°
25°
20°
15°
155° W
160°
165°
170°
175°
180°
175° E

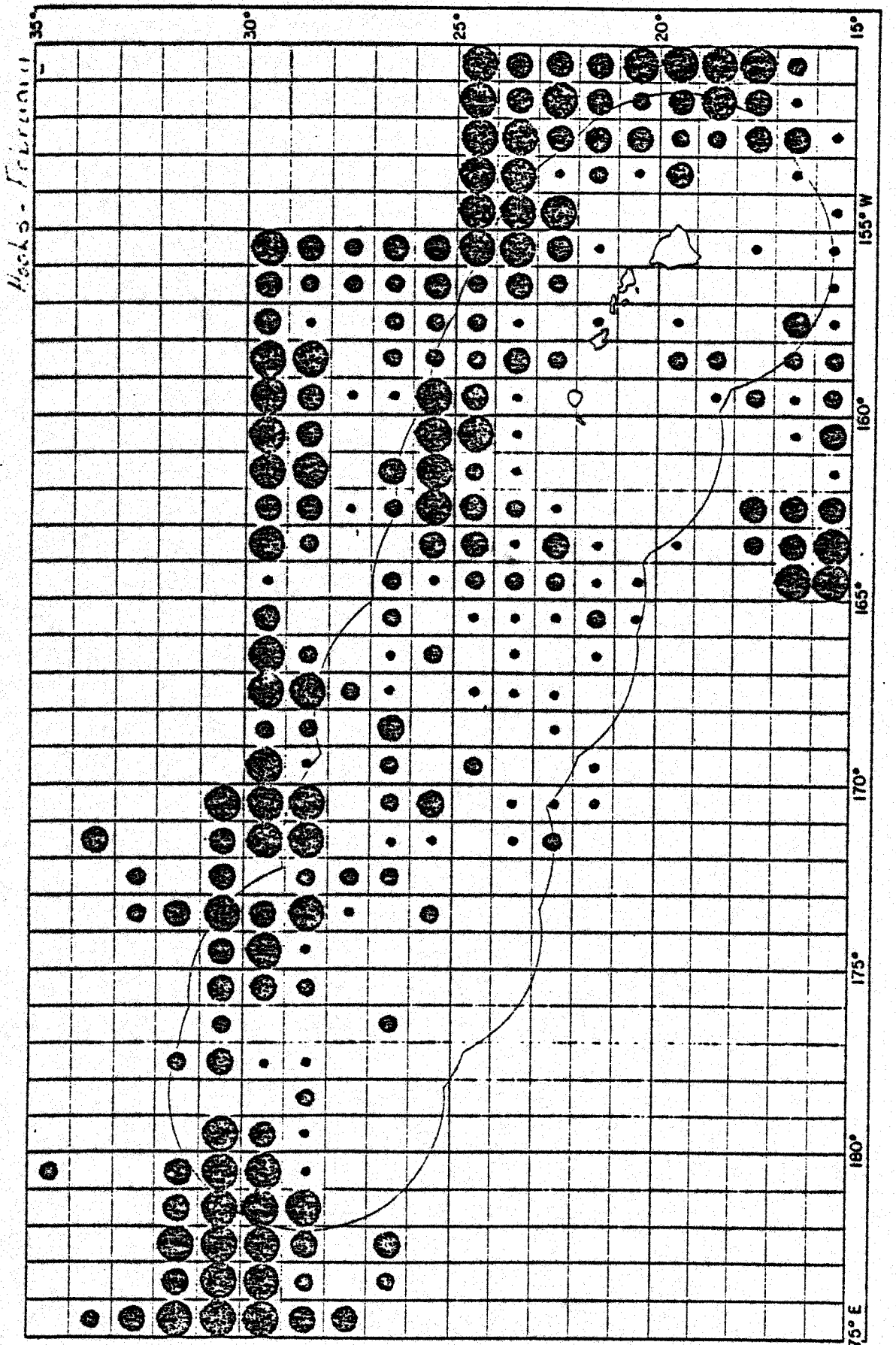
Hooks - July


Hooks - June
35°
30°
25°
20°
15°
155° W
160°
165°
170°
175°
180°
175° E


Hooks - May
35°
30°
25°
20°
15°
175° E
180°
175°
170°
165°
160°
155° W

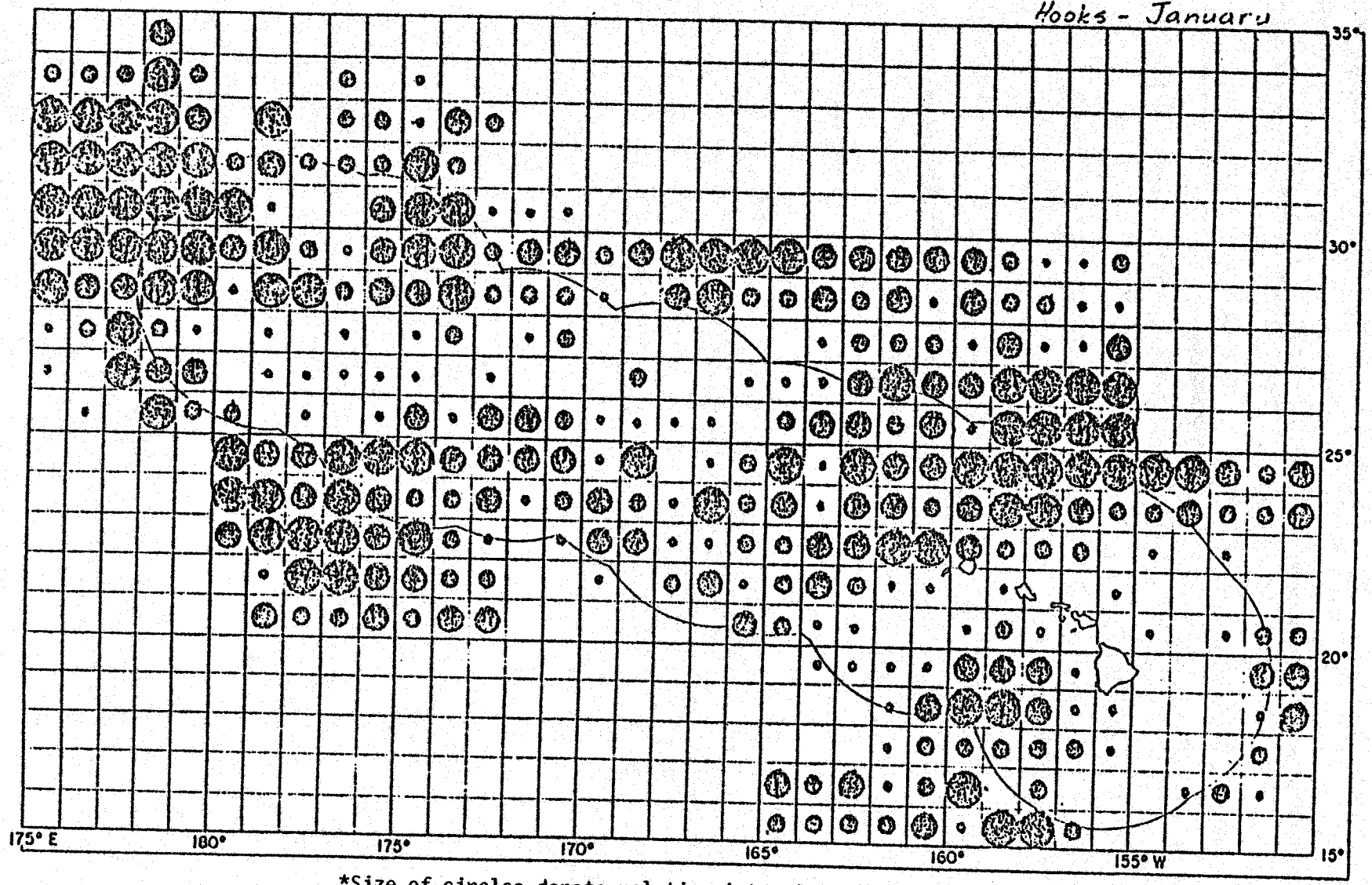
Hooks - April


Hooks - March
35°
30°
25°
20°
15°
175° E
180°
175°
170°
165°
160°
155° W


35°
30°
25°
20°
15°
155° W
160°
165°
170°
175°
180°
175° E

APPENDIX L

Monthly Foreign Longline Fishing Pattern In And Adjacent To The US FCZ Of Hawaii, 1971-75*



*Size of circles denote relative intensity of fishing effort

SOURCE: NMFS, Honolulu Laboratory

APPENDIX K

Table 4. Estimated monthly domestic blue marlin catch (kilograms) on Guam.

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1977	--------- no data ----------						0	0	0	0	0	0
1978	0	0	0	819	148	452	427	832	1100	546	0	0
1979	0	212	0	0	492	257	3841	643	0	----- no data ------		
TOTAL	0	212	0	819	640	709	4268	1475	1100	546	0	0
n	2	2	2	2	2	2	3	3	3	2	2	2
$\bar{x}$	0	106	0	410	320	355	1423	492	367	273	0	0
%	0	2.8	0	10.9	8.5	9.5	38.0	13.1	9.8	7.3	0	0
						80%						

Source: Data from Guam Department of Agriculture, Division of Aquatic and Wildlife Resource.

APPENDIX J

Monthly catch of species taken by Japanese longliners within 10-20°N and 140-150°E around Guam as a percent of the annual catch of that species (1971-1975 data).

MONTH	Albacore	Bigeye	Yellowfin	Swordfish	Striped Marlin	Black Marlin	Sailfish/ Spearfish	Blue Marlin
Jan	17.2	24.5	25.1	17.8	31.5	23.4	18.2	21.4
Feb	8.1	10.7	9.8	3.9	20.1	11.3	8.2	10.2
Mar	9.3	18.7	12.0	14.8	27.8	7.7	20.5	12.5
Apr	1.4	8.7	5.2	13.8	3.8	.8	7.1	7.0
May	.4	4.6	5.1	8.6	.1	2.8	3.6	5.7
Jun	.5	2.9	4.2	4.7	.5	6.5	7.5	4.9
July	.8	6.0	6.5	7.8	.1	6.0	1.5	7.1
Aug	.7	1.5	1.6	1.0	.1	4.8	.9	2.2
Sept	7.2	4.9	4.7	6.0	0	4.8	2.2	9.3
Oct	27.7	7.6	11.0	11.1	2.2	16.9	5.2	11.1
Nov	8.2	2.6	5.7	3.2	6.3	1.6	10.8	3.5
Dec	18.5	7.2	9.1	7.3	7.6	13.3	14.4	5.0
TOTAL	100.0	99.9	100.0	100.0	100.1	99.9	100.1	99.9

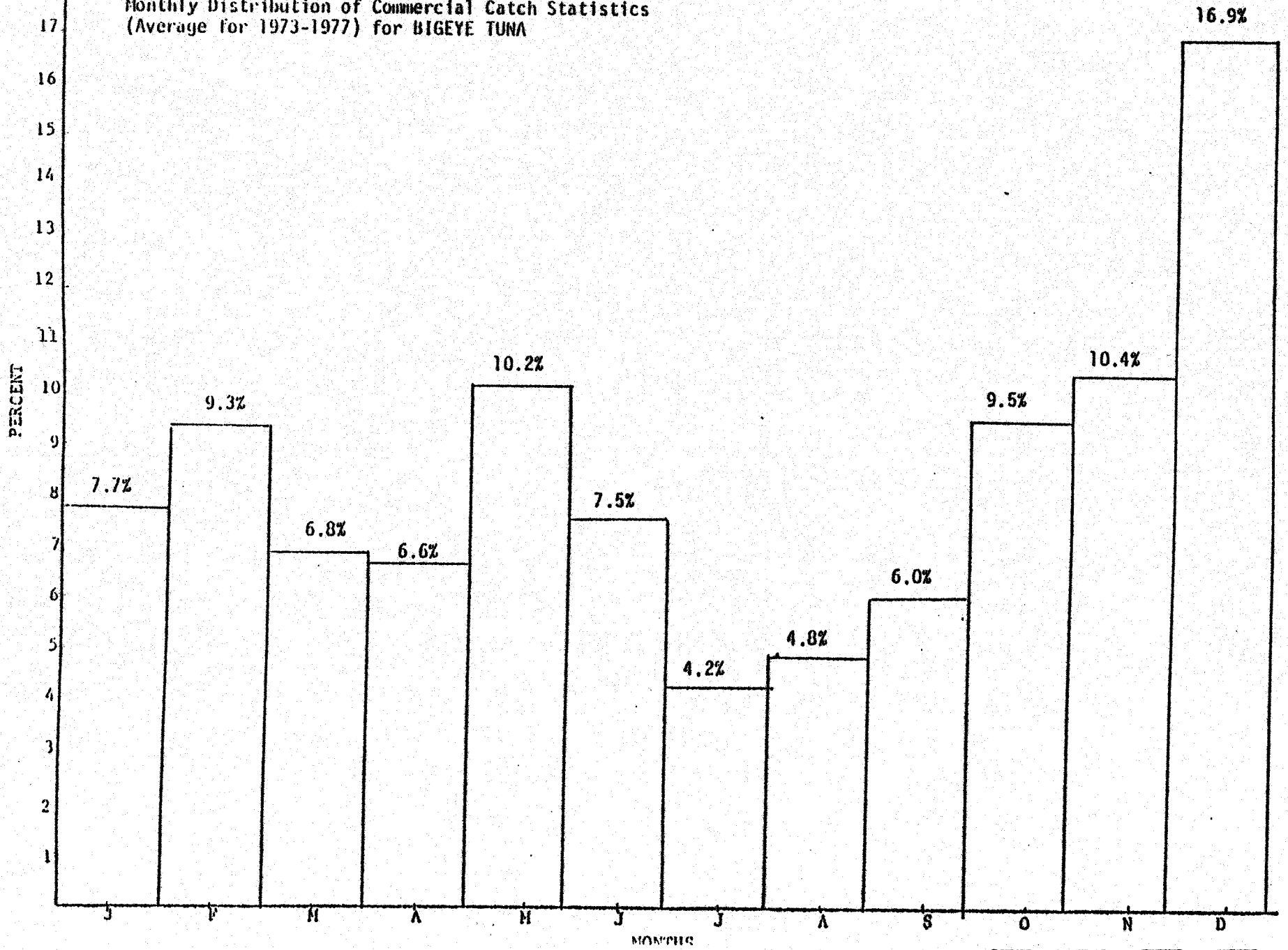
73% of Annual Blue Marlin Catch

Source: NMFS Honolulu Laboratory Data

HAWAII

APPENDIX I-4

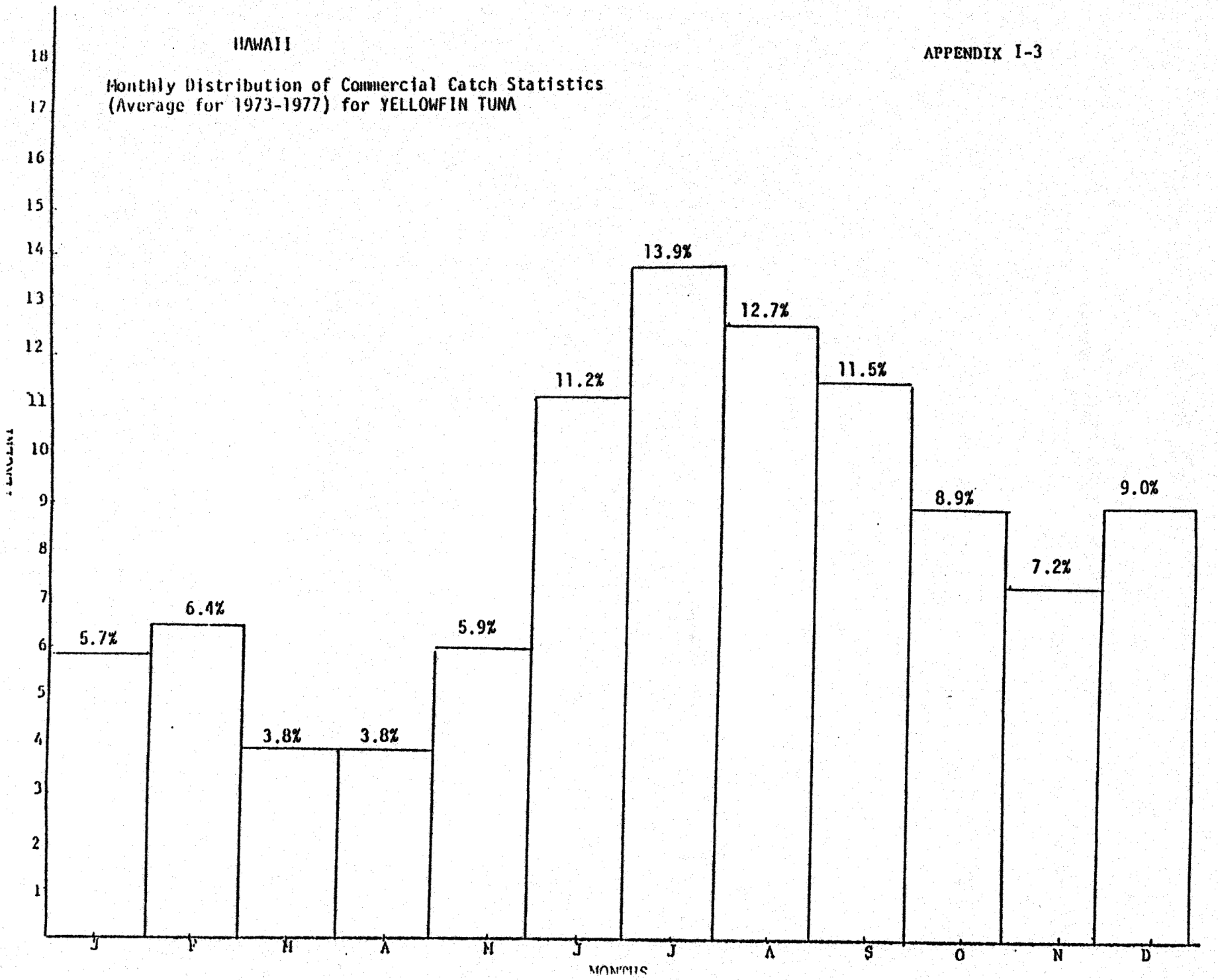
Monthly Distribution of Commercial Catch Statistics
(Average for 1973-1977) for BIGEYE TUNA



HAWAII

APPENDIX I-3

Monthly Distribution of Commercial Catch Statistics
(Average for 1973-1977) for YELLOWFIN TUNA

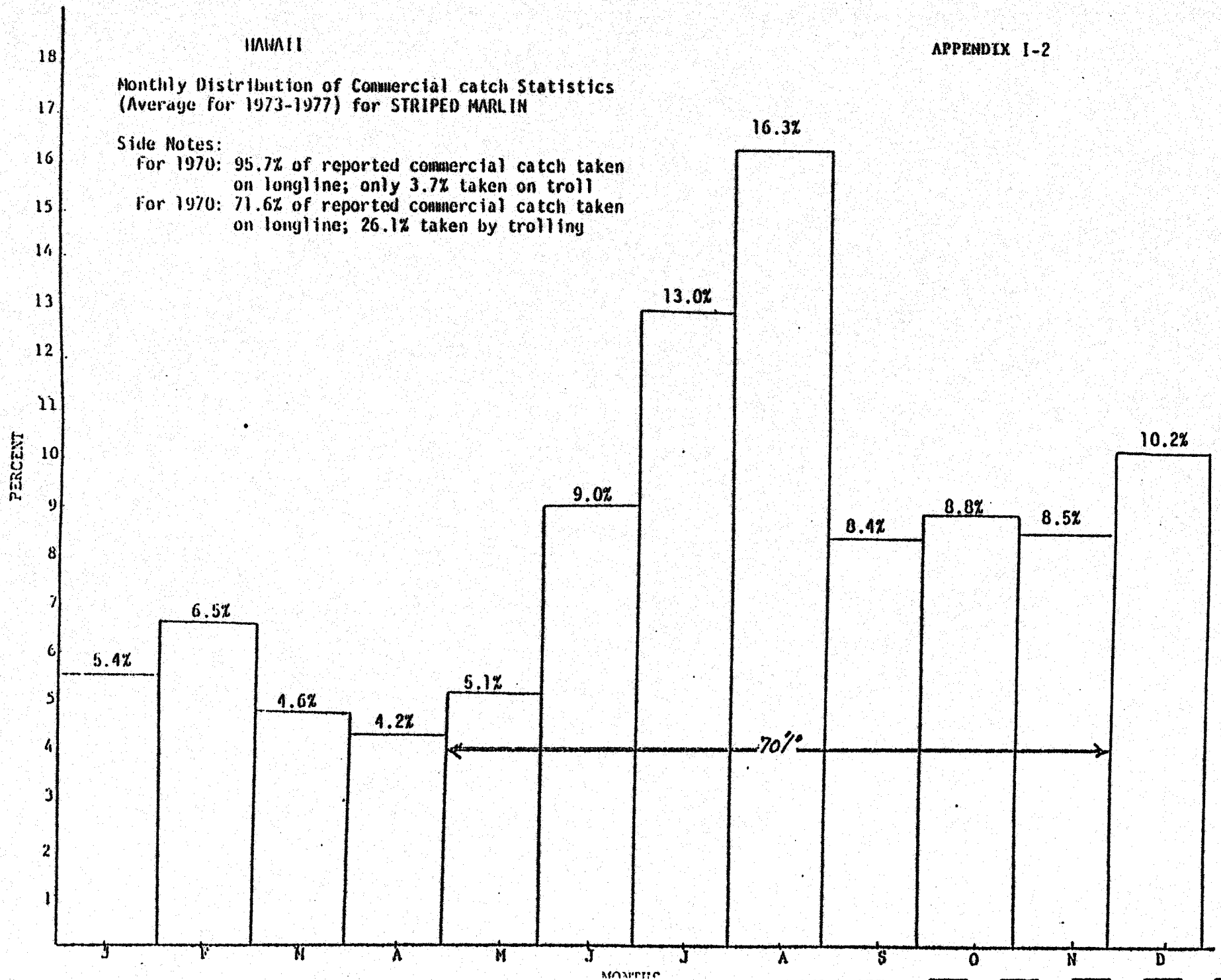


HAWAII

APPENDIX I-2

Monthly Distribution of Commercial catch Statistics
(Average for 1973-1977) for STRIPED MARLIN

Side Notes:
For 1970: 95.7% of reported commercial catch taken on longline; only 3.7% taken on troll
For 1970: 71.6% of reported commercial catch taken on longline; 26.1% taken by trolling

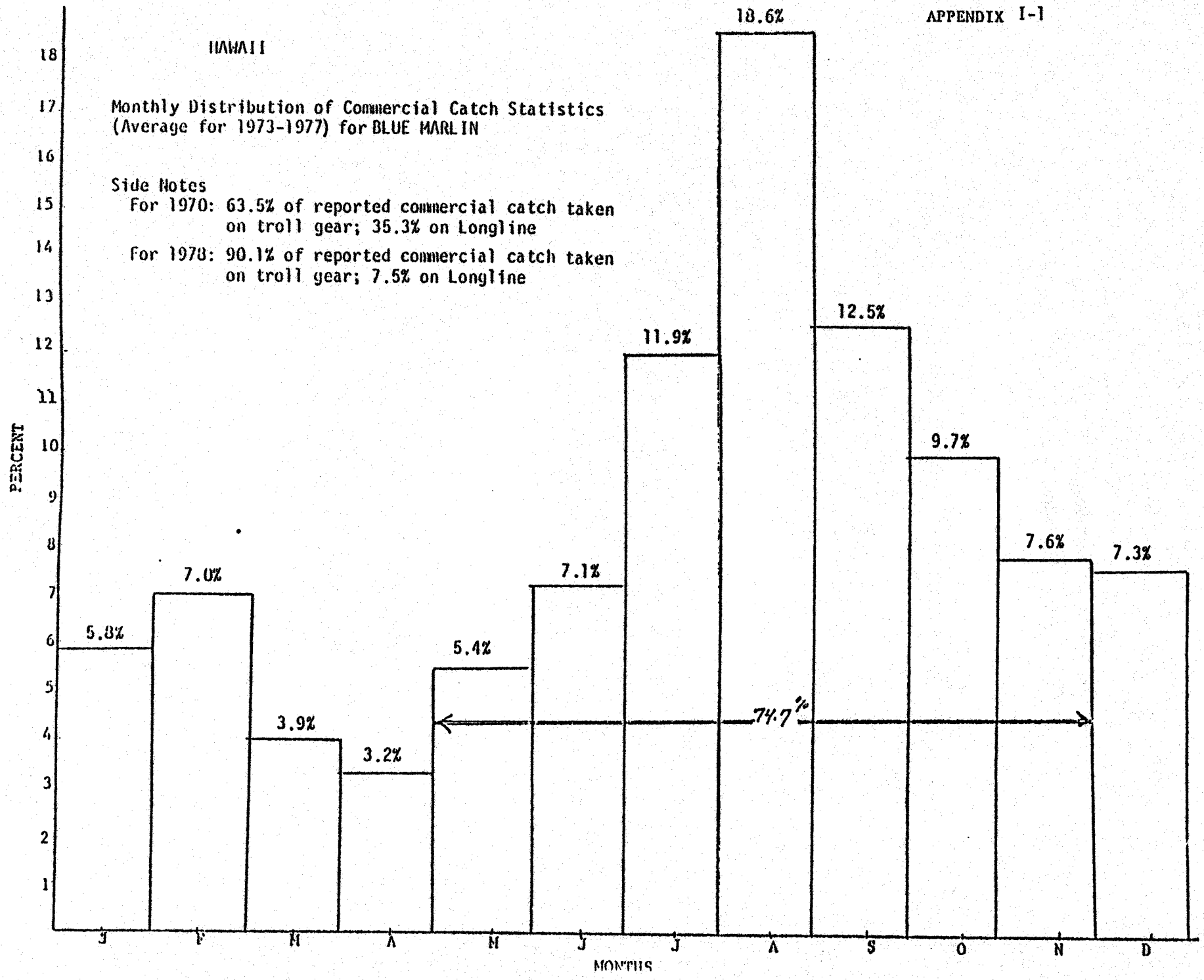


HAWAII

Monthly Distribution of Commercial Catch Statistics
(Average for 1973-1977) for BLUE MARLIN

Side Notes
For 1970: 63.5% of reported commercial catch taken on troll gear; 35.3% on Longline

For 1978: 90.1% of reported commercial catch taken on troll gear; 7.5% on Longline



- the expected effect of the measure,

- the factual basis for the expectation that the measure will achieve its intended purpose, and

- any alternative methods of achieving the same objective, explaining why the measure adopted is preferable to each alternative method.

Prepared by: James S.W. Drewry
Frances Liu

fishery resources and the marine environment are avoided; and
(iii) there will be a multiplicity of options available with respect to future uses of these resources [Section 3(2).]

While it may be difficult to demonstrate directly that any FCMA regulation of fishing by foreign longline vessels would have a measurable effect upon rebuilding, restoring, or maintaining the billfish stocks in the normal range of such stocks, other facts such as a measurable improvement in catch per unit of effort or availability of the stocks to U.S. recreational fishermen might be evidence of the required effect. In addition, it may also be possible to demonstrate that such regulation would produce social, economic, or ecological benefits, which may be considered when determining the optimum yield for the fishery. (See section 3(18).)

Sections 303(b)(2), (3), (4), and (6) of the FCMA provide authority for area closures and restrictions on seasons and fishing gear. None of these management measures is inherently unlawful for inclusion in a billfish management plan affecting foreign tuna longline vessels. However, any management measure must be carefully applied. The greater the effect of such measures on foreign longline vessels fishing for tuna, the greater the chance they will be found to be unlawful. For example, if evidence does not demonstrate reasonably that a particular area or season restriction affecting foreign longline tuna fishing would produce greater conservation and management benefits than would a lesser restriction, then the lesser restriction is the legally preferable one. Similarly, in each case where there is a choice among equally beneficial management measures, the measure which has the least adverse effect upon the conduct of foreign longline fishing for tuna is the legally preferable one.

To facilitate the careful case-by-case legal review of billfish-tuna issues, and to defend an FMP's management measures should judicial review occur, we believe that any management plan for billfish which may affect tuna fishing by foreign longline vessels should contain an evaluation of:

- the purpose of each management measure,

- the need for the measure,

Balancing of Tuna Exclusion and Billfish Conservation and Management

The ICJ opinion suggests the wisdom of a balancing test for assessing international legality where two international interests clash. Indeed balancing tests are customary in the U.S. domestic law wherever the enforcement of one legal interest seemingly conflicts with the enforcement of another, notably in cases involving constitutional rights. See, e.g., Landmark Communications v. Virginia, 98 S. Ct. 1535 (1978). In our view, given the importance of existing and potential international management regimes for tuna, a balancing test is particularly appropriate for reviewing the legality of billfish management plan measures which have the effect of regulating the incidental take of billfish by foreign longline tuna vessels. In the policies stated in sections 2(c)(1) and 2(c)(2), it appears that Congress intended that regulation which affects recognized legitimate uses of the high seas such as fishing for tuna may be undertaken only upon a showing of necessity for conservation and management of fishery resources over which the U.S. exercises exclusive fishery management authority.

In our opinion a billfish management plan may contain management measures which affect foreign longline tuna fishing in the FCZ, including area closures and season or gear restrictions. However, to be legal such measures must provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ, and must impose the least burden on foreign longline vessels fishing for tuna that will achieve conservation and management of the billfish covered by the plan.

The FCMA defines the term "conservation and management" as follows:

> The term "conservation and management" refers to all of the rules, regulations, conditions, methods, and other measures (A) which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment; and (B) which are designed to assure that -
>
> (i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;
> (ii) irreversible or long-term adverse effects on

Article 2. In pertinent part that Article reads as follows:

> The high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty. Freedom of the high seas...comprises, inter alia....
>
> (1) Freedom of navigation;
> (2) Freedom of fishing;
> (3) Freedom to lay submarine cables and pipelines;
> (4) Freedom to fly over the high seas.
>
> These freedoms, and others which are recognized by the general principles of international law, shall be exercised by all States with reasonable regard to the interests of other States in their exercise of the freedom of the high seas. [Emphasis added.]

Section 2(c)(2) of the FCMA makes it clear that the freedom of fishing is not to be adversely affected except as necessary to carry out the FCMA. In light of its express exception for tuna management, the FCMA has left intact the freedom of foreign vessels in the FCZ to fish for tuna. It would appear from the FCMA policy against impeding or interfering with such legitimate uses, as well as the international "reasonable regard" principle, that in managing billfish resources the United States must ensure foreign longline vessels a reasonable opportunity to catch tuna. The International Court of Justice (ICJ), in the United Kingdom v. Iceland Merits Judgment, July 27, 1974, ICJ Rep. 3, 13 ILM 1049, pronounced a similar view. The Court noted that the legal relationship between the United Kingdom and Iceland in the case involved a coastal preference for Icelandic fishermen in fishery resources adjacent to Iceland and a historical interest for U.K. fishermen in those same resources because of their 50-year-old traditional fishery. The Court said:

> [B]oth states have an obligation to take full account of each other's rights and of any fishery conservation measures the necessity of which is shown to exist in those waters. It is one of the advances in maritime international law, resulting from the intensification of fishing, that the former laissez faire treatment of the living resources of the sea in the high seas has been replaced by a recognition of a duty to have due regard to the rights of other States and the needs of conservation for the benefit of all. 13 ILM 1049, at 1063.

> to maintain without change the existing territorial or other ocean jurisdiction of the United States for all purposes other than the conservation and management of fishery resources, as provided for in this Act [.]

This policy declaration signals other nations that they are not to interpret the FCMA as a manifestation of a change in the U.S. view on the international legality of extended territorial sea claims nor of coastal nation jurisdiction over tuna fishing, navigation scientific research and other activities in adjacent marine areas. With respect to tuna fishing, the United States has rejected exclusive coastal state jurisdiction and has supported management by international agreement. In fact, the United States participates with Japan, Canada and various other nations on international bodies established for the conservation of tuna pursuant to the International Convention for the Conservation of Atlantic Tunas (20 UST 2887; TIAS 6767) and the Convention for the Establishment of an Inter-American Tropical Tuna Convention (1 UST 230; TIAS 2044).

Of special significance concerning the billfish-tuna question is section 2(c)(2) of the FCMA, which states that it is the policy of the U.S. Congress -

> to authorize no impediment to, or interference with, recognized legitimate uses of the high seas, except as necessary for the conservation and management of fishery resources, as provided for in this Act [.] [Emphasis added.]

One of the traditionally recognized legitimate uses of the high seas is the freedom of fishing.[3] The 1958 Geneva Convention on the High Seas (13 UST 2312; TIAS 5200), to which the United States is a Party and whose provisions were adopted by the 1958 United Nations Conference on the Law of the Sea as "generally declaratory of established principles of international law," addresses such legitimate uses in

---

[3] The concept of freedom of fishing has been modified somewhat as a result of numerous recent claims by coastal nations to extended jurisdiction over various types of fishery resources. The United States takes the position that tuna is not subject to exclusive coastal nation jurisdiction.

FCMA Purpose and Policies

An analysis of the FCMA purposes and policies, as well as the legislative history of the tuna exception, provides some guidance for resolving the tuna-billfish conflict. Section 2(b)(2) declares that one of the purposes of the FCMA is -

> to support and encourage the implementation and enforcement of international fishery agreements for the conservation and management of tuna and to encourage the negotiation and implementation of additional such agreements.

This section complements the operative provisions of the FCMA that exclude tuna, since the United States has taken the position that the assertion of unilateral management authority over tuna by the United States would probably encourage other governments to follow suit and to move away from international arrangements. See also section 202(e)(2).

The Conference Committee Report states that "there is no justification for coastal nation jurisdiction" over tuna and adds that current international tuna agreements should be supplemented by stronger agreements. H.R. Rpt. No. 94-948, 94th Cong., 2d Sess., in A Legislative History of the Fishery Conservation and Management Act of 1976, at 79. Another revealing statement is made in the House Merchant Marine and Fisheries Committee Report on the bill that led to the FCMA, concerning the provisions excepting tuna from the extension of jurisdiction and encouraging international tuna arrangements. The report notes that these provisions reflect the policy that the "United States does not recognize the right of any foreign country to extend its rights, claims or jurisdiction to [tuna]." H.R. Rpt. No. 94-445, 94th Cong., 1st Sess., Legislative History at 1113. From this legislative history and the statutory statement of purpose it is reasonable to conclude that Congress did not wish FCMA regulation of the incidental take of billfish by foreign vessels fishing for tuna to constitute a precedent for other countries to exercise exclusive jurisdiction over tuna fishing within their fishery zones.

The same theme of avoiding an international precedent is seen in section 2(c)(1) which declares that it is the policy of Congress -

United States shall not include, nor shall it be construed to extend to, highly migratory species of fish. [Emphasis added.]

Fishing in the FCZ by foreign vessels is controlled under the FCMA by the requirement that such fishing be conducted pursuant to and in accordance with a valid permit. See sections 201(a) and 204(a). "Fishing" is defined in section 3(10) to mean -

(A) the catching, taking, or harvesting of fish;
(B) the attempted catching, taking, or harvesting of fish;
(C) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or
(D) any operations at sea in support of, or in preparation for, any activity described in subparagraphs (A) through (C).

In view of this definition, the catching, taking, or harvesting of tuna in the FCZ is not "fishing" subject to FCMA regulation because tuna are not "fish." Nevertheless, when a vessel fishes for tuna in a way that can reasonably be expected to result in the catching, taking, or harvesting of billfish, it is engaged in "fishing" and is subject to FCMA regulation in order to achieve billfish conservation and management. The longline method of fishing for tuna, which unavoidably involves catching of billfish, presents such a case. To reconcile these FCMA provisions, regulation of the foreign longline take of billfish must be carried out so that it does not constitute the exercise of exclusive jurisdiction over tuna fishing.[2]

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[2] The legislative history of the FCMA indicates that billfish were included in the FCMA's management authority because of a strong concern that the billfish stocks would be seriously affected if conservation measures could not be imposed. The legislative history also acknowledges the economic value which billfish may have to the United States. (See, e.g., House floor debate on H.R. 200, October 9, 1975, remarks of Congressmen Conte and Hughes, in Legislative History at pages 945-947 and 949 respectively; and Supplemental Views on H.R. 200, by Congressman Ginn in the Report from the Committee on Merchant Marine and Fisheries, H. R. Rpt. 94-445, in Legislative History at page 1155.)

within certain non-retention zones. [1] The Councils, industry representatives and members of Congress, citing the resulting waste of billfish resources and their desire to increase availability of such resources, have questioned the effectiveness of the non-retention requirements as a means for managing this fishery. They have asked if other management measures, such as closed areas and seasons or gear restrictions, are legitimate for inclusion in billfish fishery management plans now being developed by the Councils.

DISCUSSION:

Statutory Definitions

Section 102(1) of the FCMA states that the United States shall exercise exclusive fishery management authority over all "fish" within the fishery conservation zone. The term "fish" within the meaning of the FCMA is defined in section 3(6) as -

> finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals, birds, and highly migratory species. [Emphasis added.]

In turn, section 3(14) defines "highly migratory species" as -

> species of tuna which, in the course of their life cycle, spawn, and migrate over great distances in waters of the ocean. [Emphasis added.]

It is apparent from these definitions that billfish are "fish" under the FCMA because they are finfish and are not specifically excepted. Hence billfish fall under the exclusive fishery management authority of the United States when they are in the FCZ. Section 103, on the other hand, makes it equally apparent that highly migratory species of tuna are not covered by the FCMA:

> The exclusive fishery management authority of the

---

[1] The Pacific FMP's management unit also includes wahoo and mahimahi, which are often taken in conjunction with billfish and oceanic sharks by the same vessels and gear.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

OCT 3 ..3

TO: GC - Eldon V.C. Greenberg

FROM: GCF - Jay S. Johnson

SUBJECT: Billfish Management under the Fishery Conservation and Management Act

ISSUE

Does the Fishery Conservation and Management Act of 1976, as amended (FCMA), authorize the use, in billfish fishery management plans, of conservation and management measures which affect foreign longline fishing for tuna in the fishery conservation zone (FCZ)?

CONCLUSION

Yes. A billfish management plan may contain management measures which affect foreign longline fishing for tuna in the FCZ, including area closures and season or gear restrictions, if the measures will (1) provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ and (2) impose the least burden on such vessels that will achieve conservation and management of the billfish covered by the plan. A careful, case-by-case analysis of the purposes, scope, and effects of each management measure will be necessary to ensure consistency with the FCMA and the U.S. legal position concerning international management of tuna fisheries.

BACKGROUND

Billfishes are taken by foreign tuna longliners in the FCZ as incidental catch (but not as target species of their directed fishery) and by domestic commercial and recreational fishermen both in incidental and in directed fisheries.

We have been asked by several of the Regional Fishery Management Councils and members of Congress to clarify the NOAA position concerning the management of billfish resources under the FCMA. Preliminary fishery management plans (PMP's) for Atlantic and Pacific billfish and sharks prepared by NMFS contain management measures that require foreign longline vessels to release billfish, alive or dead,

Distribution Before Clearance: None

OCT 29 [illegible]

Statutes Interpreted: FCMA

Summary: A billfish management plan may contain management measures which affect foreign longline fishing for tuna in the FCZ, including area closures and season or gear restrictions, if the measures will (1) provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ and (2) impose the least burden on such vessels that will achieve conservation and management of the billfish covered by the plan.

Written by: James S.W. Drewry and Fran Liu

Approved by:	Initials	Date
[ ] Field Counsel		
[ ] AGC/Administration		
[X] AGC/Fisheries	[signature]	9/24/79
[ ] AGC/Coastal Zone		
[ ] AGC/Enforcement		
[ ] AGC/Hearings and Appeals		
[X] Deputy GC		
[X] GC	[signature]	10/3/79

FOIA Information:

[X] May be released

[ ] May not be released

[ ] May be released in part

Portions to be deleted:

DEPT. OF COMMERCE-NOAA
RECEIVED
OCT 15 1979
SOUTHWEST REGIONAL OFFICE
OFFICE OF GENERAL COUNSEL

Remarks:

Distribution:

	Name	Date
Internal: All Offices GC;		
External:		

The policies stated in sections 2(c)(1) and 2(c)(2) of the FCMA, suggest that Congress intended regulations which affect recognized legitimate uses of the high seas, such as fishing for tuna, to be applied only when conservation and management of fishery resources over which the U.S. exercises exclusive fishery management authority are shown to be necessary.

To facilitate the case-by-case legal review of billfish-tuna issues, and to defend an FMP's management measures should judicial review occur, we believe that any management plan for billfish which may affect tuna fishing by foreign longline vessels should contain an evaluation of:

- the purpose of each management measure,
- the need for the measure,
- the expected effect of the measure,
- the factual basis for the expectation that the measure will achieve its intended purpose, and
- any alternative methods of achieving the same objective, explaining why the measure adopted is preferable to each alternative method.

I believe that this advice is fully consistent with the advice given to the Regional Councils by the Office of General Counsel in the past.

If we may be of further assistance in this matter, please do not hesitate to contact me.

With best regards,

Sincerely yours,

DICK

Richard A. Frank

Enclosure

APPENDIX H

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

THE ADMINISTRATOR

OCT 15 1979

NMFS Opinion

Honorable John B. Breaux
Chairman, Subcommittee on Fisheries
and Wildlife Conservation
and the Environment
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D.C. 20515

Dear John,

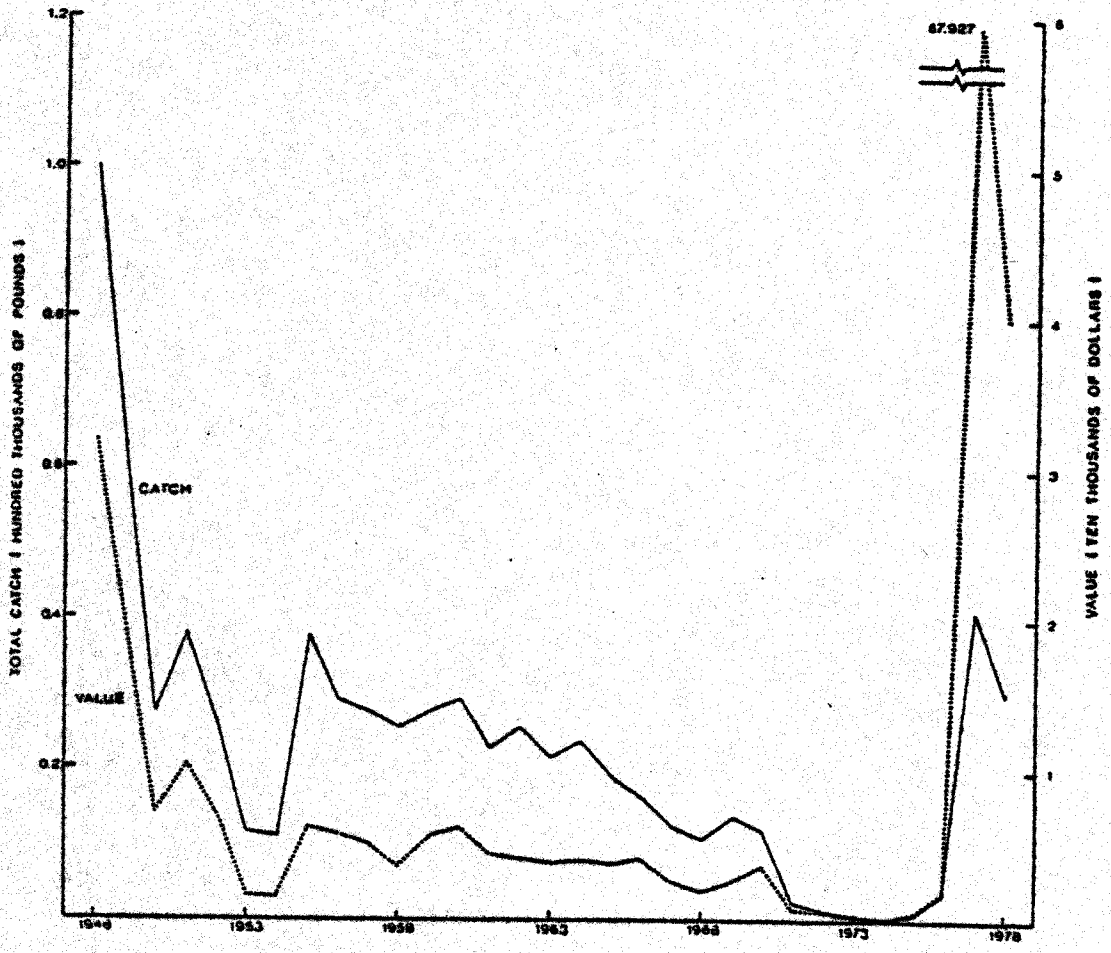
Thank you for your letter in which you asked NOAA to provide the Merchant Marine and Fisheries Committee and the Regional Fishery Management Councils with legal advice concerning the authority, under the Fishery Conservation and Management Act of 1976 (FCMA), to regulate the incidental catch of billfish by Japanese longline tuna vessels in the U.S. 200-mile zone.

I have enclosed a legal analysis which provides guidance on factors to be considered when imposing regulations which may affect foreign longline vessels fishing for tuna.

In summary, the analysis concludes a billfish management plan may contain management measures which affect foreign longline fishing for tuna in the FCZ, including area closures and season or gear restrictions, if the measures will (1) provide a reasonable opportunity for foreign longline vessels to fish for tuna in the FCZ and (2) impose the least burden on such vessels that will achieve conservation and management of the billfish covered by the plan. A careful, case-by-case analysis of the purposes, scope, and effects of each management measure will be necessary to ensure consistency with the FCMA and the U.S. legal position concerning international management of tuna fisheries.

In our view a balancing test is appropriate for reviewing the legality of measures proposed for a management plan as a basis for regulating the incidental take of billfish by foreign longline vessels fishing for tuna.

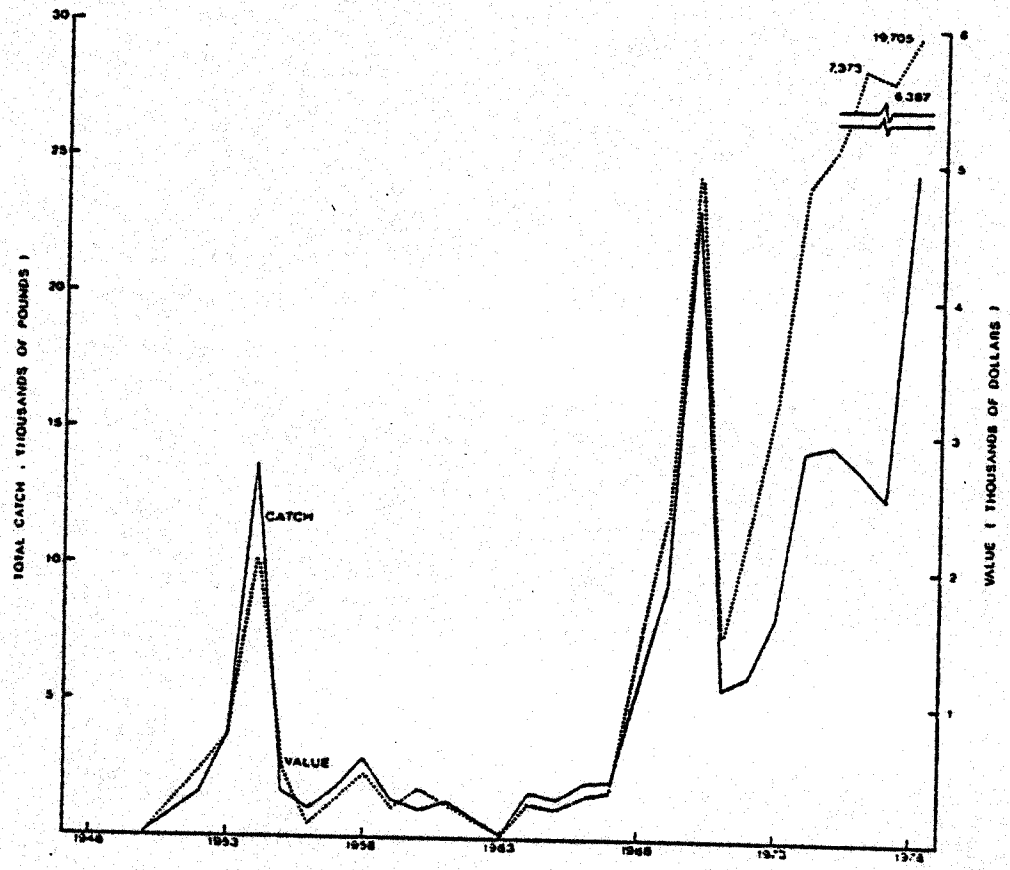
APPENDIX G-6



Total Reported Catch and Value for Broadbill Swordfish, 1948-1978

Source: State of Hawaii, DLNR, 1979

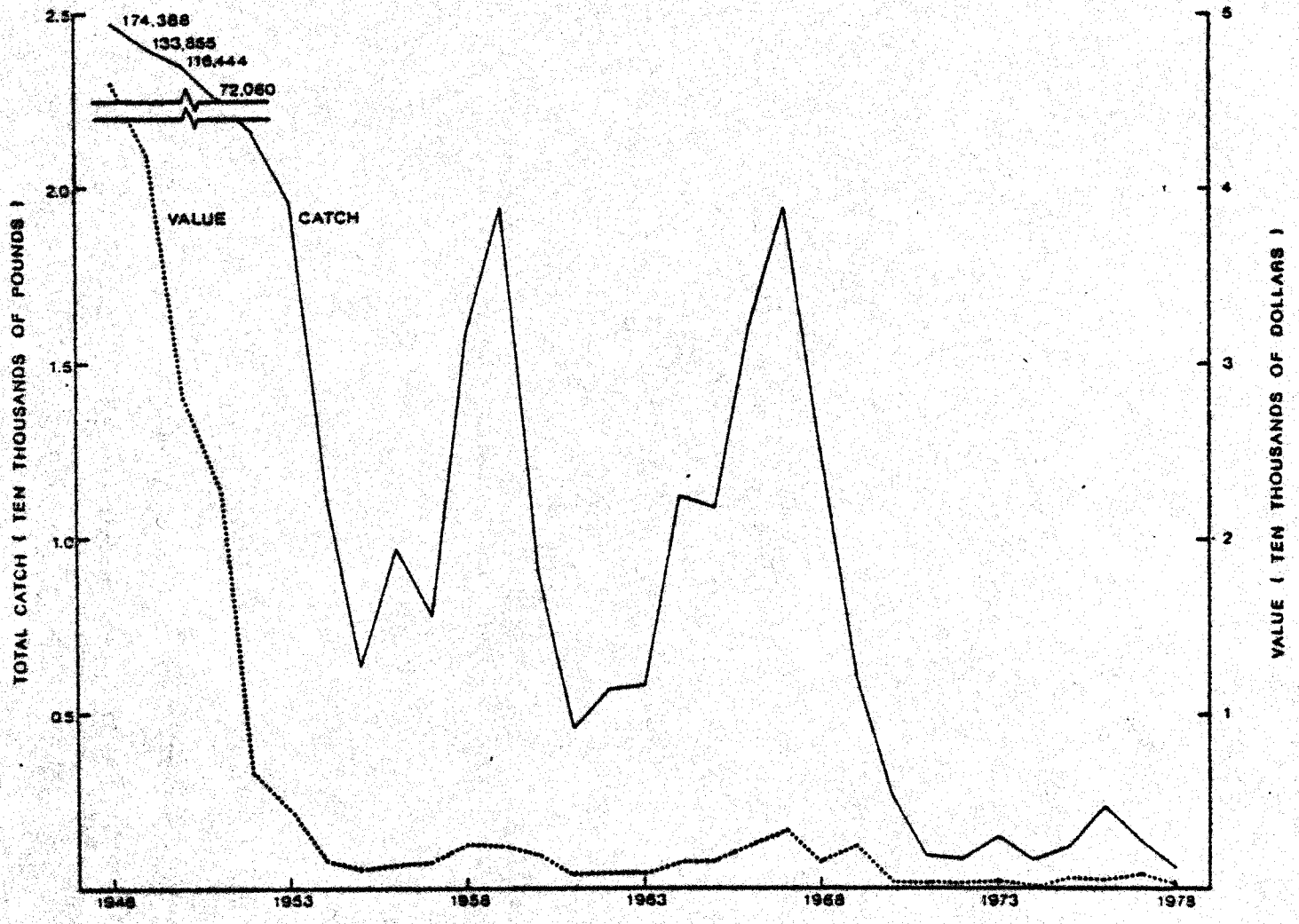
APPENDIX G-5



Total Reported Catch and Value for Shortnosed Spearfish, 1948-1978

Source: State of Hawaii, DLNR, 1979

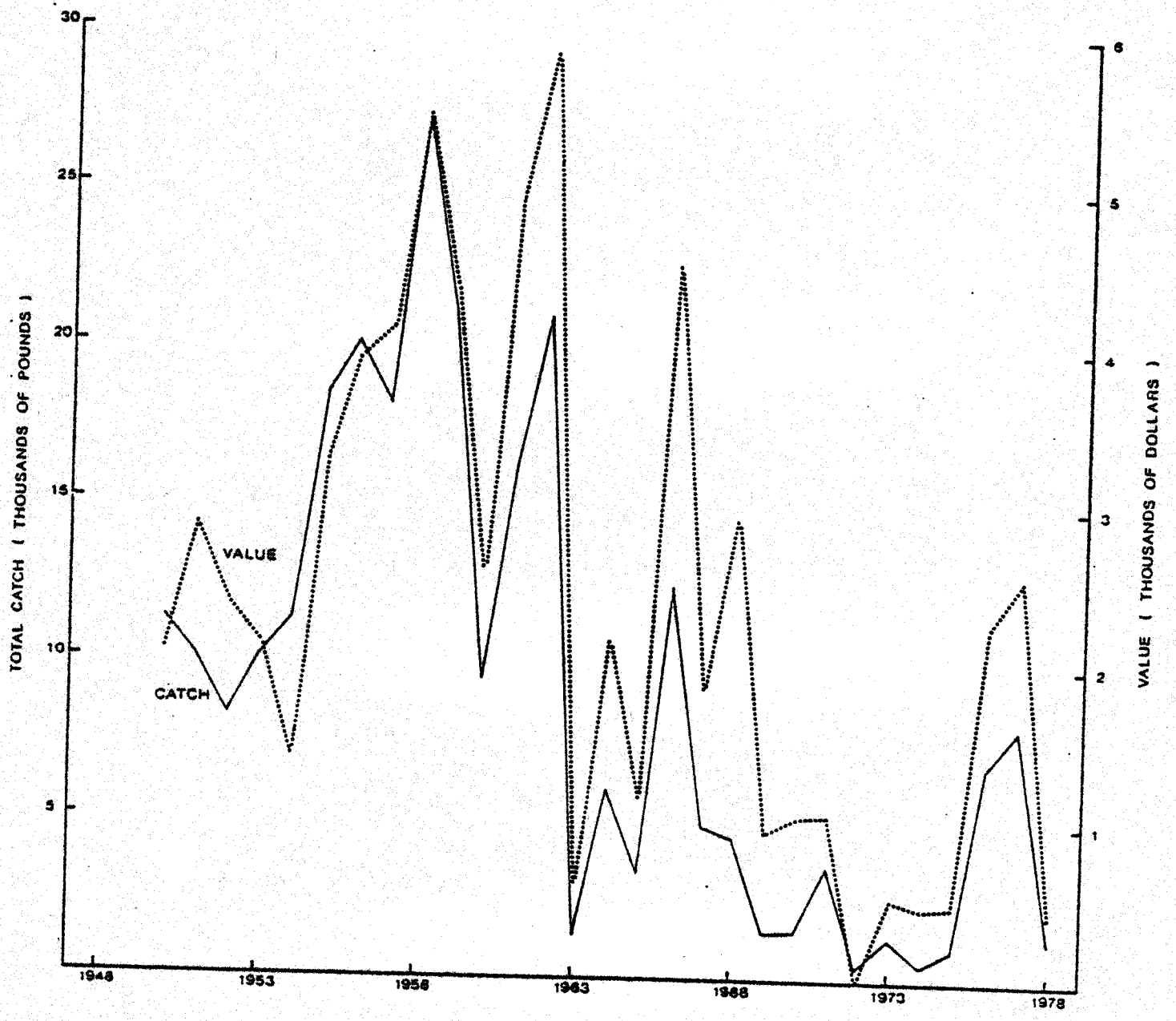
APPENDIX G-4



Total Reported Catch and Value for Sailfish, 1948-1978

Source; State of Hawaii, DLNR, 1979

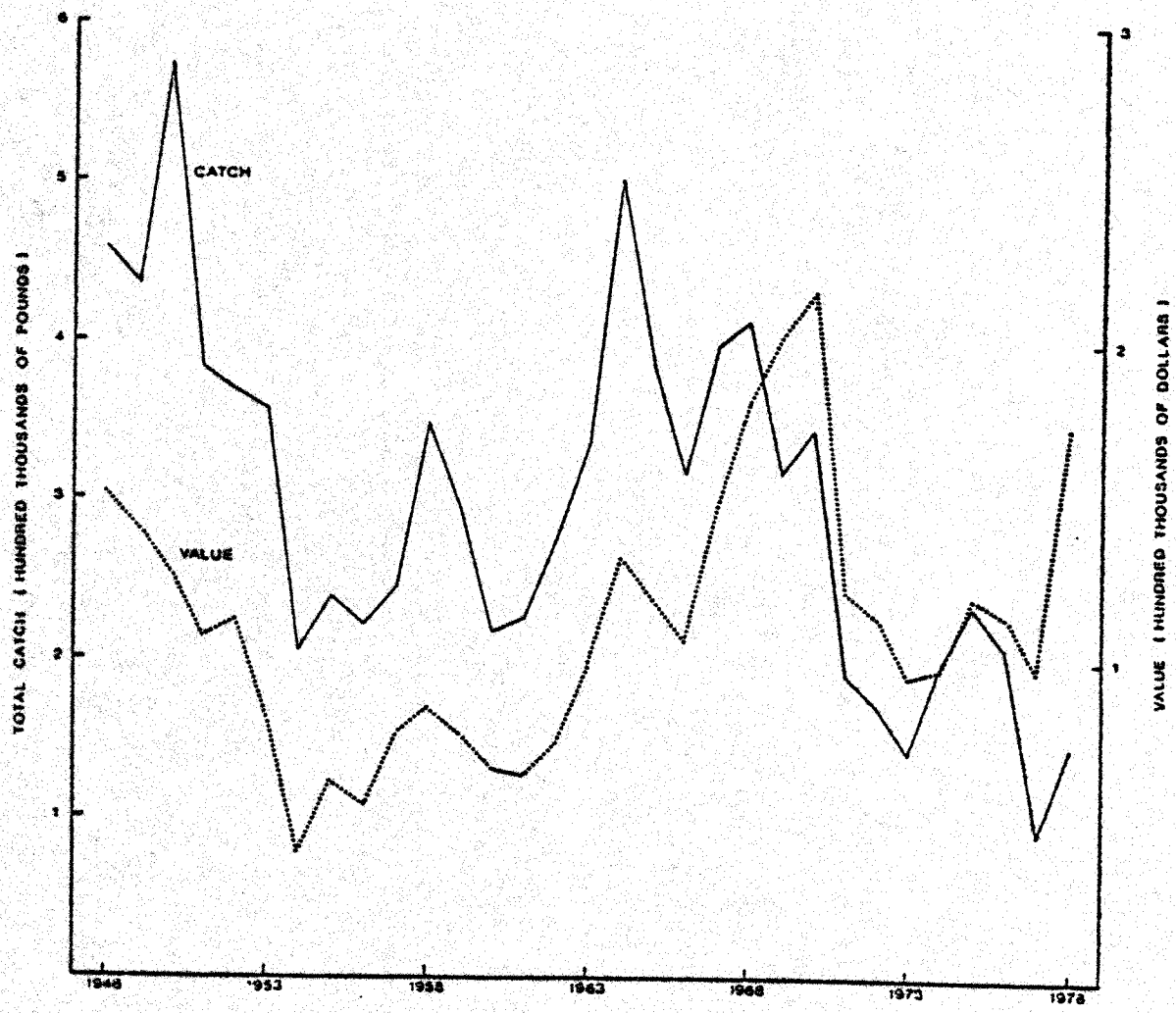
APPENDIX G-3



Total Reported Catch and Value for Black Marlin, 1948-1978

Source: State of Hawaii, DLNR, 1979

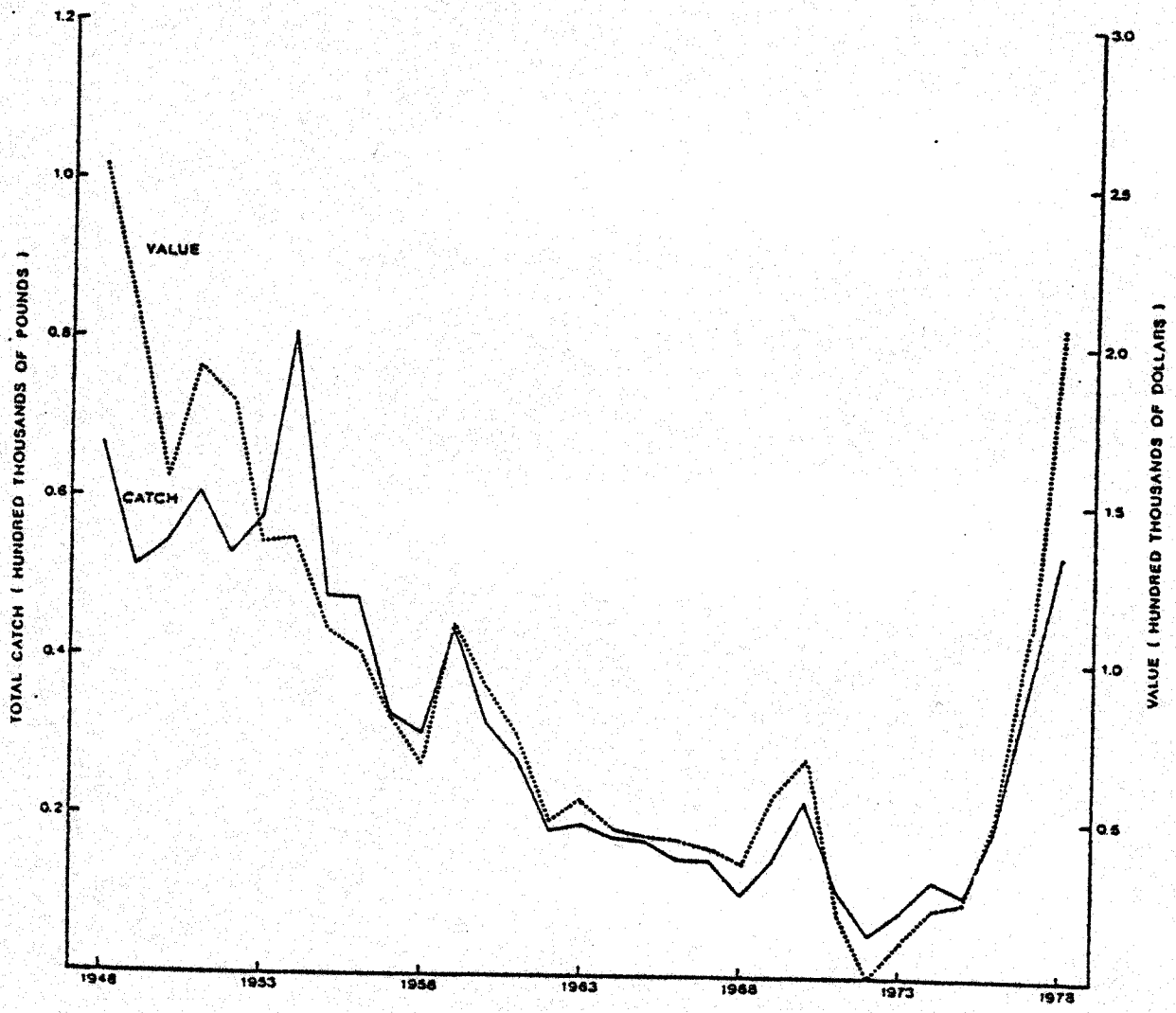
APPENDIX G-2



Total Reported Catch and Value for Striped Marlin, 1948-1978

Source: State of Hawaii, DLNR, 1979

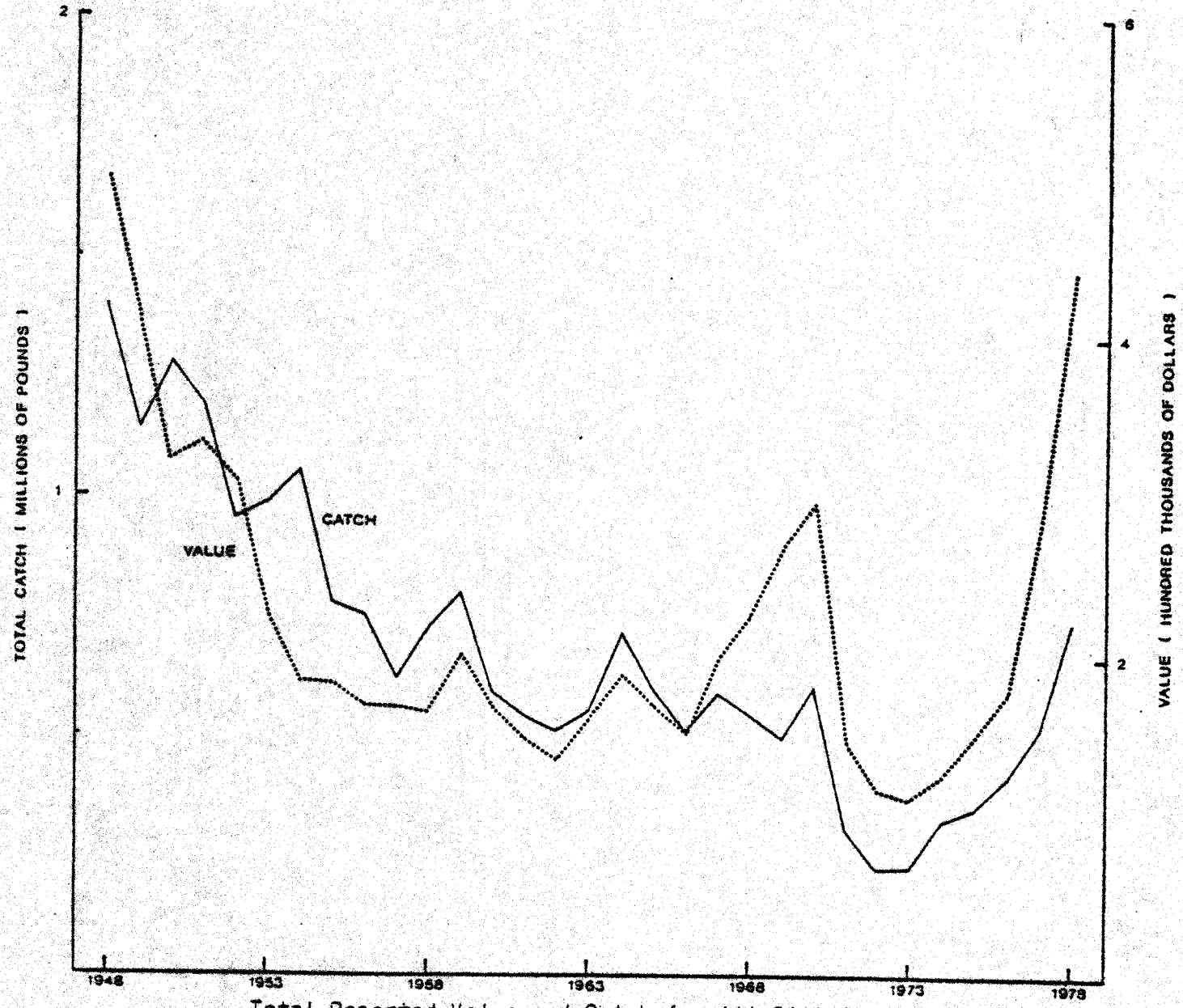
APPENDIX G-1



Total Reported Catch and Value for Pacific Blue Marlin, 1948-1978

Source: State of Hawaii, DLNR, 1979

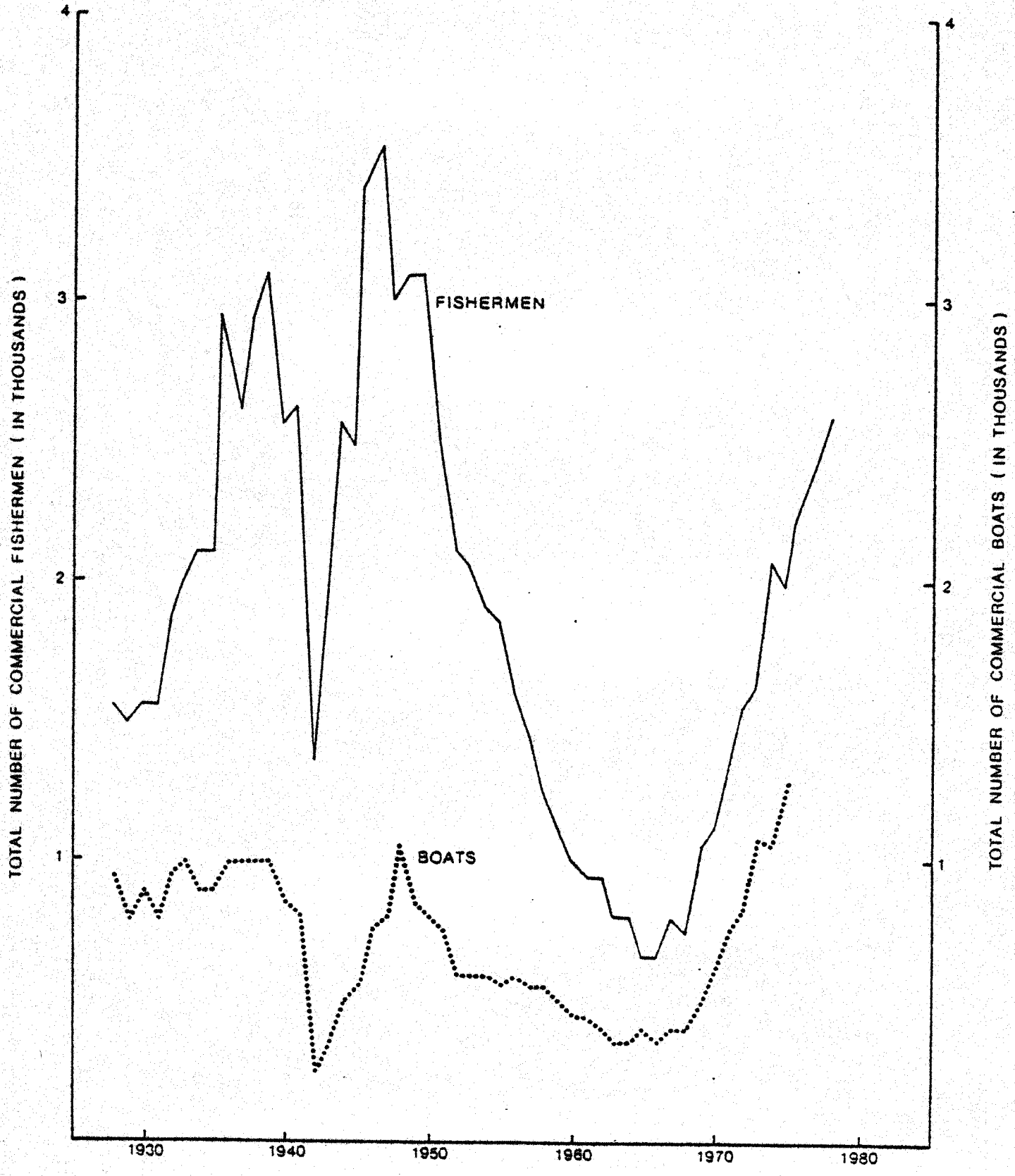
APPENDIX G



Total Reported Value and Catch for All Billfish Species, 1948-1978

Source: State of Hawaii, DLNR, 1979

APPENDIX F



Commercial Fishermen and Boats in Hawaii

Source: State of Hawaii, DLNR, 1979

TABLE E-2

ESTIMATED NUMBER OF VESSELS IN KAILUA-KONA, THE ISLAND OF HAWAII AND THE STATE OF HAWAII, BY VESSEL CLASSIFICATION, 1976

	Kailua-Kona	Big Island	State
1. Registered Vessels	-	1,382[2]	16,947[3]
2. Registered Fishing Vessels	577*	1,075	3,220[4]
3. Registered Trolling Fishing Vessels	426	730	1,704
a. Non-Charter Recreational-Commercial Trolling Fishing Vessels	386	661	1,544
b. Commercial Trolling Fishing Vessels	40	69	160
4. Charter Vessels	30	35	102
Total Trolling Fishing Vessels	456	765	1,806

1. Research Associates. A Study of Bio-economics and Optimal Management Criteria for Utilization of Pacific Billfish, Module I. (Prepared for National Marine Fisheries Service, Honolulu Laboratory, 1977.) 139 pp. plus appendices. (For all vessel classifications.)

2. State of Hawaii. Harbors Division. Department of Transportation. Report of Undocumented Vessel Registration, 1976, p. 3. (For registered vessels classification only.)

3. a) Ibid.
   b) United Staes Coast Guard. Vessel Documentation Files. 14th Coast Guard District, U.S. Department of Transportation. U.S. Documented Vessels in Hawaiian Parts, 1976 (Unpublished).

4. Information Concepts, Inc. Determinatin of the Number of Commercial and Non-Commercial Recreational Boats in the United States. Mimeographed. (Prepared for the National Oceanic and Atmospheric Administration/National Marine Fisheries Service, 1973.), p. 67.

TABLE E-1

Estimated Number of Vessels in Hawaii by Vessel Classification

	Fish and Game[1]	Department of Transportation & U.S. Coast Guard[2]	Information Concepts, Inc.[3]
Total vessels in State	-	16,947	15,321
Non-fishing vessels	-	15,761	12,335
Fishing vessels	1,437	1,186	2,986
Charter fishing vessels	-	117	-
Non-charter fishing vessels	-	1,069	-
Trolling and Charter Vessels	693	-	-

1. State of Hawaii. Department of Land and Natural Resources, Division of Fish and Game. Operating Units by Island and Gear, 1976-1977 (unpublished).

2.a. State of Hawaii, Department of Transportation, Harbors Division. Report of Undocumented Vessel Registration, 1976, p.3.

b. United States Coast Guard. Vessel Documentation Files, 14th Coast Guard District, U.S. Department of Transportation. U.S. Documented Vessels in Hawaiian Parts, 1976.

3. Information Concepts, Inc. Determination of the Number of Commercial and Non-Commercial Recreational Boats in the United States. Mimeographed. (Prepared for NOAA/NMFS, 1973). pp. 63, 67,87.

participated in the charter fishing business on an occasional basis.[2]

The number of non-charter recreational-commercial fishing vessels was estimated as an aggregated group. The report by Information Concepts indicated that 19% of the vessels in the State in 1973 participated in saltwater fishing at some time during the year. Assuming that this same percentage was applicable for 1976, this implies that there were 3,220 vessels that fished on saltwater in 1976. Information from the Research Associates' Kailua-Kona survey report was used to determine what proportion of these vessels trolled for the relevant species. Corrections were made for improper listings and for vessels which did not troll. It was estimated that 1,704 of the 3,220 total fishing vessels were in the non-charter trolling category.

The Research Associates' Kailua-Kona survey was again utilized to separate the private fishing vessel estimate into private commercial and recreational fishing vessel categories. A proportion relating the number of non-charter recreational fishing vessels to the total number of private registered trolling fishing vessels in Kailua-Kona was derived. This proportion was then projected to the data for the Island of Hawaii and to the data estimated for the State. A similar extrapolation was made for the commercial trolling vessel class. Table E-2 shows the estimate of the total number of trolling vessels in Hawaii in 1976, which was estimated to be 1,806 vessels.

[2] Official Program, 19th Hawaiian International Billfish Tournament (HIBT), Kailua-Kona, Hawaii, 1977. Ibid. 17th and 19th HIBT, 1975 and 1976.
Armstrong, Tom. Happy Time Deep Sea Fishing Charters, Honolulu and Keauhou, Hawaii (telephone interview, May 10, 1978).
Gaffney, Rick. Field editor, Hawaii Fishing News, Honolulu (telephone interview, May 10, 1978).

APPENDIX E: 1976 HAWAII FISHING VESSEL INVENTORY

Information on the number of fishing vessels in Hawaii was developed from various sources: the number of commercial fishing boats listed with the Hawaii Division of Fish and Game, the number of registered boats in the State of less than 5 net tons, and the number of documented vessels in the State greater than 5 net tons. The combined figures for State registered and Federally documented vessels represent the total vessel population of the Sate. Additional information was obtained from two surveys completed for the National Narine Fisheries Service.[1] Table E-1 presents estimates on the number of vessel provided by each source.

The total number of vessels that engage in troll fishing in Hawaii was calculated by combining separate estimates for the charter, non-charter recreational-commercial, and commercial troller vessel classes. These three groups comprise the troller fishing fleet of Hawaii.

The number of charter vessels was easily determined since separate charter vessel registration categories are kept by both the Harbors Division and Coast Guard listings. The original count of 177 charter vessels for the State of Hawaii was reduced to 102 vessels since some of the listed vessels only

[1] Information Concepts, Inc. Determination of the Number of Commercial and Non-Commercial Recreational Boats in the United States. Mimeographed. (prepared for NOAA/NMFS, 1973). 111 pp. + appendices. And, Research Associates. A Study of Bioeconomics and Optimal Management Criteria for Utilization of Pacific Billfish, Module I. (Prepared for National Marine Fisheries Service, Honolulu Laboratory, 1977) 139 pp.

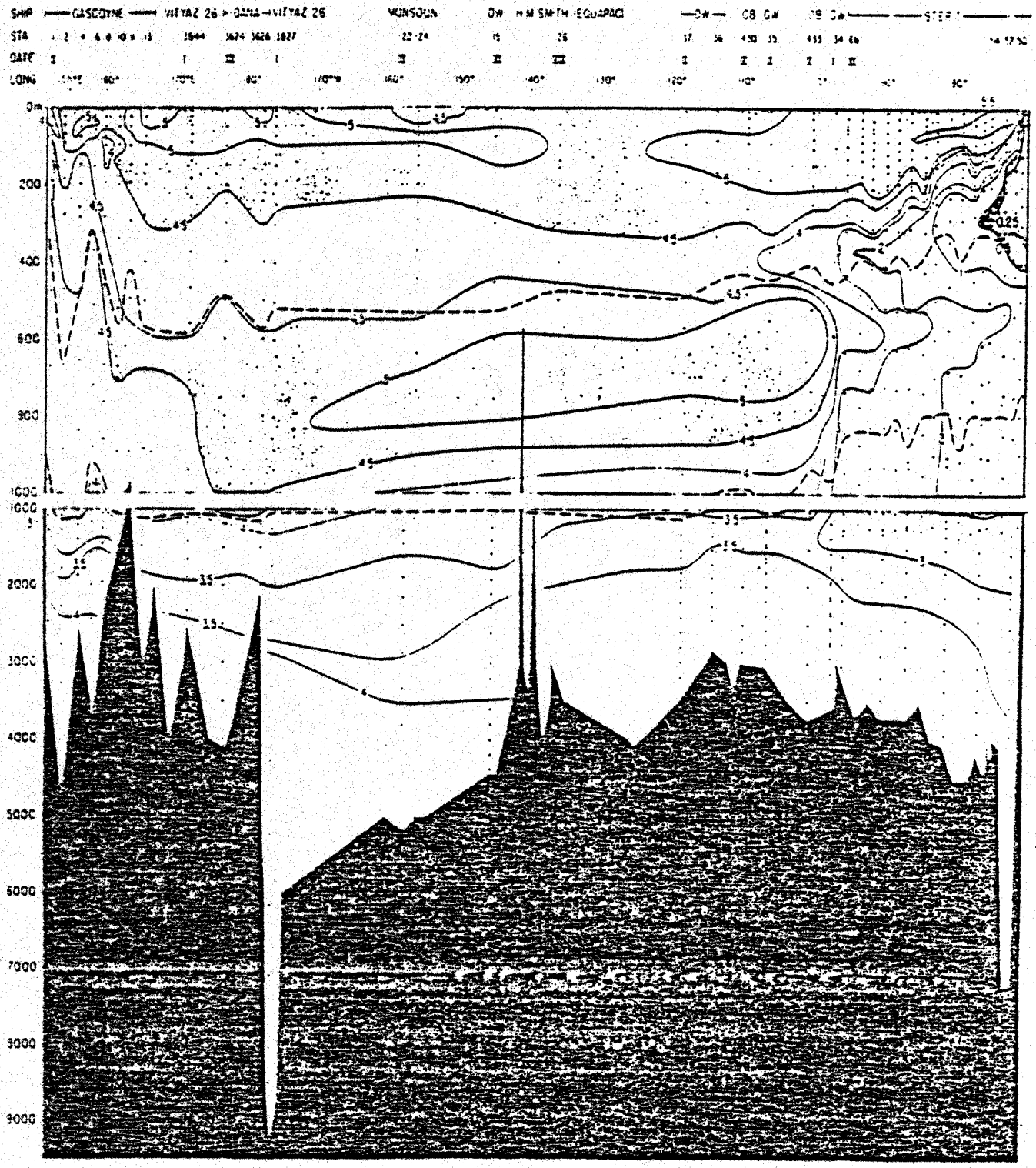


Figure D-6: OXYGEN (IN MILLILITERS PER LITER) ALONG APPROXIMATELY 27°S FROM AUSTRALIA TO SOUTH AMERICA

Source: Reid, J.L. 1965. Intermediate Waters of the Pacific Ocean. Johns Hopkins Press. Baltimore. P. 62.

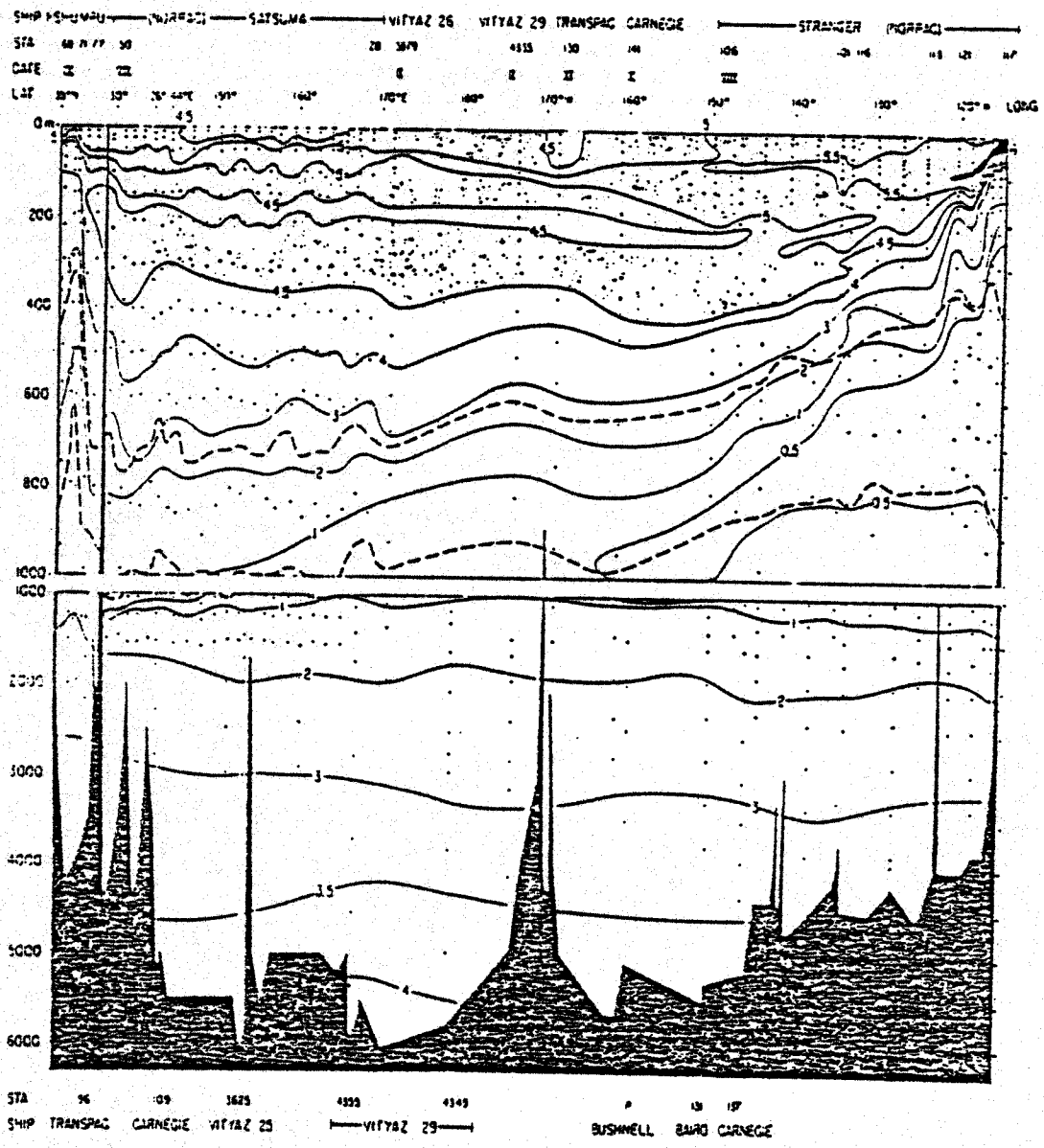


Figure D-5: OXYGEN (IN MILLILITERS PER LITER) ALONG APPROXIMATELY 27°N FROM JAPAN TO NORTH AMERICA

Source: Reid, J.L. 1965. Intermediate Waters of the Pacific Ocean. Johns Hopkins Press. Baltimore. p. 57.

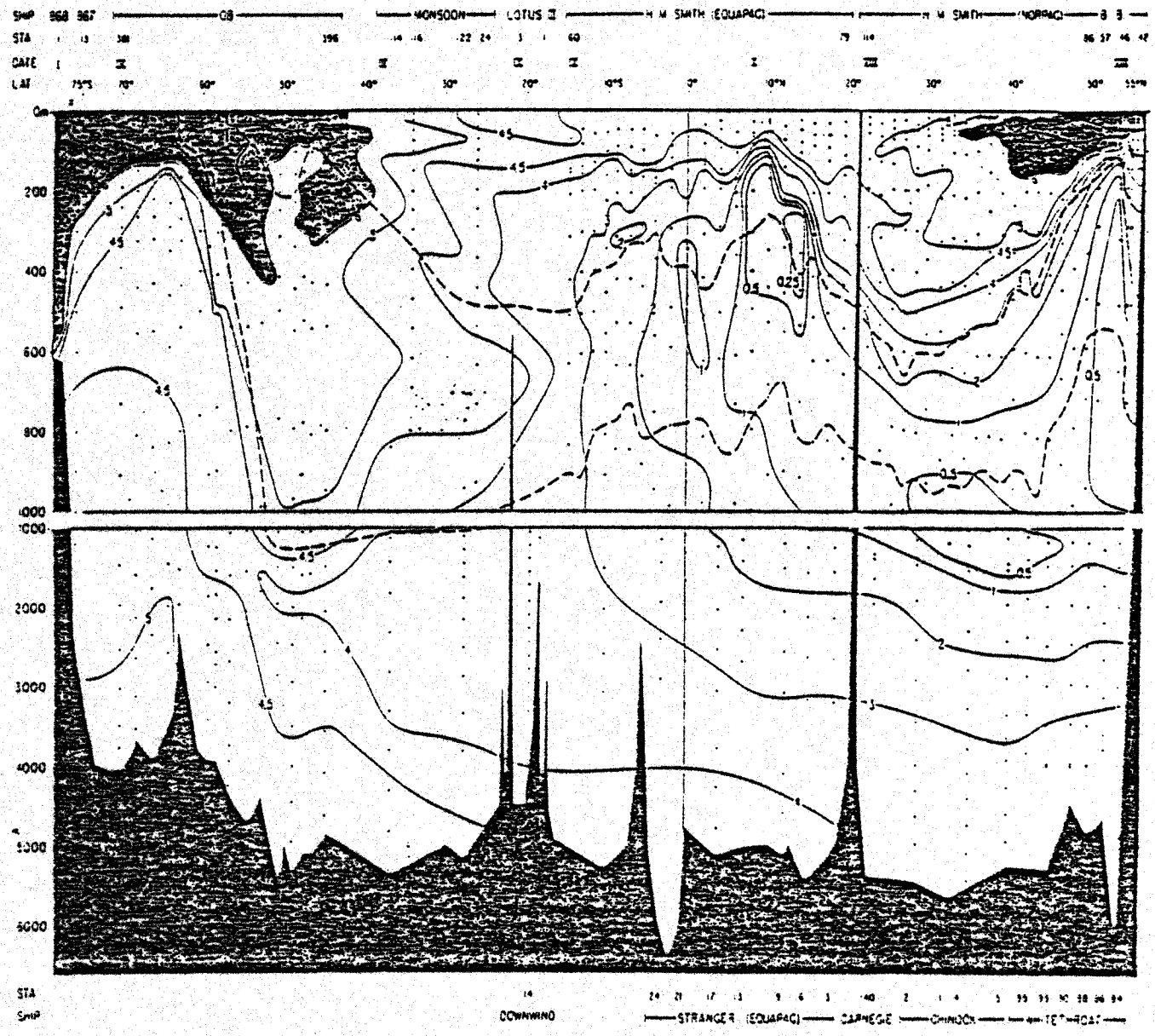


Figure D-4: OXYGEN (IN MILLILITERS PER LITER) ALONG APPROXIMATELY 160°W FROM ANTARCTICA TO ALASKA

Source: Reid, J.L. 1965. Intermediate Waters of the Pacific Ocean. Johns Hopkins Press. Baltimore. p. 53.

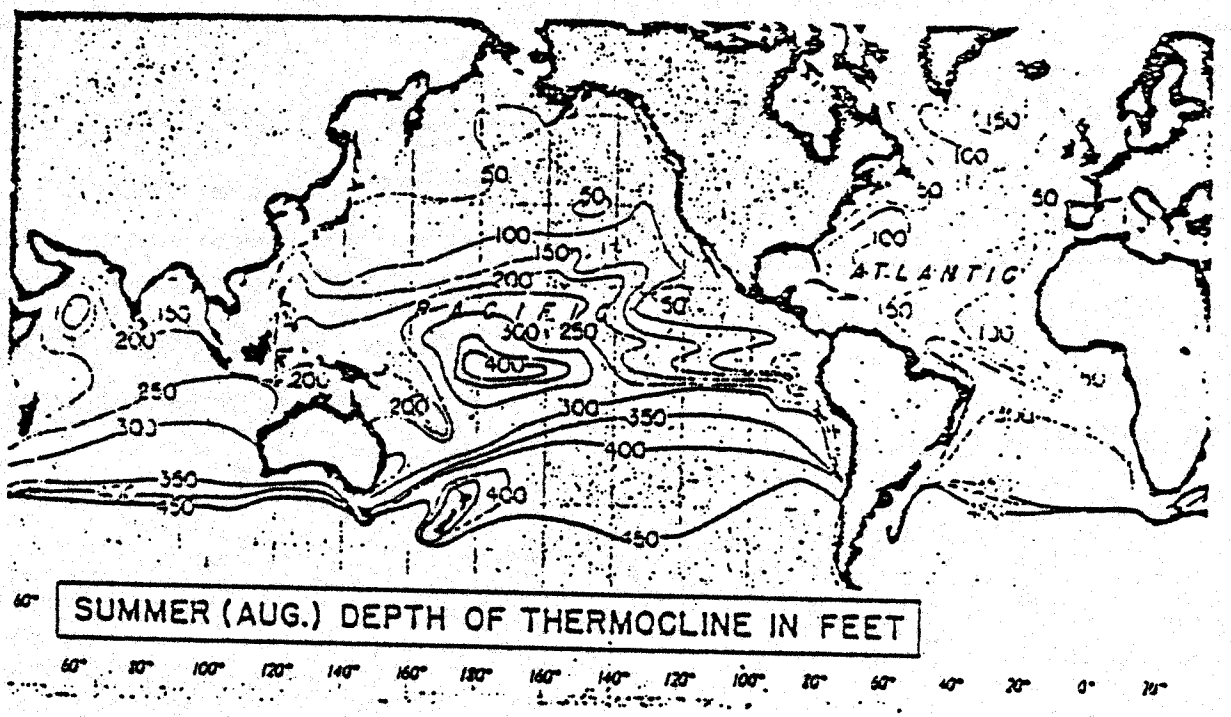
American to around 700 m near Japan. In the South Pacific along lat. 27°N from the coast of North America to Japan (Fig. D-5) the 3.0 ml/liter isopleth deepens from around 100 m off North America to around 700 m near Japan. In the South Pacific along lat. 27°S from the coast of South America to Australia (Fig. D-6) the 3.0 ml/liter isopleth is found deeper than 1,000 m everywhere except in the eastern Pacific. In the eastern Pacific this isopleth shallows from 1,000 m near long. 95°W to near the surface off the coast of South America.

relation between the oxygen-deficient layer characteristic of mid-depths in the ocean and the pelagic organisms. However, oxygen requirements of fishes under laboratory conditions have provided some data on the effects of low dissolved oxygen concentrations. In experiments conducted on skipjack tuna it was noted that hypoxic stress was first manifested, through changes in swimming behavior and speed, at about 2.8 ml/liter (4.0 ppm) (Gooding and Neil, unpub.). Observations on the oxygen requirements must probably be at least equal to that of skipjack tuna.

The 2.8ml/liter isopleth in the Pacific may be a possible delimiter of the distribution of billfish. Because dissolved oxygen values are usually given in 0.5 ml/liter intervals in the oceanographic literature, for this discussion the distribution of the 3.0 ml/liter dissolved oxygen value, which is closes to 2.8 ml/liter, is examined (Figs. D-4, D-5, D-6).

At or near the surface of the ocean the concentration of dissolved oxygen is everywhere greater than 3.0 ml/liter. In general, higher values are found in high latitudes in the North and South Pacific. At subsurface levels along long. 160°W from Antarctica to Alaska (Fig. D-4) the 3.0 ml/liter isopleth is shallowest, around 100 m, at approximately lat. 10°N. South at lat. 10°S the 3.0 ml/liter isoplethis found at a depth greater than 1,000 m. North of lat. 10°S the 3.0 ml/liter isopleth is found at a depth greater than 1,000 m. North of lat. 10°N the 3.0 ml/liter isopleth descends and reaches a depth of lcose to 600 m near lat. 30°N; it then begins to shallow again and is found slightly deeper than 100 m near lat. 55°N.

In the North Pacific along lat. 27°N from the coast of North America to Japan (Fig. D-5) the 3.0 ml/liter isopleth deepens from around 100 m off North



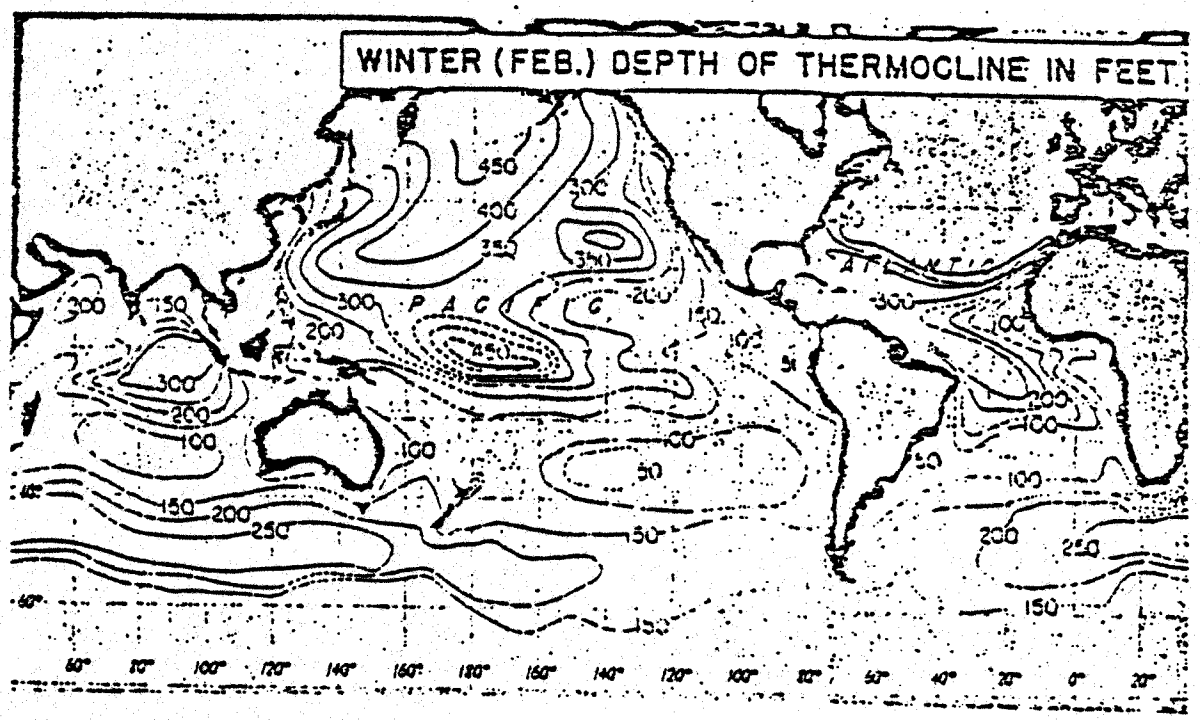


Figure D-3: SUMMER (AUGUST) AND WINTER (FEBRUARY) DEPTH OF THE THERMOCLINE IN THE PACIFIC OCEAN

Source: Brock, V.E. 1959. The Tuna Resource in Relation to Oceanographic Features. In Tuna Industry Conference Papers, May 1959. Circular 65. USDI. pp.4,5.

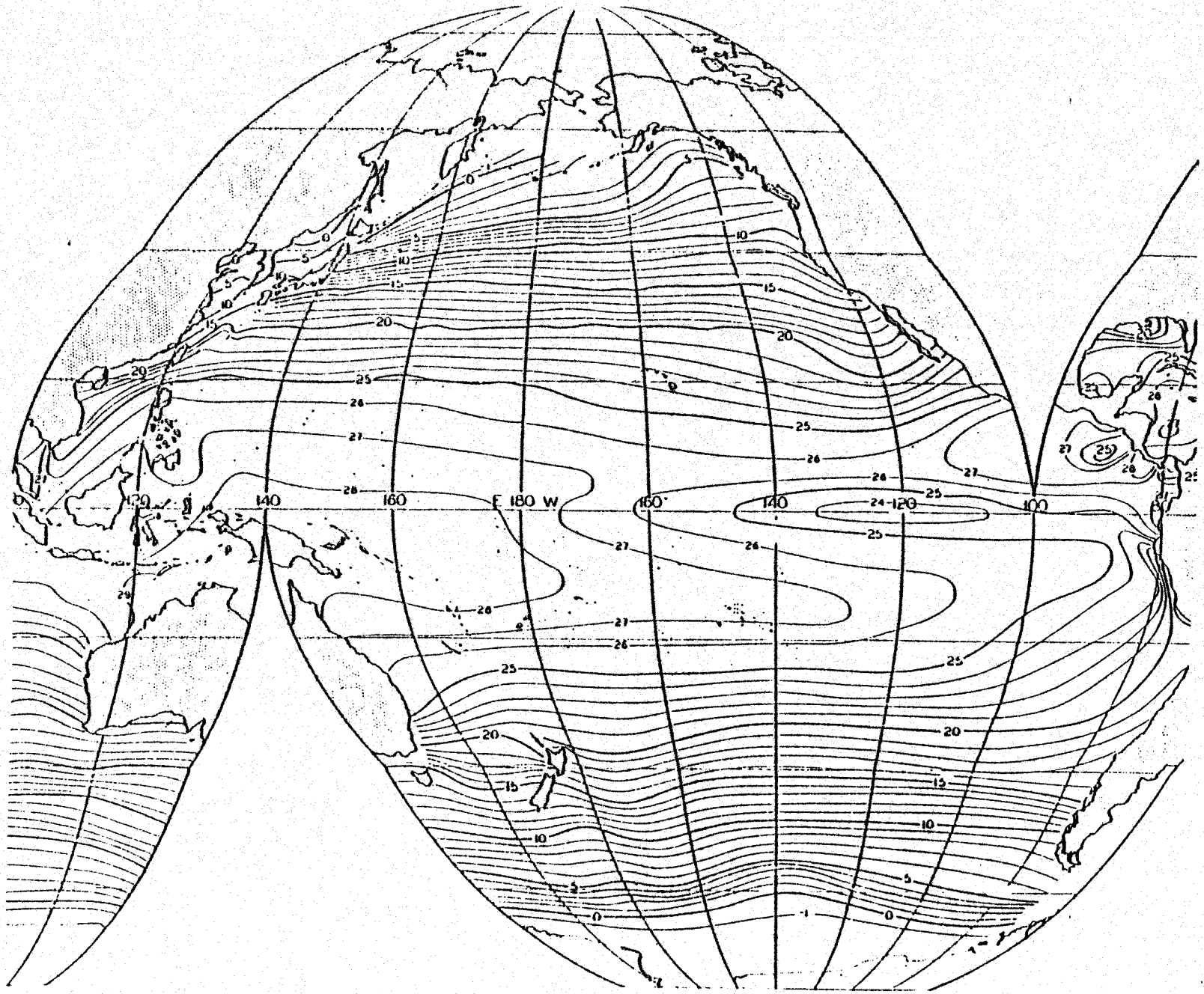


Figure D-2b: AVERAGE WINTER (FEBRUARY) SURFACE TEMPERATURE OF THE PACIFIC OCEAN

Source: The Oceans. Prentice Hall, Inc. Englewood Cliffs, N.J. Chart II.

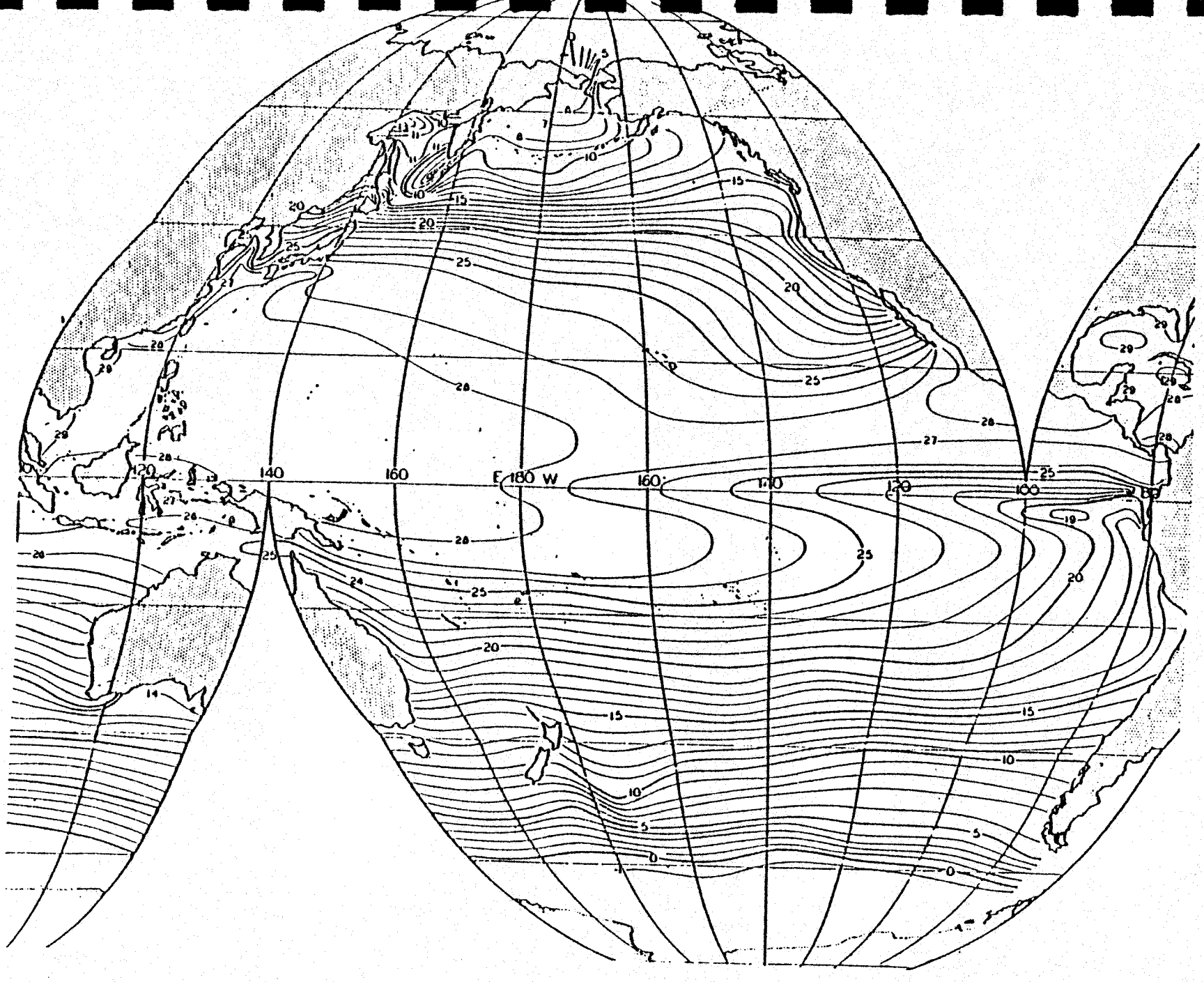


Figure D-2a: AVERAGE SUMMER (AUGUST) SURFACE TEMPERATURE OF THE PACIFIC OCEAN
Source: The Oceans. Prentice Hall, Inc. Englewood Cliffs, N.J. Chart III.

Surface temperature and depth of the mixed layer

The circulation pattern described above produces substantial differences in the surface water temperature distribution in the western and eastern sides of the Pacific Ocean (Figs. D-2a and D-2b). The western Pacific is characterized by a broad belt of tropical water, a narrow belt of temperate water, and a rapid transition to the cold waters of the higher latitudes. In contrast, the eastern Pacific is characterized by a broad belt of temperate water and a narrow belt of tropical water.

The eastern and western sides of the Pacific also offer contrasts in the depth of the mixed layer (Fig. D-3). In the tropical areas of the eastern Pacific the mixed layer is relatively thin, whereas the mixed layer is much thicker in the western Pacific.

In the higher latitudes of the central North and South Pacific, seasonal warming and cooling of the water also influences the depth of the upper mixed layer. In the North Pacific the water warms up in the summer and forms a shallow, warm mixed layer. As the temperature falls in the winter, the isothermal layer becomes colder and deeper. This same process occurs in the South Pacific: a shallow, warm mixed layer develops in the Southern Hemisphere summer and a deep cooler mixed layer in the winter. The same process is also evident in more tropical waters of the South Pacific but the seasonal pattern is less pronounced there.

Dissolved oxygen

The role that dissolved oxygen plays in limiting the distribution of billfish species in the sea is not very clear. Very little is known on the

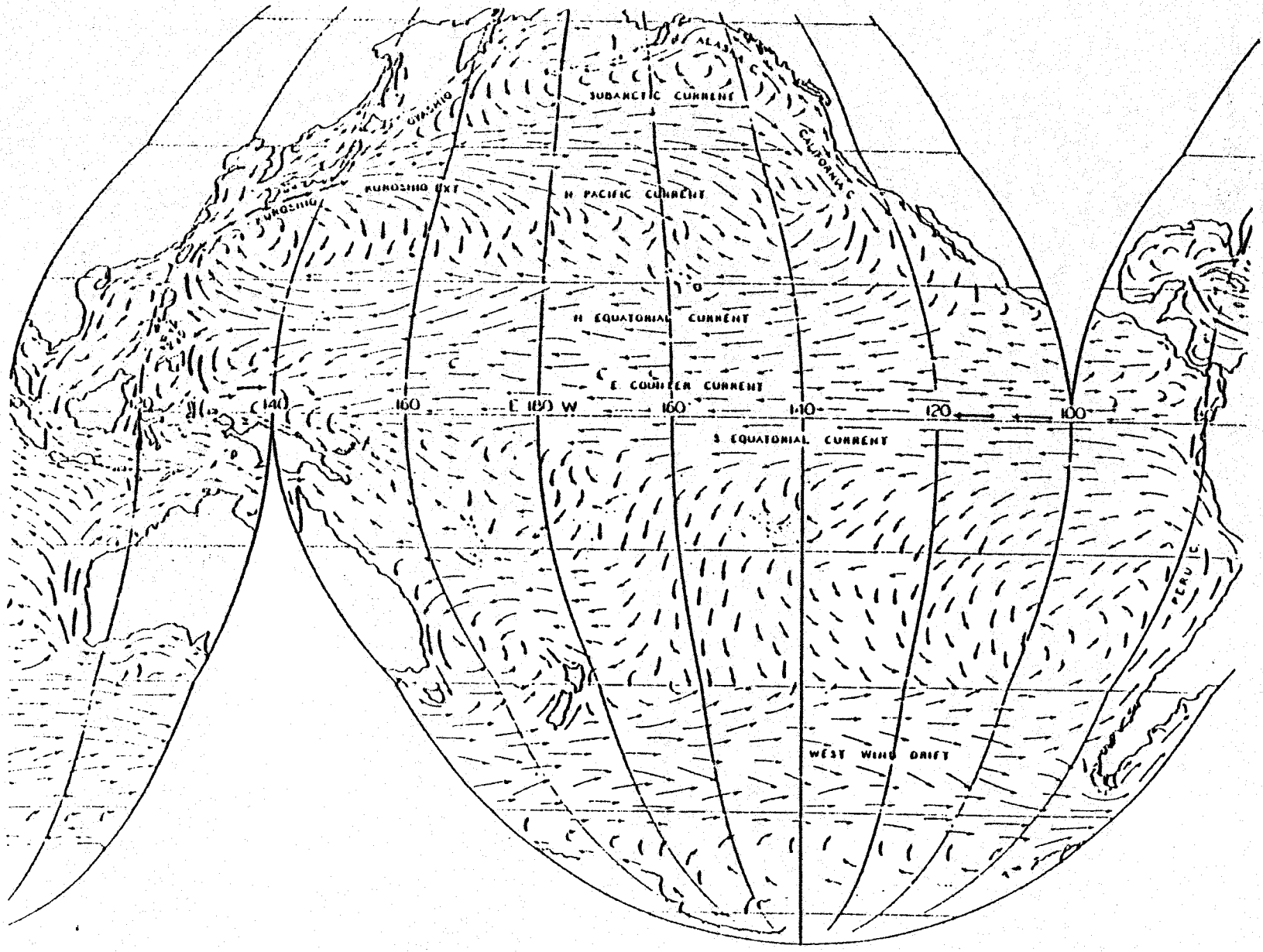


Figure D-1: SURFACE CURRENTS OF THE PACIFIC OCEAN

Source: Sverdrup, H.V., M.W. Johnson, and R.H. Fleming. 1942
The Oceans. Prentice Hall, Inc. Englewood Cliffs, N.J. Chart VII.

APPENDIX D: DESCRIPTION OF THE HABITAT

Billfish are widely distributed in the Pacific Ocean within depths to at least 250 m. Their distribution and habitat in the Pacific is related to the distribution of the physical and chemical properties of the Pacific Ocean. Information on surface current systems, surface temperature and depth of the mixed layer are particularly pertinent to billfish occurrence and distribution.

Surface current systems (Figure D-1)

Near the Equator in the Pacific Ocean there is a general westward transport of water: north of the Equator by the North Equatorial Current and south of the Equator by the South Equatorial Current. These westerly flowing currents are separated by the easterly flowing Equatorial Counter Current. As the North and South Equatorial Currents approach the western boundary of the Pacific Ocean they turn poleward and transport large volumes of relatively warm water into the temperate latitudes. In the Northern Hemsiphere this warm current, the Kuroshio, leaves the continental shores between lat. 30° and 40°N and flows in a north-easterly direction. The southerly-flowing cold current, the Oyashio, merges and mixes with the Kuroshio and transports the water back as the North Pacific Current to the eastern side of the ocean. The character of this current is changed by processes of mixing and cooling so that the current is no longer tropical but cool and temperate, when it reaches the eastern boundary of the Pacific. Near the eastern boundary the current divides and forms an eddy in the north in the Gulf of Alaska and toward the south forms the southward flowing California Current. The California Current is cool, but not cold, and transports cool water well into the Tropics and then swerves offshore once again in the equatorial area to complete the cycle.

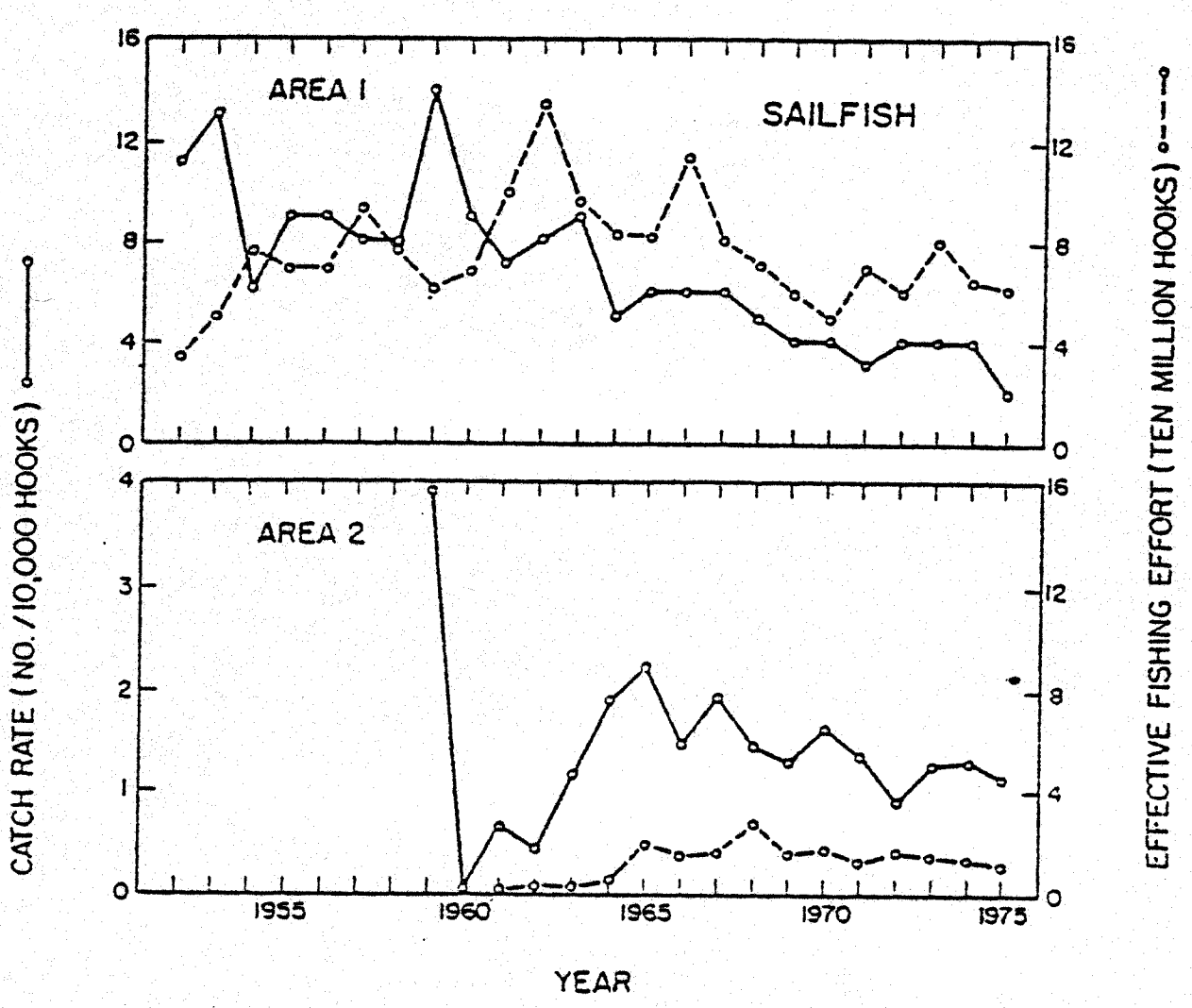


Figure C-10: CATCH RATES OF EFFECTIVE FISHING EFFORT FOR SAILFISH IN THE PACIFIC OCEAN

(See Figure 8-5 for area designation.)

Source: Shomura, R. S. 1980.

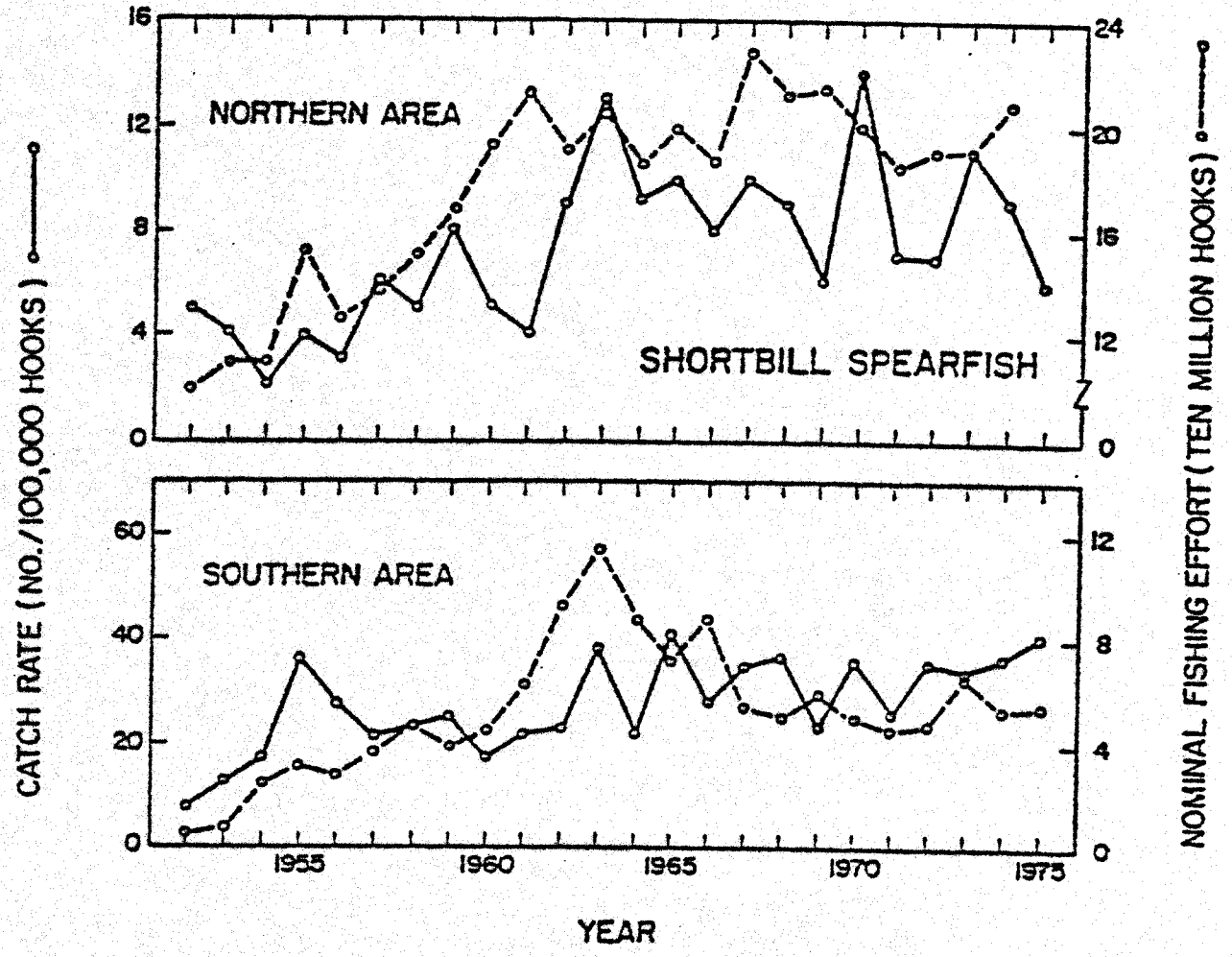


Figure C-9: CATCH RATES AND NOMINAL FISHING EFFORT FOR SHORTBILL SPEARFISH IN THE PACIFIC OCEAN

(See Figure B-3 for area designations)

Source: Shomura, R. S. 1980.

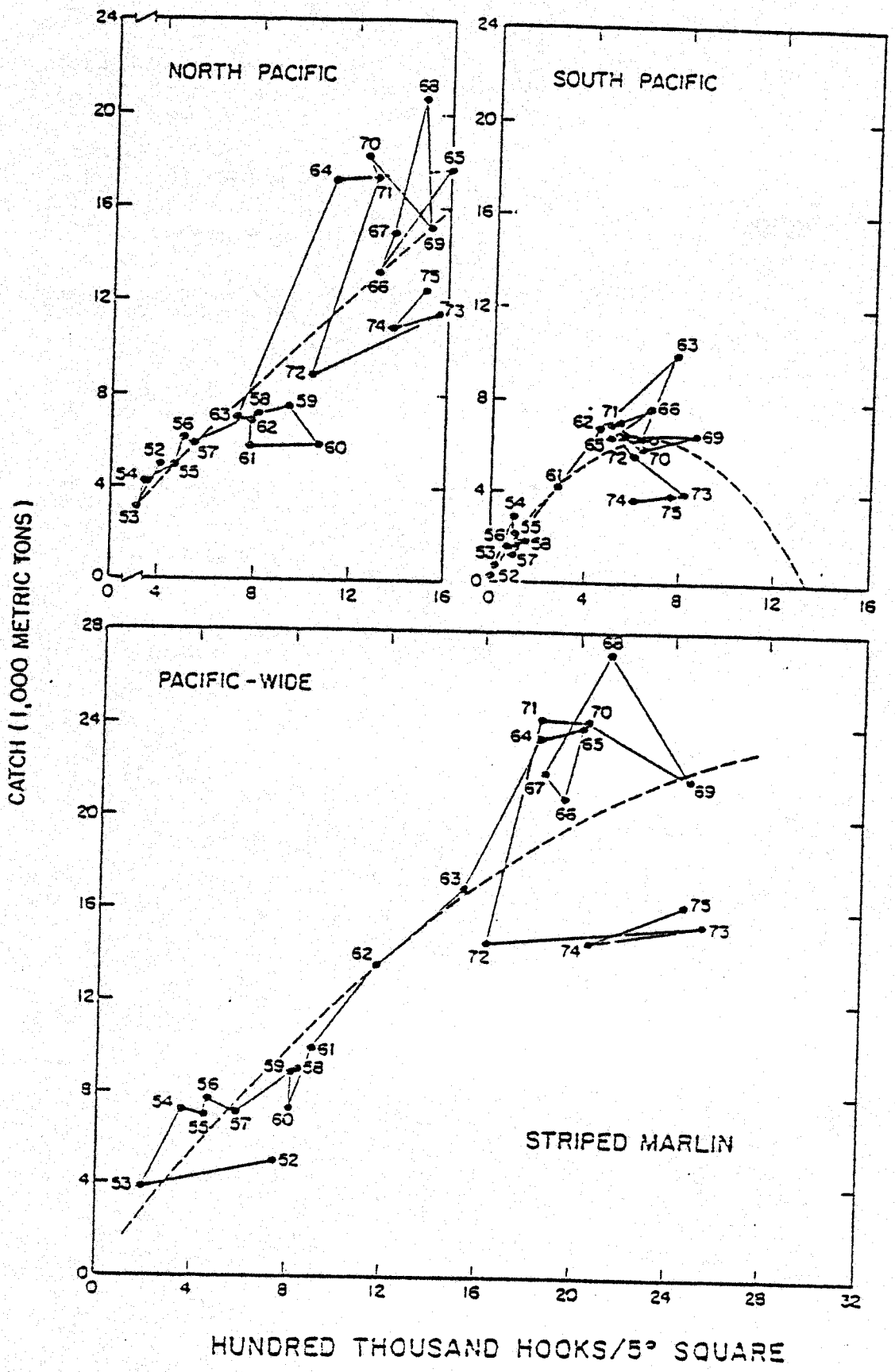


Figure C-3: RELATIONSHIP BETWEEN CATCH OF STRIPED MARLIN AND EFFECTIVE FISHING EFFORT

(The equilibrium yield curve is based on the production model. See Figure B-4 for area designations.)

Source: Shomura, R. S. 1980.

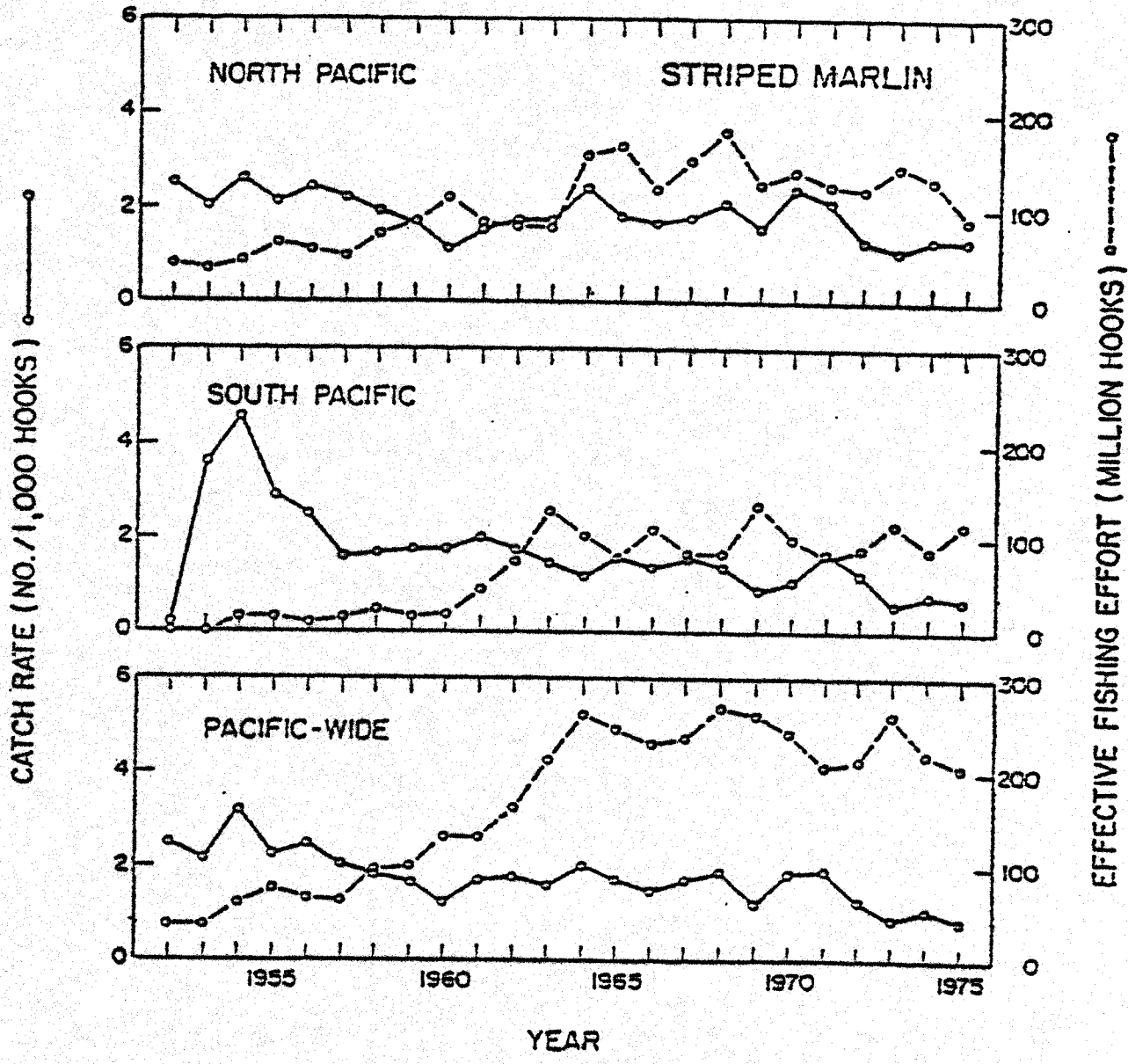


Figure C-7: CATCH RATES AND EFFECTIVE FISHING EFFORT FOR STRIPED MARLIN IN THE PACIFIC.

(See Figure 8-4. for area designations

Source: Shomura, R.S. 1980

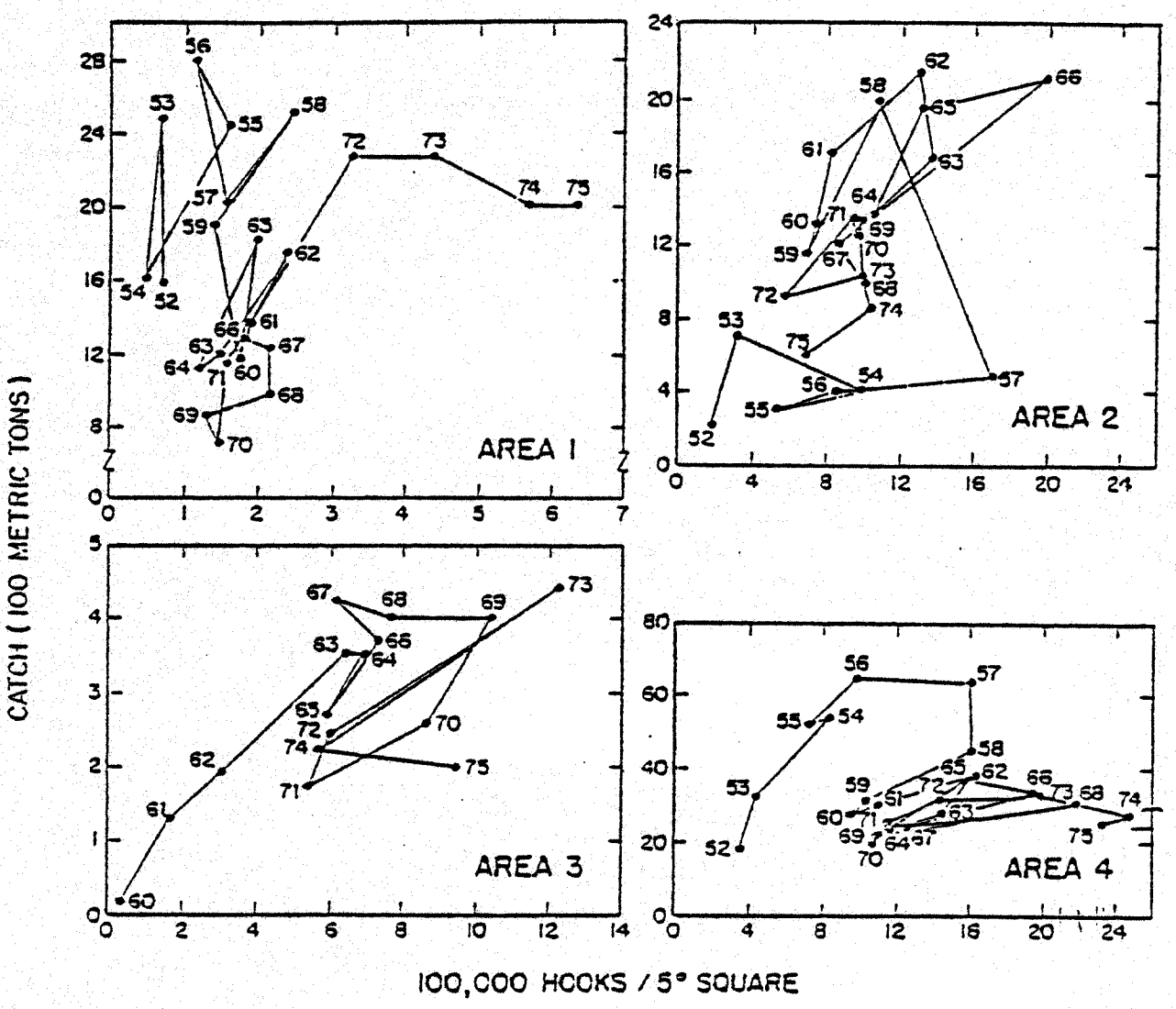


Figure C-6: RELATIONSHIP BETWEEN CATCH OF BLACK MARLIN AND EFFECTIVE FISHING EFFORT.

Source: Shomura, R.S. 1980.

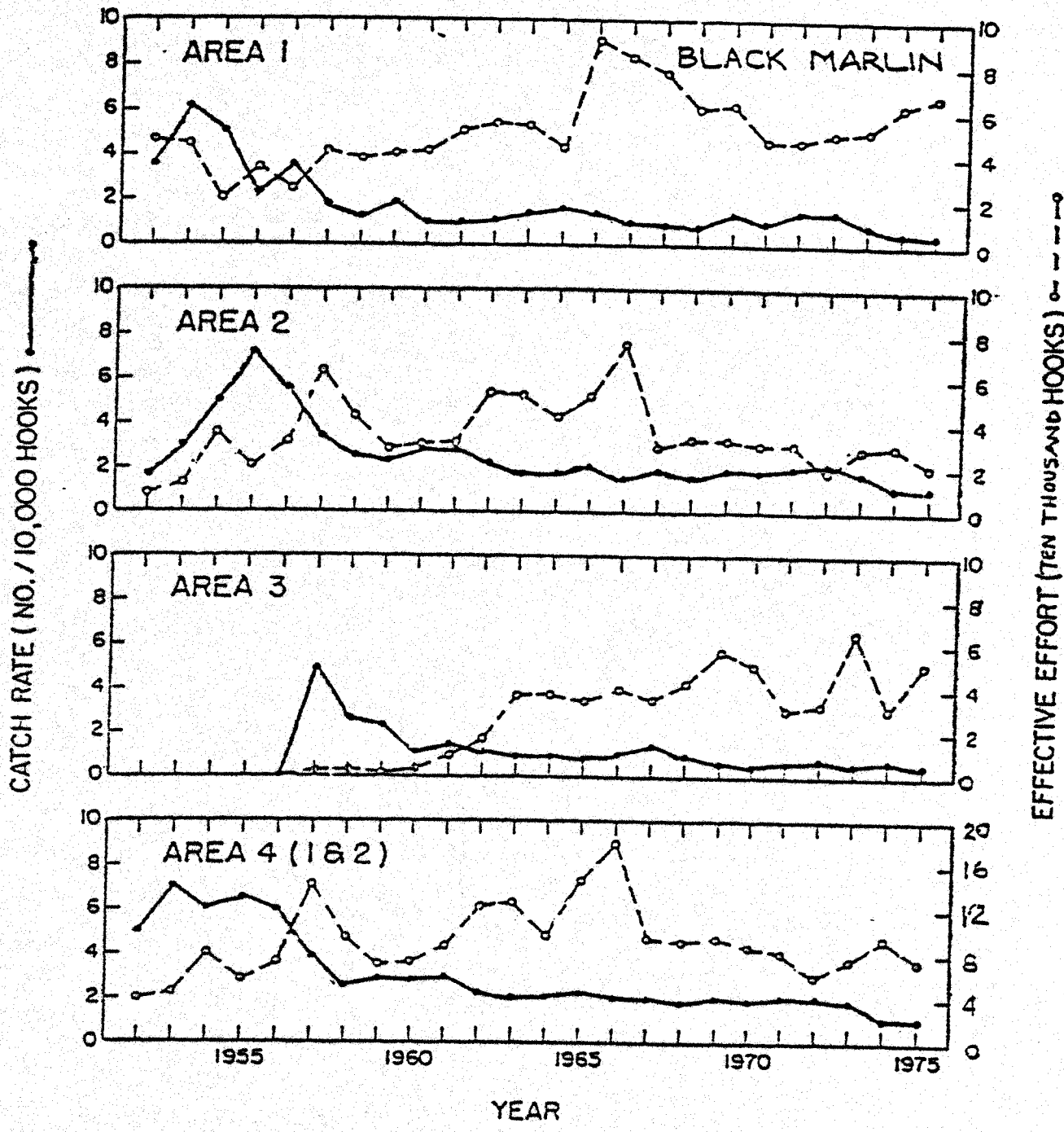


Figure C-5: CATCH RATES AND EFFECTIVE FISHING EFFORT FOR BLACK MARLIN IN THE PACIFIC OCEAN

(See Figure B-3 for area designations.)

Source: Shomura, R. S.

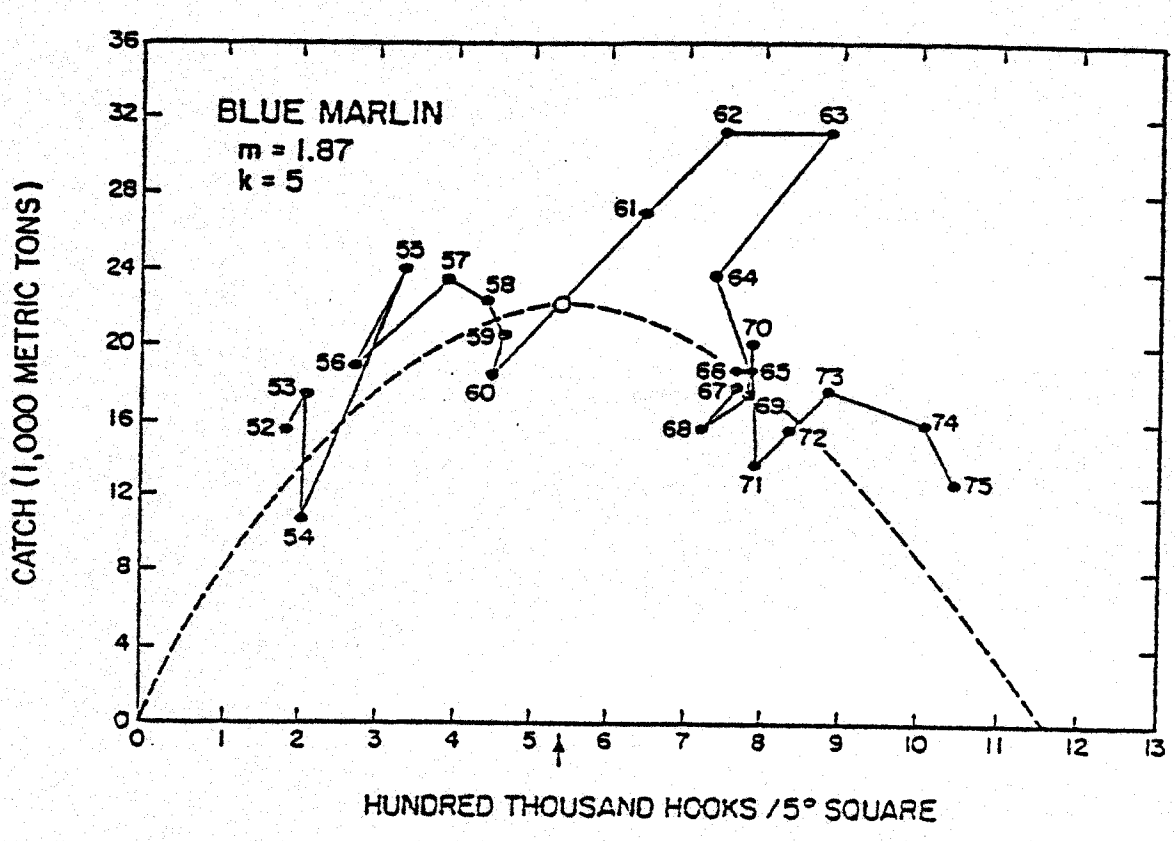


Figure C-4: RELATIONSHIP BETWEEN CATCH OF BLUE MARLIN AND EFFECTIVE FISHING EFFORT

(The equilibrium yield curve is based on the production model.)

Source: Shomura, R. S. 1980.

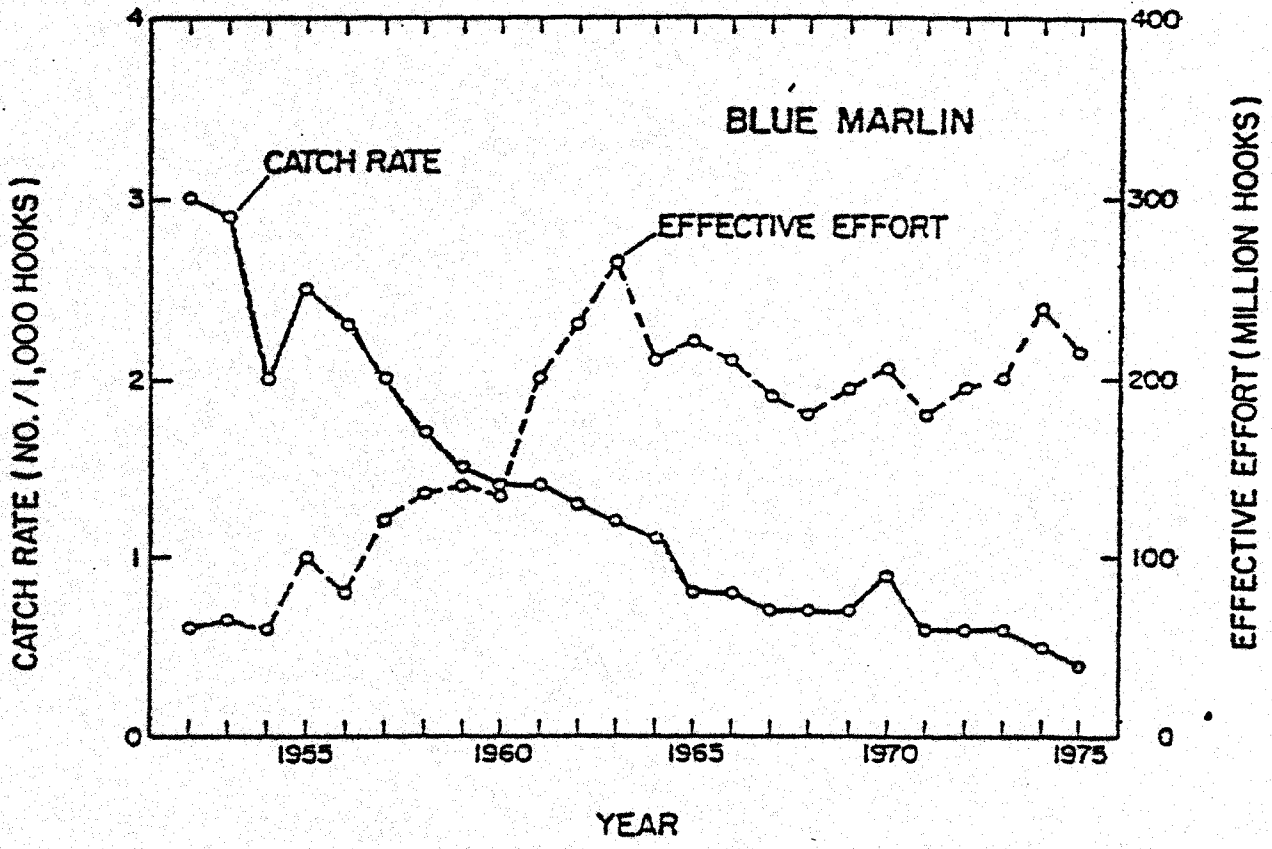


Figure C-3: CATCH RATE AND EFFECTIVE FISHING EFFORT FOR BLUE MARLIN IN THE PACIFIC OCEAN, 1952-75

Source: Shomura, R. S. 1980.

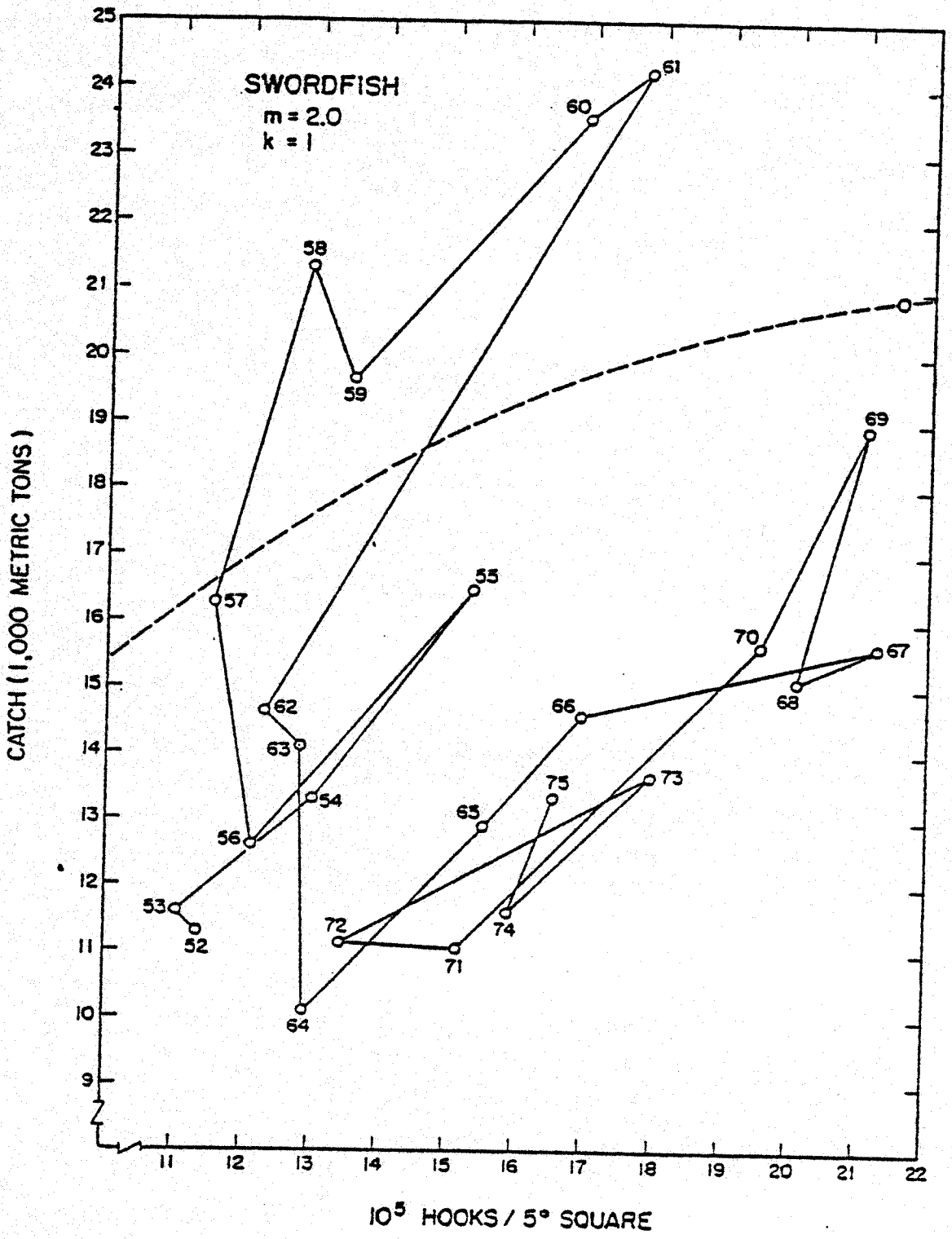


Figure C-2: RELATIONSHIP BETWEEN CATCH OF SWORDFISH AND EFFECTIVE FISHING EFFORT.

(The equilibrium yield curve - Schaefer production model - is shown for data for 1952-63 only.)

Source: Shomura, R. S. 1980

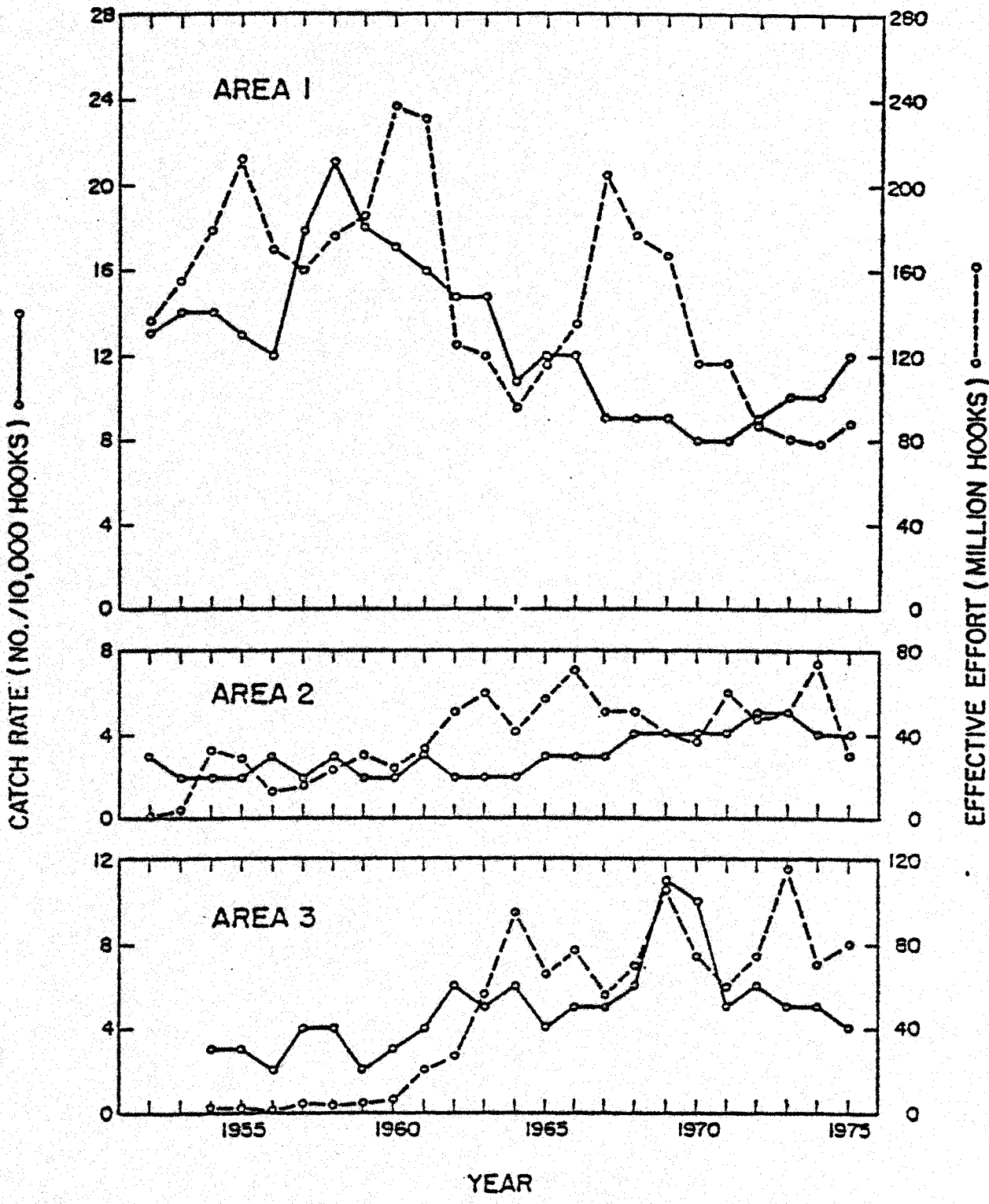


Figure C-1b: CATCH RATE AND EFFECTIVE FISHING EFFORT FOR SWORDFISH IN THE PACIFIC OCEAN

(See Figure B-1 for area designations.)

Source: Shomura, R. A.

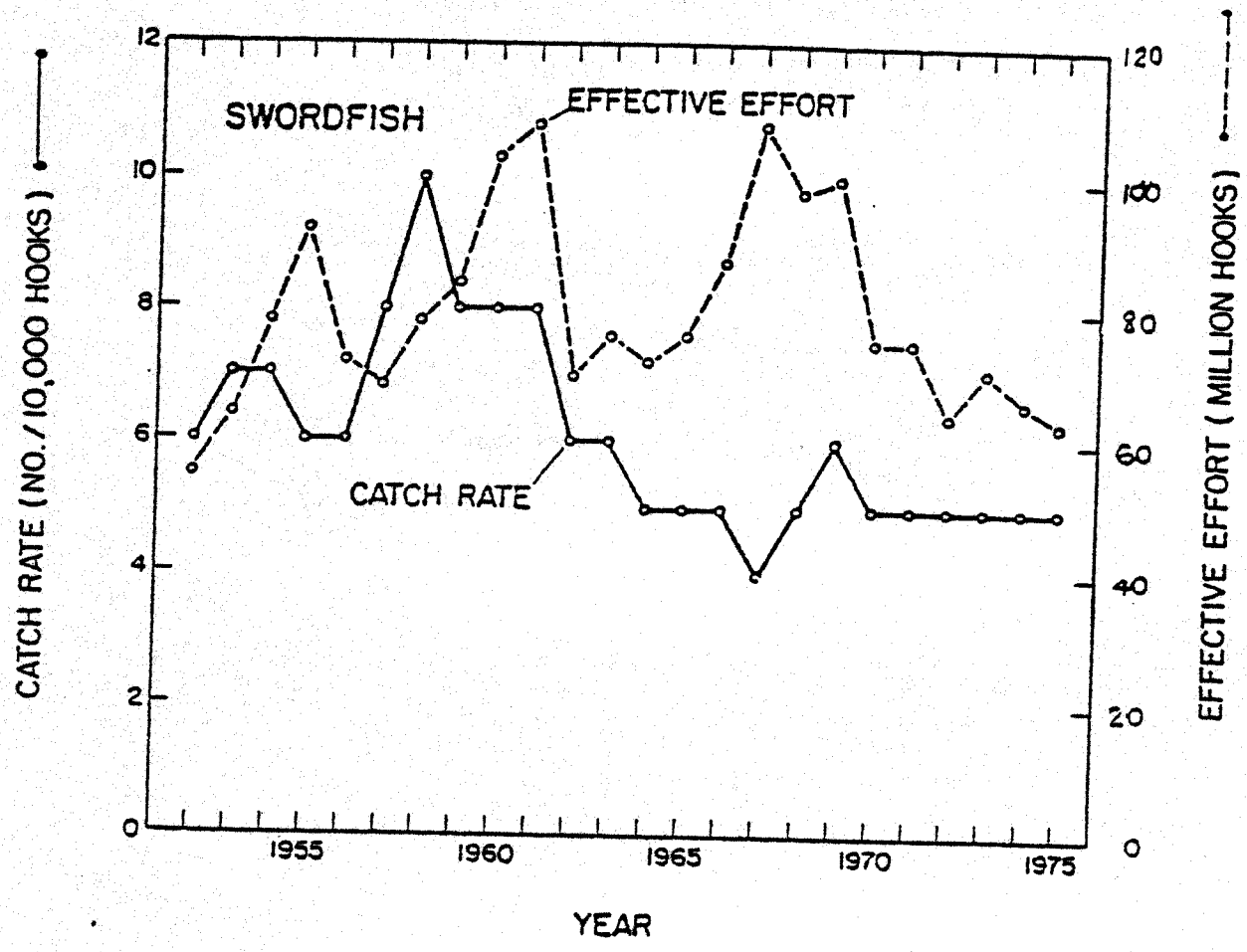


Figure C-1a: CATCH RATE AND EFFECTIVE FISHING EFFORT FOR SWORDFISH IN THE PACIFIC OCEAN, 1952-75

(A single Pacific-wide stocks is hypothesized)

Source: Shomura, R. S. 1980

EXHIBIT C-1

THE GENERALIZED PRODUCTION MODEL

This discussion follows Fox (1975)

Let:

P_τ = population size at time τ

f_τ = fishing effort at time τ

q = catchability inefficient

y = equilibrium yield

m,H,K = Parameters to be estimated

It is assumed that:

$$\frac{dP_\tau}{d\tau} = HP_\tau^m - KP_\tau - P_\tau\, h(f_\tau) \qquad (1)$$

where $P_\tau\, h(f_\tau)$ is catch at population size P_τ and effort f_τ, and that:

$$Y = qfP \qquad (2)$$

Solving for $\frac{dP}{d\tau} = 0$, that is equilibrium conditions, yields at equilibrium:

$$Y = HP^m - KP$$

$$P = \left(\frac{K}{H} + \frac{q}{H} f\right)^{\frac{1}{m-1}}$$

$$Y = f\left(\frac{Kq^{m-1}}{H} + \frac{q^m}{H} f\right)^{\frac{1}{m-1}}$$

and optimal equilibrium values of :

$$fopt = K\left(\frac{1}{m} - 1\right)/q$$

$$Popt = (K/(mH))^{1/m-1}$$

$$Ymax = H\,(K/(mH))^{\frac{m}{m-1}} - (K^m/(mH))^{\frac{1}{m-1}}$$

If a year class occurs in the catch for more than one year, the average annual catch per unit effort will be a weighted average of past effort:

$$Ui = \{k \cdot fi + (k-1) \cdot fi-1 + \text{----} \}$$

therefore $\bar{fi} = \{k \cdot fi + (k-1) \cdot fi-1 + \text{----} 1\} / \{k + (k-1) + \text{---} + 1\}$ is used as the average fishing effort over the period.

Least squares procedures are then used to obtain the best estimates of the parameters H,K and m from the data.

TABLE C-2

ESTIMATION OF MAXIMUM SUSTAINABLE YIELD (MSY)

IN THE PACIFIC

Species	MSY	Stock Condition	Current Effort
Swordfish	20,000 MT 2.2 million hooks/ 5° square	Good	13,400 MT 6 million hooks/ 5°square
Blue Marlin	22,000 MT 540,000 hooks/ 5° square	Overfished	12,500 MT 1.0 million hooks/ 5° square
Black Marlin	No estimate possible	Fished Near Capacity	3,000 MT[1] 2.3 million hooks/ 5° square
Striped Marlin	24,000 MT 3.4 million hooks/ 5° square	Fished At Or Near Capacity	16,000 MT 2.5 million hooks/ 5° square
Shortbill Spearfish	no estimate possible	Probably Good	-
Sailfish	no estimate possible	Probably Good	-

Source: Shomura, R.S. 1978.

[1]Western Pacific only.

TABLE C-1

CATCH AND EFFECTIVE FISHING EFFORT

1952-1975

Species	Catch in Metric Tons[1] (Year) minimum	Catch in Metric Tons[1] (Year) maximum	Effective Fishing Effort[2] in Million Hooks (Year) minimum	Effective Fishing Effort[2] in Million Hooks (Year) maximum
Swordfish (Figure C-2a&b)	10,112 (1964)	21,341 (1958)	275 (1952)	550 (1961 & 1967)
Blue Marlin (Figure C-4)	10,519 (1954)	25,581 (1961)	50 (1952)	260 (1968)
Black Marlin (Figure C-6)	1,806 (1952)	6,466 (1956)	40 (1952)	270 (1964, 1968, 1973)
Striped Marlin (Figure C-8)	3,789 (1953)	27,143 (1968)	1,000 (1958)	2,800 (1968)
Shortbill Spearfish (Figure C-10)	2,000 (1952)	12,800 (1965 & 1969)	105 (1952)	320 (1963)
Sailfish (Figure C-11)			31 (1952)	131 (1962)

Sources: [1]Table 5.13 of text

[2]Shomura, R. S. 1978.

C-10. The Billfish Stock Assessment Workshop used primarily Japanese longline data for these estimates.

APPENDIX C: MAXIMUM SUSTAINABLE YIELD (MSY)

Estimates of MSY and evaluations of stock condition presented in this section are from the Summary Report of the Billfish Stock Assessment Workshop (Shomura, 1980).

The following are problems which make it difficult to estimate MSY and to evaluate stock conditions precisely:

1. Lack of data on growth rates, mortality rates, reproductive rates and other vital determinants of population dynamics.

2. Limited catch per unit effort (CPUE) data are available which led to various assumptions being made for stock assessment purposes. The validity of these assumptions have not be ascertained.

   It was assumed in order to use the production model* as developed by M.B. Shaefer in the 1950's and by Fox (1975) that:

   a. CPUE is proportional to average stock abundance

   b. Ratio of CPUE to abundance remains constant over the period of analysis

   c. Total catch is known.

   The mathematics of this mode is summarized in Exhibit C-1.

3. CPUE data were obtained from the Japanese longline fishery (Annual Reports). This fishery catches billfish incidentally to tuna. Various changes in the fishery such as gear used and target species have also occurred during the period of data collection.

   The Japanese longline data provides generally reliable figures for total catch of most billfish species except that sailfish and shortbill spearfish are combined. The data provided by coastal fisheries and from Korean vessels are less reliable.

With these limitations considered, the assessments of billfish stocks were made and presented in the Tables C-1 and C-2 and in Figures C-1 through

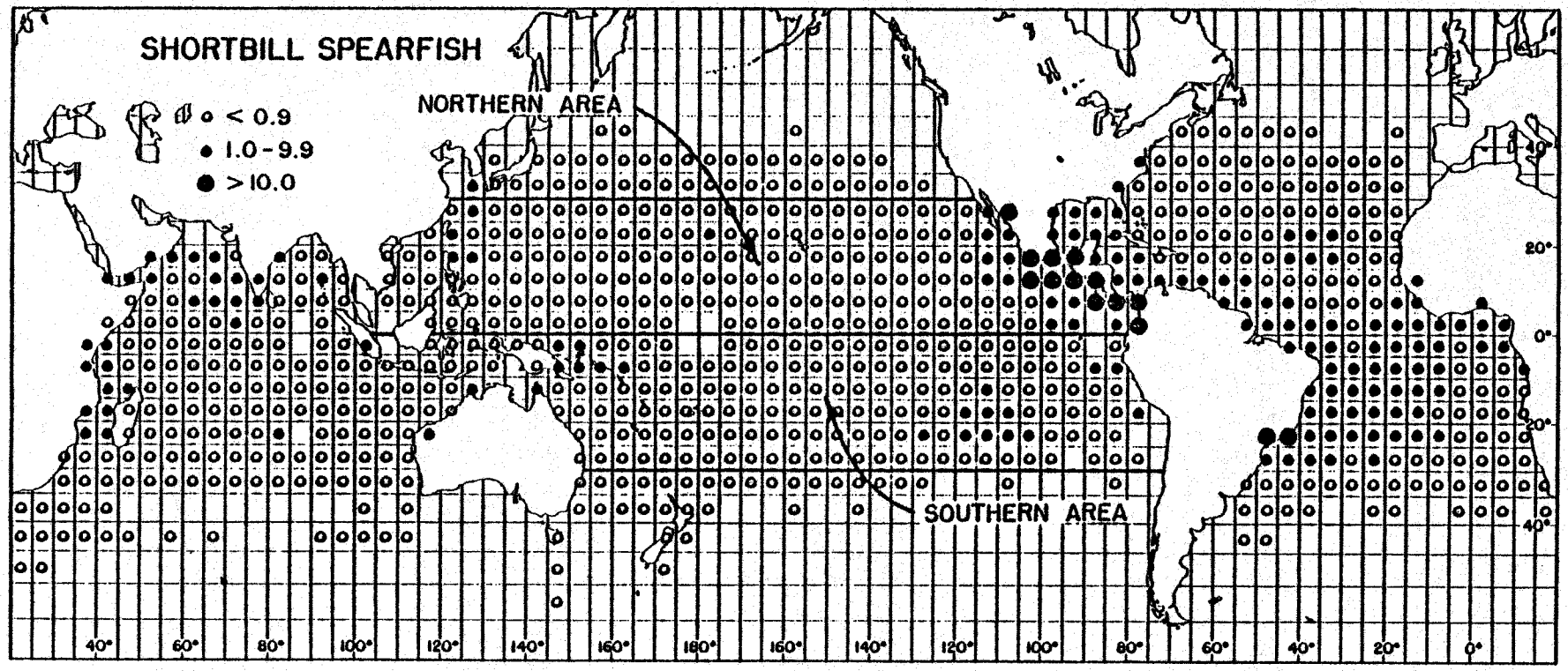


Figure B-6: Boundaries of suggested shortbill spearfish stocks.
The circles indicate mean catch rates (no. fish/1,000 hooks) area designations indicate locations of hypothesized shortbill spearfish stocks.

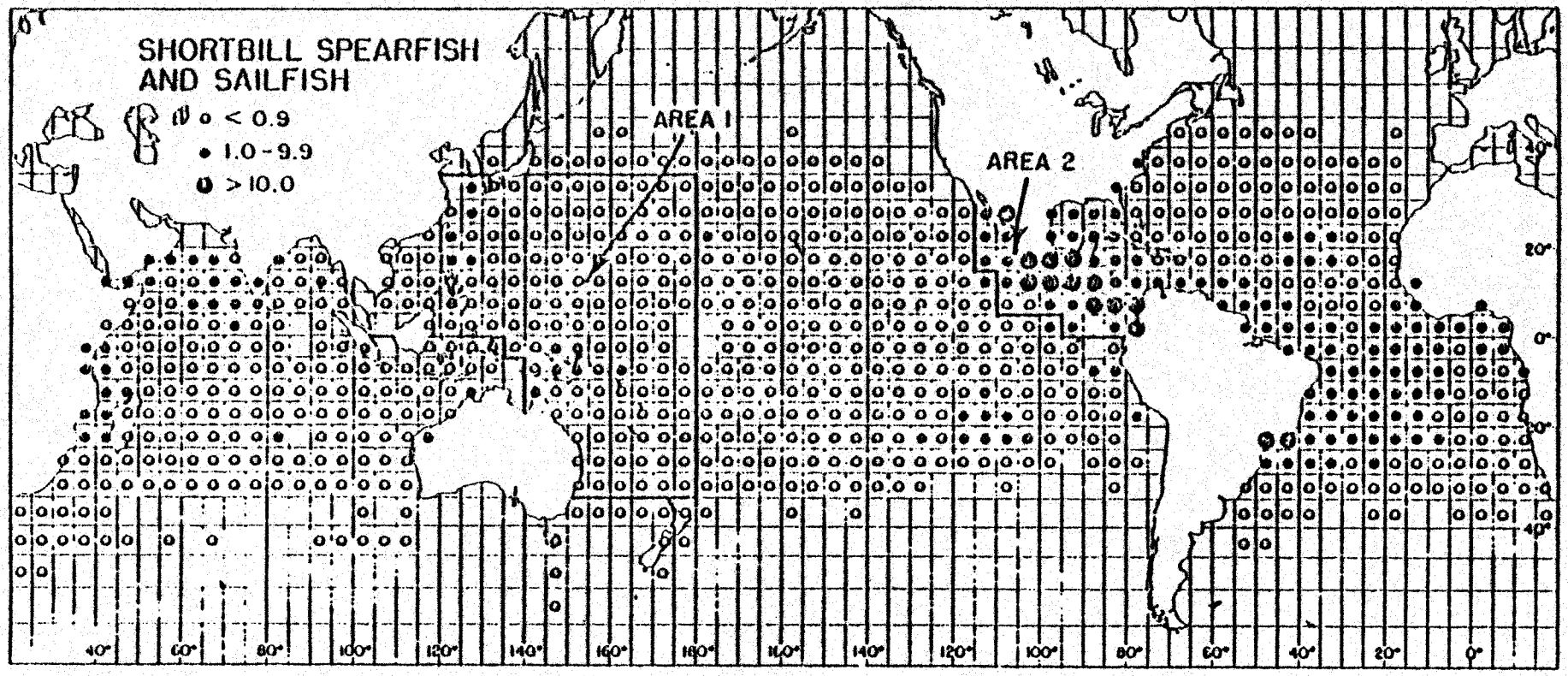


Figure B-5: DISTRIBUTION OF SHORTBILL SPEARFISH AND SAILFISH

Circles indicate mean catch rates (no. fish/1,000 hooks).

Area designations indicate locations of hypothesized sailfish stocks.

Source: Shomura, (ed), 1980

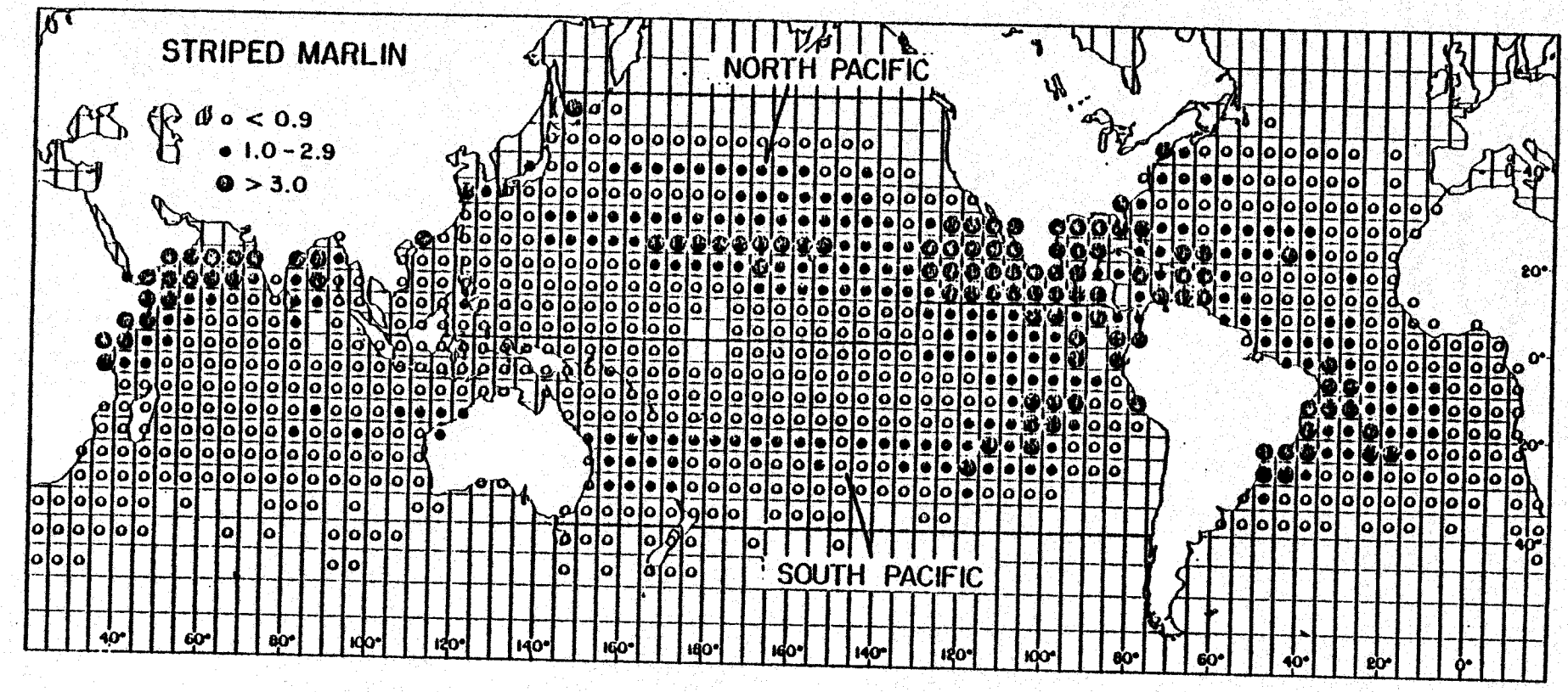


Figure B-4: DISTRIBUTION OF STRIPED MARLIN IN THE PACIFIC OCEAN

Circles indicate mean catch rates (no. fish/1,000 hooks).

Area designations indicate location of hypothesized striped marlin stocks.

Source: Shomura, (ed), 1980

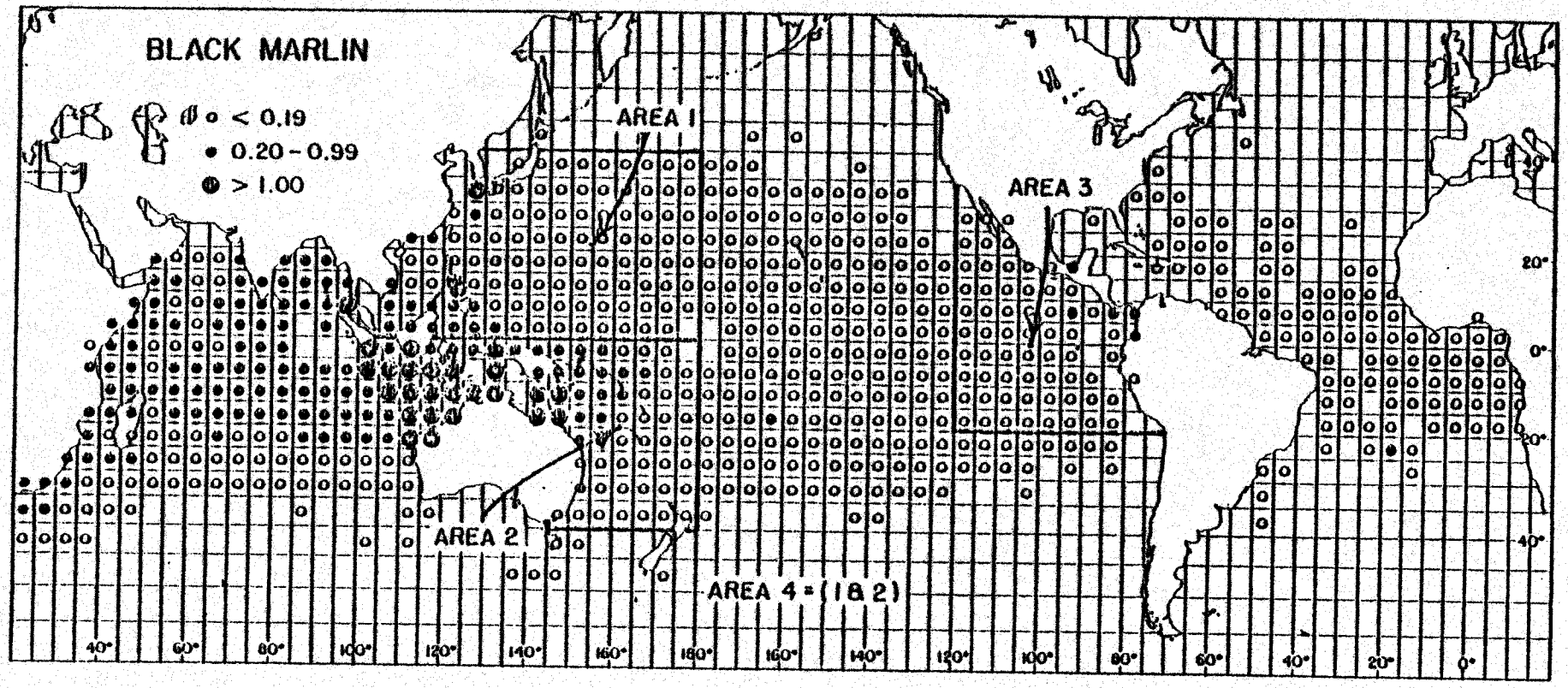


Figure B-3: DISTRIBUTION OF BLACK MARLIN IN THE PACIFIC OCEAN

Circles indicate mean catch rates (no. fish/1,000 hooks).

Area designations indicate locations of hypothesized black marlin stocks.

Source: Shomura, (ed), 1980

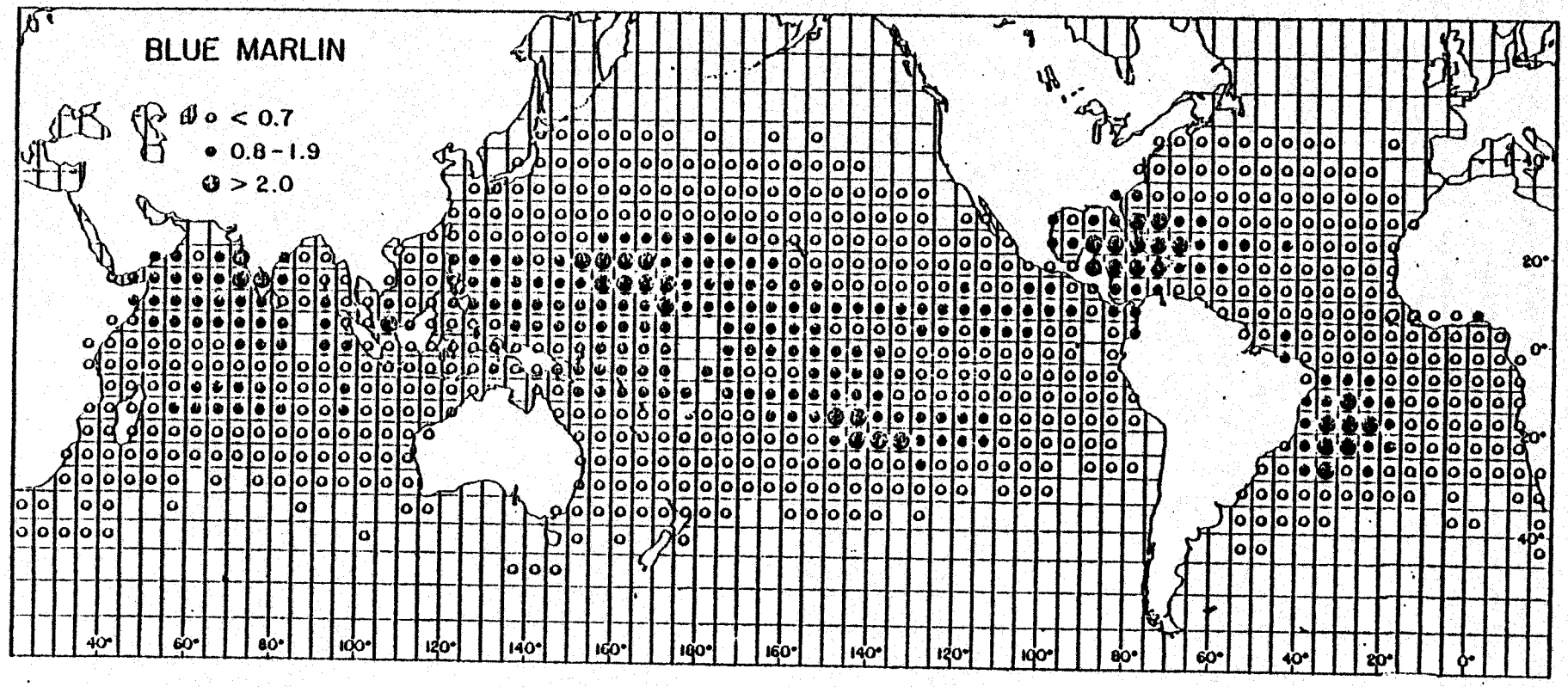


Figure B-2: DISTRIBUTION OF BLUE MARLIN IN THE PACIFIC OCEAN

Circles indicate mean catch rates (no. fish/1,000 hooks).

A single Pacific-wide stock is hypothesized for blue marlin.

Source: Shomura, (ed). 1980

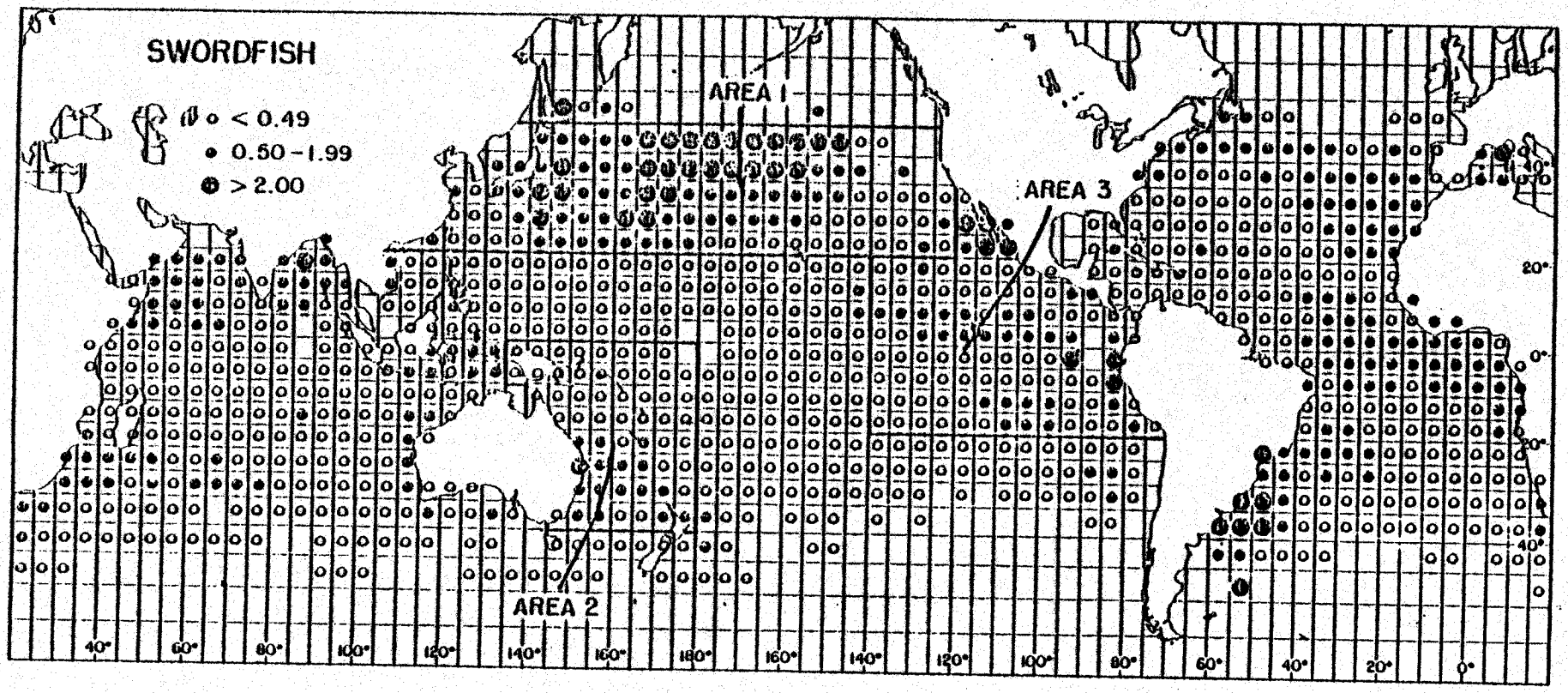


Figure B-1: DISTRIBUTION OF SWORDFISH IN THE PACIFIC OCEAN

Circles indicate mean catch rates (no. fish/1,000 hooks).

Area designations indicate locations of hypothesized swordfish stocks.

Source: Shomura, (ed), 1980.

surface by longline and gill net.

5. Shortbill Spearfish (see Figure B-5).

Pacific distribution: Between 30°N and 30°S latitude (Kikawa, 1974).

Seasonal distribution: Low density throughout range except in November through February in northwest Pacific (15°N to 30°N) and in September through November in Marquesas Islands.

Vertical distribution: Reported to occur only in water deeper than 900 m (Merrett, 1971).

6. Sailfish (see Figure B-5).

Pacific distribution: Between 45°N and 55°S latitude with high concentrations near land masses in western and eastern Pacific between 30°N and 30°S.

Seasonal distribution: At 0 to 15°N, summer peak of abundance; at 30°N, caught only in summer and fall; in Hawaii, major peak in March and April and secondary peak in October.

Vertical distribution: Caught near surface by trolling and subsurface by longline.

changes in catch rates by localities strongly suggest an annual migratory movement, this has not been confirmed by direct evidence.

Vertical distribution: Caught near surface by trolling and subsurface by longlines.

3. Black Marlin (see Figure B-3).

Pacific distribution: Between 45°N and 50°S latitude in western Pacific and 35°N and 35°S latitude in eastern Pacific. More concentrated in certain coastal areas: Coral Sea and East China Sea, near Panama and Ecuador, near mid-oceanic islands.

Seasonal distribution: Little data available. On southwestern Pacific, toward equator in summer and away from equator in winter.

Vertical distribution: Caught near surafce by trolling and subsurface by longlines.

4. Striped Marlin (see Figure B-4).

Pacific distribution: Between 45°N and 45°S latitude with areas of concentration in the eastern and central north Pacific.

Seasonal distribution: Eastern Pacific concentration expands and contracts from same position while north central concentration moves northward for summer and southward for winter. Neither concentration crosses the equator to any appreciable extent during these movements.

Vertical distribution: Caught near surface by trolling and sub-

APPENDIX B: DISTRIBUTION OF BILLFISH SPECIES

Data concerning the distribution and abundance of billfish are derived from the records kept by the fishery agencies of the high seas longline nations. These data were assembled and analyzed at the Billfish Stock Assessment Workshop convened in Honolulu, Hawaii, December 5-14, 1977 (Shomura, 1980). The figures showing the distribution of the management species are taken from Shomura (1980).

1. Swordfish (see Figure B-1).

Pacific distribution: Between 50°N and 50°S latitude with areas of concentration in the northern Pacific (20°N to 45°N), eastern Pacific (California to Chile) and southwestern Pacific (Australia to New Zealand).

Seasonal distribution (highest longline catch rates): Fall and winter in central north Pacific; summer in eastern and southwestern Pacific; late spring and summer in Hawaii; summer and early fall in California.

Vertical distribution: Caught in surface layers by harpooning and subsurface by longline.

2. Blue Marlin (see Figure B-2).

Pacific distribution: Between 45°N and 45°S latitude with areas of concentration in midwestern north Pacific and central south Pacific.

Seasonal distribution (highest longline catch rates): North and south movement across the equator synchronous with summer. Although seasonal

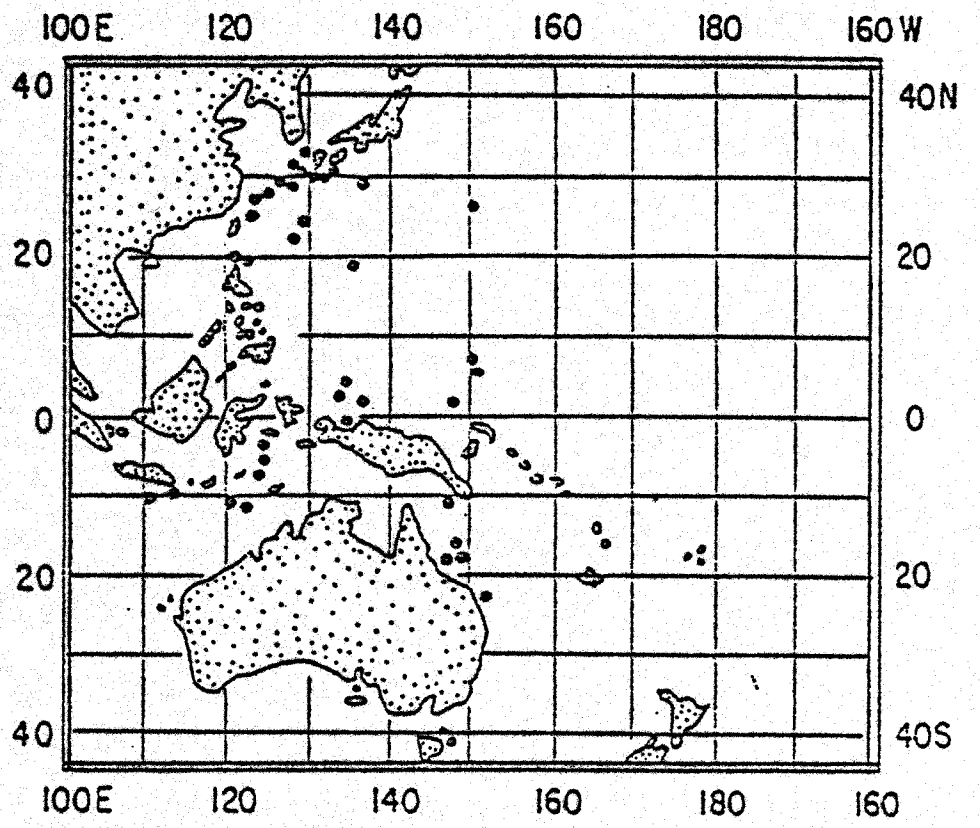


Figure A-2 OCCURENCE OF POSTLARVAL SAILFISH IN THE PACIFIC

Source: Ueyanagi, 1963

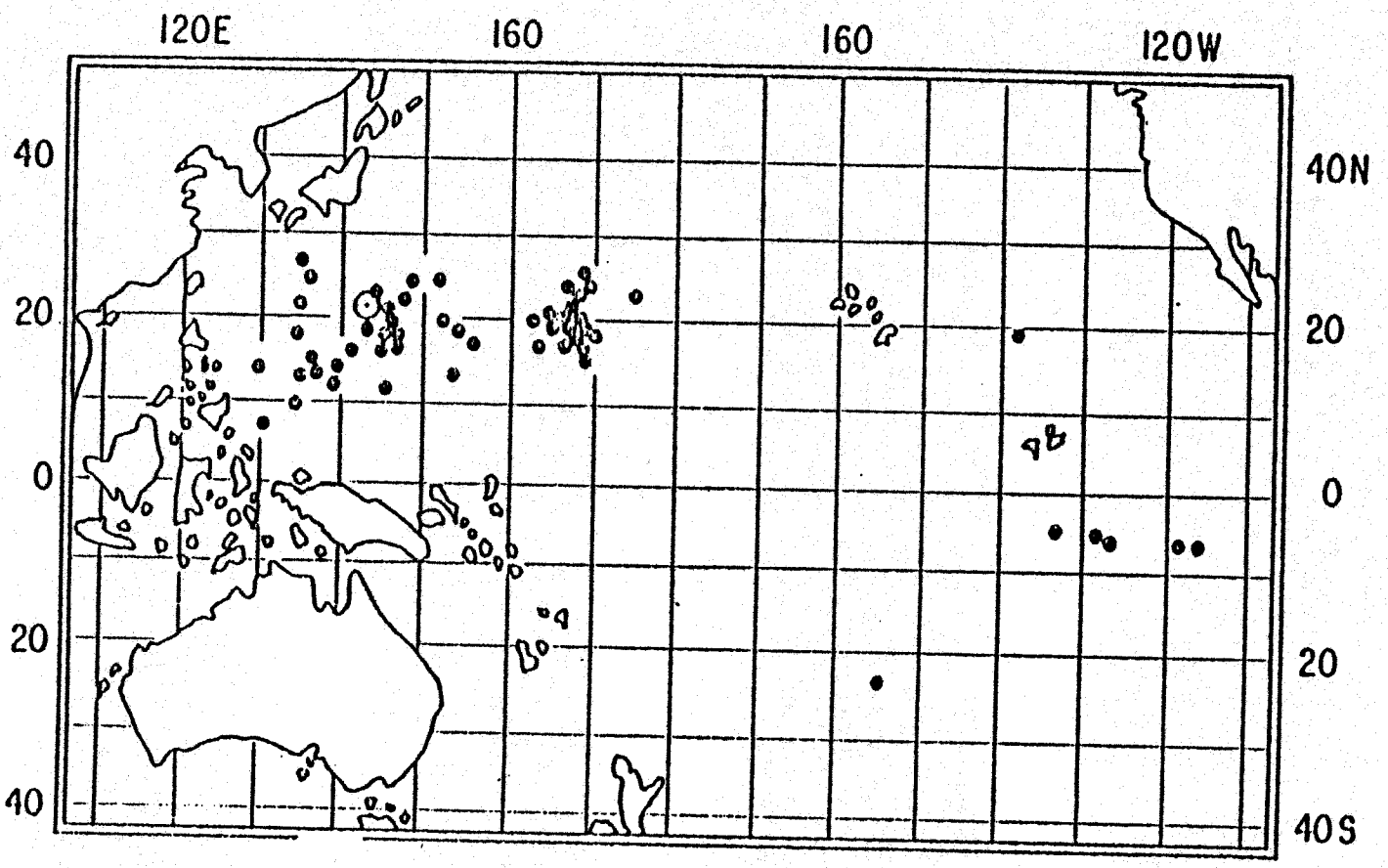


Figure A-1: LOCALITIES OF CAPTURE OF YOUNG AND POSTLARVAL SHORTBILL SPEARFISH IN THE PACIFIC

Sources: Ueyanagi, 1963; Watanabe and Ueyanagi, 1963

TABLE A-4

SUMMARY OF ESTIMATES OF GROWTH PARAMETERS OF PACIFIC BILLFISH SPECIES[1]

Species	K	t_o (yr)	L_∞ (cm)	Size Range (cm)	Source[2]
Western Pacific Swordfish	0.124		309.0	61-245	Estimates of K based on data from Yabe et al. (1959); L estimated by Yabe et al. (1959)
Blue Marlin					
Male	0.315	0.390	360.0	100-280	Skillman and Yong (1976)
Female	0.123	-0.202	626.6	50-400	Skillman and Yong (1976)
Black Marlin	0.474		282.0[3]	150-250[3]	Based on data from Koto and Kodama (1962b)
Striped Marlin	0.264		275.0[3]	120-235[3]	Based on data from Koto (1963)
Male	0.417	-0.521	277.4	144-272	Skillman and Yong (1976)
Female	0.696	0.136	251.0	131-268	Skillman and Yong (1976)
Sailfish	0.472		232.0[3]	130-210[3]	Based on data from Koto and Kodama (1962a)

[1] The parameters are for the von Bertalanffy growth equation:

$$L_t = L_\infty(1-e^{-k(t-t_o)})$$ where L_∞ = a parameter depicting asympotic maximum length

K = a parameter indicating rate of proportional growth

t_o = a parameter depicting the theoretical age at which the fish has zero length given the adult growth form.

[2] Estimates of growth parameters for these species were made at the Billfish Stock Assessment Workshop (Working Paper 6) based on length data from these sources.

[3] All other are fork lengths measured from tip of mouth to fork of tail.

TABLE A-3

SUMMARY OF ESTIMATES OF PARAMETERS OF LENGTH-WEIGHT RELATIONSHIP

$W=aL^b$

where: W = weight in kg, L = length in cm, and a and b are constants of proportionality.

Species and Locality	a	b	Size Range (cm)	Source
Swordfish				
Eastern Pacific	$2.1115X10^{-5}$	2.9605	[1]131-229	Kume & Joseph, 1969
Hawaii	$2.3296X10^{-7}$	3.5305	145-325	Skillman & Yong, 1974
Blue Marlin				
Eastern Pacific	$3.5851X10^{-5}$	2.8223	[1]167-270	Kume & Joseph, 1969
Eastern Pacific	$2.0417X10^{-6}$	3.318	[1]154-265	Wares & Sakagawa, 1974
Hawaii	$5.1827X10^{-1}$	0.6678	50-135	Skillman & Yong, 1974
Hawaii	$5.0048X10^{-6}$	3.0214	135-457	Skillman & Yong, 1974
Black Marlin				
Hawaii	$2.3787X10^{-6}$	3.1654	215-373	Skillman & Yong, 1974
Striped Marlin				
Eastern Pacific	$5.5564X10^{-6}$	3.089	[1]108-211	Kume & Joseph, 1969
Eastern Pacific	$6.9663X10^{-6}$	3.071	[1]110-215	Wares & Sakagawa, 1974
Hawaii	$5.7126X10^{-7}$	3.3756	142-310	Skillman & Yong, 1974
Shortbill Spearfish				
Eastern Pacific	$1.5325X10^{-7}$	3.7242	[1]128-156	Kume & Joseph, 1969
Hawaii	$5.0083X10^{-8}$	3.8338	140-180	Skillman & Yong, 1974
Sailfish				
Eastern Pacific	$1.1596X10^{-4}$	2.4156	[1]134-205	Kume & Joseph, 1969
Eastern Pacific	$4.3652X10^{-5}$	2.628	[1]115-222	Wares & Sakagawa, 1974
Hawaii	$2.0739X10^{-5}$	2.6054	177-281	Skillman & Yong, 1974

[1] eye-fork length

TABLE A-2

ESTIMATED LENGTH (cm), WEIGHT (kg) AND AGE OF FIRST SPAWN (in years) FOR BILLFISH SPECIES

Age (years)		1	2	3	4	5	6	7	8	9	10
Species											
Swordfish	cm	36	68	96	121	143	162	179	194	208	220
	kg	1	6	16	30	51	74	*99	126	153	181
Blue marlin [1]	cm	86	149	204	253	296	334	368	398	426	--
	kg	10	18	48	*91	146	212	284	359	439	--
Black marlin	cm	106	173	214	240	256					
	kg	Not available									
Striped marlin [1]	cm	113	182	217	234	242					
	kg	5	25	*44	57	64					
Sailfish [2]	cm	87	142	176	197	210					
	kg	6	20	*35	47	55					

* time of first spawn
1 Western Pacific female, eye-fork length
2 Hawaii female, eye-fork length

Source: Data from Table A-4 were used to calculate size at age.
Time of first spawning is based on Table A-1 where size at first spawn is given.

TABLE A-1

FECUNDITY OF BILLFISH SPECIES

Species	Number of Eggs[1] Per Spawning	Size at First Spawning (kg)	Source
Swordfish	3.0-6.2 million	80	Uchiyama and Shomura (1974)
	3.0-4.0 million		Yabe et al (1959)
Blue Marlin	unknown	54	Kume and Joseph (1969)
Striped Marlin	11.0-29.0 million	38-46	Eldrige and Wares (1974)
	14.0 million	-	Gosline and Brock (1960)
	-	33	Kume and Joseph (1969)
Shortbill Spearfish	unknown	14	Merrett (1971)
Sailfish	1.8-5.1 million	28-30	Eldridge and Wares (1974)

APPENDIX A: LIFE HISTORY INFORMATION

Spawning

Areas and seasons of spawning are presented in the text (Section 5.1.3.2) and Figures A-1 and A-2.

Fecundity

(See Table A-1)

Age and Growth

All growth studies of Pacific billfish have been based on analyses or progression of length modes of length-frequency distributions. (See Table A-4.)

Length-frequency analyses for estimates of age and growth have two major uncertainties which may lead to questionable results: (1) true age is unknown and (2) modes in the upper range of frequency distribution are often difficult to determine (Skillman and Yong, 1976).

Length-weight relationships for many species of the management unit have been determined by various investigators. (See Table A-3.)

Note that lengths of bony fishes are generally fork lengths (tip of mouth to fork of tail). Some billfish lengths are eye-fork lengths (posterior margin of orbit to fork of tail).

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July 11, 1981	Federation of Japan Tuna Fisheries Co-operative Associations, Shojiro Shimura, Director
July 11, 1981	Public Hearing, Saipan, Commonwealth of the Northern Mariana Islands (a) John Robinson, Sea Gypsy, sportfishing charter
July 13, 1981	State of Hawaii, Office of Environmental Quality Control, Harry Y. Akagi, Acting Director
July 13, 1981	Public Hearing - Agana, Guam (a) Paul Bordallo, Marianas Boat and Motors (b) Robert Smith, Billfish Advisory Panel (c) Robert Campbell, International Game Fish Association (d) Rand Kaufmann, Marianas Pacific Fishing (e) Joe Bolasios, Marianas Game Fishing Club (f) Dean Robb
July 13, 1981	Formal Close of Public Commentary Period
July 27, 1981	Department of State, Theodore G. Kronmiller, Acting Deputy Assistant Secretary, Bureau of Oceans and International Environmental and Scientific Affairs
July 28, 1981	National Marine Fisheries Service, NOAA, U.S. Department of Commerce, Roland F. Smith, Acting Director, Office of Resource Conservation and Management
July 31, 1981	National Fisheries Administration, Government of the Republic of Korea, Kim Jong Soo, Administrator
August 3, 1981	Florida State Museum, University of Florida, F. Wayne King, Director
August 7, 1981	Coordination Council (Taiwan) for North American Affairs, R. N. Tsai, Commercial Attache
August 20, 1981	Korean Deep Sea Fisheries Association, Hon K. An, Armstrong Byrd & Associates, Inc. representing the Korean Deep Sea Fisheries Association

June 16, 1981	Public Hearing - Honolulu (a) Hawaii Kai Fishing Club, Glenn S. Nishihara (b) Pokai Bay Fishing Club, Gregg Makua (c) Buzzy Agard, commercial fisherman
June 18, 1981	Public Hearing - Kona (a) Al Penrose, International Game Fish Association (b) George Parker, charter captain (c) James Hunter, Lei Aloha (d) Robert Barger, fisherman (e) Fred Keene, charter captain
June 19, 1981	City and County of Honolulu, Department of Parks and Recreation, Robert K. Masuda, Director
June 22, 1981	U.S. Department of the Army, Army Engineer District, Kisuk Cheung, Chief, Engineering Division
June 25, 1981	Public Hearing - Pago Pago, American Samoa (a) Mel Makaiwi, Star of the Sea Fishery (b) Leroy Le Doux, Office of Marine Resource, Government of American Samoa (c) Jim Sword, Marine Railway Authority (d) Robert Hsiao, Fisheries Representative of Taiwan (e) Mean-Jhong Kim, Korean Consul (f) Fritz Reed, Rod and Reel Fishing Club (g) Jim McGuire, American Samoa Gamefish Association
June 29, 1981	Dames and Moore, Donald F. Graf, Environmental Scientist
June 29, 1981	Public Hearing - Kauai (a) No comments received
June 30, 1981	Public Hearing - Maui (a) Edwin Yoshitake, commercial fisherman
July 2, 1981	State of Hawaii, Department of Planning and Economic Development, Hideto Kono, Director
July 6, 1981	Hawaii Audubon Society, Barbara J. Johnson on behalf of the Board of Directors
July 6, 1981	World Conference on Sea Turtle Conservation, Karen Bjorndal, Post-Conference Coordinator
July 7, 1981	U.S. Department of the Interior, Office of the Secretary, Pacific Southwest Region, Patricia Sanderson Port, Regional Environmental Officer

main Hawaiian Islands, thus precluding interaction with humpback whales in those areas. No definitive ecological relationships between billfish and other marine species are known other than food chain dependencies (Section 5.1.3). The TALFF set in the FMP will allow foreign fleets to operate at historic levels (or even beyond) in the FCZ, so long as they stay out of certain areas. There has been no foreign longline fishing under the federal regulations now in effect.

16.2 Chronological List of Reviewers and Oral Comments

Date	Organization/Person
June 1, 1981	State of Hawaii, Department of Health, Melvin K. Koizumi, Deputy Director for Environmental Health
June 4, 1981	State of Hawaii, Department of Defense, Office of Adjutant General, Jerry M. Matsuda, Contr. & Engr. Officer
June 4, 1981	U.S. Environmental Protection Agency, Region IX, Jake Makenzie, Director, Surveillance and Analysis Division
June 5, 1981	State of Hawaii, Department of Accounting and General Services, Division of Public Works, Rikio Nishioka, State Public Works Engineer
June 8, 1981	U.S. Department of the Army, Army Support Command, Hawaii; Adolph A. Hight, Director of Engineering and Housing
June 12, 1981	City and County of Honolulu, Department of General Planning, Ralph Kawamoto, Planner
June 16, 1981	State of Hawaii, Department of Land and Natural Resources, Susumu Ono, Chairman, Board of Land and Natural Resources
June 16, 1981	State of Hawaii, Department of Transportation, Ryokichi Higashionna, Director

Response: The FMP notes that most billfish fishing occurs within 20 miles of the islands. There is some but not much indirect taking of billfish by domestic fishermen beyond 50 miles from shore. Chart 34 (page 87) of the Angler's Guide to the U.S. Pacific Coast (1977) pictorially depicts the major Hawaii Offshore Fishing Grounds used by domestic fishermen. The grounds clearly encompass the channels of the Hawaiian Archipelago. The plan, however, proposes no regulations for domestic fishing, so there will be no overlapping regulations with the State. The Division of Aquatic Resources of the Department of Land and Natural Resources maintains records of voluntary reports submitted by fishermen fishing near the FAD's. FAD associated catches of billfish would be expected to increase since the closure zones should lead to increased density and thus the availability of billfish.

13. State of Hawaii Office of Environmental Quality Control. The document should note that offshore waters of Hawaii up to the 100 fathom isobar have been proposed as a marine sanctuary for the Hawaii humpback whale. We recommend fully considering the impact of the fishing fleets on the whales and their migrations. The document should discuss the ecological relationships of billfish and other species. Are billfish species dependent on other marine species or vice versa? The discussion of TALFF should include the past records of foreign fleets abiding by the regulations and limits set by the U.S. Government.

Response: The humpback whale sanctuary proposal would not affect the fisheries for billfish. Similarly, there is no evidence available to the Council indicating that the fishery has had or will have an impact on humpback whales. The area closures will preclude foreign longlining in waters of the

10. Hawaii Audubon Society; World Sea Turtle Conservation Conference; Deparment of the Interior; Florida State Museum. Recommended that the FMP for billfish mandate the reporting of sea turtles and marine mammals incidentally caught by longline fishermen.

Response: The Council has initiated Section 7 Consultations with the NMFS regarding incidental catches of endangered and threatened species. The Council anticipates that the FMP reporting requirements in NMFS regulations to implement the FMP will be consistent with the Biological Opinion.

11. State of Hawaii Department of Land and Natural Resources. We believe that continued reliance on the existing Preliminary Management Plan for the billfish fishery would not be desirable. We are in favor of the FMP which strives to strike a balance between the priority which must be given to our domestic billfish fishers and current U.S. tuna policy. We recommend that further clarification be made as to the relationship between the PMP and the FMP as to species and areas covered by each respective plan.

Response: The draft FMP (Section 6.2) describes the relationships.

12. State of Hawaii Department of Planning and Economic Development. Should the indicated preferred alternative be selected, the description of consistency with Hawaii's Coastal Zone Management (CZM) Program is adequate for our review purposes. We recommend that any fishery areas within the nearshore or channel waters be identified in the FMP so that we may better assess the proposed plan in terms of any overlapping regulations. We recommend that the FMP's assess the impact of Fish Aggregating Devices (FAD's) and their intended purpose to increase catches of the various species of fish covered by the FMP.

closure areas for their catches. U.S. catches of billfish are a very small component of the total annual Pacific billfish harvest as reported in the United Nations Yearbooks of Fishery Statistics. The Council believes that billfish by catches taken on foreign longline gear negatively effect domestic billfish catches.

The Council acknowledges the need for international cooperation for managing all highly migratory species of fish in and beyond the Council's Region upon ratification of the LOS Convention. In the meantime, the Council has urged the Department of State and the NMFS to take efforts to initiate the development of appropriate international/regional forums toward this end.

9. NMFS. The omission of wahoo, oceanic sharks, mahimahi, and other important species may violate National Standard 3, which requires interrelated stocks for fish to be managed as a unit.

Response: The FMP addresses this point in detail (Section 5.1.2). Briefly, the Council believes that there is insufficient information available on these species to satisfy basic FCMA requirements. Time will be required to collect and analyze information on these species gathered under the reporting and monitoring procedures specified in the billfish FMP. A strict interpretation of the National Standard would also require the inclusion of tunas. The Council believes its first obligation is to develop a management plan for billfish and to get it implemented after more than four years of work on the matter. The Council notes that NMFS has approved the splitting of billfish, swordfish, and sharks into separate management units in the Atlantic Ocean and Gulf of Mexico.

federations of foreign longline interests toward developing a system of controls which provides a reasonable assurance of gains to domestic fishermen in the Council's Region. To date, affected foreign longline interests have not offered any voluntary restraints on their operations that offer such assurance. The Council is not aware of any nations that intend to prohibit U.S. fishing for tunas off their coasts because of high incidental catch rates of other important non-tuna species of fish. The Council is aware that a large majority of the world's coastal states have included the tunas within their exclusive fisheries management and conservation zones. Unrestricted freedom to fish for tunas and billfish in the 200 mile economic zones of nations is not an emerging principle of international law as conventionally practiced.

8. National Fisheries Administration of the Government of the Republic of Korea; Korea Deep Sea Fisheries Association; Federation of Japan Tuna Fisheries Cooperative Associations. Billfish are ecologically just as highly migratory as the tunas and are so listed in the informal negotiating text of the 3rd Law of the Sea (LOS) Conference of the United Nations. Management of such species should not be broken down into incohesive national management systems and should be deal with by responsible international organizations.

Response: The FMP acknowledges that the proposed area closures cannot result in meaningful long-term biological management for billfish throughout their entire range. The fact that a very small percentage of the total Pacific tuna and billfish catch is made in the proposed closure zones illustrates the significance of these areas to foreign longline vessels. Foreign longline vessels fish throughout the full ranges of billfish and tunas in the Pacific Ocean. U.S. billfish fishermen are dependent exclusively on the proposed

highly variable fisheries that are mostly beyond the conservation control of the Council. There is a perplexing problem in determining whether to close an area to further foreign longlining or to establish other restrictions (non-retention) when a quota for any species of billfish in the pelagic fisheries complex has been taken. Monitoring and enforcement would be prohibitively expensive.

6. Department of State. The Department has no objection in principle to the concept of area closures in the FCZ for foreign longlines. The specific area closures in the draft FMP are, however, a very direct and substantial restriction on foreign tuna fishing which could ultimately have a serious negative impact on our efforts to assure fishing access for the U.S. tuna fleet.

Response: The proposed closures to foreign longlining are a direct but not a substantial resriction on tuna fishing. The proposed action alters the past geographic patterns of foreign tuna catches in the FCZ of the Western Pacific Region by 13.2 percent. Foreign longline catches of tuna can be maintained at or above historical levels. See Response to Comment No. 1.

7. Department of State. The Department believes there is merit in pursuing further the idea of persuading foreign tuna fishermen to agree voluntarily to certain restrictions on their longlining. The distinction between a voluntary measure and one mandated by U.S. law is important even though there may be little practical difference in the manner in which longlining is conducted off the U.S. coasts. Voluntary approaches can avoid setting a potentially harmful precedent in U.S. law for other nations wishing to restrict U.S. fishing for tuna off their coasts.

Response: The Council has met and will continue to meet with

considered for biological/stock protection purposes and, if so, why such measures were not adopted.

Response: Section 7 has been revised to clearly indicate that conservation measures were considered but were rejected because they would not achieve significant results. The range of billfish stocks is so large, and the amount of fishing mortality in the FCZ is relatively small. Elimination of fishing mortality in the FCZ would probably not affect billfish stocks at all. Imposing conservation measures only on domestic fishermen would be irrational without some demonstration of conservation gains and without complementary action by other nations.

5. Department of State. We would like to recommend that the Council consider management measures for foreign longliners based on bycatch allocations for the billfish species rather than on the extensive closures contemplated in the draft. The size of the bycatch allocations will be crucial to the acceptability of this type of plan, both in terms of billfish conservation and of allowing a reasonable opportunity for tuna fishing.

Response: The Council understands the State Department's desire for a FMP which presents optimum yield (OY) for billfish, domestic annual harvest (DAH), and total allowable level of foreign fishing bycatch (TALFF) for billfish in a numerical manner. The Council considered a quota approach in preparing the FMP but rejected it because numerical approaches seem to create more problem than they solve. A billfish bycatch quota approach is the approach taken by the PMP which was implemented by the NMFS over the Council's objections. Quotas pose a largely insoluble problem of establishing fair and acceptable levels of billfish catches by area of the FCZ by species. Quotas offer no solutions for

and (e) gear conflicts and billfish "waste" are essentially precluded. In the Council's view, benefits accrue to all domestic and foreign fishery sectors and easily justify the adoption of new regulations. There are minimal costs for the plan implementation process.

2. NMFS Cover Letter. The marginal benefits of changing any Federal regulations or adding to them must be sufficiently large to justify the change.

Response: Section 13.3.2 and Appendix T indicate that there will be greater cost-effectiveness under the FMP than under the PMP with respect to enforcement and administration. Under all assumptions about possible foreign longline fleet responses, except total abandonment of the FCZ, the FMP provides a better probability than the PMP for meaningful enforcement with current enforcement budgets and resources. The FMP thus achieves greater domestic and foreign fishery benefits with greater enforceability. In the Council's view, there are no added costs under this FMP.

3. NMFS Cover Letter. The Council must realize that the costs of implementing any new regulations are of primary concern to the Administration.

Response: As noted above, the management and conservation program benefits domestic fisheries, foreign longline fleets, and U.S. government agencies charged with enforcement of the FMP. Indeed, implementation cost was a constraint explicitly recognized by the Council (see Section 4.4.5). The FMP will be substantially more enforceable than the PMP with current enforcement resources.

4. The FMP should indicate whether conservation measures were

The following section presents a summary and characterization of oral and written comments received on the draft FMP. Council responses have been organized by "issue categories" ranging from specific critical issues to the more general and substantive comments. The full public record of comments received by the Council on its draft billfish plan may be obtained by writing to the Council.

Summaries of Comments Received and Responses

General Comments: The Council received 17 oral and written statements during the public commentary period highly supportive of the proposed closures for a wide variety of specific reasons enunciated in the plan. Nineteen reviewers of the plan did not specifically offer opinions on the size of the proposed area closures. Rather they provided recommendations of a technical nature.

Specific Comments

1. National Marine Fisheries Service (NMFS) cover letter. The sweeping closures of the U.S. fishery conservation zone (FCZ) to foreign longline fishing for tuna cannot be endorsed without more substantial benefits to the conservation and management of billfish than are identified in the Plan.

Response: The text of the plan has been revised to demonstrate more clearly that (a) the FMP is needed to promote increased domestic fishery benefits; (b) the FMP will provide greater opportunities for longline tuna fishing than the PMP provides with no limits on foreign catch or effort in open areas; (c) smaller area closures provide far less assurance of enhanced domestic fishery values; (d) the FMP is much more cost-effective than the PMP;

16.0 COMMENTS AND RESPONSES

The Council received 24 written reviews of the draft FMP during and subsequent to the close of the public review period. The Environmental Protection Agency stated that the draft FMP/EIS adequately described the environmental impacts of the proposed action and reasonable alternatives to the action and had no objection to the proposed action. The Department of the Interior stated that the narrative of the draft FMP required a thorough editing for the final copy but that it is a definite improvement over the Preliminary Management Plan. Some agencies submitted comments through the State of Hawaii Office of Environmental Quality Control. Many of these indicated that their agency's programs were unaffected by the proposed action, they had no comment on the draft plan, or they reserved the right to comment on the final plan.

The Council received written comments of a technical nature from the State of Hawaii Department of Planning and Economic Development, Department of Land and Natural Resources, and the Office of Environmental Quality Control. Three environmental organizations made specific suggestions regarding reporting requirements for incidental taking of turtles and marine mammals taken on longlines. Government agencies of Guam and American Samoa provided no written responses but expressed their views at public hearings.

The Council also received comments from the National Marine Fisheries Service, from foreign governments, from federations of foreign longline interests, and from the Department of State.

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Waianae: A center for recreational billfish fishing on the island of Oahu.

Population Dynamics: The science dealing with the effects of natural and human actions on the size and structure of a population over a period of time.

Production Model: One of several mathematical descriptions of the effects of natural and fishing mortality on the size (weight) of a fish population. A mathematical description of the annual added weight to a fishable stock, plus recruits added to it, less what is removed by natural mortality. This figure is usually estimated as the catch in a given year plus the increase in stock size or minus the decrease (Ricker, 1975). The production model is widely used for stock assessment purposes because its inputs are simply data on catch and effort. Because of its simplicity, the model requires a number of assumptions which are often violated (Section 5.1.5).

Recruitment: The rate at which new fish (recruits) enter the fishery by reaching catchable size or reaching an age where their distribution and behavior makes them vulnerable to the fishing gear, or the total amount of recruits added in a given period of time (i.e, the recruitment rate integrated over the time period), or the process of adding recruits.

Stock: A population or portion of a population that can be treated as a single unit for management purposes (Section 5.1).

Subsistence Fishery (Fishing): A fishery to obtain food for personal use rather than for sale or recreation.

Total Allowable Level of Foreign Fishing (TALFF): The TALFF is that portion of the OY that is made available to foreign vessels (Section 11.4)

Morphometric: Study of measurements and relationships of various external dimensions of the body and body parts. Comparisons of these relationships, for example, those for blue marlin from one area with blue marlin from another area, are made primarily to infer genetic groupings such as populations, stocks, or races.

Mortality: Refers to the death rate in a population from natural and fishery causes. Together these constitute total mortality. Mortality rates can be considered on an instantaneous or an annual basis. (Instantaneous mortality rates are the limits approached by average rates over progressively shorter periods.)

Optimum Yield (OY): The amount of fish which produces maximum benefits to the Nation, especially considering food production and recreational opportunities (Section 10).

Overfishing: A term often used to describe fishing at a level of effort in excess of the level needed to obtain the MSY. The term is also used to imply that fishing has reduced a stock to such a level that its reproductive potential is reduced. Overfishing may occur in a fishery at different levels of effort for recreational and commercial users. This may occur, for example, when recreational users prefer fish of larger size than commercial users (Section 5.1.4.3).

Population: A general term for all the individuals of a species or several species of fish occupying a particular area. A sub-population is a portion of the whole population that is isolated in time or space (Section 5.1).

Fishery Management Plan (FMP): A plan prepared by the Council and implemented by the Department of Commerce for the conservation and management of fishery resources in the Fishery Conservation Zone (Preface).

Fish Cake: A processed fish product consisting of blended minced fish and vegetable materials.

Highly Migratory Species: Species of tuna which in the course of their life cycle, spawn and migrate over great distances of the ocean, including but not limited to: albacore, Thunnus alalunga; bigeye tuna, T. obesus; bluefin tuna, T. thynnus; skipjack tuna, Katsuwonus pelamis; southern bluefin tuna, T. maccoyii; and yellowfin tuna, T. albacares. This definition comes from the FCMA.

Lovejoy Model: A simulation model developed to evaluate the effects of foreign longline fishing on the domestic catches and populations of blue marlin and striped marlin under various management options (Section 8).

Magnuson Fishery Conservation and Management Act (FCMA): Federal law (P.L. 94-265, passed in 1976 and amended in 1978 and 1980) covering fishing activity in U.S. waters between State waters and 200 nautical miles from the coastline (Preface).

Management Unit: A species or a group of fish species affected or exploited by the same fishery or fisheries (Section 5.1).

Maximum Sustainable Yield (MSY): The greatest average amount, in theory, that can be harvested from a population of fish on a continuing basis (Section 5.1.5).

convenience of the passengers rather than taking and storing large quantities of fish.

Domestic Annual Processing (DAP): An estimate of that portion of the harvest by domestic fishing vessels that will be processed on an annual basis by domestic processors (Section 11.2).

Domestic Annual Harvest (DAH): An estimate of the total catch of the management unit species that the domestic fleets will make in one year. DAH is equal to the total domestic catch of the management unit species made by all domestic fishing methods in any one year (Section 11.1).

Domestic Fishery or Fishing: A fishery conducted by vessels of the United States.

Effort: A numerical measure of the amount of gear used in an attempt to catch fish. Effort may be expressed in terms of number of hooks fished per day, number of boat days, man hours, trolling line hours, etc.

Fishery: A fishery is a composite of the following essential components: a resource consisting of a population of a species or set of species usually with similar ecological requirements or characteristics; a number of fishermen who regularly exploit the resource, together with their boats and equipment for harvesting and handling the fish; and a market in which fishermen can sell their catch (Section 5).

Fishery Conservation Zone (FCZ): U.S. waters from the seaward boundary of a State or Territory to 200 nautical miles from the shoreline (Preface).

14.0 GLOSSARY

Definition of terms used in this FMP and Appendixes.

Abundance: The number of fish of a species present in an area of interest over a specified unit of time.

Availability: The proportion of a stock that is within the area of a fishery or the range of the type of fishing gear used. Availability may vary yearly and seasonally even when abundance remains nearly constant. For example, the abundance of blue marlin in the North Pacific may be constant over several years, but their availability to the Hawaiian fishery may change from year to year because of local changes in the oceanic climate or for other reasons.

Billfish Stock Assessment Workshop: A workshop held in Honolulu, Hawaii, from December 5-14, 1977, to produce a scientific assessment of the status of the billfish stocks in the Pacific and Atlantic Oceans along with a summary of appropriate background information, supporting analysis, and recommendations (Shomura, 1980).

Catch: The number or weight of a particular species or group of species taken in a unit of time.

Catch Per Unit of Effort (CPUE): The average catch taken by a defined unit of fishing effort. In a longline fishery, for example, the number of blue marlin caught per vessel per day or per thousand hooks set.

Charter Boat: A commercial fishing boat that takes recreational fishermen fishing in return for the payment of a fee. The boat may or may not sell the fish caught. Such boats generally are designed for the comfort and

average (1973-1977) longline catches of billfish and tunas made by foreign fleets in the FCZ of Hawaii was estimated to be $8.3 million.

13.6 Foreign Fishing Fees

The Council recommends that fees for foreign fishing for billfish and associated species (mahimahi and wahoo) be set sufficiently high to recover the full cost of management and enforcement in the U.S. FCZ.

A more comprehensive economic evaluation of the recreational fishery in all areas; and all segments for all areas, similar to the Kailua-Kona survey but extended State-wide in Hawaii and including Guam, the CNMI, and American Samoa.

An assessment of the importance of subsistence fishing for billfish and associated species for all areas.

An analysis of the recreational charter boat market, and the domestic food market to obtain a better description of DAH.

An evaluation of fuel cost availability as it may influence domestic annual harvest (DAH) capacity.

Priorities and responsibilities for such research have not yet been developed. The Council, however, estimates that the cost of research to obtain social and economic information on the billfish fishery to be conducted is $50,000 per year for several years.

13.5 Revenues and Taxes

The gross sales income for the Hawaii domestic fleet (all areas, all types of fishing) from the sales of billfish species was estimated to be $347,567 for 1976 (see table 8.7). Gross income for the relevant fleets from the sale of all species (tunas, mahimahi, billfish, etc.) was estimated at $4.75 million. In 1981 dollars at an annual inflation rate of 12%, this amounts to $8.36 million. It must be emphasized again that sales revenues are not an effective measure of the value of the fisheries.

This estimate is expected to increase under the provisions of this plan. The combined effect of a 12% inflation rate plus the expected increased catch rate raises the estimated gross sales revenue to about $10 million. Of this, an assumed 40% or $4 million million enters direct and indirect local, state, and federal tax channels. Sales and revenues in Guam and American Samoa are unknown. By way of comparison, the ex-vessel value (Yaizu, Japan) of

c) Number and description of vessels.

d) Description and value of products.

e) Markets and processing capacities.

f) Investment costs for vessels, gear, processing plants, equipment, etc.

g) Estimates of potential growth in the fishery - capacity and annual harvest, and processing capacity.

Preparation of this FMP has shown that there are fairly large gaps in the currently available data base to meet the statutory requirements of the FCMA at this time. These gaps can be filled by special research or periodic survey projects developed in coordination with the Council and directed toward providing better estimates for items such as the following:

Value of catch for American Samoa and Guam, and gross sales income for all areas.

Investment data for all areas.

Man/boat days for all areas.

Employment data for all areas.

Economic viability analyses for all segments for all areas.

Product values for all areas and products.

Processor income data, all areas, if processing becomes relevant.

Processor plan and equipment values, all areas, if relevant.

Employment and labor income (shoreside), all areas (goes much beyond billfish management per se).

An assessment of the economic and social importance of management unit species for all areas.

A more thorough assessment of the markets for billfish products in all areas.

how are they related?" The methodologies employed by scientists to provide such answers are irrelevant to the Council, as long as answers will be forthcoming on a timely basis.

13.4.1.2 Stock Assessment. Getting a better understanding of the condition or health of the various stocks of billfish in the Pacific is of equal importance to the Council since the first National Standard is to prevent overfishing while achieving the optimum yield from each fishery. More definitive work is needed to determine the condition of billfish stocks, especially for blue and striped marlin.

13.4.1.3 Biological Parameters. There are puzzles that remain to be solved, including where and under what conditions billfish spawn; the major components of their diet during different times of the year and at different times of their life cycle; growth rates of different species; the reproductive age span of the various species; and the tuna species (if any) following the same migratory routes and patterns.

13.4.2 Socio-Economic Research

The FCMA requires determinations of the socio-economic conditions of the various sectors participating in the fishery. These include:

a) Definition and characterization of user groups as well as area and community characteristics.

b) Employment and revenue data.

focus on monitoring possible violations in areas recommended to be closed to foreign longlining, rather than monitoring all fishing and trying to control foreign catch. This should result in a much more effective and efficient enforcement program.

13.4 Research Needs

The information base which was used in developing this draft FMP leaves much to be desired. In particular, information on the biological parameters of billfish stocks is tenuous and the social economic descriptors of the fisheries are far from being complete or up-to-date. Additional research is needed to manage billfish stocks on an international scale, and to better satisfy the mandatory statutory requirements of the FCMA.

13.4.1 Biological Research

Billfish are widely found on the high seas as well as the FCZ. Management and research programs confined solely to the FCZ and conducted unilaterally cannot be expected to be effective in terms of biological conservation. Three categories for biological research on billfish are apparent:

13.4.1.1 Stock Structure and Migratory Behavior. A basic tenet embodied by the "National Standards" of the FCMA is that individual stocks of fish shall be managed as a unit throughout their range, and that interrelated stocks of fish be also managed as a unit in close coordination. The question that arises is "What is (are) the stock structure(s) of the different species of billfish caught in the FCZ and

capability, including observers and vessel inspections. A Coast Guard high endurance cutter can travel 200-300 miles a day. In relatively clear weather with moderate seas, the vessel's radar will be reasonably certain to identify any fishing vessel within 15 miles of either side of the cutter. Thus, in a day, the cutter would provide good coverage of about 6000-9000 square miles per day at a cost of $18,800. An aircraft patrol covers about 200 miles per hour, or 1600 miles per 8-hour day. On a clear day with moderate seas, radar and visual sightings will be quite reliable within 30 miles to either side. Thus, in a day, an aircraft patrol can cover about 48,000 square miles at a cost of $10,400. By example, the proposed Guam FCZ closure (about 60,000 square miles) can be effectively patrolled once by aircraft in about 10 hours at a cost of $13,000; or by a cutter in 6½ to 10 days at a cost of more than $100,000. Area closures with aerial surveillance are clearly more cost-effective than quotas and non-retention zones with aerial and vessel patrols and observers for enforcement purposes. With an effort plan requirement, the effectiveness of aerial patrols should be increased since patrols can be targetted. Occasional surveillance of the whole FCZ is appropriate to monitor foreign fishing in open zones.

The cost-effectiveness of enforcing the FMP is greater than the cost-effectiveness of the PMP.

In summary, the FMP will not add to current costs incurred by NMFS and the U.S. Coast Guard for administering and enforcing the PMP. The FMP provides a basis for re-deployment of staff and facilities to

ducts a series of aircraft and vessel surveillance patrols during a year with a primary fisheries enforcement mission, according to the schedule below:

AIRCRAFT SURVEILLANCE

FREQUENCY	AREA	PATROL HOURS	COST
Weekly	Hawaii	(442 hours* @ $1,300/hour)	$574,600
Quarterly	Guam	(60 (4X15) hours* @ $1,300/hour)	78,000
Quarterly	Samoa	(40 (4X10) hours* @ $1,300/hour)	52,000
Total		542 Hours/Year	$704,600/year

VESSEL SURVEILLANCE

TYPE VESSEL	PATROL DAYS	COST
High Endurance Cutter	(20 Days/yr* @ $18,768/day)	$375,360
Buoy Tender	(25 Days/yr* @ $ 5,487/day)	137,175
Patrol Boat	(108 Days/yr*@ $ 2,136/day)	230,688
Total	153 Days/Year	$743,223/year

Total Aircraft plus Vessel Surveillance Costs/Year $1,447,823

This schedule is intended to cover all fishery management regulations simultaneously. Rarely are flights or vessel patrols added for any specific fishery plan. The budget will by and large remain fixed whether there are 4 plans or 8 plans in effect. Also, a flight in progress for fishery enforcement may be diverted for another mission if some other problem is identified during the flight.

The emphasis of this plan, therefore, is not to find the "lowest enforcement cost" management program, but to find the most enforcement-cost-effective management program, given the objectives of the plan. In the Council's view, the area closure approach is the best option. As indicated before, the PMP requires at-sea enforcement

several categories of research needs and a number of information gaps. Some of these needs can be satisfied by specialized surveys upon completion of the vessel inventory project in FY81. The Council anticipates that a judgement will be made on the relative advantages and disadvantages of continuing the NMFS-sponsored recreational fishing survey (national coverage) as compared to more specialized survey(s) under NMFS or Council auspices. The Council notes also that the Northwest Region, NMFS, is managing a contract for collection of socio-economic data on recreational fisheries. The results of that project will be watched closely to determine whether a similar survey approach would be useful in the Council's area. Finally, the Council notes that studies anticipated to be undertaken in conjunction with the Bottomfish FMP development process may provide information on much of the shore-side activity associated with fisheries (markets, product forms, prices, etc.), some of which should prove to be very relevant to the billfish fisheries.

13.3.2 Enforcement Costs

The U.S. Coast Guard and NMFS share primary enforcement responsibility under the FCMA. Both agencies have multiple enforcement missions. The Coast Guard handles maritime law enforcement (including fisheries, maritime theft, smuggling interdiction), aids to navigation, merchant marine safety, and envirnomental protection. The NMFS responsibilities include enforcement of fisheries, marine mammals, and endangered species laws. The budget of each agency is to some degree allocated to particular types of enforcement (e.g., fisheries); but funds are not allocated by fishery. For example, the Coast Guard con-

the observer program. The net cost to the U.S. is thus zero.

d. Foreign fishing surveillance. The major surveillance effort will be carried out by U.S. Coast Guard aircraft with occasional surface patrols in the waters around the Hawaiian Islands, American Samoa, Guam and the CNMI. Surface patrols will be concentrated in areas where there is anticipated high level of foreign fishing while aircraft patrols will cover the entire FCZ.

e. Domestic fishery monitoring. The Council notes that considerable progress is being made in establishing better data collection programs for billfish and other species. The most important projects are planning and design of a Fishery Information Network (NMFS, States, and Council involvement); compilation of all available fisheries data in a single source (Council funding to States, NMFS coordination); and establishment of a vessel inventory (NMFS) and design of possible mechanisms for specialized surveys to obtain social, economic, and cultural information as well as catch and effort data (Council). For the immediate future, therefore, the Council proposes that there be no other major changes made in domestic fishery monitoring (i.e., data collection) programs. Current efforts are sufficient, although there could be a better degree of follow-up effort by the State of Hawaii and the Territories of Guam and American Samoa to insure that all who should report are in fact reporting their catches and effort; and a voluntary charterboat log form should be developed by NMFS and the charterboat fleet operators.

f. Social and economic research. The Council has identified

from the NMFS and the Council.

13.2.3 Processor Report

Processor reports are not applicable until such time as sufficient billfish processing becomes established. Auction houses which handle a large proportion of current billfish sales in Hawaii are already required to report on their operations to the state.

13.3 Costs of Administration and Enforcement

13.3.1 Administration Costs:

a. Foreign fishing permit processing: The administrative mechanism for issuing foreign fishing permits is in place. Close to 1000 foreign fishing permits were granted for 1980 under the PMP, although no known foreign longline fishing occurred in 1980. The FMP would result in reduced administrative costs if the number of permits requests decreases.

b. Foreign fishing catch reports. To the extent foreign fishing would be permitted under this FMP, foreign vessels' catch and effort reports would be required (Section 13.2.1). The non-retention approach would not, however, apply. Reporting by foreign vessels would thus be greatly simplified.

c. Foreign fishing observers. To the extent that foreign longlining is permitted, the Council recommends that the Regional Director of the NMFS exercise discretion in placing observers on foreign vessels. Foreign vessels are required to pay the full cost of

designed to obtain these data without imposing substantial new burdens on recreational fishers.

Recreational licensing, which is an alternative to a sampling regime, would be a significant departure from existing social and cultural patterns in Hawaii and is not being proposed here. The likelihood of Legislative adoption of a single species-group license for recreational fishing is relatively remote. More important, the burden on recreational fishers themselves could lead to problems in terms of report accuracy and the acceptability of fishing regulations by such fishers.

13.2.2.2 American Samoa and Guam

Neither American Samoa nor Guam has extensive domestic commercial fishing operations, and as a result there are minimal licensing and reporting requirements. However, there is a well recognized need for improved data from these areas upon which to base development and management decisions.

Domestic Fishing: Sample surveys, probably in the form of creel surveys, should be periodically undertaken. These could perhaps be augmented by an "incentive" program to entice local fishermen to record and submit catch informaton specifically on billfishes. The incentive programs should be investigated by the local fishing authorities with assistance

operator will be low. The relevance of the data in terms of clarifying the significance of the charter boat contribution to the fishery and local economies may be appreciated by charter boat skippers. The Council proposes that charterboat operators cooperate with the NMFS to help design a log format that is suitable to their needs and will provide information for monitoring the domestic fishery for billfish. Until such a form is developed and instituted, established reporting requirements (Hawaii commercial catch reports) should be supplemented by special surveys.

Recreational/Subsistence Fishing: Regular sample surveys of the non-commercial fishing population, either in the form of creel surveys or boat owning household samples, are needed to collect catch and effort data from this sector.

.....Some information requirements would include:

number and weight of fish caught, by species and area

type of gear used (handline, trolling by lure, trolling with bait)

proportional use of catch (sale, home, friends)

approximate frequency and length of trips

approximate expenditures

The Council and the Honolulu Laboratory, NMFS, are sponsoring a project to determine the "universe" of vessel owners so that periodic catch and effort surveys can be

Reports" which give relatively accurate catch and effort data for those fishermen who do report. There are serious problems in measuring the level of effort with State statistics, such as pooling of catches which leads to understatement of effort. Although there are some problems with the State system, it is well-integrated with the type of operation typical of Hawaii deep-sea fishers, and the reported billfish catch lends itself to abstraction from "all species" reports.

Charter Boat Operations: Better monitoring of reports of charter boat operations is desirable including logs and reporting all trips and catches, whether the catch was sold or not.

..... The necessary information includes:

number, location, and duration of trips (hours fished and in-transit)

number, weight (and value) of billfish (by species) and mahimahi and wahoo taken, by area, and disposition of the catch

number of lines in the water

number of passengers per trip

Although a reporting scheme directed specifically toward charter operations would be a small addition to current State of Hawaii requirements, the commercial nature of these operations and the relative ease of recording of these data mean that the cost of data collection to the

amount of their gross sales.

The Council notes that the State of Hawaii, the Territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands, and the NMFS are in the early stages of design and planning for a fishery information network (FIN) covering all species. The billfish FMP catch and effort statistics should constitute a data file in the network. Data reporting requirements will be reviewed to insure that this file will be an effective FIN component.

Until the design of FIN becomes operational, the existing State and Territorial data collection procedures should be maintained for monitoring participation levels and success of the various domestic billfish fisheries at the lowest cost to the industry.

13.2.2.1 Hawaii

Commercial Longline: Continuation of State of Hawaii "Flagline Catch Reports" which have provided reliable estimates of catch and effort for this fishery.

..... State reporting requirements include:

number, weight and value of each species by area and day of landing

number of baskets (sets) used and location

type of bait used

(See Appendix M)

Commercial Deep-Sea Handline and Troll:

Continuation of State of Hawaii "Commercial Fish Catch

as "confidential" data, with penalties for unauthorized use or disclosure.

In addition, if daily activity reports are required of all domestic troll fishermen who have the potential to catch billfish on each trip, there could be as many as 65,000 trip entries in official logbooks. The costs of data processing alone might exceed the benefit of the entire FMP. Furthermore, since many trollers only occasionally catch billfish, as opposed to other more frequently caught species, there would be a natural tendency to ignore reporting requirements aimed solely at billfish. The result would be to seriously skew the accuracy, the validity and usefulness of catch and effort statistics. The Council is not in a position to require "all species" catch reports in the FCZ at this time, since this would appear to be unmandated regulation of fishing for other species which are outside the scope of this particular FMP (e.g., the catch of tuna captured by longline vessels, skipjack tuna caught by trollers, and bigeye tuna caught by ika shibi fishermen). The Council does propose, however, that catch of mahimahi and ono be recorded and reported along with billfish catch so that a sufficient data base can be developed for managing these fisheries in the future.

Experience with the State of Hawaii statutorily mandated system for collection of commercial catch data suggests that many fishermen who fish only occasionally do not file timely reports. It is also suspected that many fishers are reluctant to file accurate catch reports, in order to disguise the location of their effort, and the

11. Estimated average depth of hooks

12. Other information as may be judged to be necessary by the Regional Director of the NMFS to monitor the fishery

The logbook format should be designed to be compatible with logbooks currently in use by foreign operators, to the extent feasible.

Each permitted foreign vessel should submit quarterly reports summarizing effort, catch (by species), disposition of the catch (freezing, discard, released alive), and areas fished in the FCZ. Each report should be submitted within a reasonable time, e.g. three (3) months, of the end of the quarter to the Regional Director, Southwest Region, NMFS. Specific reporting formats and details will be specified in the regulations to be published in the Federal Register to implement the FMP.

13.2.2 Domestic Fishing

The Council recommends that domestic vessels presently operating under State and Territorial licensing and reporting procedures continue to record and report their activities. Information is necessary from which to draw sample data to derive estimates of domestic catches and effort. Larger commercial fishing enterprises are more capable of collecting and reporting detailed catch data than small or recreational fishers for whom detailed record keeping may appear to be too cumbersome. Requirements to submit detailed time, effort, and size data, collected under a mandatory reporting schedule, often are resisted by individualistic fishermen because they may expose fishing strategies, notwithstanding the fact that the data must be maintained

necessary to serve the objectives of the FMP.

An objective of the FMP is to help initiate international cooperation in billfish management and compilation of accurate catch and effort statistics throughout the Pacific. Although only a small percentage of the total Pacific catch is obtained in the FCZ of the Western Pacific Region, wider reporting within and beyond the FCZ is directly related to the Council's ability to foster such international cooperation. However, the accuracy of reported data is directly related to the nature of the reporting requirements and the attitude of fishermen toward those requirements.

13.2.1 Foreign Longline Vessel Reporting Requirements

All foreign vessels permitted to fish in the FCZ must maintain a daily log of their activities when fishing in the FCZ. The logbook format should be designed by NMFS to record information necessary for monitoring the fishery for compliance with this plan, for example,

1. Name and call sign of the vessel
2. Permit number
3. Area of the FCZ being fished
4. Date
5. Daily position, within 1° longitude and latitude
6. Number and round weight (in kilograms) of billfish and other fish caught, by species
7. Tonnage of tuna caught, by species
8. Type of set; deep longling or regular longline.
9. Number of hooks set per soak
10. Average soaking time

13.0 PLAN ADMINISTRATION AND ENFORCEMENT

13.1 Enforcement Requirements

13.1.1 Domestic

No additional enforcement resources are required.

13.1.2 Foreign

U.S. Coast Guard fishery enforcement budget is described in Section 13.3.2. Surveillance flights and occasional surface patrols are conducted in the waters around the Hawaiian Islands, the banks of American Samoa and the FCZ around Guam throughout the year. The surveillance problems for these areas would be less under the FMP than the PMP since foreign longlining would be prohibited in areas of the FCZ that are important to the domestic fishery.

13.2 Billfish Reporting Options

There are basically five different types of fishing which must be considered in proposing a reporting scheme for billfish management:

a) domestic longline and handline fishing

b) commercial deep-sea handline and troll fishing

c) charter boat operations

d) private recreational/subsistence fishing

e) foreign longline fishing

It would be possible to impose the same reporting requirements on all five types of activities in each of the management areas, but this would not be

plan would impose no restrictions on domestic fishing activities, and no amendment of State laws or regulations would be necessary to insure effective management under the plan. The plan would, however, endorse existing reporting requirements to improve the basis for future management decisions and the data base for fishery assessment. The NMFS is working with the State of Hawaii and the territories to determine how current data collection programs can be adjusted so that their programs may furnish the data required.

Whether this arrangement will continue is unknown.

12.6 Department of Transportation

The U.S. Coast Guard, Department of Transportation, shares enforcement responsibilities with NMFS under the FCMA. Enforcement difficulty will vary depending on the management approaches selected. The FMP proposes specific area closures, which are relatively easier to enforce species quotas and/or non-retention zones. The Council, NMFS and the Coast Guard are working together to insure that feasibility and cost enforcement are fully considered. Simplicity and "self enforceability" of measures is especially critical in the Western Pacific Region due to the large FCZ area and shrinking enforcement resources.

12.7 Department of State

The Department of State is involved in negotiations concerning boundaries of the FCZ and international management of highly migratory species of tuna. The Council recognizes the Department's concern that the control of foreign longlining for tuna should not go beyond necessary to achieve the Council's objectives for fishing for billfish and associated species in the FCZ. The proposals in this draft plan are intended to be sensitive and responsive to the Department's concerns.

12.8 State Fishery Laws and Regulations

There are no provisions in current State laws or regulations which control domestic fishing for or landings of billfish and associated species in the FCZ, although catch reports are required to be filed if fish are sold. This

12.4 Department of the Interior Laws and Policies

The U.S. Fish and Wildlife Service (FWS) administers the Hawaiian Islands National Wildlife Refuge in the northwestern Hawaiian Islands. There is no overlap between boundaries of the refuge and the boundaries of the FCZ. This FMP will have no direct impact on management of the refuge resources since fishing under this FMP will occur well beyond the boundaries of the refuge. If the domestic fishery expands, there may be increased possibility for emergency landings of vessels on refuge islands. However, control of emergency landings is beyond the authority of this plan. No other FWS-managed resources are expected to be affected in any way by this plan.

The Department of the Interior has continuing oversight responsibilities for administration of the Territories of Guam and American Samoa. The Department has vested increasing authority for management in the territorial governments, and supports increased economic development and self-sufficiency. This plan is intended to encourage growth of the domestic fishery (commercial, recreational, and subsistence) without impairing or curtailing the economic benefits attributable to foreign vessels' deliveries of tuna to U.S. canneries in American Samoa and to tuna trans-shipment operations in Guam. This plan appears to be fully consistent with Department of the Interior policies.

12.5 Department of Defense

The Department of Defense administers Midway Island. Clearance was given in 1979 for a U.S. tuna packer to maintain a tuna purse seiner in the harbor to purchase fish from a fleet of U.S. albacore fishing vessels operating beyond the FCZ of the Hawaiian Islands. This program is intended to facilitate growth of the U.S. distant-water fishery in that portion of the Pacific.

TABLE 12.1
MARINE MAMMALS AND ENDANGERED AND THREATENED SPECIES
RECORDED IN THE FCZ OF THE WESTERN PACIFIC REGION

Scientific Name	Common Name
*Megaptera novaeangliae	(humpback whale)
Balaenopteraedeni	(Bryde's whale)
*B. physalus	(fin whale)
*Physeter catodon	(sperm whale)
Orcinus orca	(killer whale)
Pseudorca crassidens	(false killer whale)
Steno bredanensis	(rough-toothed dolphin)
S. attenuata	(spotted dolphin)
S. caeruleoalba	(striped dolphin)
Tursiops truncatus	(bottlenosed dolphin)
Feresa attenuata	(pygmy killer whale)
Kogia sp.	(dwarf and pygmy sperm whale)
Peponocephala electra	(melon-headed whale)
Globicephala macrorhynchus	(short-finned pilot whale)
Grampus griseus	(Risso's dolphin)
Ziphius cavirostris	(goosebeak whale)
Mesoplodon densirostris	(densebeak whale)
*Monachus schauinslandi	(Hawaiian monk seal)
+Chelonia mydas	(green turtle)[1]
*Eretmochelys imbricata	(hawksbill turtle)[1]
*Dermochelys coriacea	(leatherback turtle)[1]
*Diomedea albatrus	(albatross)

* endangered species + threatened species [1] (Joint NMFS-FWS jurisdiction)

cating whether the action is likely to jeopardize the continued existence of a species or will result in modification or destruction of "critical habitat" for such species.

Table 12.1 indicates the endangered and threatened species which either are resident in or occur within the marine biota covered by this plan. None of the cetaceans listed are expected to be affected in any way by the measures proposed in this FMP. Sea turtles have been reported as being taken on occasions on longline gear. Endangered and threatened sea turtles occur throughout the FCZ and other parts of the central and western Pacific. If taking does occur, small numbers of individuals are likely to be affected, and such taking must be reported to NMFS. The measures in this FMP do not appear likely to jeopardize the continued existence of any endangered or threatened species of sea turtle. No "critical habitat" has been designated for listed species in the Council's area of concern.

The Council has initiated formal Section 7 consultations with the NMFS and the FWS to confirm the above assessment. The Biological Opinion has not been included in the final FMP submitted by the Council, since NMFS has not completed the opinion at this time.

Consistency" was prepared for review by the Territory of American Samoa's Development Planning Office.

12.2 Marine Mammal Protection Act of 1972 (MMPA)

The MMPA requires that the Secretary of Commerce not authorize directly or indirectly the reduction of the population of a marine mammal species or stock below its optimum sustainable population level. Under the MMPA, the National Marine Fisheries Service has established a permit program under which a Certificate of Inclusion may be issued to commercial fishermen (including foreign vessels) to allow them to "take" marine mammals (including harassment of and even killing marine mammals) to protect their catch and gear from depredation.

There have been reports of porpoise taking bait off the lines of domestic trollers and deep-sea handline fishermen. There is no documentation of incidental take of marine mammals in either the foreign longline fishery or the domestic fisheries for billfish.

12.3 Endangered Species Act of 1973, as amended (ESA)

The ESA requires Federal agencies to use their authorities to protect, restore and enhance threatened and endangered species and their habitats. A Federal agency (e.g., the Council) may not take action which is likely to jeopardize the continued existence of a species listed as threatened or endangered, except under very limited circumstances. Before undertaking an action, a Federal agency must request consultations under Section 7 of the ESA with the National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (FWS), as appropriate. A Biological Opinion then will be issued indi-

12.1.3 American Samoa

The proposed Coastal Zone Management Program for American Samoa has been approved by the Office of Coastal Zone Management, NOAA, in September, 1980. The measures in the draft FMP are consistent with proposed coastal zone plan for American Samoa. The FMP would promote harvest of billfish and associated species within the limitations of the resource. Direct impacts on the coastal zone will be negligible.

The approved CZM Program of American Samoa notes that the tuna canneries are the main source of private sector employment in American Samoa. They draw their fish from Korean and Taiwanese vessels. The small local commercial fishing industry has experienced a decline during the period 1974-78, but has been on the upswing again for the past two years. Offshore sport fishing is seen to be very limited at this time, despite the availability of fishable concentrations of popular sport fish. Many of American Samoa's households catch fish for their own use at some time during the year, using the near-shore waters in the traditional manner. The major impediment to the commercial and sports fisheries is said to be limited docking and cold storage facilities.

The American Samoa Office of Marine Resources is developing a comprehensive fisheries development plan which is supported by the CZM program. Several surveys are currently underway to assess fishery resources and fishing activity patterns in American Samoa.

The measures proposed in this FMP are consistent with the American Samoa CZM policies and requirements. This "Determination of

12.1.2 Guam

The Territory of Guam CZM Program was approved in August, 1979. The seaward boundary of Guam extends three miles out to sea. Principal activities under the first year CZM implementation grant include master plan development for a commercial port; preparation of a Fisheries Management and Development Plan; and increased management of fish and wildlife resources. The principal management policy in the CZM program is to achieve economic development within the limits of Guam's natural resource base. The State Plan states: "All living resources within the territorial waters of Guam, particularly corals and fish, shall be protected from over-harvesting and, in the case of marine mammals, from any taking whatsoever".

The measures proposed in this draft FMP are consistent with the Guam CZM policies and requirements. The plan proposes to allow harvest of billfish and associated species within the limitations of the fishery resources involved. Direct impacts on the coastal zone will be negligible. Master port development planning and the overall fishery development plan being prepared will provide for mooring and processing facilities needed should this FMP generate growth of the domestic fishery.

This "Determination of Consistency" was prepared for review by the Territory of Guam Bureau of Planning during the review period for this draft FMP.

willingness and desire to include all interested parties in the plan development process for managing billfish in the (offshore) coastal zone management area and beyond.

The measures proposed in this plan are believed to be fully consistent with the approved Hawaii CZM program. This plan seeks to achieve the optimum yield from the billfish fisheries of the FCZ surrounding the entire Hawaiian Archipelago. There will be no direct impacts on the (offshore) coastal zone. There may be some long-term indirect effects if further expansion of the domestic fishery occurs and requires additional moorage and processing facilities on shore.

This "Determination of Consistency" of the draft FMP with the State's CZM objectives and policies was prepared for review by the Hawaii Department of Planning and Economic Development (DPED) during the review period of this draft plan. DPED concurred with the determination.

The Council does not take nor to imply a position with respect to Hawaii's claim over "archipelagic" waters. The Council does note, however, that Hawaii law forbids non admitted aliens from fishing within the boundaries of the State. The recommended area closures to foreign longline fishing in the FCZ surrounding Hawaii are consistent with this aspect of State law.

The State's position regarding the boundaries of the State is indicated in Appendix R.

recreational fishing experiences for billfish by domestic fishermen.

2. It is established that billfish were caught by ancient Hawaiians in their pursuit of ahis using deep-sea handlines (David Malo, 1898; Margaret Titcomb, 1972, and Stell Newman, 1972). The Council acknowledges the importance of the pelagic zone fisheries in the history and culture of ancient Hawaii as well as to modern-day fishermen of Hawaiian heritage. This FMP is intended to "protect and preserve historic and pre-historic resources of significance in Hawaiian and American culture".

3. The FMP is designed to preserve valuable billfish ecosystems of significant biological or economic importance. Ongoing and recommended research and data collection programs are designed to improve the technical basis for billfish management.

4. Billfish fishing is an important segment of the overall fisheries development scenario(s) of the State of Hawaii. The recent growth of fishing, especially in the troll fisheries, has prompted plans for shoreside facilities including boat launch ramps, small boat harbors, and other shoreside facilities to support fishing operations. Billfish fishing clearly has had economic inducement effects in the local economy especially in Kona and other prime tourist destinations in Hawaii.

5. Four years of input from the Billfish Advisory Panel, from the Scientific and Statistical Committee, and ample opportunity for public commentary on this draft FMP indicate the Council's

2. Historic Resources

- Protect, preserve, and where desirable, restore those natural...historic and pre-historic resources in the (offshore) coastal zone management area that are significant in Hawaiian and American history and culture.

3. Coastal Ecosystems

- Protect valuable coastal ecosystems from disruption and minimize impacts on all coastal ecosystems
  - .. Improve the technical basis for natural resource management
  - .. Preserve valuable coastal ecosystems of significant biological or economic importance

4. Economic Uses

- Provide public or private facilities and improvements to the State's economy in suitable locations.

5. Managing Development

- Improve the development review process, communication, and public participation in the management of (offshore) coastal resources.

Each of these objectives and policies has some bearing to the billfish management measures of this FMP:

1. Billfish are an example of recreational resources. The second objective of this FMP is to enhance the opportunity for successful

12.0 RELATIONSHIP OF RECOMMENDED MEASURES TO OTHER APPLICABLE LAWS AND POLICIES

12.1 Coastal Zone Management Act

Section 307 (c) (1) of the National Coastal Zone Management Act of 1972 (CZMA) requires that all Federal activities which directly affect the coastal zone be conducted in a manner which is consistent with approved State coastal zone management programs to the maximum extent practicable. The State of Hawaii and the Territories of Guam and American Samoa are all participating in the CZM program. This fishery management plan, therefore, must be reviewed to determine if the proposed measures will or are likely to affect the coastal zone, and if so, whether the proposed measures are consistent with each State's program.

12.1.1 Hawaii

An approved program has been in effect in Hawaii since 1978. State policies relating to the billfish management measures of this FMP are contained in the Hawaii CZM statute (Chapter 205 A, HRS) and in the "Procedures Guide for Achieving Federal Consistency with the Hawaii Coastal Zone Management Program (DPED, no date). These are:

1. Recreational Resources

   - Provide adequate, accessible, and diverse recreational opportunities in the (offshore) coastal zone management area.

e. Catch rate will be equal to 1973-1977 average levels (Table 9.4).

The resulting estimates of TALFF (all billfish species combined) by area are:

Main Hawaii Islands	0 MT
NWHI, 100-200 miles from shore	344 MT
American Samoa	125 MT
U.S. Possessions	383 MT
Guam	0 MT

No limits are proposed for incidental catches of mahimahi, wahoo, sharks, and other non-tuna species. All incidental catches, however, must be reported by species.

11.4 Total Allowable Level of Foreign Fishing (TALFF)

The Council does not propose any limits on foreign longlining catch or effort, so long as certain areas of the FCZ are not fished by foreign fleets. Thus, a non-numerical definition of TALFF is appropriate for this fishery:

> TALFF is the amount of billfish which will be taken by foreign longliners in the FCZ fishing in accordance with the measures in this plan and with measures adopted in voluntary agreements.

Estimates of expected foreign catch by sub-area of the FCZ can be made, albeit qualifiedly, based on a number of uncertainties and assumptions:

a. The historical (1973-1977) effort previously applied within 100 miles of the NWHI and within the FCZ of the main Hawaiian islands will relocate to the FCZ 100-200 miles off of the NWHI;

b. Average annual effort in the open parts of the FCZ around American Samoa will remain at 1973-1977 levels or increase slightly to compensate for the small loss of fishing opportunity in the FCZ areas encompassing banks heavily used by domestic fishermen.

c. Average annual effort around U.S. Possessions will equal the 1973-1977 average plus transfers of historical effort from the FCZ around Hawaii and Guam.

d. Average annual effort in the FCZ around Guam will relocate to waters beyond the FCZ of Guam, and catch rates will equal the catch rates around the CNMI;

(1978) respectively. The DAH is estimated to be at least 10 MT for Guam and 5 MT for American Samoa for 1982, although actual catches may exceed these predictions considerably.

In all three areas, the domestic catch will be dependent on the local availability of fish, weather conditions, and to a lesser extent, on fuel costs. In years past, conditions of availability have made reported billfish catches of Hawaii fluctuate from year to year by as much as 50% (Appendix G).

11.2 Domestic Annual Processing (DAP)

Virtually all of the billfish that enter local markets in Hawaii, American Samoa, and Guam are purchased by consumers in the fresh-fish form. There is no canning. A small portion of Big Island fish are smoked. There is no other processing of any significance. Local fish cake factories use only small amounts of billfish (Red and White Foods, personal communication).

Fresh fish markets have sufficient capacity to handle all domestically-caught billfish.

An estimate of annual processing capacity is inapplicable to this fishery since there is no processing done in the industrial meaning of the term.

11.3 Joint Venture Processing (JVP)

There is no evidence of any interest in a joint venture with foreign processing vessels, and there is no excess harvest capacity available for joint ventures. Thus, the amount of billfish available for joint venture processing is determined to be zero.

part of the entire sport catch in Hawaii, Samoa, and Guam is sold. It has been estimated that during the period 1970-1974, the recreational fishery harvested 55% of the domestic billfish catch in Hawaiian waters (State of Hawaii, Department of Land and Natural Resources, 1979). Since then the recreational component has grown greatly and troll-caught billfish that enter markets have outstripped local longline billfish landings by a wide margin (Table 5.9). Trollers now outproduce the local longline fleet by about 15 times in the case of tunas and billfish and by as much as 40 times in the case of wahoo and mahimahi. Preliminary data indicate that recreational fishermen caught 1696 MT of billfish in 1979 in Hawaii.

Reported commercial billfish landings in Hawaii more than tripled between 1973 (106 MT) and 1978 (337 MT). Reported commercial landings have grown by an annual average of nearly 30% during this period (Table 5.10). Based on the NMFS study of the fishery done in 1976, it is surmised that State of Hawaii commercial landings data may understate actual catches by a factor of 3 or 4.

It is difficult to predict the actual level of domestic billfish harvests because it is generally agreed that the statistical information is far from complete and inadequately explained, especially as it refers to fishing effort. Tabulations of reported catches, in particular, should be read with caution. The total domestic harvest in Hawaii is estimated to have been at least 732 MT (1976 estimate of total domestic catches), and would reach 915MT in 1982, assuming only a 25% increase in domestic harvest in that six-year period.

The available data indicated that an estimated 8 MT and 4 MT of billfish were landed by domestic fishermen in Guam (1980) and American Samoa

11.0 DOMESTIC CATCH AND PROCESSING CAPACITY, JOINT VENTURE PROCESSING, AND TOTAL ALLOWABLE LEVEL OF FOREIGN FISHING

11.1 Domestic Annual Harvest (DAH)

Harvest capacity can be thought about in a variety of ways. It can reflect ambition, desire, or capability. Capacity can be viewed in terms of capability of satisfying markets and in terms of fishing effort needed to achieve certain catches. There are no capacity limitations on local fresh fish markets that sell billfish. All billfish placed on the market are sold, but at prices that vary greatly. When fishing is "hot" during summer peak activity periods and many billfish are landed, prices (ex-vessel) can and do drop to as low as 25¢ per pound and lower. On the other hand, when fish in general are scarce and during winter holiday seasons, prices paid to fishermen for billfish can go to $3 per pound and higher. Billfish and sashimi grade tunas are subject to a strong seasonal peak in demand around the New Year's holiday.

The six species of billfish occuring in the Hawaii region collectively contribute a fair portion to the total reported Hawaii landings. Blue marlin and striped marlin are the overwhelmingly dominant commercial and recreational billfish in the Islands: together they normally account for 88-95% of the billfish landings. Broadbill swordfish, shortbill spearfish, black marlin, and sailfish make up the remaining portion. The billfish products reaching the Hawaii retail market are supplied by the commercial longlining fishery and the recreational fishery. In addition to recreational fishing benefits, a large