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ENVIRONMENTAL IMPACT STATEMENT/PRELIMINARY FISHERY MANAGEMENT PLAN

✓ PRECIOUS CORALS COASTAL ZONE
INFORMATION CENTER

U.S. National Oceanic and Atmospheric Administration
Marine Fisheries Service

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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

OFFICE OF THE REGIONAL DIRECTOR
SOUTHWEST REGION

NATIONAL MARINE FISHERIES SERVICE
TERMINAL ISLAND, CALIFORNIA

JANUARY 1977

SUMMARY SHEET

COASTAL ZONE
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U. S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER FOREIGN HARVEST OF PRECIOUS CORALS
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413
IN THE U.S. FISHERY CONSERVATION ZONE

() DRAFT (x) Final Environmental Statement

Responsible Federal Agency: Regional Director, Southwest Region
National Marine Fisheries Service
NOAA/DOC
Terminal Island, California 90731

- 1. Name of Action: (x) Administrative () Legislative
- 2. Description of Action: Under P.L. 94-265 the Secretary of Commerce must draft temporary rules and regulations governing foreign harvest of precious corals within the U.S. Fishery Conservation Zone until such time as the Regional Fishery Management Councils created by P.L. 94-265 develop preliminary fishery management plans and regulations. The temporary measures are set out in the proposed action, a Preliminary Management Plan for the precious coral resources within the U.S. Fishery Conservation Zone in the Western Pacific Ocean (west of the 180° meridian) and the Central and Eastern Pacific (east of the 180° meridian).

Presently there is documented harvesting of precious corals in the zone by Japanese vessels off Midway, Wake, Yap and Saipan Islands. While valuable precious coral stocks are thought to occur in many areas, especially in the Northwestern Hawaiian Islands, the only stocks which have been fully surveyed and assessed are on the Makapuu bed off Oahu (Hawaii). These stocks are now fully harvested by domestic fishers.

The proposed action prohibits the direct foreign harvest of precious corals from any bed in the zone until such bed has been surveyed and

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scientifically assessed, and until the level of surplus yield for foreign vessels has been determined.

The action also prohibits the incidental killing or harvesting of precious corals, except when such incidental harvesting is judged by the Secretary of Commerce to not seriously damage U.S. interests.

3. Summary:

a. Environmental impacts: The proposed action may result in some incidental harvest of precious corals in the area open to foreign ground fish operations, but no significant losses of U.S. precious coral resources are expected.

b. Adverse environmental effects: No adverse environmental effect is anticipated to result from the proposed action.

4. Alternatives: Three alternatives were considered: (1) unrestricted intentional harvest of precious corals in the zone, (2) unrestricted incidental harvest of precious corals in the zone, and (3) the proposed action.

5. Comments Requested:

Department of the Interior
Department of Transportation
Department of State
Western Pacific Fishery Management Council
State of Hawaii, Division of Fish and Game
Governments of Guam and American Samoa

6. Hearings: A public hearing was held in connection with the proposed action on November 18, 1976, in Honolulu, Hawaii. Few comments were received from the U.S. precious coral harvesters, State and Federal agencies, and coral scientists.

7. Draft Statement to CEQ: October 22, 1976 .
8. Final Statement to CEQ: January 21, 1977 .

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I. INTRODUCTION

This document presents a combined preliminary fishery management plan for Precious Corals and draft environmental impact statement (DEIS) describing the possible effects on the human environment of implementing the management plan. The preliminary management plan has been prepared under authority of the Fishery Conservation and Management Act of 1976 (FCMA) and the DEIS has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA).

NEPA sets forth the strategy of the Congress to achieve coordination of Federal activities and environmental consideration. NEPA's basic purpose is to insure that Federal officials weigh and give appropriate consideration to unquantified environmental values in policy formulation, decision making and administrative actions, in addition to technical and economic considerations. Section 102(2)(C) of NEPA requires preparation of a detailed environmental impact statement in the case of major Federal actions that may significantly affect the quality of the human environment.

The Fishery Conservation and Management Act of 1976 (P.L. 94-265) provides for the conservation and management of fishery resources of the United States by establishing a fishery conservation zone of 200 nautical miles, within which the United States has exclusive management authority over all fishery resources except highly migratory species. The Act calls for the preparation and implementation of fishery management plans, through which the objectives of a National Fishery Management Program may be accomplished.

The fishery management plans provide the basis for allocation of harvest, predicated on scientific information and involving the needs of the States, the fishing industry, recreational groups, consumers, environmental organizations, and other interested parties. In essence, the allowable catch of any fishery resource will be based on the optimum yield from that resource.

Foreign nations will be allowed to take only that portion of the optimum yield which cannot be harvested by U.S. vessels. The Act further outlines a specific application, licensing and enforcement procedure regarding the participation of foreign nations in any U.S. fishery.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Fisheries Management Under Extended Jurisdiction

The Fishery Conservation and Management Act provides that the Secretary of Commerce must prepare preliminary fishery management plans when applications are received from foreign nations for permission to fish in the new fishery conservation zone, provided that no fishery management plan will be prepared by a regional fishery management council prior to March 1, 1977. This document is such a preliminary fishery management plan, and incorporates the NEPA requirements for a DEIS as well.

To the extent practicable, preliminary management plan must describe the fishery, provide a preliminary estimate of the optimum yield, and determine the total allowable level of foreign fishing (if any). In addition, the preliminary plan should contain permit requirements for foreign fishing vessels, as well as data reporting procedures that must be met during fishing activities.

Preliminary management plans become effective March 1, 1977, and remain in effect until superseded by approved Regional Fisheries Management Council plans. Regulations implementing preliminary management plans may be promulgated by the Secretary of Commerce as interim measures pending regulations promulgated by the Secretary from Council plans.

A foreign nation begins entry into a U.S. fishery through the signing of a Governing International Fishery Agreement prior to making formal application for fishing rights. This agreement acknowledges the exclusive fishery management authority of the United States and forms a binding commitment on that nation to comply with the terms and conditions specified under the Act. Any existing international agreements other than Governing International Fishing Agreements, are considered valid only if they were in effect prior to enactment of the Act and have not expired, been renegotiated, or negated in any manner.

The Secretary of State, in cooperation with the Secretary of Commerce, determines that allocation of the total allowable surplus the applicant will receive.

B. Environmental Setting

1. Geophysical setting

The precious coral resources occur on banks and seamounts of the Hawaiian Islands, American Samoa, Guam, and U.S. territories and possessions in the Central, Eastern and Western Pacific, at depths of 200-500 m, on hard bottoms swept clean by strong currents.

2. Biological systems

Four species of gorgonian and zoanthid corals are involved. While there are certain differences between species, generally the precious corals are characterized by low growth and mortality rates compared with other fishery resources. As a result, unfished coral populations are relatively stable from year to year, and moderate changes in the vital rates have comparatively small effects on total abundance. By the same token, precious coral populations recover very slowly from overharvesting, and must be exploited with extreme caution.

3. Social and economic setting

Raw precious coral is cut and polished for the manufacture of jewelry. In Hawaii the harvesting and processing of precious corals and the manufacture and marketing of precious coral jewelry employs around 500 people. Retail sales of the finished jewelry are about \$10 million. Production of coral jewelry worldwide, dominated by Japan and Italy, is about \$300 million at the retail level.

4. Relevant problems and issues

Two issues particularly germane to the development of precious coral harvesting policies are

a. Vulnerability of coral stocks to overharvesting

A prudent harvesting policy for a newly discovered resource would permit exploitation only after careful scientific assessment of biological production potentials.

b. Viability and growth of the industry

The precious coral industry in Hawaii depends on a steady reliable supply of raw coral. Given the erratic supply and generally rising price of imported coral, development of the local industry can best be enhanced by reserving U.S. precious coral stocks for U.S. harvesters.

C. The Preliminary Fishery Management Plan

1. Preliminary description of the fishery

a. Areas and stocks involved

This plan concerns the utilization of four genera of precious corals within the 200-mile zones of Hawaii, American Samoa, Guam and U.S. territories and possessions in the Pacific Ocean and on the "continental shelf" of these islands as defined in P.L. 94-265. An important unsettled issue is the status of Hawaii with respect to the "Archipelago Concept" (Anonymous 1974). If this concept applies to Hawaii, there would be two important results:

(1) The area of State jurisdiction would increase, and some of the precious coral beds considered in this preliminary management plan would fall under State jurisdiction, and

(2) The U.S. Fishery Conservation Zone would be expanded.

Similarly, jurisdictional questions exist in Guam and American Samoa, where the projected U.S. 200-mile zones overlap with areas presently or potentially claimed by other governments.

The four genera, classified as "continental shelf fishery resources," are

Red or pink coral (Corallium spp.)

Gold coral (Parazoanthus sp.)

Bamboo coral (Acanella sp.)

Bamboo coral (Keratoisis sp.)

Corallium, Parazoanthus, and Acanella are branched corals, whereas Keratoisis grows in a single vertical stem.

A fifth genus of commercial importance in Hawaii, Antipathes spp. (black coral), is also listed as a creature of the continental shelf. Since we expect no foreign interest in harvesting black coral and since the known Antipathes resource of Hawaii occurs predominantly within the territorial sea, we do not consider this genus here. Regulatory measures for the harvesting of black coral are being considered by the State of Hawaii, Division of Fish and Game.

Within the fishery management unit the four genera coexist at depths of about 350-450 m, on hard, gently sloping banks swept clean by strong currents. The total area of substrate supporting precious coral populations, and the average density of the four genera thereon, is unknown.

Our general understanding of precious coral distribution within the management unit may be summarized as follows:

American Samoa. No information is available on precious coral stocks.

Guam. No commercially important quantities of precious coral have been found near Guam or in the northern Marianas; however, Corallium is known to occur north of Pagan Island (Grigg and Eldredge 1975).

Hawaii. Beds of pink, gold, and bamboo coral have been located at six locations in the Hawaiian Archipelago (Grigg 1974) (Figure 1). These are as follows.

- (1) Off Kaena Point, Oahu
- (2) Off Makapuu, Oahu
- (3) 81 Fathom Bank, between Nihoa Island and Necker Island (lat. 23.3°N, long. 163.5°W)
- (4) Brooks Bank (lat. 24.1°N, long. 166.8°W)
- (5) 180 Fathom Bank north of Kure Island (lat. 28.8°N, long. 178.5°W)
- (6) A sixth bed, primarily of gold coral, has been discovered off Kea-hole Point, Hawaii.

Only the Makapuu bed has been extensively surveyed, and it supports the only existing commercial fishery. The area of this bed

is estimated to be 3.6 km². Of the other five areas, the Brooks Bank and 180 Fathom Bank are considered to hold the most promise for domestic harvesters.

Other unexplored banks in the Hawaiian Archipelago undoubtedly support precious coral stocks. Outside the 200-mile zone on the Milwaukee Banks (lat. 32.5°N, long. 173.0°E), large quantities of precious corals have been dredged by Japanese vessels.

Trust Territory and Possessions. Japanese vessels have harvested precious corals off Wake, Yap, Midway and Saipan Islands, primarily red corals. The beds being harvested have not been surveyed by American scientists.

b. Statistical history of exploitation

In 1965 Japanese fishermen began the harvest of Corallium at a depth of 400 m on the Milwaukee Banks. The total harvest by the Japanese in this area is unknown, but in 1969 alone, they reportedly took about 113,000 kg of pink coral from the Milwaukee Banks. The banks have an area of several hundred square kilometers (Grigg 1974).

In 1966 a bed of Corallium secundum was discovered in the Molokai Channel off Makapuu, by U.S. nationals, and the Hawaiian harvest of pink coral began shortly thereafter. Dredges were used initially, on a small scale, and a harvest of about 1,800 kg was taken during the first 3 years (Grigg, MS)¹. Dredging was then terminated, but by 1972 research by the Sea Grant Program of the University of Hawaii led to the development of an economically feasible harvesting system based on the use of a submersible. Local industry adopted the submersible technology and harvested Corallium

¹Grigg, R.W. 1976. Fishery management of precious and stony corals in Hawaii. Univ. Hawaii Sea Grant Program. Sea Grant TR-77-03.48p.

and Parazoanthus on the Makapuu bed from November 1973 until September 1975. On September 10, 1975, the Secretary of the Interior (Secretarial Order 2978) banned coral harvesting in Federal waters. The order is effective until September 30, 1976. The Department of the Interior has adopted a set of regulations which would allow U.S. commercial coral harvesters to operate in Federal waters under permits issued by the Department (Federal Register Document 76-19383; Federal Register, vol. 41, no. 129, July 2, 1976). The Department of the Interior does not have authority, however, to promulgate regulations concerning foreign harvest of or damage to precious corals. Whether the Department of the Interior regulations will remain in force after March 1, 1977, is a legal issue which is not resolved.

The harvest of gold coral on the Makapuu bed began in 1974. Bamboo coral has not yet been harvested. Table 1 gives the estimated landings of pink and gold corals on the bed since the inception of harvesting.

There is presently no documented foreign harvesting of precious corals within Hawaii's 200-mile zone. However, Taiwanese dredgers reported to be operating on the Milwaukee Bank in 1976 may also have harvested corals within the U.S. Fishery Conservation Zone. Precious corals may be knocked down and perhaps even recovered by Japanese and Soviet trawlers operating on the Hancock Seamount and other banks in the vicinity of the Northwestern Hawaiian Islands. Japanese vessels harvested about 100 mt of precious corals off Midway, Wake, Yap and Saipan Islands in 1975.

c. Types and numbers of vessels employed

Domestic: One 70 ft surface support vessel operating on the Makapuu bed at the time of the closure in September 1975

Foreign: About 90 Japanese vessels, of which 26 are specialized, were engaged in the precious corals fishery in 1975 off Guam, Wake, Yap and Saipan Islands.

d. Types and numbers of fishing gear employed

Domestic: One two-man harvesting submersible, supported by surface vessel, operating on the Makapuu bed at the time of the closure in September 1975

Foreign: The type of gear used on specialized Japanese vessels is unknown.

e. Historical impacts of foreign fishing on domestic fishery

There is no documented foreign harvest of precious corals within the 200-mile zone around Hawaii, but the Japanese harvest in 1975 around U.S. possessions and Saipan Island is known to have been 100 mt. Soviet and Japanese trawlers may be cropping corals on the banks incidentally to the harvest of bottom fishes such as the pelagic armorhead (Pentaceros richardsoni) and alfonsin (Beryx splendens). Impacts of this foreign effort on the domestic fishery are unknown.

f. History of regulations of foreign fisheries (including violations)

None

g. History of cooperative research, conservation, management and data exchange

None

2. Status of the fishery stocks

Detailed information is available only for the precious corals on the Makapuu bed. The status of other stocks, only some of which have been located but none of which have been assessed, is unknown. Assessments of potential yield for pink coral and the underlying estimates of biological parameters are based on the work of Grigg. Assessments for gold and bamboo coral are based on extrapolations of pink coral results, and are considered much less reliable than the pink coral assessments.

a. Distribution of exploited stocks

Known precious coral beds (areas supporting densities of coral colonies sufficient to arouse commercial interest) are listed in in Section II.C.1.a.

b. Abundance of exploited stocks

The only known exploited bed which has been surveyed in the management unit is the Makapuu bed. In 1971 the bed was surveyed to determine the number of colonies of each kind of coral and the size composition of the unexploited coral populations. The average density of pink coral was estimated to be $0.022 \text{ colonies/m}^2$. Applied to the total area of the bed (3.6 million m^2) this gives a standing stock of about 80,000 colonies.

The size composition of the unfished pink coral population was also determined during the 1971 survey. The average weight of pink coral colonies in the unfished population, at equilibrium, was estimated to be 0.93 kg. This information was combined with the estimate of numerical abundance to give a total biomass estimate of about 74,000 kg for the unexploited pink coral population.

The estimated densities of gold coral (Parazoanthus sp.) and bamboo coral (Keratoisis nuda) on the Makapuu bed were 0.003 colonies/m² and 0.01 colonies/m², respectively (Grigg 1974). However, the distribution of gold and bamboo corals is such that the effective bed area for these species is only about 1.8 km², about half the area for pink coral. Thus the estimated unfished abundance of gold coral was about 5,000 colonies, and for bamboo coral it was about 18,000 colonies. To estimate initial biomasses for gold and bamboo corals it is necessary to have information on average weight of colonies in the equilibrium unfished populations. Exact information is not available; rough estimates are 2.2 kg for gold coral and 0.6 kg for bamboo coral. These lead to estimates of about 11,000 kg for gold coral and roughly 10,000 kg initial biomass for the one genus of bamboo coral. Since gold coral may grow faster than pink coral (the colonies of this species do reach greater heights), this biomass estimate may be conservative.

c. Growth and mortality rates

A study of annual growth rings in cross-sections of pink coral branches suggests that the height of a colony increases about 0.9 cm per year, at least until an age of about 30 years. A height-weight relationship for pink coral has also been determined. A maximum height of 50-60 cm is attained by pink coral, whereas gold coral reaches 250 cm, and Keratoisis grows to about 300 cm.

The growth rate estimate was combined with size-distribution data to reveal the age composition of the unexploited pink coral population. With this information an estimate of the instantaneous natural mortality rate was determined. The estimate is 0.066 on an annual basis. This implies an annual survival rate of 93%-94%.

As a result of the slow growth rate and low natural mortality rate, a year-class or cohort of pink coral colonies will not reach its maximum biomass until an age of 31 or 32 years.

d. Reproduction and recruitment

Pink corals reach sexual maturity at an age of about 13 years, or a height of about 12 cm, and reproduce annually during June and July. However, the estimate of height at maturity is not very precise.

The relationship between spawning stock and recruitment in pink coral is unknown. However, because pink corals have a very long life-span, the population is composed of many year-classes; therefore the total stock size will be very stable even with moderate year-to-year fluctuations in recruitment.

An estimate of the average steady state recruitment in the unexploited Makapuu stock is obtained by multiplying the pre-harvest stock size (80,000 colonies) by the estimated instantaneous natural mortality rate (0.066 per year). This gives an estimated recruitment on the Makapuu bed of 5,109 pink coral colonies per year.

e. Yield per recruit

Assuming non-selective, relatively continuous harvest of pink coral colonies above a certain minimum height, maximum yield per recruit is achieved by setting the minimum height at 25 cm (minimum age at harvest equal to about 25 years) and applying an instantaneous fishing mortality rate of 0.14 per year. This will give a maximum yield per recruit of about 190 g. If it were feasible to crop all colonies of a year-class as they reached a certain size, then the maximum yield per recruit, or maximum potential yield per recruit, would be obtained by setting this critical size equal to 31 cm. This size corresponds to the age when the year-class would be expected to reach its maximum biomass. The maximum potential yield per recruit would be about 234 g.

f. Maximum sustainable yield

Assuming a constant recruitment of 5,109 colonies of pink coral per year, the maximum yield per recruit under continuous fishing at a constant rate translates to a maximum sustainable yield of about 970 kg per year on the Makapuu bed. If the colonies of a year-class could be cropped immediately on reaching the critical age, then the maximum potential sustainable yield would be about 1,200 kg per year, under the same assumption on recruitment.

For gold and bamboo corals, where estimates of population parameters are not available, we may derive very approximate estimates of maximum sustainable yield using rough figures on biomass of the unexploited stocks and the estimate of natural mortality rate

for pink coral. Since the estimates of biomass for gold coral were conservative, we first assume it is perhaps twice as great, or about 25,000 kg. The resulting estimates of maximum sustainable yield, using the method of Gulland (1970) are 650 kg per year for gold coral and 260 kg per year for bamboo coral. Estimates of maximum sustainable yield on the Makapuu bed are summarized in Table 2.

Estimates of MSY for other precious corals beds cannot be made in this way due to a lack of data. It is necessary instead to make certain assumptions concerning the abundance and availability of precious corals in these other beds. These are as follows:

1. That the five other beds listed on page 4 of this preliminary management plan are equal in aggregate size to the Makapuu bed.
2. That species composition, growth rates, recruitment, and yield per recruit factors are the same as on the Makapuu bed.
3. That precious corals beds near Midway, Wake, Yap and Saipan Islands are being harvested well above MSY.

Under these assumptions, MSY for the located but unsurveyed beds listed on page 4 is estimated at 1,200 kg, 650 kg, and 260 kg of pink, gold, bamboo coral respectively. The estimated MSY for beds near Midway, Wake, Yap and Saipan is less than 100 mt/yr.

g. Current domestic fishing status

The Makapuu bed has been exploited periodically since 1966. Estimated harvest of pink and gold corals are given in Table 1. The average annual harvest of pink coral in these early years of the fishery has exceeded the estimated maximum sustainable yield for the Makapuu bed stock. However, there are about 20 year-classes in the harvestable stock (the portion of the stock larger than the minimum size being harvested). Thus 20 years are theoretically required before the stock, and the annual yield, come into equilibrium with the current level of fishing effort, assuming this factor and the other vital rates remain constant during the period. Obviously, these conditions will not hold exactly, but it is nevertheless likely that the present transitional yields are greater than the expected equilibrium yields associated with the present level of fishing effort. This is to be expected during the early phase of exploitation, when the accumulated production of many year-classes is being "skimmed off" the population. If fishing were to continue at its present intensity it is likely that annual harvest of pink coral would decline, gradually reaching an average value approximately equal the estimated MSY.

In the case of gold coral, the present annual harvest appears to be about equal to the rough estimate of maximum sustainable yield given in Table 2, that is, about 650 kg per year.

3. Optimality

a. Biological considerations

Relative stability of the precious coral stocks is assured by the longevity of coral colonies, but the long life-span--or rather the large number of year-classes in the exploitable stock--has other important consequences.

(1) The response of the population size and related variables to sharp increases in exploitation rate is drawn out over many years. Thus yield, age structure and other variables are nearly always in transitional states. Evaluations of harvest policies aimed at achieving fixed equilibrium yields must bear this in mind.

(2) If the stock has been overexploited for several years, a long period of reduced fishing effort is required to restore the stock to its earlier abundance.

Because of the long recovery time of precious corals, a wise development policy for a newly discovered coral bed would be to permit exploitation only after assessments of the virgin stocks were made. The required information for such an assessment would include

(1) Total area of the bed

(2) Estimates of the density of the various species of precious coral on the bed.

(3) Estimates of the size and age composition of the coral populations.

While this preliminary management plan is directed only at a temporary policy on foreign harvest of precious corals, it should be useful here to set out the biological framework for a more comprehensive management program. Assuming constant recruitment and the other biological conditions discussed in Section 2, one biologically rational harvest policy for the Makapuu bed pink coral population would be to set the minimum harvestable colony height equal to 25 cm. This would provide about 12 years between sexual maturity and exposure to fishing mortality, and therefore help to ensure adequate reproduction. Further, if fishing were conducted at an annual instantaneous rate of 0.14, this minimum size would provide the maximum yield per recruit. If all colonies were cropped just as they reached this size the yield per recruit would be even greater, only slightly less than the maximum potential yield per recruit.

However, the reliability of the estimate of average size at maturity is so low that a more cautious policy would be warranted. Specifically, it could be recommended that the minimum height at harvest be set equal to 30 cm. With a fishing mortality rate of 0.16 this would give an average annual harvest of about 940 kg, only 3% less than the estimated MSY. This would clearly be a very small price to pay for the added insurance on stock reproduction.

The minimum height restriction, if obeyed, might be adequate by itself to prevent biological overharvesting. However, much of the coral has been broken into pieces by the time it is brought to the dock, and it might therefore be difficult to detect

the harvest of undersize colonies. Accordingly, a further restriction on harvest would be advisable to safeguard the population--the annual harvest of pink coral on the Makapuu bed should not exceed the MSY, or 1,000 kg.

Finally, a biologically rational policy clearly requires the use of coral harvesting gear which permits selective cropping of individual colonies and which allows the recovery of all colonies broken off from the seabed. The use of coral dredges and similarly destructive and wasteful methods should therefore be prohibited. It is estimated that coral dredges entangle and recover only 40% of the colonies actually knocked down. Once knocked down on the seabed a colony dies, and its skeleton deteriorates.

A further argument for the use of selective gear such as submersibles is that they will allow each coral stock on the bed to be cropped according to its own optimal policy.

b. Relevant socio-economic factors

Precious corals harvested on the Makapuu bed provide raw material for the local manufacture of jewelry, which is sold mainly on the large and growing tourist market in Hawaii. The ex-vessel value of precious coral is determined by color, size, and other characteristics. Among pink coral, the highest value is given to the light pink "Hawaiian Angelskin" colonies, with red and white colonies and other shades bringing lower prices. Value is directly proportional to the size (basal diameter) of a colony.

The average ex-vessel value of the precious corals harvested by submersible on the Makapuu bed is about US\$100 per kg, with low grade pieces bringing only about \$22 per kg and high quality colonies selling for up to \$660 per kg. Taking an average of \$100 per kg, this gives a total landed value of about \$200,000 for the 1975 harvest of pink and gold corals.

The harvesting of precious corals with submersibles is a high-technology operation. Relatively few people would be able to obtain the capital necessary to undertake a successful venture in coral harvesting with submersibles, compared with most other types of fisheries.

At the time of the closure of Federal waters to coral harvesters in 1975 the Makapuu operations involved only eight people directly in the harvesting. However, at least 500 people were employed in various stages of processing the raw coral and in the manufacture and sale of coral jewelry. Annual retail sales of precious coral jewelry in the Hawaii industry have been approximately \$10 million.

Worldwide, precious coral jewelry has brought about \$300 million at the retail level. Production is dominated by Japan and Italy (Anonymous 1974).

Without the local harvest of pink and gold corals, the local coral jewelry industry would need to import partially processed coral from Japan and other producers. It would therefore be vulnerable to sharp fluctuations in production rates, supply, and prices which are characteristic of the Japanese harvesting operations. Historically,

the practice of Japanese coral dredgers has been to completely exhaust a newly discovered bed, then to seek out other virgin grounds (Grigg 1971). For example, with precious coral becoming more "precious" in areas close to home, Japan developed the Milwaukee Banks coral fishery. That resource is now thought to be essentially depleted. In 1966, 100 Japanese dredgers were operating on the banks. Just 4 years later the beds were able to support only eight vessels (Grigg 1971).

If the Hawaii precious coral industry is to survive and prosper, it must have access to a reliable and controllable supply of raw material. The Makapuu bed is just a small fraction of the total area thought to be commercially productive in the Hawaiian Archipelago. Thus an adequate supply is available locally. Further with rising tourist expenditures and growth in personal income of Hawaiians, there is every expectation that considerable expansion in local markets is possible (Law 1970; Kok-Kian Poh 1971). In addition there is the prospect of developing markets on the U.S. mainland.

Clearly this potential will not be realized unless the U.S. maintains sole access to the precious coral resource. Only then will it be possible to develop a sound policy of exploration, biological assessment, and economically sound harvesting.

Given the lack of data to calculate a precise estimate of MSY, the longevity of coral colonies, and the long time required to restore over-harvested beds, the optimal management approach is to adopt a conservative harvesting policy pending the availability of more complete data. Therefore, for beds of precious corals in the U.S. Fishery Conservation Zone seaward of the Hawaiian Archipelago, American Samoa, Guam,

and U.S. territories and possessions covered by this preliminary management plan, other than the Makapuu bed, optimum yield is estimated to be zero for 1977. If new surveys of known or unlocated beds are made, or if new information becomes available from foreign interests, the Western Pacific Fishery Management Council and/or National Marine Fisheries Service may revise this estimate appropriately for 1978. Optimum yield of pink, gold and bamboo corals on the Makapuu bed is estimated to be 1000 kg, 650 kg and 260 kg per year, respectively.

d. Estimated domestic production potential

The present domestic precious coral harvesting industry is capable of cropping the estimated optimum yields, and is in fact now doing so.

e. Section 201(g) of the Fishery Conservation and

Management Act of 1976 states that, "to the extent practicable, each such [Preliminary Management Plan]

(1) shall contain a preliminary description of the optimum yield from such fishery and the total allowable level of foreign fishing with respect to such fishery" Ideally, this provision calls for a four step process by which the total allowable level of foreign fishing will be derived:

(1) Estimation of MSY

(2) Calculation of OY, based on MSY as modified by relevant economic, social, or ecological factors;

3. Assess the capacity and the extent to which U.S. fishing vessels will harvest OY;
4. Derive the total allowable level of foreign fishing.

In the case of this Preliminary Management Plan, this four step process has been followed, even though MSY cannot be estimated with any precision except for the Makapuu bed.

As is indicated, however, the optimum yield can be set at zero for beds other than the Makapuu bed, based on the clear need for protection of these beds until a full survey and assessment can be carried out.

Under these conditions, the total allowable level of foreign fishing on all beds of precious corals within the U.S. Fishery Conservation Zone of the Hawaiian Islands, American Samoa, Guam, and U.S. territories and possessions in the Pacific Ocean east and south of Hawaii, is zero.

4. Conservation and management measures applicable to foreign fisheries.

a. Data to be reported by foreign fishery

None, except that in the case of incidental take by foreign vessels harvesting seamount groundfish resources, data shall be submitted as specified by the Secretary of Commerce.

b. Zones and/or periods of limited foreign fishing

None.

c. Catch limitations

None allowed except for incidental catch by the seamount ground fish fishery west of 180°.

d. Other limitations, Conditions, or Requirements

The direct and intentional killing or harvesting of precious corals by foreign fisheries is prohibited everywhere within the 200-mile zones of Hawaii, American Samoa, Guam and U.S. territories and possessions in the Eastern, Central and Western Pacific, until such time as the coral resources can be assessed and maximum sustainable yields determined. Incidental killing or harvesting of precious corals is temporarily allowed in connection with armorhead trawling west of long. 180° as permitted under the Seamount Groundfish Fishery preliminary management plan. In the event that a foreign vessel kills or harvests precious coral while pursuing other fishery resources under permit in areas west of 180°, a determination will be made by U.S. regulatory authorities as to the implications of such incidental harvest. Depending on the results of such an evaluation the foreign vessel may be prohibited immediately from further fishing in the areas where the coral was killed or harvested, or may be required to modify fishing gear or fishing tactics in such a way that the further killing or harvesting of precious corals is prevented.

e. Coastal state fishery conservation and management

measures recommended for incorporation into this plan

None

f. Other measures

None

g. Relationship of conservation and management measures to conservation needs

The recommended management measures provide full protection of the precious coral resources and are based on the most up-to-date scientific assessments available.

h. Relationship of conservation and management measures to National Standards

The management measures are fully consistent with National Standards as outlined in P.L. 94-265.

i. Approximate costs of conservation and management measures

Undetermined

5. References to relevant background documents

Anonymous. 1974. Hawaii and the sea - 1974. State of Hawaii Department of Planning and Economic Development (111 p.).

Grigg, R. W. 1971. Status of the precious coral industry in Japan, Taiwan, and Okinawa: 1970. UNIHI-SEAGRANT-AR-71-02, 12 p.

Grigg, R. W. 1974. Distribution and abundance of precious corals in Hawaii. In Proceedings of the Second International Coral Reef Symposium 2:235-240. Great Barrier Reef Committee, Brisbane.

Grigg, R. W., and L. G. Eldredge. 1975. The commercial potential of precious corals in Micronesia, Part 1 - The Mariana Islands. Univ. Guam Sea Grant Publ. UGSG-75-01, Univ. Guam Mar. Lab. Tech. Rep. 18, 16 p.

Grigg, R.W. 1976, Fishery Management of precious and stony corals in Hawaii. UNIHI-Sea Grant TR-77-03,48p.

Gulland, J. A. 1970. The fish resources of the ocean. FAO (Food Agric. Organ. U.N.) Fish. Tech. Pap. 97, 425 p.

Kok-Kian Poh. 1971. Economics and market potential of the precious coral industry in Hawaii. UNIHI-SEAGRANT-AR-71-03, 22 p.

Law, C. K. 1970. The economics of Hawaii's coral jewelry industry - A preliminary study. Univ. Hawaii Sea Grant Advisory Rep. 2, 32 p.

III. RELATIONSHIP OF THE PROPOSED ACTION TO OCS, MARINE AND COASTAL
ZONE USE PLANS, POLICIES, AND CONTROLS FOR THE AREA

A. Regional Council Fishery Management Plans and Other Preliminary
Plans

This plan is related to the preliminary plan for Seamount Groundfish Fishery Resources in Hawaii, since it discusses the conflict between trawling operations and potential coral harvesting, and since it restricts the incidental killing of precious corals by foreign trawlers on the Hancock Seamount and associated guyots west of 180°.

B. Marine Sanctuary and Other Special Management Systems

This plan has no relation to Marine Sanctuaries or State Coastal Zone Management Programs.

C. Current and/or Proposed Oil, Gas, Mineral, and Deepwater
Port Developments

Manganese crusts are known to occur at depths of 1,200 to 6,000 feet on the sea floor of the Hawaiian Archipelago (Anonymous 1974). Mining of this mineral resource might directly damage precious corals, since these occur at depths up to 2,000 feet on the Oahu shelf and other areas. The impact of siltation and other potentially negative side effects of deep-sea mining on the viability of precious coral populations has not been determined.

IV. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

The action is expected to protect the immediate and long-range interests of the precious coral industry in Hawaii, an industry depending on a steady, reliable supply of raw coral for its viability.

Retail sales of precious coral jewelry by the industry are now about \$10 million annually. Considerable potential for expansion exists, though the magnitude of this growth has not been determined.

The proposed action will have no negative effects on the local economy or the physical or biological environment. The plan is based on a management philosophy which explicitly recognizes the necessity of cautious and biologically safe harvesting.

The proposed action will displace foreign precious coral harvesters from areas exploited near Midway, Wake, Yap and Saipan Islands. Also, the action may restrict fishing activities by foreigners when such activities result in the killing or harvesting of precious corals incidental to the catch of other marine resources. Given such constraints, it may not be possible for foreigners to harvest certain other kinds of resources as efficiently as possible. Consequently, some loss of economic potential on the part of foreign fishing fleets may occur.

V. ALTERNATIVES TO THE PROPOSED PLAN

Two management alternatives for coral beds not yet scientifically assessed are to

- 1 - Permit the direct foreign harvest of precious corals in the zone with no restrictions.
- 2 - Permit the unrestricted incidental harvest of precious corals, but no fishing operations directed specifically at the harvest of corals.

If the first alternative were adopted, a resource of potentially great value to the local precious coral jewelry industry in Hawaii would be subject to possible overharvesting, and this could significantly reduce the potential growth in the industry and attendant economic output. Harvesting precious coral stocks without first assessing biological production potentials and determining optimal harvesting strategies would be reckless, wasteful, and inconsistent with the National Standards for management of fishery resources.

The second policy alternative is potentially as dangerous as the first, since fishing methods that might take precious coral incidentally, such as bottom trawls, would knock down colonies in the path of the gear just as surely as coral dredges.

The selected policy allows foreign vessels exploiting groundfish on the seabed to continue such operations in a limited geographic area, in accordance with regulations stipulated in their fishing permits, even if precious corals are killed or harvested incidentally, provided that such taking of coral is judged by the Department of Commerce or its designated agents not to damage U.S. interests. Thus it provides for reasonable foreign use of fish stocks having a harvestable surplus as long as such use does not conflict unduly with the development of U.S. precious coral industries and with long-term conservation requirements.

VI. PROBABLE ADVERSE EFFECTS OF THE ACTION WHICH CANNOT BE AVOIDED

It is unavoidable that certain kinds of foreign fishing, such as bottom trawling, will kill or harvest precious corals incidentally in certain areas. To the extent that such fishing operations are permitted

to continue by the Secretary of Commerce, there will be a reduction in the amount of precious coral available to U.S. harvesters. Further, because most such operations are not efficient in capturing or recovering colonies knocked down on the bed, there will be waste of the resource. Recovery of previously damaged beds may be delayed.

VII. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF MAN'S ENVIRONMENT
AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The proposed action provides for the intentional harvesting of precious corals only after stocks have been scientifically assessed and optimum long-term yield policies have been developed. Thus it protects the supply of precious coral from negligent, wasteful over-exploitation which might lead to short-term economic gain for foreign harvesters but long-term shortages and economic losses for U.S. precious coral interests.

VIII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED
IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Implementation of the proposed action will restrict the foreign harvest of precious coral resources in certain areas west of 180°. Thus such resources might be committed to more limited use than otherwise might occur. Likewise, the action could lead to some irretrievable loss of precious coral, should the Secretary of Commerce decide to permit the incidental killing and harvesting of precious coral colonies in these areas. Such losses would be restricted to the area open to foreign groundfishing operations. Neither of these situations is regarded as seriously damaging to short-or long-term U.S. interests.

Table 1.--Estimated harvests of pink and gold corals on the Makapuu bed.

Years	Gear	Harvest		Estimated total ¹	
		Pink	Gold	Harvest + knockdown Pink	Gold
		<u>Kg</u>	<u>Kg</u>	<u>Kg</u>	<u>Kg</u>
1966-69	Dredge	1,800	?	4,500	?
1970-72	- - - No harvesting - - -				
1973	Submersible	540	0	540	0
1974	Submersible	2,209	734	2,209	734
1975	Submersible	1,385	621	1,385	621

¹Assumes that only 40% of the colonies knocked down by the dredge were actually entangled and recovered.

Table 2.--Estimates of maximum sustainable yields for pink, gold, and bamboo corals on the Makapuu bed (kg per year).

Coral type	Instantaneous harvesting	Continuous harvesting	"Gulland" estimate
Pink	1,200	970	1,900
Gold	--	--	650
Bamboo	--	--	260

FIGURES

1. Locations of five commercially valuable precious coral beds in the 200-mile zone of Hawaii. Boundary of the 200-mile zone is also indicated.
2. The 200-mile zone around Guam. The small slices of area bounded by the dashed lines are exclusively within U.S. jurisdiction. The remaining area overlaps with the Trust Territory of the Pacific Islands or areas potentially claimed by its constituents.
3. The 200-mile zone around American Samoa. The small area bounded by dashed lines southeast of Rose Island is exclusively within U.S. jurisdiction. The remaining area overlaps with areas claimed or potentially claimed by other governments.

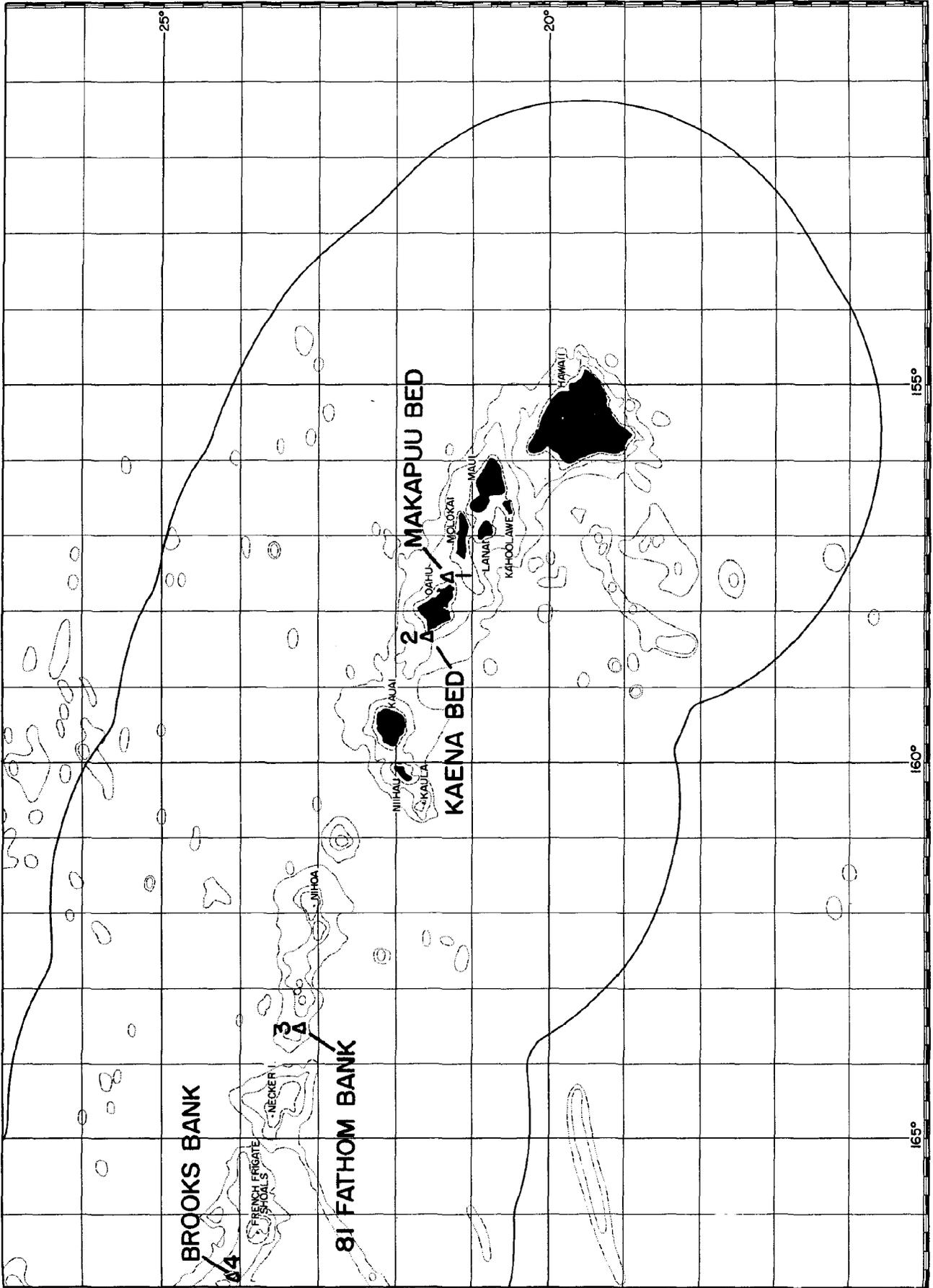


Figure 1

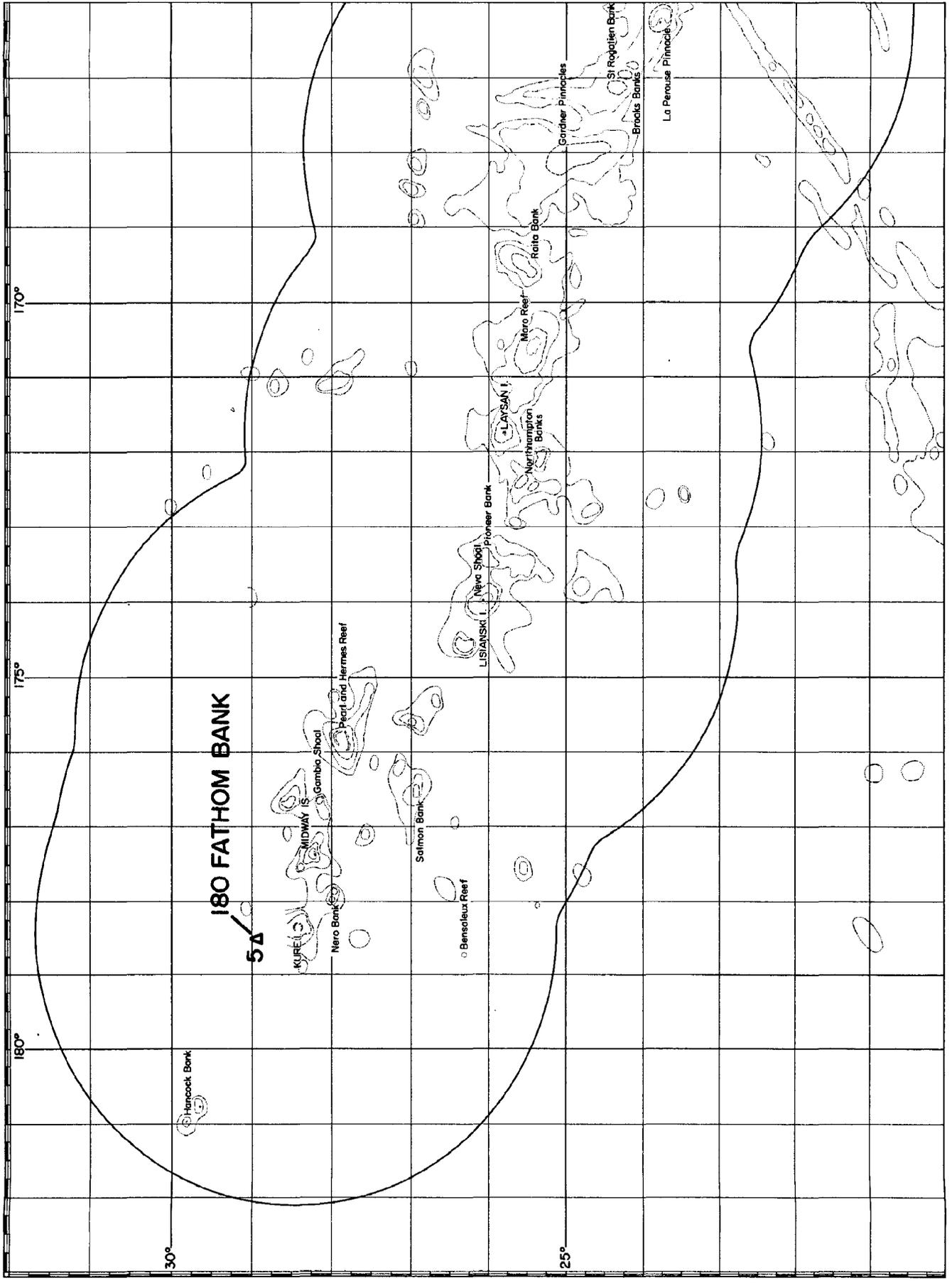


Figure 1.--Continued.

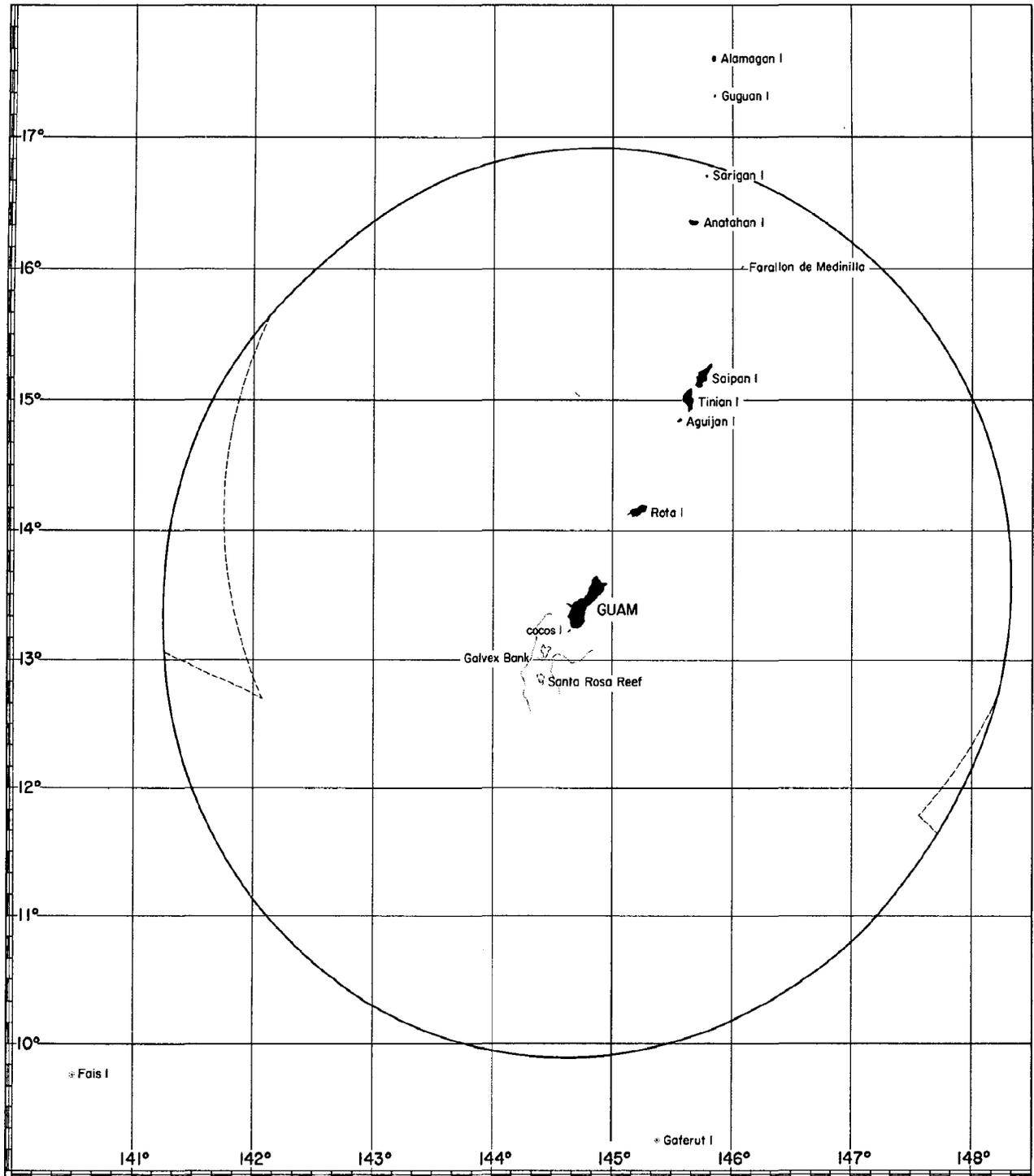


Figure 2

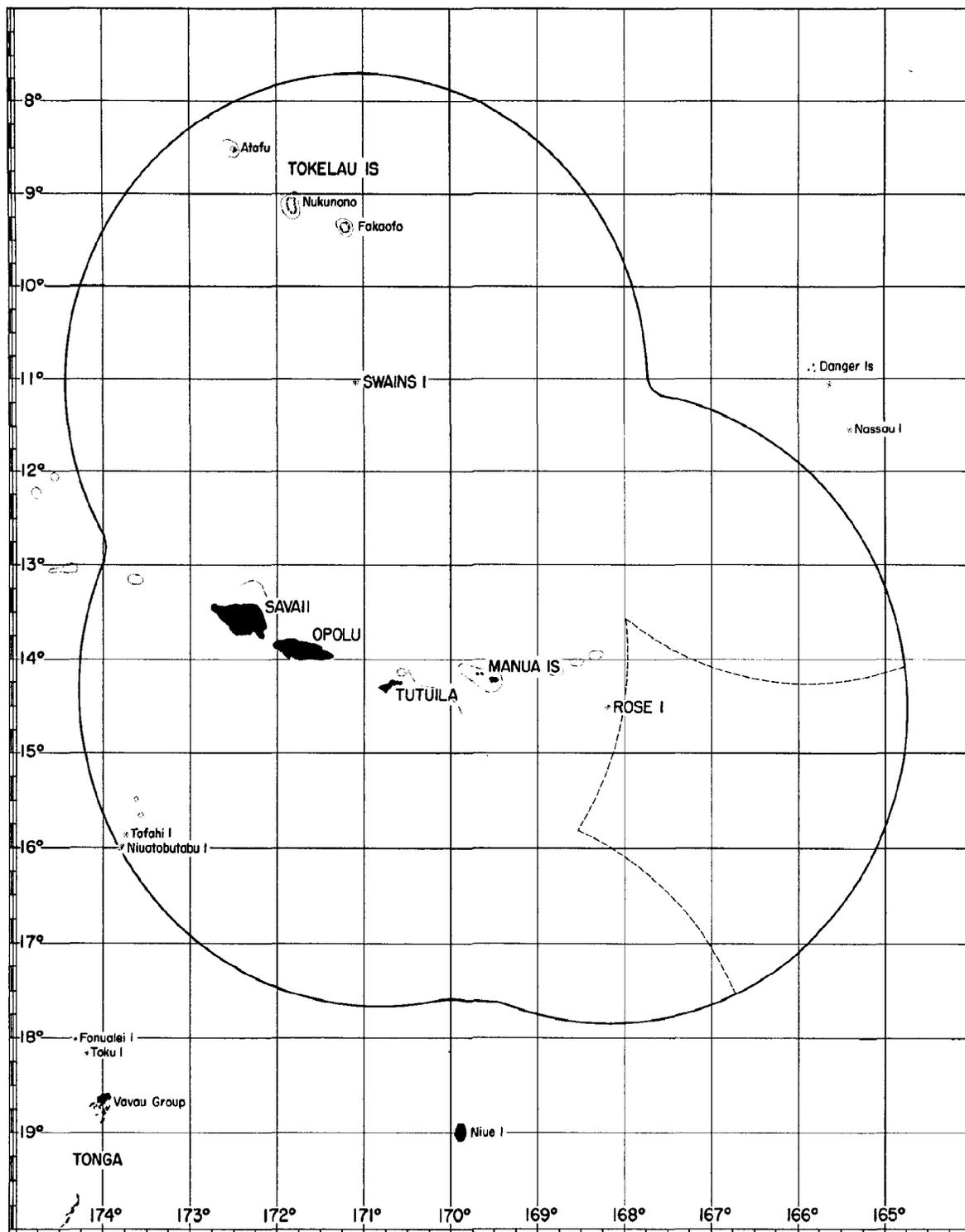


Figure 3

Precious Corals Fishery

- 1) About 90 vessels are engaging in precious corals fishery, of which 26 vessels are specialized in harvesting precious corals (Red Corals) (harvest season: Mar.-Nov.). The size of these specialized vessels is between 90 to 130 gross tons. | 1
- 2) Their harvesting grounds within 200 miles off the coasts of the U.S. are off the Midway, Wake, Yap and Saipan Islands. | 2
- 3) The total harvest by 26 specialized vessels in 1975 was about 100 metric tons. | 3
- 4) The Japanese delegation expected the continuation of this fishery. | 4

RESPONSE TO COMMENTS FROM AKIRA MATSUURA

1. This information was not available for preparation of the DEIS/PMP, but has been incorporated into Section II. C.1. (pages 6-7).
2. The scope of the DEIS/PMP has been broadened to include U.S. territories and possessions in the Western Pacific and the Central and Eastern Pacific.
3. See response number 1 above.
4. Directed foreign fishing for precious corals in the portions of the U.S. Fishery Conservation Zone covered by this Preliminary Management Plan would be prohibited. Incidental catch would be allowed in connection with groundfish trawling operations so long as the Secretary of Commerce found it not to be damaging to U.S. interests. Foreign nations wishing to undertake a directed precious corals fishery may wish to submit to the Secretary such data, studies, and analyses as are available so that these may be considered in future planning efforts by the Secretary and/or the Western Pacific Fishery Management Council.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

November 24, 1976

Dr. Gerald V. Howard
Regional Director
National Marine Fishery Service
300 S. Ferry Street
Terminal Island, California 90731

Dear Dr. Howard:

Thank you for the opportunity to review and comment on the draft EIS/PFMP for precious corals. With the exception of a few minor suggestions for word changes that are listed below, I concur with the analysis and recommendations contained in the draft Pre-management plan. Much of the analysis is based on my research at the University of Hawaii. The only statistic in the Pre-management plan that differs from my analysis (Grigg 1976) is the standing crop of the unfished pink coral in the Makapuu Bed. I chose to use a more conservative estimate of average weight in order to make the calculation, however, the figure used in the Pre-management plan is perhaps a more accurate estimate given the mathematics that underlie the Beverton and Holt Model. This point, however, is only of academic importance since estimates of MSY do not depend on it.

5

Below is a list of suggested word changes:

Page A-1, 5th line from bottom: Insert "fully" between the words been and surveyed.

Page 4, after (5): Add (6) "A sixth bed, primarily of gold coral, has been more recently discovered off Kea-hole Point, Hawaii."

Page 5, 1st line: "five" areas

6

Page 9, last line: Keratoisis grows to about "300 cm."

Page 10, line 11: Add "about" 13 years.

Page 14, line 8: Change to "about 12 years."

Page 15, line 11: Change to "Once knocked down, a colony dies and its skeleton slowly deteriorates."

The reference to my manuscript on page 5 should be updated and added to the bibliography. It should now read: Grigg, R. W. 1976. Fishery management of precious and stony corals in Hawaii. UNIHI-Sea Grant-TR-77-03. 48 p.

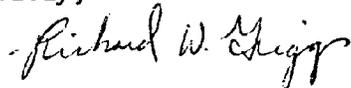
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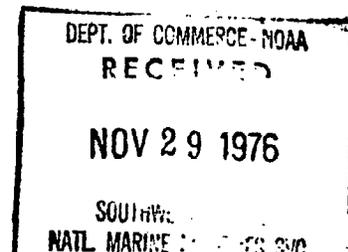
Finally, I notice there are requirements for the reporting of incidental and unintentional catch by foreign vessels. Will this information be in the public domain and if so, will it be possible for me to receive such reports as they become available to the Southwest Region. Perhaps they could be mailed by way of the Western Pacific Regional Council.

8

Sincerely,



Richard W. Grigg
Associate Marine Biologist
P.O. Box 1346
Kaneohe, Hawaii 96744



RESPONSE TO COMMENTS FROM RICHARD GRIGG

5. No changes necessary in DEIS/PMP
6. Changes were made as recommended.
7. The reference was updated.
8. Information which is submitted to NMFS will be made available to the Western Pacific Fishery Management Council for its fishery planning efforts.



DEPARTMENT OF THE ARMY
 HONOLULU DISTRICT, CORPS OF ENGINEERS
 BLDG. 230, FT. SHAFTER
 APO SAN FRANCISCO 96558

PODED-PV

30 November 1976

Gerald V. Howard
 Regional Director
 National Marine Fisheries Service
 NOAA/DOC
 300 South Ferry Street
 Terminal Island, California 90731

Dear Mr. Howard:

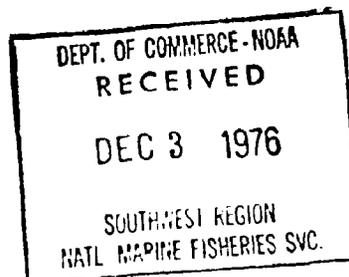
We concur in the recommendations and actions proposed in the Draft Environmental Impact Statement entitled "Precious Corals, Western Pacific Region," particularly the prohibition of the use of coral drag nets and the requirement for periodic monitoring of coral stocks. Since the Mariana Islands District, Trust Territory of the Pacific Islands, has recently voted to become an incorporated territory of the United States, we suggest that the Mariana Islands be included under the coral fisheries management plan. We also suggest that the Lahaina (Maui, Hawaii) black coral fishery be investigated to determine the extent of possible overfishing pressures.

9
10

Thank you for the opportunity to review the DEIS. Please forward a copy of the final EIS when it is available.

Sincerely yours,

B. R. Schlapak
 B. R. SCHLAPAK
 Lt. Col., Corps of Engineers
 Deputy District Engineer



RESPONSE TO COMMENTS FROM U.S. ARMY CORPS OF ENGINEERS

9. In response to comments from Japan, the Preliminary Management Plan has been broadened to apply to U.S. territories and possessions in the Western and the Central and Eastern Pacific.

10. The Preliminary Management Plan pertains only to controls on foreign fishing. We will convey to the Western Pacific Fishery Management Council your concern about possible over fishing of the Lahaina black coral resources.

HAWAII MARINE

CONSULTANTS

CHARTERS

December 27, 1976

Mr. Gerald Howard, Director
National Marine Fisheries Service
Southwest Region Office
Terminal Island, California

Dear Mr. Howard:

I would like to take this opportunity to thank you and your staff, and Richard Shomura and Bob Iverson of the Honolulu lab for prompt attention to the problem of my acquiring copies of the DEIS/PMP concerning Hawaiian fishery resources.

The matter has been suitably resolved, and I have copies of the plans in hand. Unfortunately, the holiday season has my work load backed up, and I have been unable to study the documents at great length, although I have perused them.

I realize that the period for accepting public comment is past, but I would like to make some brief comments here.

My observation, after reading the Seamount Trawl resource study, is that we are attempting to depend on foreign fishery statistics, which are no doubt invaluable, and useful to us, for management planning purposes. I also got the feeling that there is little consideration of the potential of a greatly expanded American fishing effort and commensurate consumer interest. I would be much more comfortable with the document if it made it stressed that expanded American stock assessment efforts were essential before even a reasonable stab at optimum sustainable yield and like figures could be obtained. I don't believe we can rely solely on foreign fishing statistics for long term planning efforts.

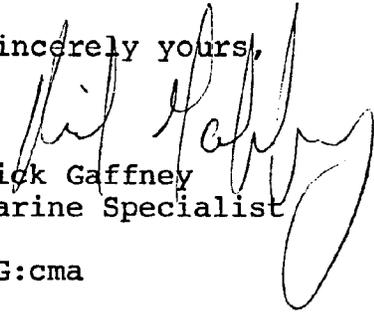
Vis a vis the precious coral DEIS/PMP. All due consideration appears to have been given in this work, and a clearer conclusion has been reached as a result of research already done in the area. This backs up the stress I place on the need for proper resource management to begin with in-depth stock assessment work.

11

Mr. Gerald Howard, Director
December 27, 1976
Page 2

Again, thank you for your prompt consideration of my earlier requests, and the opportunity to comment on these works.

Sincerely yours,


Rick Gaffney
Marine Specialist

RG:cma

DEPT. OF COMMERCE-NOAA
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CONTINUED REGION

RESPONSE TO COMMENTS FROM RICK GAFFNEY

11. No response necessary.

APPENDIX

CONDITIONS AND RESTRICTIONS

Part V EASTERN, CENTRAL, AND WESTERN PACIFIC

Subpart A General Provisions

1.0 Purpose.

The purpose of these Conditions and Restrictions is to implement P.L. 94-265 in respect to selected fisheries in the Eastern, Central, and Western Pacific.

2.0 Definitions.

- (a.) Western Pacific. That area of the Pacific Ocean west of the 180° meridian.
- (b.) Central and Eastern Pacific. That area of the Pacific Ocean east of the 180° meridian.
- (c.) Regional Director. The National Marine Fisheries Service Regional Director of the Southwest Region, 300 South Ferry Street, Terminal Island, California 90731.

Subpart D

1.0 Definitions.

- (a.) The terms used in this Subpart will have the meaning ascribed to them in this chapter unless otherwise defined herein.
- (b.) Regulations in this Subpart will apply to fishing for: Red or Pink Corals (Corallium spp.), Gold Corals (Parazoanthus spp.), Bamboo Corals (Acanella spp.) and Bamboo Corals (Keratoisis spp.).

(c.) Precious corals. Those genera described in 1.0(b) above.

2.0 Catch.

(a.) It is unlawful for foreign registered fishing vessels to intentionally harvest or attempt to harvest precious corals within the U.S. Fishery Conservation Zone in the Central and Eastern Pacific and in the Western Pacific.

3.0 Incidental Catch.

(a.) In the event of an incidental catch of precious corals by foreign registered fishing vessels fishing within the U.S. Fishery Conservation Zone in the Western Pacific, as would be permitted under the regulations pertaining to the Seamount groundfish fishery, such catch shall be reported to the Regional Director. The information required is delineated in Section 4.0.

4.0 Reporting.

(a.) All incidental or unintentional catches of precious coral shall be documented in daily log books as required by the Preliminary Management Plan for Seamount Groundfish Fishery Resources. As indicated therein, data on incidental catch of precious corals shall comprise weight, in kilograms, by species, and the time, date, location, and depth of the catch.

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