REGULATORY AMENDMENT TO THE FISHERY MANAGEMENT PLAN FOR THE REEF FISH FISHERY OF PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS CONCERNING RED HIND SPAWNING AGGREGATION CLOSURES INCLUDING A REGULATORY IMPACT REVIEW AND AN ENVIRONMENTAL ASSESSMENT

CARIBBEAN FISHERY MANAGEMENT COUNCIL

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I INTRODUCTION

The Fishery Management Plan for the Shallow-water Reeffish Fishery of Puerto Rico and the U. S. Virgin Islands (FMP) became effective September 22, 1985. The FMP (and each of the amendments) was prepared, under the authority of the Magnuson Act, by the Caribbean Fishery Management Council to establish a management system for the reef fish resources within the Exclusive Economic Zone (EEZ) and the waters under the authority of the Commonwealth of Puerto Rico and the Territory of the U.S. Virgin Islands, from the shoreline to the edge of the insular platform.

The FMP that went into effect in 1985, established regulations to rebuild declining reef fish stocks in the fishery and reduce conflicts among fishers. It established the criteria for the construction of fish traps; required owner identification and marking of gear and boats; prohibited the hauling of or tampering with another person's traps without the owner's written consent; prohibited the use of poisons, drugs and other chemicals and explosives for the taking of reef fish; established a minimum size limit on the harvest of yellowtail snapper (Ocyurus chrysurus) and Nassau grouper (Epinephelus striatus); and established a spawning season closure for Nassau grouper.

In November 1990, Amendment 1 to the FMP established regulations to rebuild declining reef fish stocks. It prohibited the harvest or possession of Nassau grouper; closed an area in the EEZ southwest of St. Thomas, U.S. Virgin Islands to all fishing during the spawning season for red hind (Epinephelus guttatus); increased minimum mesh size for traps to 2 inches; defined overfishing; revised the section on habitat description; provided for the collection of socio-economic data through federal/state agreements already in existence.

In October 1993, Amendment 2 to the FMP incorporated the major species of the deep-water reef fish fishery and the marine aquarium finfish fishery into the reef fish management unit. This action was accompanied by a change in the FMP's original title and to the present the FMP is known as the Fishery Management Plan for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands (Reef Fish FMP). To protect important species and rebuild declining reef fish stocks Amendment 2 prohibited the harvest or possession of jewfish (Epinephelus itajara); prohibited the harvest/possession/sale of certain species used in the aquarium trade; restricted the collection of marine aquarium fishes to hand-held dip nets and slurp guns; closed 2 additional red hind spawning aggregation areas, to all fishing, from December through February; closed a spawning aggregation area, to all fishing, for mutton snapper (Lutjanus analis) from March through June each year in St. Croix, U.S. Virgin Islands; and changed the criteria for the construction of fish traps.

II STATEMENT OF THE PROBLEM

A seasonal closure for red hind (Epinephelus guttatus) was established in Puerto Rico in 1993. The location of the spawning aggregation is given by the following point coordinates (see Figure 1):

POINT	LATITUDE	LONGITUDE
A	18°11.0'N	67°25.5'W
B	18°11.0'N	67°20.4'W
C	18°08.0'N	67°20.4'W
D	18°08.0'N	67°25.5'W

The seasonal closure, to all fishing, in the above mentioned area, runs from December 1 to February 28 of each year.

It was brought to the attention of the Council that the red hind closure established off Mayagüez in 1993 needs revision because the closure area is too large and there are two additional red hind spawning aggregations that need protection.

The commercial fishers have stated that the area around Buoy 8, (Tourmaline Bank) which is, under the current regulations, closed from December 1 through February 28. is too large. The red hind spawning aggregation is restricted to an approximate radius of 1.5 miles around Buoy 8 and not in most of the area to the west of this radius. Further, because the sea bottom in most of the area that is presently closed is sandy, it has traditionally been used to store fish traps during bad weather so that the fishers may avoid having to bring traps back to shore with each bad weather event.

After holding an informal meeting with commercial fishers from the area the Reef Fish Committee reviewed the new information. The alternatives suggested by the commercial fishers were then presented at a Public Hearing.

As a result of these meetings and hearings, the Council proposes the closure of two additional (Abrir La Sierra or Buoy 6 and Bajo de Cico) red hind spawning aggregations off the west coast of Puerto Rico and a re-definition of the site (Tourmaline Bank) originally closed in 1993.

Background information:

The proposed action addresses continuing and growing concerns by the public and the Council over scarce resources, and the need to protect important species when they aggregate for spawning. Whenever possible, the Council relies upon closing aggregation sites during spawning seasons to regulate the fishery instead of size limits or quotas that result in excessive fishing mortality to juveniles. Most species that

aggregate during the spawning season are highly vulnerable to capture at that time. Allowing mature individuals the opportunity to spawn is important to reverse declines in stocks.

Since a red hind spawning area in the EEZ southwest of St. Thomas was first closed on December 1, 1989, through the duration of the spawning season (that is, through February 28, 1990) and each consecutive year after that, and the closure of 2 additional red hind spawning aggregation areas, one off Mayagüez and the other on Lang Bank, St. Croix (1993), the Council has attempted to identify additional spawning aggregation areas to further protect declining resources.

During the spawning season, many reef fishes are very aggressive and extremely vulnerable to capture. Protecting spawning aggregations is a sound management practice and the Council prefers spawning area closures to other approaches, such as size limits and quota management, that are more labor intensive and inflict high rates of mortality on undersized fish. Because of their concentration and distribution through most of the water column when aggregating to spawn, a total ban on gear capable of taking fish is necessary.

The Fisheries Research Laboratory (FRL) of the Department of Natural and Environmental Resources and the CFMC have identified several spawning aggregations around Puerto Rico, three off the West coast (Figure 2) and one of these three (Tourmaline Bank) has been closed since 1993. The Reef Fish Stock Assessment (SAFE Report, 1992) group recommended that spawning aggregations be protected. It is at this time that the species are more vulnerable and, traditionally, fishing effort increases during the periods of spawning aggregations. Whenever possible, the Council relies upon closing aggregation sites thus, allowing mature individuals the opportunity to spawn. This is an important step in reversing the observed declines in fish population.

Information available regarding the status of the red hind fishery indicates that landings have shown a continuous decline since 1991 (Figure 3). The data shown in Figure 3 are for the West Coast which include the towns of Cabo Rojo, Mayagüez, Añasco, Rincón, Aguada, and Aguadilla. Action was taken by the Council when grouper landings in general showed a decline in their percentage of the total commercial catch; from 13% in 1989 to 5.3% in 1994 (Table 1). In the West Coast, as well as all around the Island, red hind landings have shown a dramatic decrease in recent years (Figure 3 and Table 2). The increase in the commercial landings for groupers, seen in Figure 3, could be due to the increase in the harvesting of coneys (Epinephelus fulvus). There has been a shift in species of groupers in the commercial landings category of the FRL. Coneys, rock hind, red hind, graysby are prevalent now as opposed to the past landings of Nassau grouper, jewfish, yellowfin and red groupers. Monthly landings reported for red hind have also shown a declining trend (Figure 4) which is specially noticeable during the peak spawning months of

January and February. Monthly grouper landings show enormous variability (Figure 5) which warrants more detailed explanation.

Fishery-dependent data from the FRL show that the number of red hinds measured through the Biostatistical Sampling Program has decreased from 1,422 red hinds measured in 1991, to 590 red hinds measured in 1993. The red hind size frequency distribution continues to show a decline in the average size of fish in Puerto Rico. The SAFE report (1992) showed a decrease in mean size of commercially caught red hinds from 1985 (290 mm) to 1990 (265 mm). The commercial landings of red hind show a continuous declining trend, since 1991, in number and size of fish caught. Fishery-independent data show that the average size of red hinds caught at the spawning aggregations has declined as well as the total number of fish harvested from the aggregations at Bajo de Cico and Abrir La Sierra or Buoy 6 (A. Rosario per. com.). Figures 6 and 7 show the data from the fishery-independent survey for 1994-1995 and 1995-1996 at Bajo de Cico and Abrir La Sierra, respectively, (A. Rosario, unpublished data).

The FRL, abiding by the regulations in place, did not sample the red hind area closure of Tourmaline Bank during December through February from 1993 to the present. In addition, although at the public hearing it was stated that recreational fishers were very actively fishing at Abrir La Sierra, there are no data available from the recreational sector.

Most of the red hinds caught during the annual fishery-independent (SEAMAP-Caribbean and FRL Reef Fish Monitoring Program) surveys were harvested at Bajo de Cico and the area around Buoy 6 (Abrir La Sierra). This was the case not only between December and February of each year, but also during sampling the rest of the year. The surrounding areas do not show significant numbers of red hinds at any time (A. Rosario, per. com.). The FRL has been monitoring the spawning aggregations for 5 years, between December and March each year, specifically Stations 95 and 96 (Bajo de Cico) and Station 59 (Abrir La Sierra or Buoy 6). The monitoring effort began in 1987 and continues to the present. The only year for which monitoring was not possible was in 1993. The 3 stations (95,96,59) account for 77% of the total annual sample. Highest numbers of red hinds have been reported for Bajo de Cico since 1992.

A dramatic change in the sex ratio of red hinds, decreasing from 8:1 to 3.9:1 females to males, has been detected between 1988-1989 and 1993-1994. It is possible that the number of females to males at the time of spawning affects the success of the spawning output. This could be specially significant when considered in conjunction with the decrease in mean size of fish at the aggregations and throughout the year. In most fish, the number of eggs is related to the size of the fish, that is, the bigger the fish the more eggs it has. The combination of these data need to be looked at in more detail.

Red hind maximum CPUE correspond to the spawning season. Smith and Ault (1993) and Rosario (1996) show that mean CPUE is 1.5 to 2 times higher than during the non-spawning season. However, sampling of the 1993 spawning aggregation was not completed. Spawning season for red hind has been reported to extend from December through February (Erdman, 1977; Garcia-Moliner, 1986) with peak spawning in January (Sadovy et al., 1994). The two species which dominate the fishery-independent catch in the sampling area are red hind and coney. The dominant factor in determining which species dominates the catch is the sampling of the spawning aggregation when red hinds are most vulnerable and the greatest numbers of fish are caught over this short period of time (Rosario, 1996).

Fishery-independent data have been collected since 1988, using hook and line and fish traps. Unpublished data from the FRL shows a sharp decline in the mean size of red hinds caught off the west coast of Puerto Rico (Rosario, 1996; Figure 8).

The most commonly used gear in the commercial harvest of red hinds are hook and line and fish traps. Red hinds caught with traps in the fishery-independent surveys were significantly larger than those sampled with hook and line (Rosario, 1996). However, data from the commercial catch show that red hinds caught with hook and line were larger than those caught with traps (Matos, 1991) at least for the years 1988-1990.

Groupers are now widely acknowledged to be extremely vulnerable to anything other than light fishing pressure and large size of first capture. This has been shown consistently in different studies and appears to be a pattern typical of species, like many of the groupers, which are long-lived, slow-growing, and aggregate for spawning. Protogynous hermaphrodites (change from female to male) may be particularly susceptible to differential mortality of males since females may not change sex quickly enough to compensate male losses. Many fish that aggregate to spawn are likewise increasingly being recognized as vulnerable to heavy exploitation of aggregations. There are good examples of declines in, and disappearances of, aggregations worldwide. Some of the more spectacular (and more extreme) examples involve aggregations of various grouper species in both the western Atlantic and Indo-Pacific that have severely dwindled after only a few years of pressure. We can only guess at what the long- and short-term effects are on non-aggregation catches due to the decline in aggregation catches. It is clear that aggregation protection is widely and consistently supported by fishers who depend on the long-term sustainability of aggregating species for their livelihood.

Spawning aggregations that are large (in terms of number of animals participating) are relatively few and are widely spaced in distribution. These spawning aggregations are particularly vulnerable and they should receive maximum protection within practical and socio-economic constraints.

Red hind catches in western Puerto Rico constitute a substantial proportion of local grouper catches and very likely depend on "healthy" aggregations in the areas currently under discussion. Given that red hind in western Puerto Rico show evidence of growth, and possible recruitment, overfishing, and continue to show a decline in landings since 1991, management approaches should be conservative. The data collected by FRL are critical in monitoring the long-term impacts of fishing and effectiveness of management measures for this species.

There are two additional factors which might have a significant impact on red hind stocks: (1) recreational fishing activities, and (2) net-fishing. According to testimony offered at public hearings, recreational fishers are fishing the red hind aggregations and selling hundreds of pounds of this species. This fishing activity should be monitored to determine the impact of the recreational sector on this fishery (this holds true for other reef fishes.) Detrimental use of fishing gear include the unattended nets and the non-regulation of fishing activity. Specifically, nets are being fished at night and left unattended (from 5 p.m. till 6 a.m. the next morning) and fished in areas such as Bioluminescent Bay in La Parguera. This is not much of a problem for certain species (e.g., trunk fish and lobster) which survive the long hours but, these nets are killing hundreds of fish (groupers, mutton snappers, hogfish). These fish spoil and have to be thrown out. The mesh being used is 5½" with three panels and of nylon #9, #12 and #15.

III OBJECTIVES OF THIS AMENDMENT

The original objectives addressed by the Reef Fish FMP, as amended, are unchanged. The objectives are to: 1) obtain the necessary data for stock assessment and for monitoring the fishery; 2) reverse the declining trend of the resource by (a) restoring and maintaining adult stocks at levels that ensure adequate spawning and recruitment to replenish the population and (b) preventing the harvest of individuals of species of high value (e.g., snappers, groupers, and others) that are less than the optimum size; 3) reduce conflicts among users of the resource; 4) promote international cooperation in managing the pan-Caribbean species; and 5) help resolve the ciguatera problem.

The proposed adjustment to a management measure (red hind area closure) in this amendment is directed toward fulfilling some of these objectives (1, 2, and 3 above) and is in accordance with this FMP's overfishing definition. It is recommended that the State expand the data collection efforts and monitoring of spawning aggregations (for groupers and other species) through the Department of Natural and Environmental Resources.

IV MANAGEMENT MEASURE AND ALTERNATIVES

The management measure adopted by the Council and those considered but rejected are presented below:

Adopted Measure 1 **(Preferred option): Close the corresponding sections of the EEZ in all three (3) areas presented below to all fishing between December 1 and February 28 of each year. (Figure 9 shows all three areas as well as the original red hind area closure.)**

1. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 8 at Tourmaline Bank. (This is part of the area already closed but it allows for the use of the sandy area where red hinds are not found.) This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°11.2	67°22.4
B	18°11.2	67°19.2
C	18°08.2	67°19.2
D	18°08.2	67°22.4

2. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 6 at Abrir La Sierra Bank. This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°06.5	67°26.9
B	18°06.5	67°23.9
C	18°03.5	67°23.9
D	18°03.5	67°26.9

3. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius centered around a buoy to be deployed in the area known as "Bajo de Cico." This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°15.7	67°26.4
B	18°15.7	67°23.2
C	18°12.7	67°23.2
D	18°12.7	67°26.4

Discussion: Red hind (one of the most prevalent species in the commercial landings) are being harvested at less than optimum size. The average size and production of red hind have been shown to be declining. These conditions are contrary to objective 2b of the FMP: "Prevent the harvest of individuals of species of high value (e.g., snappers, grouper, and others) which are less than the optimum size."

Red hind, as many other species of reef fish, aggregate in geographically limited areas for spawning. Protection of spawning aggregations is a practical way to reduce fishing mortality at the time when fishing effort is the most intensive and CPUE is the highest. Protection of these areas will also increase the likelihood of spawning success. The benefits of the closure could depend, however, on the extent that fishing effort and catch are increased or decreased during the remainder of the year. Complementary regulations from the government of Puerto Rico are recommended to protect the spawning aggregations.

The federal waters in these areas are to be closed to all fishing, neither commercial nor recreational fishers, will be permitted in the area. There is no known selective method of harvesting other species in the areas where the red hinds aggregate to spawn. The fishing gears used are non-selective (except for professional spear fishers who could discriminate among fishes), fish traps and hook and line. Because aggregating fish are highly susceptible to capture by a variety of gears, a total ban on all fishing is needed to protect the spawning aggregations and to facilitate effective enforcement of this measure.

It is believed that this will be less of a burden on the commercial fishers since they can redirect their fishing effort to other species. In addition, the sandy areas around Buoy 8 at Tourmaline Bank can be used by the commercial fishers to keep their traps during periods of bad weather.

Each of the identified spawning aggregations provides an effective rectangular enforcement area of 9 square miles for a total of 27 square miles of closed area. Enforcement of these areas will not present a problem for the US Coast Guard and other enforcing agencies.

The areas need to be well demarcated (with buoys) at least during the period of the closure.

REJECTED MEASURE: **Close only one or two of the considered areas for three months.**

The Council would not be protecting the additional spawning aggregations which have been identified and monitored. As stated previously, aggregations need protection because of the heavy fishing pressure that they experience when fish are most vulnerable to capture (that is, at reproduction) and because of the large number of ripe

fish which are removed without allowing them to spawn. The sex ratio and the mating groups are disrupted when fishing takes place over the aggregations and the behavior and spawning activity might be further jeopardized. It is necessary to protect as many spawning aggregations as possible, especially since so few have been identified around Puerto Rico and not protecting them could result in the collapse of the fishery. Protection of the maximum number of aggregations allows for a greater number of fish to spawn.

REJECTED MEASURE: Close the area for red hinds but allow fishing for other species.

It is not possible for fishing to take place over a red hind spawning aggregation and selectively fish for other species. Fishing gear used in these areas does not discriminate by species. In addition, enforcement will be almost impossible if fishers are allowed in the closed areas.

REJECTED MEASURE: No action. Keep the same area of seasonal closure as is (Amendment 2 of the Reef Fish FMP, 1993).

Leaving the identified areas unprotected from intensive fishing effort could lead to the demise of the spawning aggregations. Red hind are very aggressive and easily caught when aggregated for spawning. No action would definitely contribute to a continued decline of red hind resource.

The argument against keeping the closed area as it is currently defined, is that most of the area is not actually protecting a spawning aggregation, but is unduly burdening the fishers targeting other species in the area. At the public hearing it was stated that most of the area closed at present includes fishing grounds for other species rather than red hinds. At present, the area is approximately 3 x 5 miles. It has been proposed that the area be made smaller and that in conjunction with that area, 1 or 2 other aggregations be protected. See preferred option above.

It has been brought to the attention of the Council that the area closed is too large. The aggregation takes place over a smaller area (about 1.5 mile radius around Buoy 8). The currently closed area, approximately 3 x 5 miles, is an added burden on the commercial fishers fishing in the area for snapper and other species. Three (3) aggregations have been identified off the West coast of Puerto Rico (Sadovy et al., 1994). Figure 2 shows the three aggregation sites identified by Sadovy et al. (1994) and the proposed closed areas as identified by the commercial fishers are shown in Figure 9. The identification of the spawning aggregations has been done by both the fishing and the scientific community. It would be more effective to protect the spawning aggregations in these smaller areas than to keep the large area presently closed.

Other Measures Considered and Rejected

1. Prohibit fishing for red hind island-wide during the three months of spawning (December - February).

This alternative was rejected because fishing gears are not selective and all red hinds caught would have to be returned to the water unharmed which might prove very difficult. High mortality is expected because the depth from which the red hinds are removed (37-90 m) do not allow the fish to deflate the swim bladder, unless kept in live-wells until the swim bladder deflates, thus reducing predation when returned to the sea. In addition, island-wide enforcement would be very difficult since there would be no way of proving, except when caught "red handed," that fish were caught in federal waters. This however could be avoided if local governments adopt the same regulation, i.e., closed season during December through February.

2. Close the three proposed areas off Mayagüez (Buoys 6 and 8, and Bajo de Cico) and establish a closed season for red hind in Puerto Rico and the U.S. Virgin Islands during December through February of each consecutive year.

The Council considers that at present this measure would cause an unnecessary extra burden to the commercial fishers in addition to the problems mentioned in 1 above with the high mortality of red hind due to the depths at which it is hooked.

3. Close the red hind aggregations only during daylight hours.

Fishers stated that red hinds do not bite at night. However, data from the FRL (A. Rosario, unpublished) show that a total of 765 red hinds have been sampled from the fishery-independent survey between 2 p.m. and 8 p.m. The mean size of these red hinds, caught with hook and line, was 265 mm (same average size as for red hinds caught during daylight hours.) Anecdotal information also suggests that red hinds do bite at night.

Commercial fishing for species other than red hind is done in the proposed closed areas. Specifically, night-fishing is done for snappers. Other species which are caught in the area include tunas, mackerel, shark, and dolphin fish. Data from the FRL do not show increased landings for any of these species during the months of the closure. These species are pelagic and there is no indication that they aggregate in the proposed area closures.

4. Prohibit the sale of red hind during the months of the closure.

The amount of red hind caught outside the spawning aggregations or imported from other areas into Puerto Rico is unknown. Prohibition of imported red hind is not

warranted at this time. The available information does not show the need for this measure at present.

5. Close all aggregations around Puerto Rico and the U.S.V.I.

There should be a number of unknown aggregations and aggregations which might still be healthy. If fishing effort increases, other aggregations might need to be closed and monitored. The Council has decided to postpone closing other aggregations until more information becomes available.

The Council considered and rejected combinations of the above rejected measures, e.g., close all spawning sites and establish a closed season for Puerto Rico and the U.S.V.I., because these are not necessary at this time. However, if the declining trend continues, such stricter measures might be needed.

V RECOMMENDATIONS TO THE LOCAL GOVERNMENT

1. It is recommended that complementary regulations be developed by the local government [i.e., close the corresponding sections of the territorial waters around the proposed areas for the red hind seasonal closure] to protect spawning aggregations.

2. It is recommended that the closed areas be monitored to assess the effect of this measure on the stock.

3. Fishing activity from both the commercial and the recreational sectors have an impact on the species' stock.

3a. It is recommended that the local government assess the net fishing activity and its effect on the fish populations.

3b. No information is available on the catch and effort of recreational fishers in Puerto Rico. According to testimony offered at public hearings, recreational fishers are fishing the red hind aggregations and selling hundreds of pounds of this species. This fishing activity should be monitored to determine the impact of the recreational sector on this fishery. It is recommended that surveys be conducted to assess the impact of reeffish recreational fishing activity.

4. Near shore habitat is of extreme importance in the life cycle of many species, among them the red hind. Nursery grounds are usually found over seagrass beds, mangrove ecosystems and reef areas. These are very sensitive ecosystems which are negatively impacted by such anthropogenic activities as pollution, sedimentation, boating activities (e.g., anchoring, use of motorized boats in shallow areas). Thus, it is recommended that the local government assess the condition of these near shore

habitats and proceed with conservation, protection and restoration efforts, if necessary in the area.

VI PROCEDURES FOR ADJUSTING MANAGEMENT MEASURES AS SPECIFIED IN THE FMP

Amendment Number 1 to the Fishery Management Plan for the Shallow-Water Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands (1990) included a section entitled "Procedures for Adjusting Management Measures" which stated that "Adjustments that may be made by this procedure include size limits, closed seasons or areas, and fish trap mesh size, and the level of SSBR necessary to rebuild an overfished stock."

The Council will conduct one or more public hearings, depending on the nature of the proposed adjustments, prior to taking final action. For adjusting measures within the regulatory scope of the FMP, a regulatory amendment, consisting of a regulatory impact review, environmental assessment, and a proposed rule, will be prepared for submission to the Regional Director. After reviewing the proposed regulatory adjustment for consistency with the Magnuson Act, other applicable law, and the objectives of the FMP, the Regional Director will forward the proposed rule for publication in the Federal Register. The proposed rule will describe the proposed change(s) and make the supporting documents available for public review and comment. After a 30-day comment period, public input will be addressed by the Council and Regional Director and a final rule prepared for publication. In addition to overfished conditions of a resource, other concerns may trigger the adjustments of management measures. These concerns may involve new gear introductions that might damage overfished resources, environmental disasters, etc.

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FIGURES

FIGURE 1. PROPOSED RED HIND AREA CLOSURE -- TOURMALINE BANK

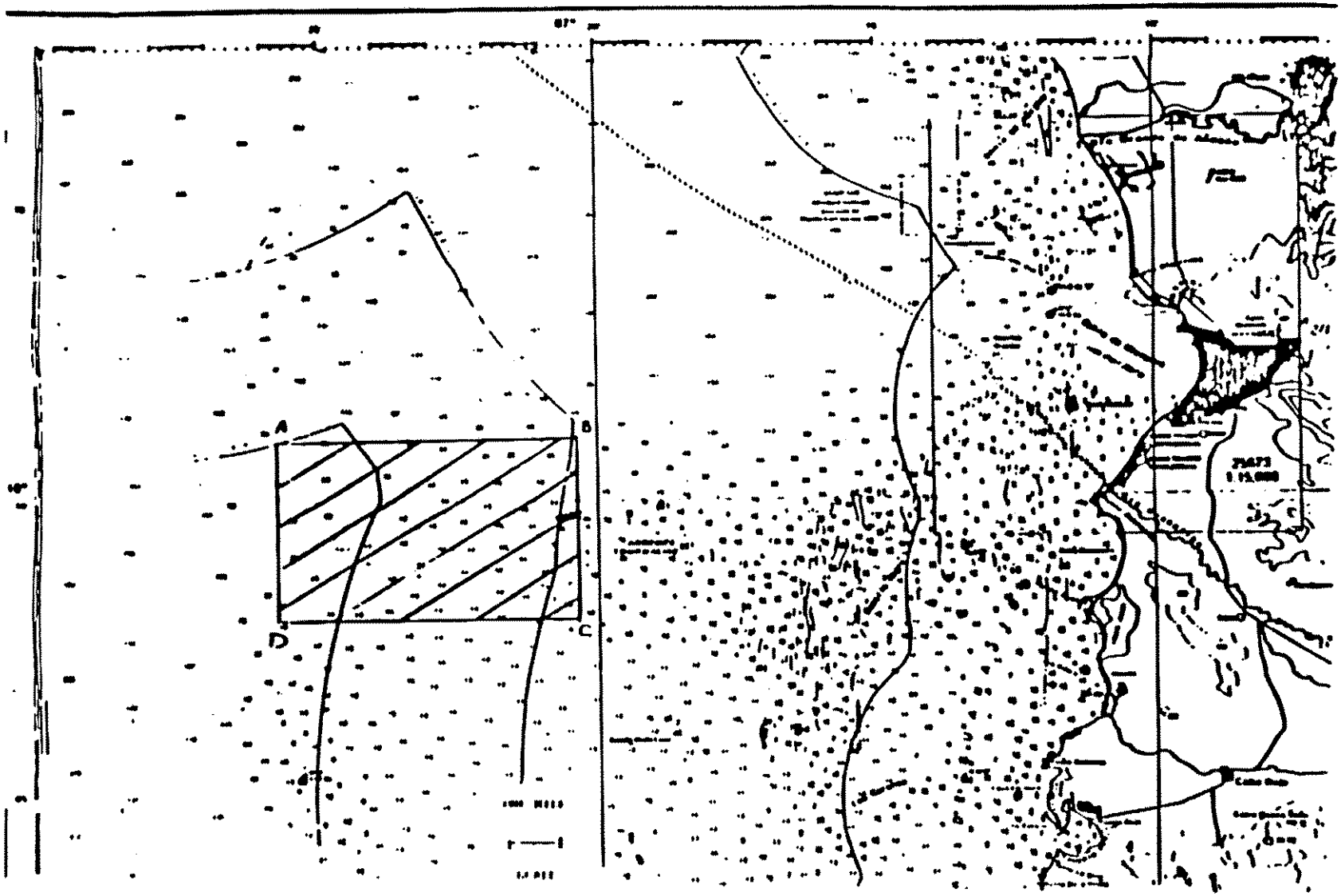

FIGURE 1. RED HIND AREA CLOSURE (1993)

Ref.: Amendment 2 to the Fishery Management Plan for the Shallow-Water Reef Fish Fishery of Puerto Rico and the U. S. Virgin Islands

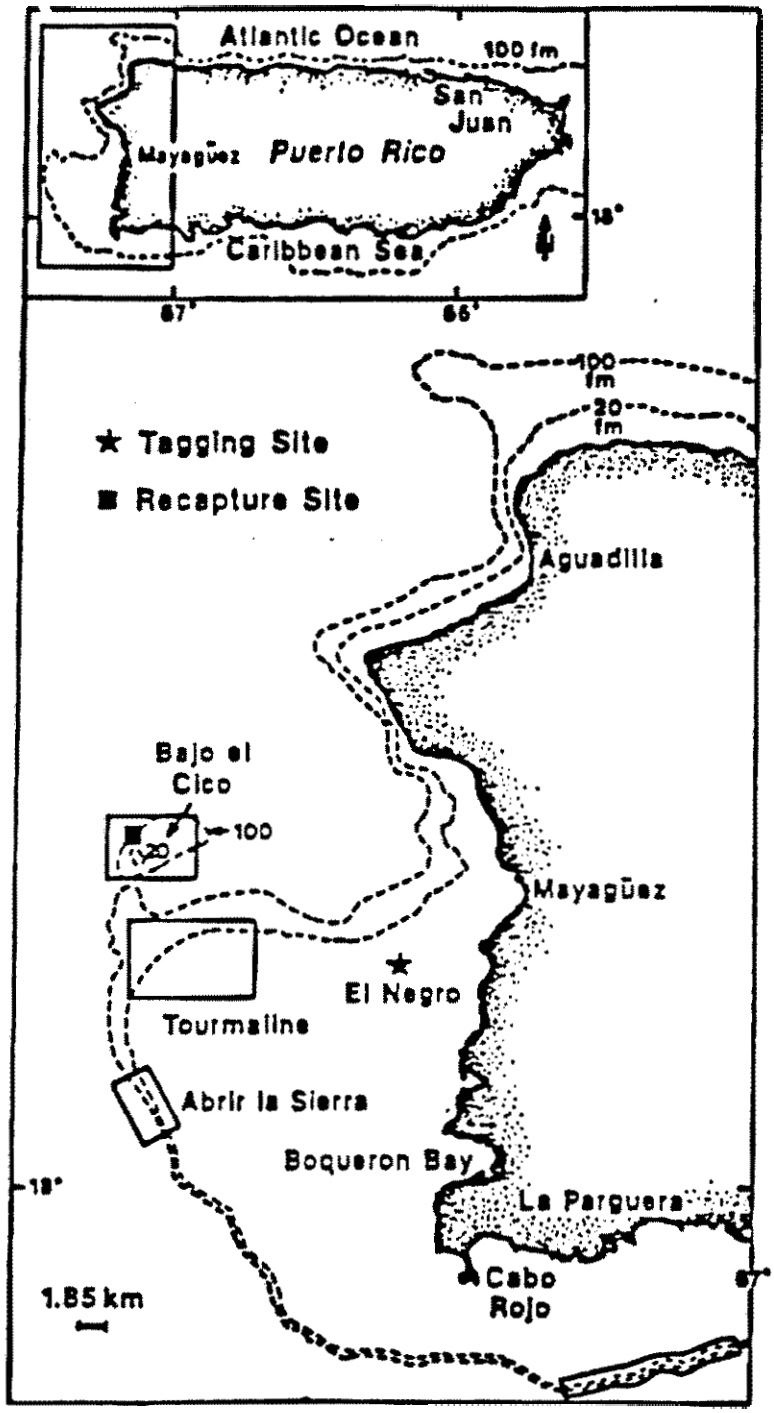

Fig. 1. Map of Puerto Rico and detail of west and southwest coasts showing locations of known red hind spawning aggregation areas indicated by the four boxes. The tagging (star) and recapture (square) sites of a single animal are marked. The narrow area south of La Parguera is described in Colin et al. (1987) and in Shapiro et al. (1993a). The 20 and 100 fathom depth contours are indicated (1 fathom = 1.83 m).

FIGURE 2. MAP SHOWING KNOWN RED HIND SPAWNING AGGREGATIONS

Ref.: Sadovy, et al. 1994

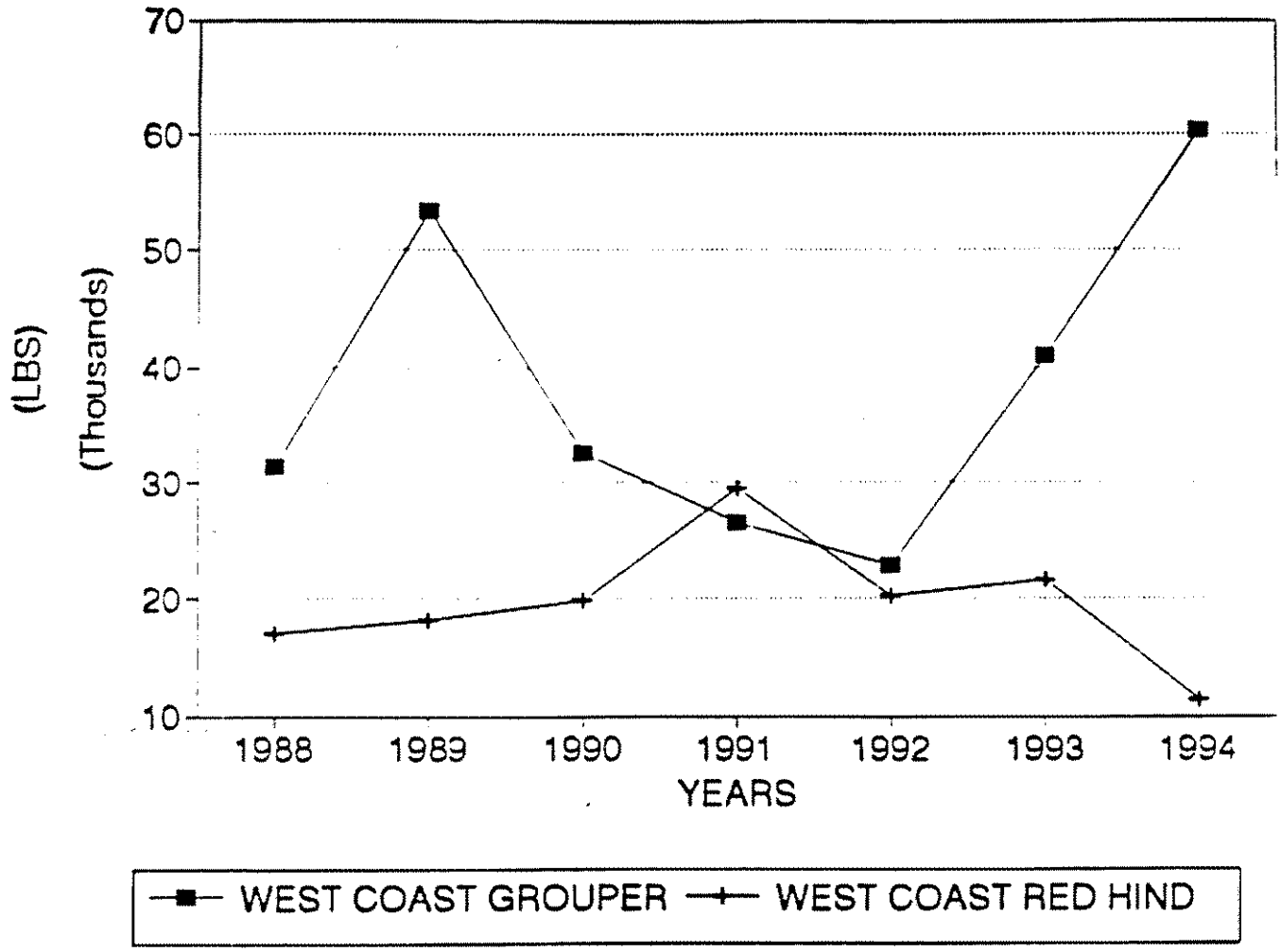

FIGURE 3. COMMERCIAL LANDINGS OF GROUPERS AND RED HIND FOR THE WEST COAST OF PUERTO RICO

Red hind landings PR

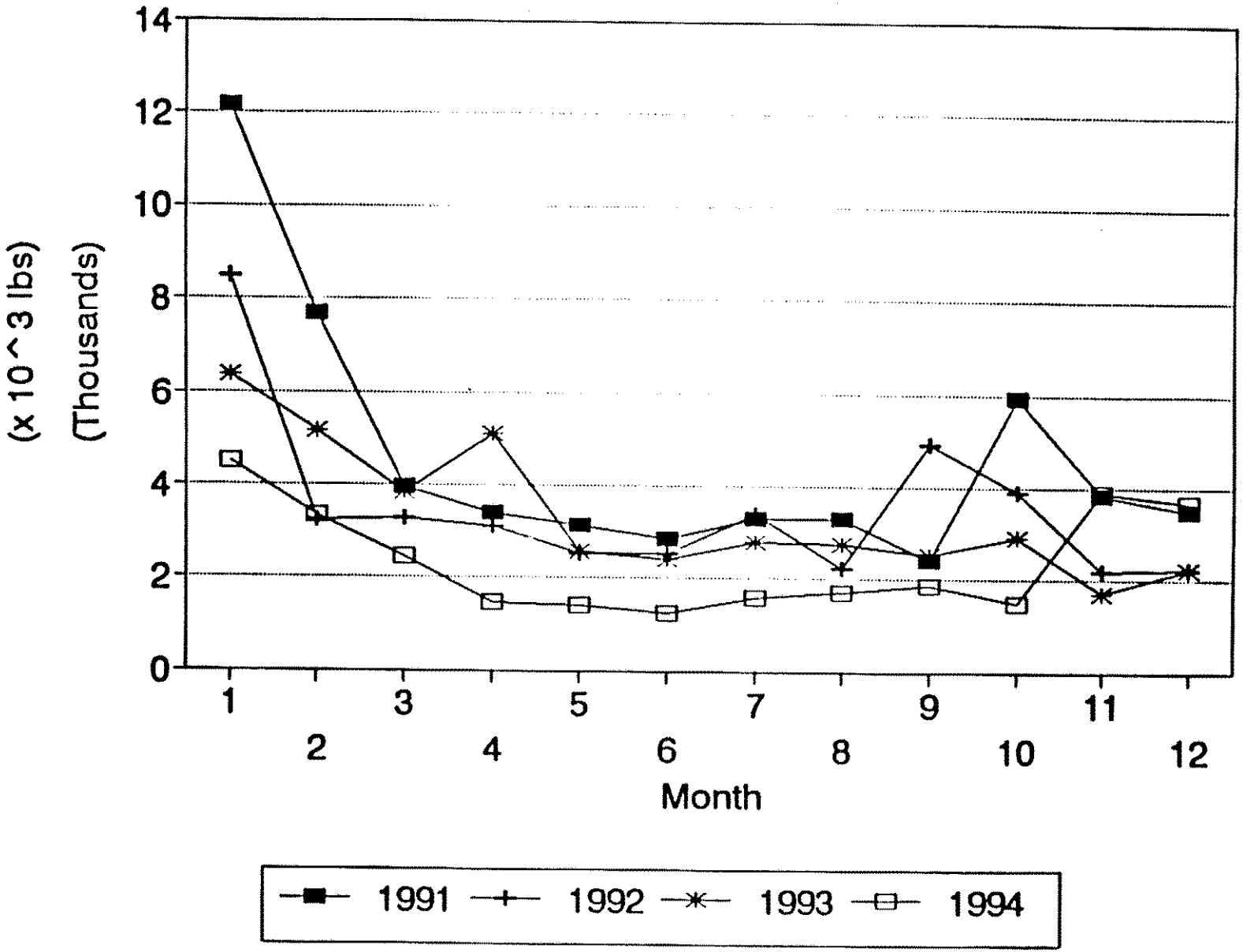

FIGURE 4. MONTHLY COMMERCIAL RED HIND LANDINGS REPORTED FOR PUERTO RICO BETWEEN 1991 AND 1994

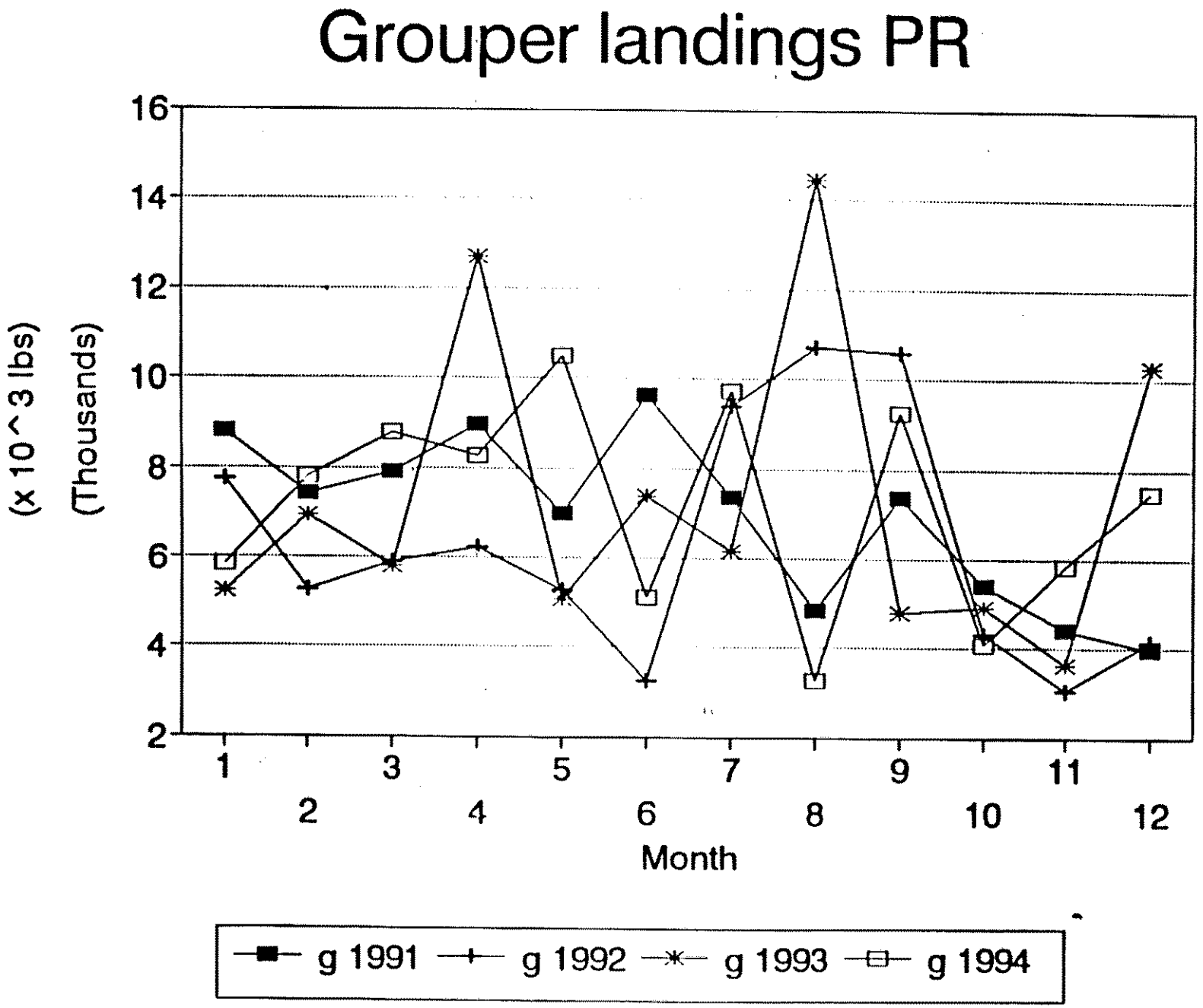

FIGURE 5. MONTHLY COMMERCIAL LANDINGS FOR GROUPERS REPORTED BETWEEN 1991 AND 1994 IN PUERTO RICO

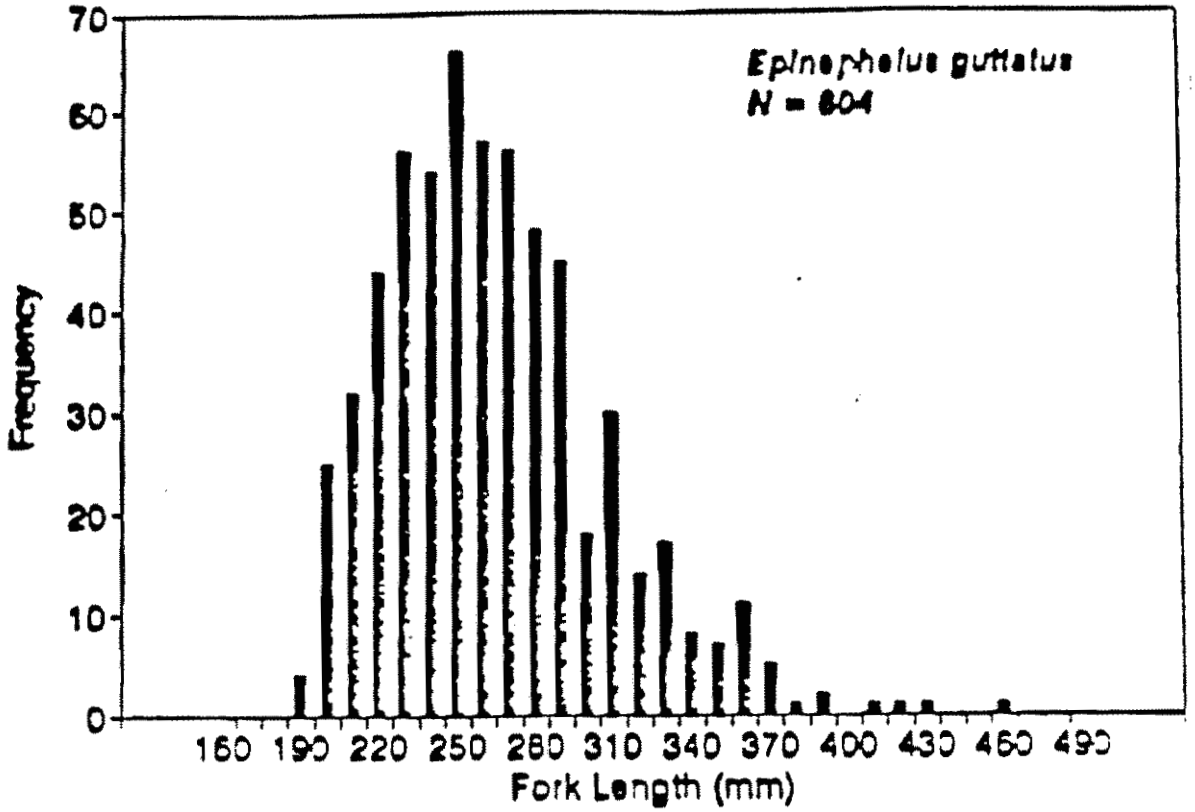

FIGURE 6a. FISHERY-INDEPENDENT DATA SHOWING SIZE FREQUENCY DISTRIBUTION FOR 1994-1995 RED HIND SPAWNING AGGREGATION AT BAJO DE CICO

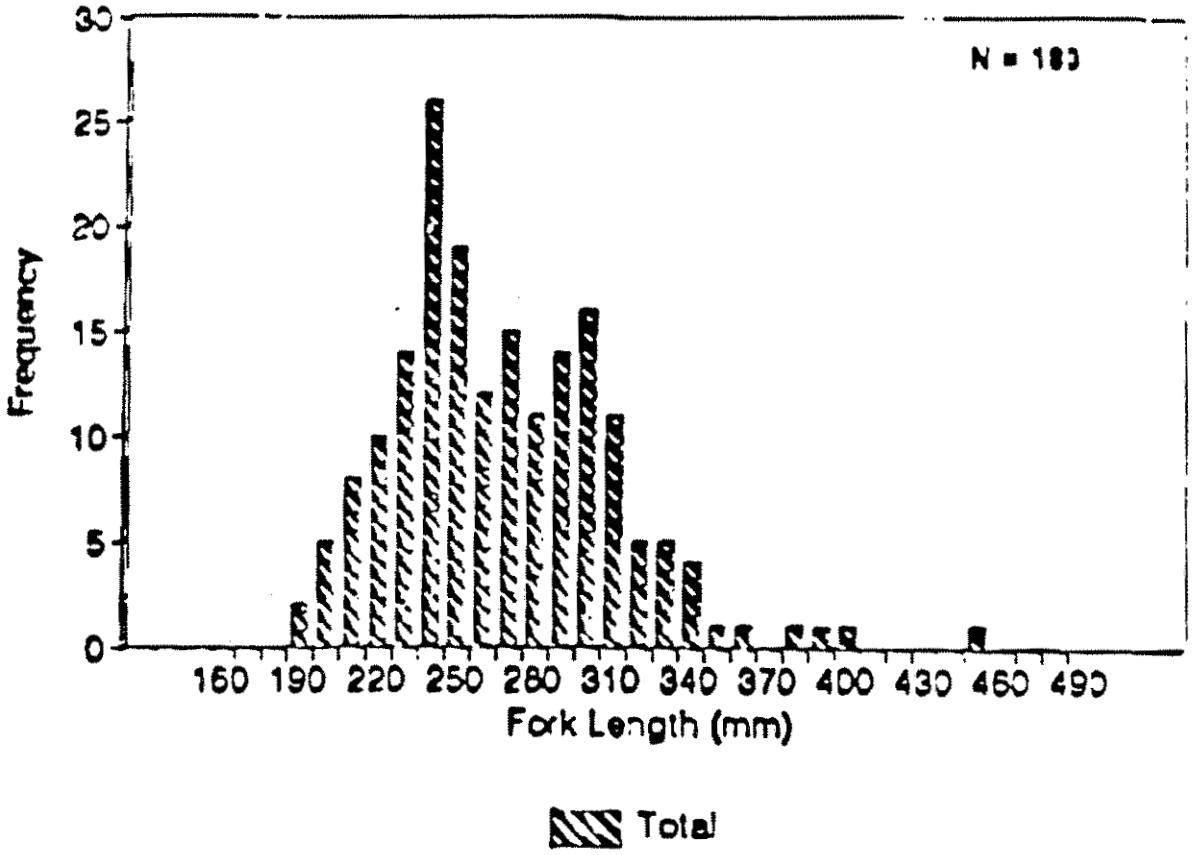

FIGURE 6b. FISHERY-INDEPENDENT DATA SHOWING SIZE FREQUENCY DISTRIBUTION FOR 1995-1996 RED HIND SPAWNING AGGREGATION AT BAJO DE CICO

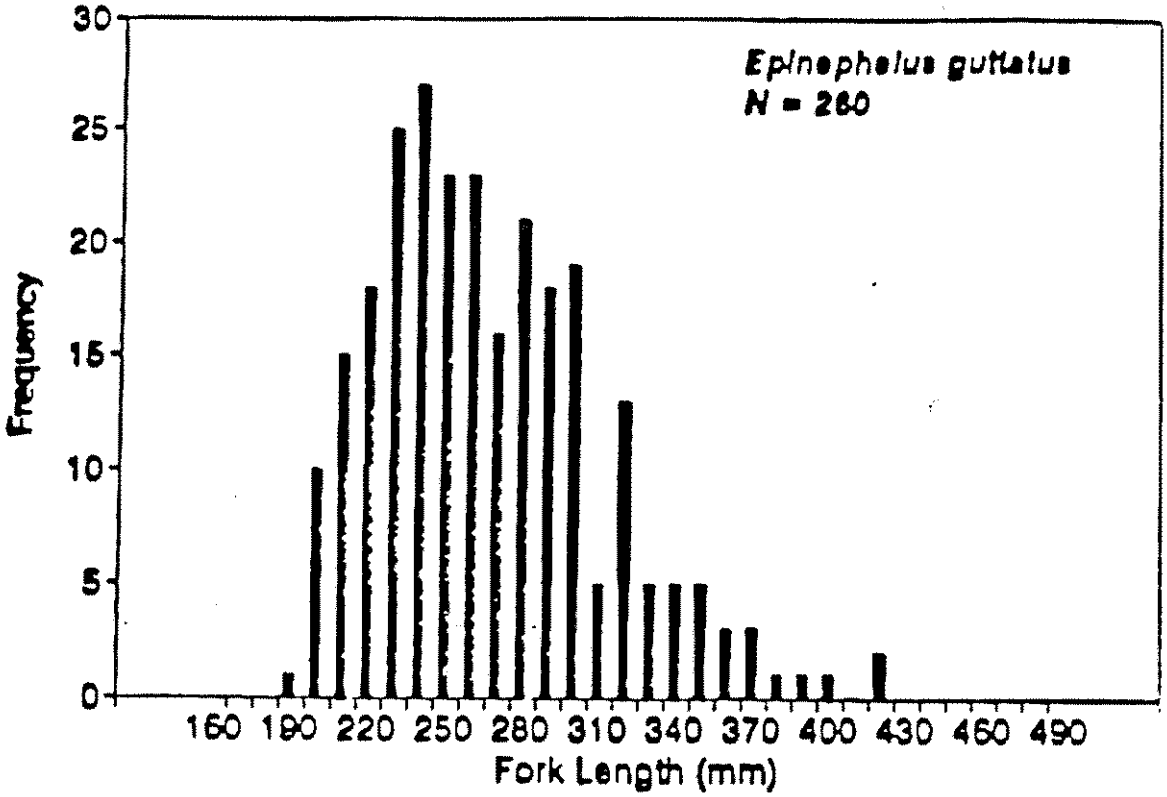

FIGURE 7a. FISHERY-INDEPENDENT DATA SHOWING SIZE FREQUENCY DISTRIBUTION FOR 1994-1995 RED HIND SPAWNING AGGREGATION AT ABRIR LA SIERRA

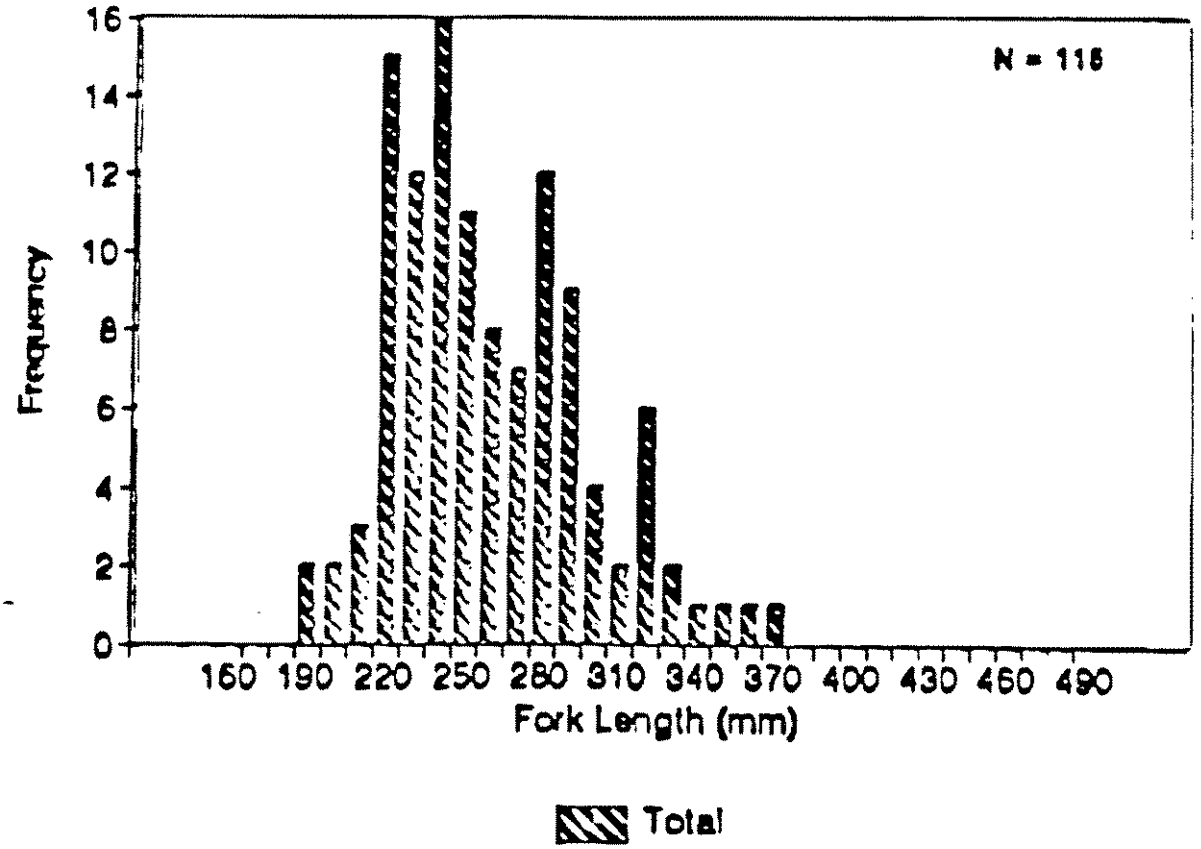

FIGURE 7b. FISHERY-INDEPENDENT DATA SHOWING SIZE FREQUENCY DISTRIBUTION FOR 1995-1996 RED HIND SPAWNING AGGREGATION AT ABRIR LA SIERRA

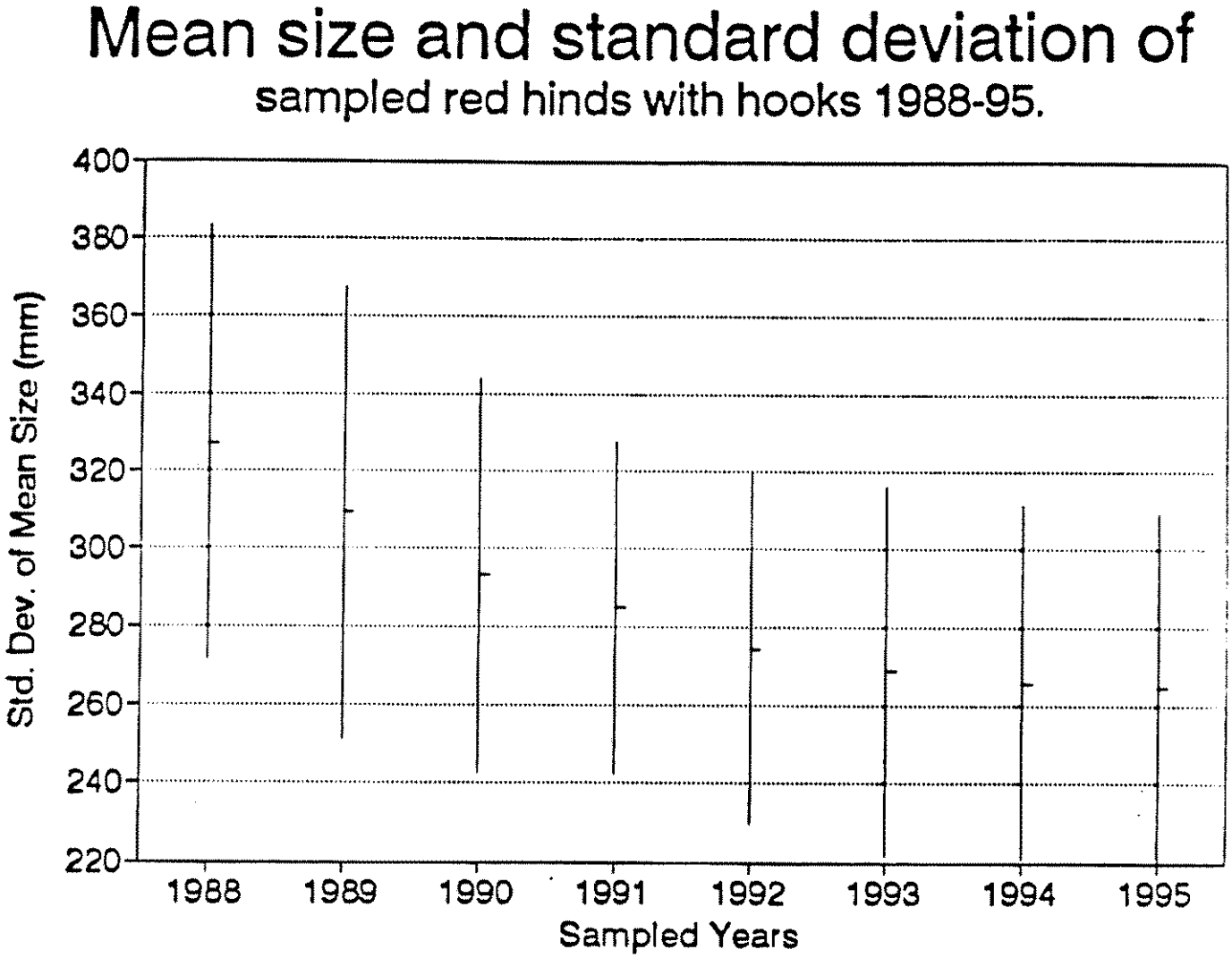

FIGURE 8. FISHERY INDEPENDENT SIZE DATA FOR RED HINDS

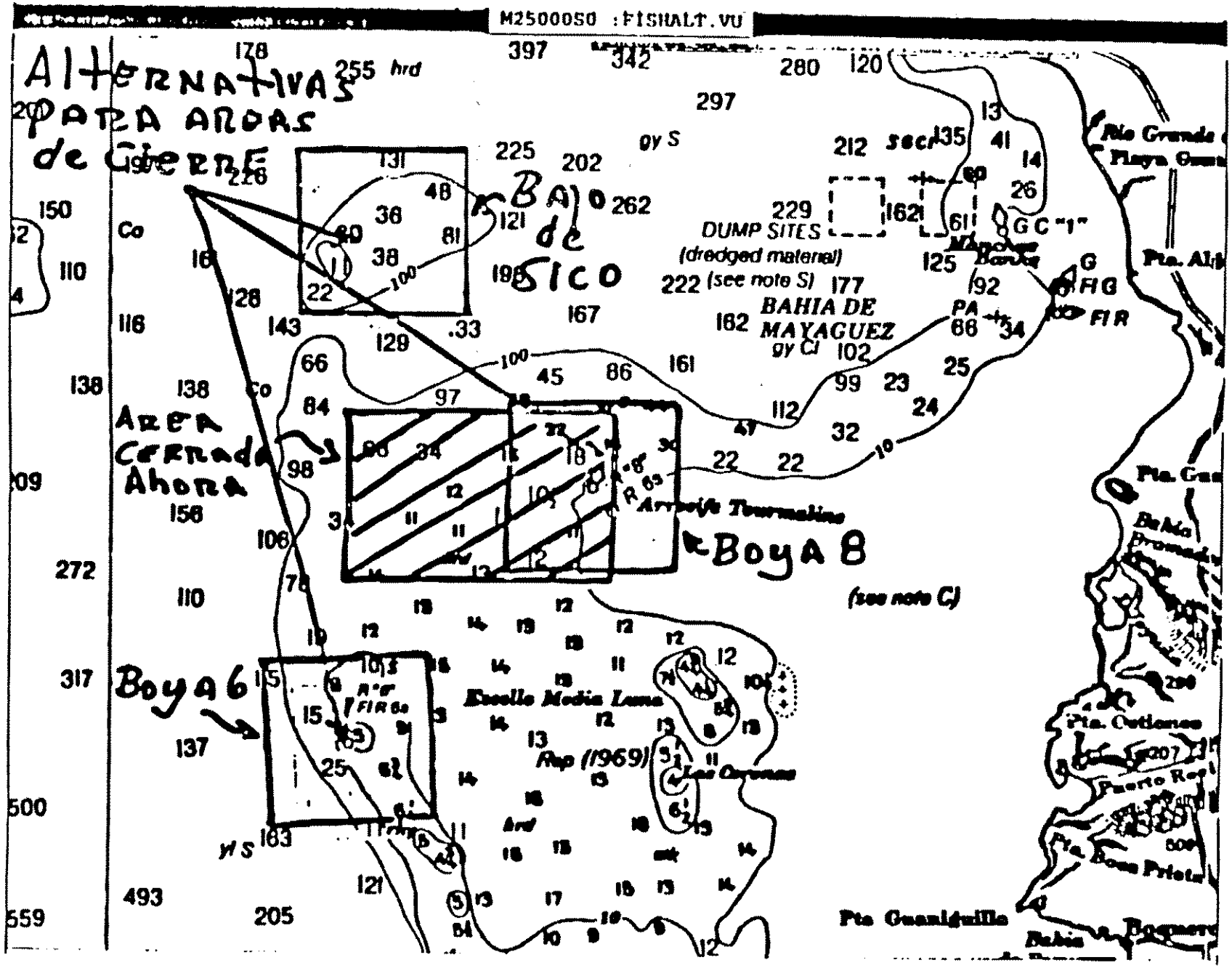

FIGURE 9. RED HIND CLOSURE (1993) (HATCH AREA) AND THREE (3) ALTERNATIVES CONSIDERED

TABLES

TABLE 1. Total Commercial Landings Reported for Puerto Rico

YEAR	TOTAL FISH/ SHELLFISH x 10^6 lbs	TOTAL FISH x 10^6 lbs	TOTAL VALUE x 10^6 lbs	GROUPERS PERCENT OF TOTAL CATCH
1994	2.7	2.3	5.7	5.3%
1993	3.9	2.2	6.9	5.3%
1992	3.4	1.8	6.1	6.1%
1991	2.5	2.1	4.3	5.8%
1990	2.2	1.9	3.6	4.7%
1989	2.3	1.9	3.8	13%
1988	2.1	1.7	3.2	

TABLE 2. Commercial Landings reported for the West coast and the total commercial landings reported for Puerto Rico for grouper and red hind.

YEAR	WEST COAST GROUPER	P/LB	WEST COAST RED HIND	P/LB	PR GROUPER	PR TOTAL RED HIND
1994	60,298	1.58	11,312	1.45	85,930	28,730
1993	40,889	1.52	21,620	1.42	87,400	40,411
1992	22,911	1.46	20,255	1.35	75,835	42,015
1991	26,582	1.40	29,514	1.27	83,022	55,512
1990	32,505	1.35	19,836	1.21	62,462	39,516
1989	53,415	1.35	18,133	1.12	90,508	38,126
1988	31,392	2.84	17,044	1.15	62,443	29,023

APPENDIX I

REGULATORY IMPACT REVIEW

AND

DETERMINATION OF THE NEED FOR AN

INITIAL REGULATORY FLEXIBILITY ANALYSIS

FOR THE REGULATORY AMENDMENT TO THE FISHERY MANAGEMENT PLAN

FOR THE REEF FISH FISHERY OF PUERTO RICO

AND THE UNITED STATES VIRGIN ISLANDS

CONCERNING RED HIND SPAWNING AGGREGATION CLOSURES

Caribbean Fishery Management Council

August, 1996

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1.0 INTRODUCTION

Executive Order (E.O.) 12866 "Regulatory Planning and Review" was signed on September 30, 1993 and established guidelines for promulgating new regulations and reviewing existing regulations. While the E.O. covers a variety of regulatory policy considerations, the costs and benefits of regulatory actions are a prominent concern. Section 1 of the E.O. is repeated in its entirety:

Section 1. Statement of Regulatory Philosophy and Principles.

(a) The Regulatory Philosophy. Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people. In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts, and equity), unless a statute requires another regulatory approach.

(b) The Principles of Regulation. To ensure that the agencies' regulatory programs are consistent with the philosophy set forth above, agencies should adhere to the following principles, to the extent permitted by law and where applicable:

(1) Each agency shall identify the problem that it intends to address (including, where applicable, the failures of private markets or public institutions that warrant new agency action) as well as assess the significance of that problem.

(2) Each agency shall examine whether existing regulations (or other law) have created, or contributed to the problem that a new regulation is intended to correct and whether regulations (or other law) should be modified to achieve the intended goal of regulation more effectively.

(3) Each agency shall identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

(4) In setting regulatory priorities, each agency shall consider, to the extent reasonable, the degree and nature of the risks posed by various substances or activities within its jurisdiction.

(5) When an agency determines that a regulation is the best available method of achieving the regulatory objective, it shall design its regulations in the most cost-effective manner to achieve the regulatory objective. In doing so, each agency shall consider incentives for innovation, consistency, predictability, the costs of enforcement and compliance (to the government, regulated entities, and the public), flexibility, distributive impacts, and equity.

(6) Each agency shall assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.

(7) Each agency shall base its decisions on the best reasonably obtainable scientific, technical, economic, and other information concerning the need for and consequences of the intended regulation.

(8) Each agency shall identify and assess alternative forms of regulation and shall, to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt.

(9) Wherever feasible, agencies shall seek views of appropriate State, local, and tribal officials before imposing regulatory requirements that might significantly or uniquely affect those governmental entities. Each agency shall assess the effects of Federal regulations on State, local and tribal governments, including specifically the availability of resources to carry out those mandates, and seek to minimize those burdens that uniquely or significantly affect such governmental entities, consistent with achieving regulatory objectives. In addition, as appropriate, agencies shall seek to harmonize Federal regulatory actions with related State, local and tribal regulatory and other governmental functions.

(10) Each agency shall avoid regulations that are inconsistent, incompatible, or duplicative with its other regulations or those of other Federal agencies.

(11) Each agency shall tailor its regulations to impose the least burden on society, including individuals, businesses of differing sizes, and other entities (including small communities and governmental entities), consistent with obtaining the regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations.

(12) Each agency shall draft its regulations to be simple and easy to understand, with the goal of minimizing the potential for uncertainty and litigation arising from such uncertainty.

In compliance with E.O. 12866, the Department of Commerce (DOC) and the National Oceanic and Atmospheric Administration (NOAA) require the preparation of a Regulatory Impact Review (RIR) for all regulatory actions which either implement a new Fishery Management Plan (FMP) or significantly amend an existing plan, or may be significant in that they reflect important DOC/NOAA policy concerns and are of public interest.

The RIR is part of the process of preparing and reviewing fishery management plans and provides a comprehensive review of the changes in net economic benefits to society associated with proposed regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve problems. The purpose of the analysis is to ensure that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The Regulatory Flexibility Act (P.L. 96-353) has the purpose of relieving small businesses, small organizations, and small governmental entities from burdensome regulations and record keeping requirements. The Small Business Administration (SBA) defines a small business in the commercial fishing activity, classified and found in the Standard Industrial Classification Code, Major Group, Hunting, Fishing and Trapping (SIC 09), as a firm with receipts up to $2.0 million annually. Additionally, the SBA defines a small business in the charter boat activity to be in the SIC 7999 code, Amusement and Recreational Services, not elsewhere classified, as a firm with receipts up to $3.5 million per year.

To meet the basic objective of the Regulatory Flexibility Act (RFA), federal agencies are required to determine if proposed regulations will have a significant economic impact on a substantial number of small business entities and the RIR serves as the source of most of the information for the determination. However, certain information required for IRFA determinations is not necessarily available in the RIR. For example, if the RIR does not contain an estimate of the number of small businesses affected, a description of the small businesses affected or a discussion of the nature and size of impacts, then the determination section would be expanded to include such information.

Pursuant to E.O. 12866 a regulation is considered a "significant regulatory action" if it is likely to result in an annual effect on the economy of $100 million or more or has other major economic effects. Since the annual ex-vessel value of the U.S. Caribbean fisheries is estimated to be about $10 million, it is clear that there will not be annual effects on the economy of $100 million or more. Therefore, these proposed measures, if enacted, would not constitute a "significant regulatory action".

2.0 PREVIOUS MANAGEMENT REGIME

The Fishery Management Plan for the Shallow-water Reeffish Fishery of Puerto Rico and the U. S. Virgin Islands (FMP) became effective September 22, 1985. The FMP (and each of the amendments) was prepared, under the authority of the Magnuson Act, by the Caribbean Fishery Management Council to establish a management system for the reef fish resources within the Exclusive Economic Zone (EEZ) and the waters under the authority of the Commonwealth of Puerto Rico and the Territory of the U.S. Virgin Islands, from the shoreline to the edge of the insular platform. Management was deemed necessary because a number of the major reef fish species were thought to be overfished.

The FMP, that went into effect in 1985, established regulation to rebuild declining reef fish species in the fishery and reduce conflicts among fishers. It established the criteria for the construction of fish traps; required owner identification and marking of gear and boats; prohibited the hauling of or tampering with another person's traps without the owner's written consent; prohibited the use of poisons, drugs and other chemicals and explosives for the taking of reef fish; established a minimum size limit on the harvest of yellowtail snapper (Ocyurus chrysurus) and Nassau grouper (Epinephelus striatus); and established a spawning season closure for Nassau grouper.

In November 1990, Amendment 1 to the FMP established the following regulations to rebuild declining reef fish species: (1) it prohibited the harvest or possession of Nassau grouper; (2) closed an area in the EEZ southwest of St. Thomas, U.S. Virgin Islands to all fishing during the spawning season for red hind (Epinephelus guttatus); (3) increased minimum mesh size for traps to 2 inches; (4) defined overfishing; (5) revised the section on habitat description; (6) provided for the collection of socio-economic data through federal/state agreements already in existence.

In October 1993, Amendment 2 to the FMP incorporated the major species of the deep-water reef fish fishery and the marine aquarium finfish fishery into the reef fish management unit. This action was accompanied by a change in the FMP's original title and the present FMP is known as the Fishery Management Plan for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands. To protect important species and rebuild declining reef fish species Amendment 2 prohibited the harvest or possession of jewfish (Epinephelus itajara); prohibited the harvest/possession/sale of certain species used in the aquarium trade; restricted the collection of marine aquarium fishes to hand-held dip nets and slurp guns; closed 2 additional red hind spawning aggregation areas, to all fishing, from December through February; closed a spawning aggregation area, to all fishing, for mutton snapper (Lutjanus analis) from March through June each year in St. Croix, U.S. Virgin Islands; and changed the criteria for the construction of fish traps.

3.0 PROBLEM STATEMENT

Recently the Council has learned of problems with the red hind seasonal area closure off Mayagüez, Puerto Rico. Although commercial fishers are aware of the importance of protecting spawning aggregations for the long-term sustainability of the fishery, they believe that the area selected for closure in 1993 is too large. Most of the area closed west of Buoy 8 (Tourmaline Bank) is not red hind preferred sea bottom (i.e., most of the bottom is sand, not coral) and thus, hinders fishers from harvesting other species that are present in the area (e.g., snappers). It is also a burden to the commercial fishers that a non-spawning area is closed when it is that same area that they have traditionally used for safe-keeping traps in times of bad weather. They keep the traps in the sandy areas rather than bringing them to shore.

The problems in the fishery (see Section II of the Regulatory Amendment) can be summarized as follows:

3.1 The area closure for red hind established in 1993 is too large and puts an unnecessary burden on the commercial fishers.

3.2 It is not possible to always distinguish red hind from other grouper species from the commercial landings statistics.

3.3 It is not possible to distinguish between daylight and night time fishing from the landings data.

3.4 Fishery-dependent data, such as cost and returns from fishing activities, which would be used to predict the reactions of fishery participants to regulations, is largely not available.

3.5 There are conflicts among the users of the resource, especially among commercial and recreational fishers.

3.6 The size of the recreational fishery is unknown.

4.0 OBJECTIVES OF THIS AMENDMENT

The objectives addressed by the Reef Fish FMP, as amended, are unchanged. These objectives are: 1) obtain the necessary data for stock assessment and for monitoring the fishery; 2) reverse the declining trend of the resource by (a) restoring and maintaining adult stocks at levels that ensure adequate spawning and recruitment to replenish the population and (b) preventing the harvest of individuals of species of high value (e.g., snappers, groupers, and others) that are less than the optimum size; 3) reduce conflicts among users of the resource; 4) promote international cooperation in managing the pan-Caribbean species; and 5) help resolve the ciguatera problem.

The proposed adjustments to the existing management structure (i.e., modifying one spawning area and adding two additional areas) is directed toward fulfilling objectives 1, 2, and 3 above. In addition, the proposed action directly addresses problem 3.1 and is in accordance with the overfishing definition in the FMP. As a way of determining whether the objectives will be met, the government of Puerto Rico is requested to expand the data collection and monitoring of spawning aggregations (for groupers and other species) through the Department of Natural and Environmental Resources.

5.0 ANALYTICAL APPROACH

The proposed regulatory amendment under consideration is designed to help meet the objective of the FMP regarding rebuilding of stocks and thus resolving the primary problem of overfishing. A combination of circumstances have led to increased levels of fishing effort over the spawning aggregations of groupers (e.g., red hind) especially at this time when the species is most vulnerable. Any changes in net economic benefits derived from the fishery depend heavily on the effect that the adjustment to the management strategy will have on the biological well-being of the stock. The biological effect of the adjustment can be used as the basis for the economic output. Analysis of the proposed adjustment will determine whether or not it contributes positively to the RIR condition of realizing a net positive economic benefit.

The analysis used in this RIR will be qualitative and will attempt to discover if the proposed action can contribute to economic improvements in the fishery, but for the most part will not attempt to estimate dollar value on the gains and losses discussed. The reason for this is that the data on the economics of the fishery is insufficient even though the biological decline of the fishery is well established.

Previous analyses of similar management measures (i.e., Amendment 2 to the Reef Fish FMP which closed two red hind spawning aggregations) was based on the assumption that the Council will close the areas to all fishing, thereby eliminating all fishing effort during the period of the closure. The RIR had determined in the case of Amendment 2 that considering all positive and negative influences on net national benefits, "the imposition of these two spawning area closures for red hind is expected to result in a long-term increase in net national benefits that exceeds the expected short-term losses."

6.0 ANALYSIS OF PROPOSED MANAGEMENT MEASURE AND ALTERNATIVES

Onē proposed alternative in this amendment is to reduce the size of the existing Tourmaline Bank closure to resolve problem 3.1. In addition, and since the implementation of Amendment 2, additional red hind spawning aggregations have been identified in the EEZ off the west coast of Puerto Rico. These two areas have been scientifically sampled between 1994 and 1996 and the Fisheries Research Laboratory of the DNER confirms, through fishery-independent data, the presence of spawning aggregations and spawning activity in these two areas. Further, recent public testimony

indicates that fishing pressure in these areas has increased. The best known locations, based on anecdotal information from the commercial fishers, historical productivity, and scientific research, cover a rectangular area of approximately 9 square miles each (See Figures 1, 2, and 9 in the Amendment. The three proposed alternatives are formally described below.

PROPOSED MANAGEMENT MEASURES:

Close the corresponding sections of the EEZ in all three (3) areas presented below to all fishing between December 1 and February 28 of each year. (Figure 9 in the Amendment shows all three areas as well as the original red hind area closure.)

1. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 8 at Tourmaline Bank. (This is part of the area already closed but it allows for the use of the sandy area where red hinds are not found.) This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°11.2	67°22.4
B	18°11.2	67°19.2
C	18°08.2	67°19.2
D	18°08.2	67°22.4

2. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 6 at Abrir La Sierra Bank. This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°06.5	67°26.9
B	18°06.5	67°23.9
C	18°03.5	67°23.9
D	18°03.5	67°26.9

3. Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius centered around a buoy to be deployed in the area known as "Bajo de Cico." This area is bound by rhumb lines connecting the following point coordinates:

Point	Latitude (N)	Longitude (W)
A	18°15.7	67°26.4
B	18°15.7	67°23.2
C	18°12.7	67°23.2
D	18°12.7	67°26.4

The analysis of these closures is based on the assumption that the Council proposes to eliminate all fishing effort from these areas during the period of the closure. This would mean the exclusion of all commercial and recreational fishing effort.

This measure provides several potential areas of benefits in the form of increased surpluses for producers, consumers and recreational fishers. It could also produce less desirable side effects that can offset at least part of the potential gains. The various potential gains and losses will probably result in a net economic benefit from this measure as discussed below.

The proposal to modify the Tourmaline Bank closure by eliminating the so-called "sandy area" should have a positive net benefit to society. According to the information in the amendment, the area to be reopened is not a red hind spawning area. Further, it has been used historically as a haven to place traps during bad weather. Since the current closure makes the trap placement illegal, the fishermen have to incur additional costs of moving traps to another location (at sea or on land), run the risk of losing traps during bad weather or run the risk of a violation. Hence, the proposed modification should reduce current fishing costs while having no major biological effects and hence no long term economic ramifications. **Therefore, the conclusion of the RIR is that the proposal to modify the Tourmaline Bank spawning area closure will result in a net positive economic benefit to society.**

The proposed closure of the two additional red hind spawning areas is a classic example of foregoing short-term gains in producer and consumer surplus in exchange for stock rebuilding that provides for larger catches in the future. In such a scenario, it can be a fairly straight forward process to determine the direction, if not the magnitude, of the change in net national benefits that is expected. This can be done if there is any information available on short-term harvesting profits (used as a rough estimate of producer surplus under an assumption of heterogeneous firms), some estimate of any predicted change in consumer surplus and an estimate of consumer surplus associated with recreational fishing trips. Then, with some information on the future yield stream, the

discounted value of the surplus streams can be estimated and compared with the short-term losses.

However, in the case of the fisheries under discussion, there is no good information on the current levels or values of catches so the process cannot be followed. Furthermore, this case is somewhat more complicated than the normal case since the measure calls for a cessation of all recreational and commercial fishing activities for all species in the closure areas. Hence there is a wider class of both benefits and costs (short-term losses) associated with this type of spawning closure and these are discussed in the following paragraphs. Regardless of the complicating factors that preclude even a crude quantitative analysis, the available evidence on virtually all the species affected by the measure indicates that they are overfished and several, including red hind, are under a defined rebuilding program at the present time. The proposed spawning closures are designed to aid the rebuilding process and return some fishery value that has been lost via open-access fishing for a prolonged period of time.

Although the proposed measure is directed specifically at recovery of the red hind stock, there are obvious short term losses as well as long term benefits for all the species in the Reef Fish FMP as well as for spiny lobster.

Although the present Amendment does not contain details on the importance of these red hind spawning areas, i.e., there is no description of the percent of spawners represented by these aggregations or where the potential new recruits eventually go, there appears to be some level of agreement among those with knowledge of the fishery that these closures will result in a trend toward some stock recovery or at least a slowing of the present rate of stock decline. This should lead to benefits from the closures, even if total fishing effort does not change. The reason that total effort may not change is that fishers may elect to fish adjacent areas. Even if this occurs, additional effort in other areas may not significantly alter the total catch of fish because the present level of effort may be so high that increases (or decreases) in effort will not affect the total catch.

The possible relocation of effort just alluded to does have potential adverse consequences that are not related to the total fish catch. A "second-best" fishing strategy may simply relocate effort to other spawning aggregations (e.g., spawning areas identified in the vicinity of La Parguera). If this happens, a portion of the potential benefits from the closures will be lost due to "damage" to these other concentrations of red hind spawners.

Regardless of potential adverse consequences of the relocation of fishing effort, there appears to be some consensus that biological benefits are derived from allowing a "rest period" for any heavily fished area. Although this concept is not well articulated or quantified in the literature, this RIR assumes that such an effect exists and will not be offset by relocation of effort to other areas since the other areas are already "stressed" by the present level of effort. If this biological benefit actually exists, the effect should

eventually translate into positive future economic benefits in terms of increases in producer, consumer and recreational surpluses. Another potential biological benefit derives from a body of thought that fishing on spawning aggregations may reduce spawning capability to a degree that exceeds the effect of removing the spawners. This effect is thought to result from a disruption of the species social structure (Shapiro, et al., 1993).

The benefits (to the extent that they would actually be realized via state-federal cooperation and compliance with fishing regulations) should be more lasting than potential benefits from measures such as escape panel restrictions or other measures to regulate fishing gear. The reason for this is because even if increased overall benefits from this measure eventually attract new effort into the fishery, some of the benefits are described as being independent of total fishing effort.

This analysis assumes that the closures will not be so extensive as to halt all capture (for commercial and recreational purposes) of all species from a major portion of the waters surrounding Puerto Rico and the U.S. Virgin Islands. A total closure of all waters for a 3 month period during the height of the tourist season would undoubtedly cause major disruptions in commerce related to both commercial and recreational fishing. In such a case, the temporary dislocation of the small firms involved would probably create the need for government expenditures that may exceed the expected economic benefits related to stock recovery.

This measure will require the expenditure of funds to change the management regime and to enforce the new rules. Section 7.0 (Management Costs) contains more detail which is summarized as follows. The Council administrative costs, including public hearing costs, staff salaries, Council meetings and other relevant costs are estimated at $19,995. Additionally, NMFS administrative costs are estimated at $6,000 and there will be a one time cost of $9,000 to place marker bouys in the closure areas.

While the reduction in the area of the Tourmaline Bank closure, will have no effect on enforcement costs, the addition of the two additional closed areas will. Potential sources of cost increases include expenditures by the United States Coast Guard (USCG), NMFS and the Commonwealth of Puerto Rico. However, since the USCG is patrolling these areas as part of their schedule to enforce other laws, no additional costs in terms of USCG patrols is expected from this measure. Further, no additional NMFS enforcement costs are expected. However, cooperative efforts by the government of Puerto will entail an expenditure estimated at $11,311.

In summary, the total first year cost of the proposed action is estimated to be $46,306.

Considering all positive and negative influences on net national benefits discussed in this section, the RIR concludes that the imposition of these two additional spawning area closures for red hind is expected to result in an increase in long

term, net national benefits that exceeds the expected short-term losses plus the management costs.

REJECTED MEASURE: Close only one or two of the considered areas for three months.

The Council would not be protecting the additional spawning aggregations which have been identified and monitored. As stated previously, aggregations need protection because of the heavy fishing pressure that they experience when fish are most vulnerable to capture (that is, at reproduction) and because of the large number of ripe fish which are removed without allowing them to spawn. The sex ratio and the mating groups are disrupted when fishing takes place over the aggregations and the behavior and spawning activity might be further jeopardized. It is necessary to protect as many spawning aggregations as possible, especially since only so few have been identified around Puerto Rico and not protecting them could result in the collapse of the fishery. Protection of the maximum number of aggregations allows for a greater number of fish to spawn.

The expected economic outcome of this rejected measure is for positive economic benefits but less than the benefits expected for the measures adopted by the Council.

REJECTED MEASURE: Close the area for red hinds but allow fishing for other species.

It is not possible for fishing to take place over a red hind spawning aggregation and selectively fish for other species. Fishing gear used in these areas does not discriminate by species. Mortality of red hind will most likely be high (fish will suffer the effects of pressure) since fishery-independent data show red hinds most commonly caught at 37-90 m depth. Hence, the biological impact would be negative in the sense that not much progress relative to the status quo would be possible. It follows that there would be no or only minor economic gains. Furthermore, the enforcement costs would still exist while being difficult from a compliance standpoint. The conclusion of the RIR is that this rejected measure would result in a loss of economic benefits.

REJECTED MEASURE: No action. Keep the same area of seasonal closure as it is (Amendment 2 of the Reef Fish FMP, 1993).

Amendment Number 1 to the Reef Fish FMP contained an RIR analysis that predicted a positive economic outcome if other red hind spawning aggregations were identified and closed. Since there is no new information to the contrary, the expected economic outcome of this no action measure is for no change in economic benefit.

Other Measures Considered and Rejected:

REJECTED MEASURE: Prohibit fishing for red hind island-wide during the three months of spawning (December - February).

Red hinds are caught along with a number of other species and are caught during the period December-February outside the spawning aggregations. Fishing gear is non-selective and at present there is no way of avoiding red hinds when fishing for other reef fish species. The reef fish fishery is complex and there would be an unnecessary burden on the commercial fishers if this measure is adopted. High fishing mortality will be expected without a true benefit to the fishery and the commercial fishers. Enforcement costs would still exist and enforcement of such a measure this measure will be difficult if not impossible. The RIR conclusion is that the rejected measure would result in a loss of economic benefits.

REJECTED MEASURE: Close the three proposed areas off Mayagüez (Buoys 6 and 8, and Bajo de Cico) and establish a closed season for red hind in Puerto Rico and the U.S. Virgin Islands during December through February of each consecutive year.

The Council considers that at present this measure would cause an unnecessary extra burden to the commercial fishers in addition to the waste because of the high fishing mortality expected (due to the depths at which red hinds are hooked). No true benefit to the commercial fisher and the fishery is expected from this measure. As with similar rejected measures, the RIR determination is that there would be no benefits but costs would remain and the expectation would be for a loss in net economic benefits.

REJECTED MEASURE: Close the red hind aggregations only during daylight hours.

Red hinds are not excluded from the night-time fishing activity, but the rate of fishing mortality due to night catches has not been determined. Enforcement would be difficult and more expensive if fishing is allowed inside the closed areas. The RIR is unable to make a determination of expected economic outcome due to a total lack of information relative to the measure.

REJECTED MEASURE: Prohibit the sale of red hind during the months of the closure.

The amount of red hind caught outside the spawning aggregations or imported from other areas into Puerto Rico is unknown. Prohibition of imported red hind is not warranted at this time. The available information does not show the need for this measure at present. An RIR analysis would require more information about the specifics of this rejected measure and a determination of outcome is therefore impossible to make.

REJECTED MEASURE: Close all aggregations around Puerto Rico and the U.S.V.I.

Full details on other potential spawning aggregation locations are not available and it is difficult to provide an economic impact analysis. However, if these become known the benefits from closing all spawning grounds at the same time should exceed the benefits from the proposed measure as long as one major condition is met: the closures should not be so extensive as to halt a major portion of the capture of all species in the waters surrounding Puerto Rico and the U.S. Virgin Islands. Closing numerous areas to all fishing during the winter months, the peak months for tourism in the Caribbean, would cause major losses to the fishing industry as well as to the tourism industry (decrease in variety and numbers of fresh fish available) and to commerce in general. There is no RIR determination at this point because the number and extent of the other aggregations is unknown.

7.0 MANAGEMENT COSTS

Statement of Council Estimated Cost as of August 2, 1996

Costs associated with Council Meetings*

Estimated Cost of Council Members Compensation to one meeting [1] |	$5,385
Estimated Cost of Travel Expenses to one meeting [2] |	$3,435
Estimated Cost of Compensation and Travel Expenses	$8,820

*Council Meetings are estimated to last 16 hours. It has been estimated that the Council devoted 16 hours (including a Reef Fish Committee meeting and the 88th Council meeting) to the changes to the Reef Fish FMP.

Time Devoted by Staff

It is estimated that the Special Assistant to the Executive Director for FMP Development and the Executive Director had dedicated thirty and fifteen percent (30% and 15%), respectively of their time during 1996 to the development of the appropriate changes to the Reef Fish FMP.

Salary of the Special Assistant 4 months at 30%	$4,665
Salary of the Executive Director 4 months at 15%	$3,856
Estimated Cost of Staff	$8,521

1 | Based on average daily compensation for the years 1995 and 1996 ($359/day including 13.75% COLA).
2 | Based on average per diem for Non-Foreign Areas for 1995 and 1996

Public Hearings

Estimated Council Member Compensation to one-day hearing (1)	$ 359
Estimated Council Member Travel Expenses to one-day hearing (1)	$ 229
Estimated Staff Members Travel Expenses to one-day hearing (3)	$ 675
Estimated Cost of Conference Room (one hearing)	$ 200
Estimated Cost of Announcements (one hearing)	$1,191
Estimated Cost of One Public Hearing (one-day)	$2,654

Summary of Estimated Costs

Consideration at Council Meetings	$8,820
Time Devoted by Staff	8,521
Public Hearings	2,654
Total Estimated Administrative Council Cost of the Amendment to the Reef Fish FMP as of August 2, 1996	$19,995
Estimate of National Marine Fisheries Service Administrative Cost	$ 6,000
Cost of Marker Buoys (One-time cost for buoy life in excess of five years)	$ 9,000
Estimate of Additional Enforcement Costs United States Coast Guard	None
National Marine Fisheries Service	None
Government of Puerto Rico:	
Educational to increase compliance	$ 3,180
Field operations (prorated equipment, salary, per diem)	$ 8,131
	$11,311

SUMMARY OF COSTS OF FMP

Caribbean Council (Through April 22, 1996)	$19,995
NMFS Administrative (One-time)	$ 6,000
Marker Buoys (One-time)	$ 9,000
Additional Enforcement Costs by PR Government	$11,311
TOTAL FIRST YEAR COSTS	$46,306

8.0 SUMMARY OF NET ECONOMIC BENEFIT OF THIS AMENDMENT

Table 1 follows and shows a summary of the effects on net national benefits that flow from this amendment. As explained in the analytical approach used in the RIR, most of the effects are described in terms of direction of change and it can be noted that in some cases there is not enough information available to make even this type of determination.

9.0 DETERMINATION FOR A NEED FOR AN INITIAL REGULATORY FLEXIBILITY ANALYSIS

The Regulatory Flexibility Act requires a determination as to whether or not a proposed rule has a significant impact on a substantial number of small entities. If the rule does have this impact then an Initial Regulatory Flexibility Analysis (IRFA) has to be completed for public comment. The IRFA becomes final after the public comments have been addressed. If the proposed rule does not meet the criteria for "substantial number" and "significant impact," then a certification to this effect must be prepared.

Although the number of harvesting firms fishing in the areas under consideration is not known with certainty, an estimate can be made from existing data. A 1988 survey by the Puerto Rico DNER documented that there were 882 vessels in operation in Puerto Rico. Of these, 161 operate from ports that have the potential of fishing these areas. This implies that a maximum of 18 percent of vessels would be impacted and it is doubtful that the actual number is this large because they have access to other areas and not all fish for red hind. Hence, the determination is made that the proposed rules will not affect a substantial number of small firms. Those firms that will be affected (negatively in the short run and then positively over a longer period of time) harvest a wide variety of species, including red hind. Red hind accounts for only a small portion of the annual fishery value in Puerto Rico (for example, 1.3% in 1993). Since the vessels are engaged in a multi-species fishery, and since red hind catches will be affected in only some of the spawning areas and only for three months per year, the effect on annual gross revenues is expected to be considerably less than 5 %. Accordingly, there is no expectation that a substantial number of firms will be impacted by the rules and those that are affected will not be impacted by a significant amount in terms of changes in gross revenues. Therefore, an IRFA has not been prepared.

10.0 REFERENCES

Shapiro, D.Y., Y.S. Sadovy, and M.A. McGehee. 1993. Periodicity of sex change and reproduction in the red hind, Epinephelus guttatus, a protogynous grouper. Bull. Mar. Sci. 53(3):1151-1162.

Table 1: Summary of long-term net economic benefit from the proposed and rejected to the management measures.

MEASURE	PRODUCER SURPLUS	CONSUMER SURPLUS	RECREATIONAL SURPLUS	PUBLIC/PRIVATE COSTS	NET ECONOMIC BENEFITS
Modify Existing Tourmaline Closure	Positive (reduced cost)	No Change	Small Positive	Minor	Positive
Close 2 red hind spawning areas	Positive	Positive	Positive	$46,306	Major Positive
Status Quo	No Change	No Change	No Change	None	No Change
Close only one spawning area	Positive (smaller than for proposed measure)	Positive (smaller than for proposed measure)	Positive (smaller than for proposed measure)	<$37,306	Positive (smaller than for proposed measure)
Close for red hind fishing only	Negative	Negative	Negative	$37,306	Negative
Close entire red hind fishery during spawning season	Negative	Negative	Negative	>$37,306	Major Negative
Close red hind during spawning after one year	Negative	Negative	Negative	>$37,306	Major Negative
Daylight closures	Unknown	Unknown	Unknown	>$37,306	Unknown
Prohibit sale	Unknown	Unknown	Unknown	Unknown	Unknown
Close all spawning areas	Unknown	Unknown	Unknown	Unknown	Unknown

APPENDIX II

ENVIRONMENTAL ASSESSMENT FOR THE REGULATORY AMENDMENT TO THE FISHERY MANAGEMENT PLAN FOR THE REEF FISH FISHERY OF PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS CONCERNING RED HIND SPAWNING AGGREGATION CLOSURES

Caribbean Fishery Management Council

AUGUST, 1996

COVER SHEET

RESPONSIBLE AGENCIES: Caribbean Fishery Management Council
National Marine Fisheries Service

TITLE OF PROPOSED ACTION:

Regulatory Amendment to the Fishery Management Plan for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands Concerning Red Hind Spawning Aggregation Closures

CONTACT FOR FURTHER INFORMATION:

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TYPE OF DOCUMENT: Environmental Assessment (EA)

ABSTRACT:

The Caribbean Fishery Management Council (Council) is proposing an amendment to adjust a management measure under the Fishery Management Plan for the Reef Fish Fishery (Reef Fish FMP) of Puerto Rico and the U.S. Virgin Islands. The management program is designed to address the impacts of human activities on the condition of red hind resources and to respond to the rapidly declining trend in the fishery. This amendment to the FMP will close three areas (approximately 3 x 3 miles each), to all fishing, during the months of December through February, to protect the red hind spawning aggregations centered on Bajo de Cico, Abrir La Sierra (also known as Buoy 6), and Tourmaline Bank (Buoy 8). Changes are proposed to the originally closed area (Amendment 2 to the Reef Fish FMP, 1993) for red hind (Buoy 8 or Tourmaline Bank). The proposed alternatives respond to (a) identification and monitoring data from additional spawning areas and (b) to comments from the commercial fishers regarding the unnecessary burden placed on them by closing an area too large. The EA explores the environmental consequences of the proposed action and alternatives, and considers the possible economic impacts of limiting harvest on commercial fishers of the resources.

1.0 PURPOSE AND NEED

The Caribbean Fishery Management Council is aware of the continuous decline of red hind (Epinephelus guttatus) and the grouper resources in Puerto Rico and the U.S. Virgin Islands, as well as in other areas of the Caribbean. The Council wants to stop the declining trend in the fishery and manage the fishery for long term sustainable yields. There are a number of factors affecting the status of the fishery. Among these are: the declining trends in commercial landings, overfishing, the decrease in the spawning populations, the high demand for the product and increase in price per pound over time. Also, the increase in recreational boating (e.g., anchoring) causes damage to critical habitat required for juvenile settlement and affects water quality. The recreational fishery probably takes a high percentage of juveniles and recreational fishing effort has increased at the spawning aggregation sites. According to testimony offered at public hearings, recreational fishers are fishing the red hind aggregations and selling hundreds of pounds of this species. This fishing activity should be monitored to determine the impact of the recreational sector on this fishery (this holds true for other reef fishes.) The Council believes that "taking no management action" might result in total collapse of the fishery as it has happened in other fisheries. In the U.S. Caribbean commercial fishing extinction (economic) has already been observed in the drastic declines in the Nassau grouper and Jewfish resources (see Reef Fish FMP and amendments, 1985; 1993). Whenever possible, the Council relies upon closing aggregation sites during spawning seasons to regulate the fishery instead of size limits or quotas that result in excessive fishing mortality to juveniles. Most species that aggregate during the spawning season, such as the red hind, are highly vulnerable to capture at that time. Allowing mature individuals the opportunity to spawn is important to reverse declines in abundance.

The Reef Fish Stock Assessment Group recommended (SAFE Report, 1992) that spawning aggregations be protected. It is at this time that the species are more vulnerable and, traditionally, fishing effort increases during the periods of spawning aggregations.

Commercial fishers brought to the attention of the Council the need to protect two additional spawning aggregations (Abrir La Sierra or Buoy 6 and Bajo de Cico) as well as a need to re-define the closure area in Tourmaline Bank (Buoy 8). The re-definition of the area is needed to better protect the red hind spawning aggregation, and to remove an unnecessary burden imposed on the commercial fishers. The closure area established in 1993, west of Buoy 8, is too large an area. Since the red hind spawning aggregation is confined to approximately a 1.5 mile radius around Buoy 8, the area closed west of this radius imposes an unnecessary burden on the fishers. Commercial fishers have stated that most of the area presently closed is sandy bottom and it has traditionally been used to store fish traps during bad weather.

In response to comments received regarding the red hind area closure off the West Coast of Puerto Rico (1993), the documented trends in the decline of the fishery for red hind, and the recommendations on the SAFE Report (1992) the Council is proposing a conservative approach in this amendment to adjust a management measure under the Reef Fish FMP for Puerto Rico. The Amendment is proposed to remove an unnecessary burden imposed on the commercial fishers and reverse the declining trend in the fishery. The Council believes that this action will remove the unnecessary burden created for the commercial fishers and still can rebuild the red hind resources and contribute to the long-term maintenance of a healthy fishery. The red hind fishery should also be maintained because it is one of the smaller groupers and it is not known to be part of the ciguatera problem.

The Council is responsible for managing resources in the federal waters surrounding Puerto Rico and the United States Virgin Islands. The area extends from the inner boundary of the EEZ (that is, 9 nm isopleth for Puerto Rico and 3 nm isopleth for the U.S.V.I.) to the 200 nm outer boundary of the EEZ. In addition to the geographical management area for the proposed measures it is recommended that efforts be made to achieve pan-Caribbean cooperation in the management of the shared resources. One important reason for this recommendation is that the larvae of many species settling in the U.S. Caribbean might be supplied by the spawning population from other areas of the Caribbean. Thus, protection of spawning aggregations of red hinds, as well as of other species, throughout the Caribbean is an essential consideration for a sustainable resource in the near future.

The Council has two other FMPs implemented in the U.S. Caribbean. These are the Spiny Lobster FMP (1981) and the FMP for Corals and Reef Associated Plants and Invertebrates (1993). An FMP for Queen conch is currently under review.

MANAGEMENT OBJECTIVES

The objectives addressed by the Reef Fish FMP, as amended, are unchanged. These objectives are: 1) obtain the necessary data for stock assessment and for monitoring the fishery; 2) reverse the declining trend of the resource by (a) restoring and maintaining adult stocks at levels that ensure adequate spawning and recruitment to replenish the population and (b) preventing the harvest of individuals of species of high value (e.g., snappers, groupers, and others) that are less than the optimum size; 3) reduce conflicts among users of the resource; 4) promote international cooperation in managing the pan-Caribbean species; and 5) help resolve the ciguatera problem.

Red hind (one of the most prevalent species in the commercial landings) are being harvested at less than optimum size. The average size and production of red hind appear to be declining. These conditions are contrary to objective 2b of the FMP: "Prevent the harvest of individuals of species of high value (e.g., snappers, grouper, and others) which are less than the optimum size."

The Council, by closing additional spawning sites, will also be reversing the decline of the resource by maintaining adult stocks at levels that are adequate to ensure spawning levels to replenish the population.

ISSUES TO BE CONSIDERED
OVERFISHING - *How can we reduce direct and indirect harvests of resources (e.g., spawning* stocks)?
ECONOMIC IMPACTS - What are the effects of limiting harvest by commercial and recreational fishers and what are the benefits to other users?
HABITAT LOSS - What is the effect of continued degradation of habitat (e.g., Seagrass beds) on commercial fish stocks and threatened and endangered species?
MONITORING & ENFORCEMENT - How can we improve the opportunities for effective monitoring and enforcement of conservation rules?
INEFFICIENT UTILIZATION - How can we reduce mortality of juveniles and spawning populations?
INADEQUATE INFORMATION - How can we improve the data base for more effective management of resources?
REGIONAL MANAGEMENT - What is the best way to ensure a consistent management regime for the U.S. Caribbean?

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The following adjustment to a management measure (proposed action) under the Reef Fish FMP is intended to address the management objectives discussed above. A number of alternatives are presented which have been considered by the Council.

ADOPTED MEASURE **(Proposed Action): Close the corresponding sections of the EEZ in all three (3) areas presented below to all fishing between December 1 and February 28 of each year. (Figure 9 of the Amendment shows all three areas as well as the original red hind area closure.)**

1. **Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 8 at Tourmaline Bank. (This is part of the area already closed but it allows for the use of the sandy area where red hinds are not found.) This area is bound by rhumb lines connecting the *following point coordinates:***

Point	Latitude (N)	Longitude (W)
A	**18°11.2**	**67°22.4**
B	**18°11.2**	**67°19.2**
C	**18°08.2**	**67°19.2**
D	**18°08.2**	**67°22.4**

2. **Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius around Buoy 6 at Abrir La Sierra Bank. This area is bound by rhumb lines connecting the following point coordinates:**

Point	Latitude (N)	Longitude (W)
A	18°06.5	67°26.9
B	18°06.5	67°23.9
C	18°03.5	67°23.9
D	18°03.5	67°26.9

3. **Close the corresponding section of the EEZ in an area of one and a half (1.5) miles radius centered around a buoy to be deployed in the area known as "Bajo de Cico." This area is bound by rhumb lines connecting the following point coordinates:**

Point	Latitude (N)	Longitude (W)
A	18°15.7	67°26.4
B	18°15.7	67°23.2
C	18°12.7	67°23.2
D	18°12.7	67°26.4

Closure is aimed at protecting the spawning stock at the peak of their spawning activity. Although red hinds are reported with ripe gonads from December through March, it has been scientifically shown that there is a peak in the spawning activity during the months of the proposed closure. Red hinds, among other species, are aggressive and extremely vulnerable to capture during the spawning season. Increased fishing effort during spawning time can deplete populations of fish that aggregate for spawning. This argues for a definite closure during this time of the year. This conservative management strategy offers the long-term benefit of protecting the spawning stock and the long-term sustainability of the fishery rather than the short-term benefit of increasing yield over such short period of time.

Red hinds, like many of the groupers, are specially vulnerable to heavy fishing pressure because of the peculiarities in the life history of the species. Groupers are long-lived, slow-growing, aggregate for spawning and are protogynous hermaphrodites (change from female to male). Red hinds, because of their hermaphroditism, may be particularly susceptible to differential mortality of males since females may not change sex quickly enough to compensate male losses.

The areas are to be closed to all fishing, neither commercial nor recreational fishers, will be permitted in the area. There is no known selective method of harvesting other

species in the areas where the red hinds aggregate to spawn. The fishing gears used are non-selective (except for professional spear fishers who could discriminate among fishes), fish traps and hook and line. Because aggregating fish are highly susceptible to capture by a variety of gears, a total ban on all fishing is needed to protect the spawning aggregations and to facilitate effective enforcement of this measure.

Although an economic burden will be imposed on the commercial fishers for a short period of time (3 months), the long term benefits expected from protecting the spawning stock outweigh the impact of the seasonal closure. The imposition of the proposed amendment is expected to result in a long-term increase in net national benefits that exceeds the expected short-term losses

REJECTED MEASURE: Close only one or two of the considered areas for three months.

The Council would not be protecting the additional spawning aggregations which have been identified and monitored. As stated previously, aggregations need protection because of the heavy fishing pressure that they experience when fish are most vulnerable to capture (that is, at reproduction) and because of the large number of ripe fish which are removed without allowing them to spawn. The sex ratio and the mating groups are disrupted when fishing takes place over the aggregations and the behavior and spawning activity might be further jeopardized. It is necessary to protect as many spawning aggregations as possible, especially since only so few have been identified around Puerto Rico and not protecting them could result in the collapse of the fishery. Protection of the maximum number of aggregations allows for a greater number of fish to spawn.

REJECTED MEASURE: Close the area for red hinds but allow fishing for other species.

It is not possible for fishing to take place over a red hind spawning aggregation and selectively fish for other species. Fishing gear used in these areas does not discriminate by species. Enforcement will be almost impossible if fishers are allowed inside the closed area.

REJECTED MEASURE: No action. Keep the same area of seasonal closure as it is (Amendment 2 of the Reef Fish FMP, 1993).

Leaving the identified areas unprotected from intensive fishing effort could lead to the demise of the spawning aggregations. Red hind are very aggressive and easily

caught when aggregated for spawning. No action would definitely contribute to a continued decline of red hind resource.

Most of the area closed at present is not actually protecting a spawning aggregation but unduly burdening the fishers targeting other species in the area. At the public hearing it was stated that most of the area closed at present includes fishing grounds for other species rather than red hinds. At present, the area is approximately 3 x 5 miles. It has been proposed that the area be made smaller and that in conjunction with that area, 1 or 2 other aggregations be protected. See preferred option above.

A closure during the reproductive period may serve to reduce overall fishing mortality, especially since red hind are most vulnerable to harvest at that time. Efforts to protect spawners may advance the rebuilding schedule, insofar as recruitment is localized. Therefore, the "No action" is not responsive to deteriorating resource conditions.

Other Measures Considered and Rejected

1. **Prohibit fishing for red hind island-wide during the three months of spawning (December - February).**

This alternative was rejected because fishing gears are not selective and all red hinds caught would have to be returned to the water unharmed which might prove very difficult. High mortality is expected because the depth from which the red hinds are removed (37-90 m) do not allow the fish to deflate the swim bladder, unless kept in live-wells until the swim bladder deflates, thus reducing predation when returned to the sea. In addition, island-wide enforcement would be very difficult since there would be no way of proving, except when caught "red handed," that fish were caught in federal waters. This however could be avoided if local governments adopt the same regulation, i.e., closed season during December through February.

2. **Close the three proposed areas off Mayagüez (Buoys 6 and 8, and Bajo de Cico) and establish a closed season for red hind in Puerto Rico and the U.S. Virgin Islands during December through February of each consecutive year.**

The Council considers that at present this measure would cause an unnecessary extra burden to the commercial fishers in addition to the problems mentioned in 1 above with the high mortality of red hind due to the depths at which it is hooked.

3. **Close the red hind aggregations only during daylight hours.**

Fishers stated that red hinds do not bite at night. However, data from the FRL (A. Rosario, unpublished) show that a total of 765 red hinds have been sampled from the

fishery-independent survey between 2 p.m. and 8 p.m. The mean size of these red hinds, caught with hook and line, was 265 mm (same average size as for red hinds caught during daylight hours.) Anecdotal information also suggests that red hinds do bite at night. Enforcement will be almost impossible if fishers are allowed inside the closed area.

Commercial fishing for species other than red hind is done in the proposed closed areas. Specifically, at night fishing is done for snappers. Other species which are caught in the area include tunas, mackerel, shark, and dolphin fish. Data from the FRL do not show increased landings for any of these species during the months of the closure. These species are pelagic and there is no indication that they aggregate in the proposed area closures.

4. Prohibit the sale of red hind during the months of the closure.

The amount of red hind caught outside the spawning aggregations or imported from other areas into Puerto Rico is unknown. Prohibition of imported red hind is not warranted at this time. The available information does not show the need for this measure at present.

5. Close all aggregations around Puerto Rico and the U.S.V.I.

There should be a number of unknown aggregations and aggregations which might still be healthy. If fishing effort increases, other aggregations might need to be closed and monitored. The Council has decided to postpone closing other aggregations until more information becomes available.

3.0 AFFECTED ENVIRONMENT

The Reef Fish FMP, as amended (1991; 1993) provides a description of the resource. This Regulatory Amendment (Section II) includes a revision of the latest information and description of the red hind fishery.

Description of the Resource

Species in the FMU

The proposed amendment will adjust a management measure under the Reef Fish FMP which will establish closed areas for the red hind, Epinephelus guttatus off Mayagüez, Puerto Rico.

Description of Fishery

Section II of the Amendment to the Reef Fish FMP provides the background information with the description of the fishery. Following is a summary of this information:

History of Exploitation

Groupers have been a prevalent group in the commercial landings in Puerto Rico. Although it has been reported that red hind has been historically a dominant species in the commercial harvest, it was not until very recently (1988) that separate statistics have been recorded for the species. Traditionally, red hinds are mostly harvested during the reproductive period --December through February-- when they aggregate to spawn. These spawning aggregations, which take place every year at specific sites (e.g., Bajo de Cico and Abrir La Sierra off Mayagüez, Puerto Rico), have been fished by commercial fishers for many years. Other grouper species also aggregate for spawning and over time, the increased effort and fishing pressure at the aggregations contributed to decimate populations and to the collapse of the fishery (e.g., Nassau grouper).

Commercial Fishing

Fisheries in Puerto Rico are characteristically multi-species/multi-gear fisheries. The west coast has traditionally been the most productive fishing area (e.g., Matos, 1993) yet landings have decreased since the 1970's. Among the highest ranking species reported in the commercial landings of the West coast are (e.g., 1991-1994) silk snapper, conch, parrotfishes, groupers, grunts and tuna.

Historically, commercial fishers have harvested red hind throughout the year and have targeted spawning aggregations in specific areas around Puerto Rico such as Tourmaline Bank off the West coast and La Parguera off the Southwest coast. Commercial landings for red hind have shown a declining trend since 1991, off the West coast of Puerto Rico.

Section II of this regulatory amendment to the Reef Fish FMP summarizes the information available (fishery-dependent and fishery-independent data) for the proposed new closure areas. During the proposed 3-month closure the fishery-independent catches are dominated by red hinds in the proposed new closure areas. The are no commercial landings data, derived from the voluntary trip ticket collection effort by the Fisheries Research Laboratory, that specify the harvest areas (e.g, Bajo de Cico).

Recreational and Non-Consumptive Uses

There are no data available on the recreational harvest of red hind or any other reef fish species. Anecdotal information places the recreational fishers at the spawning aggregations harvesting red hind and later selling the catch. However, there is no information on the size or number of the fish harvested by recreational fishers. The number of recreational fishers is also unknown.

Fishery Habitat

Ecological description of the proposed new closure areas:

The west coast's insular platform has been generally described as heterogeneous. The wide variety of bottom types include interdispersed coral, both hard and soft, sandy (various types), hard bottom, algal plains and seagrass beds. Rosario (1996) gives a general description of the areas of Bajo de Cico and Abrir La Sierra at depths of 37-90 m. The information is derived from the nautical charts and from material (e.g., pieces of soft coral, seagrass blades, etc) recovered from the traps fished in the area. These 2 areas are on the edge of the west coast platform and the bottom cover is of sponges and soft and hard corals in Bajo de Cico and soft corals and sandy algal plains in Abrir La Sierra.

A primary economic value of marine habitats lies in their importance to commercial fisheries, including reef fish, conch and lobster. Overfishing might be partly, a result of the degradation and loss of essential habitat for juvenile settlement and development. Also, adults of many species can not settle or grow if the appropriate habitat has been damaged or lost. There is information presented in Amendment 1 to the Reef Fish FMP which clearly explains the importance of habitat as nursery grounds, spawning grounds, and fishing grounds for red hind as well as numerous other species of reef fish. Protection and conservation of these essential habitats is of critical importance for the fishery.

Additionally, habitat conservation concerns are addressed, as recommendations, to the local government regarding the rehabilitation and conservation of near shore habitat critical for recruitment and development of juvenile marine organisms.

Status of the stock

Red hind in western Puerto Rico show evidence of growth-, and possible recruitment-, overfishing (Sadovy et al., 1994). The fishery-dependent data for the West coast of Puerto Rico show a continuous decline since 1991. Fishery-independent data of the monitoring of the spawning aggregations for 1994-1995 and 1995-1996 at Bajo de Cico and Abrir La Sierra (A. Rosario, unpublished data) show that the size of the fish

present at the aggregations has decreased. Mean size of red hind from the West coast has been shown to be decreasing (Figure 8 of the Amendment). Data from the fishery-independent surveys and monitoring of spawning aggregations are only available for the West coast of Puerto Rico.

The greatest benefit to the Nation is derived from the long term effects that the management measures will have on the resource. That is, rebuilding of the stock and long term sustainable yields. The Council believes that the proposed management measure ensures the best use of the resource allowing fishing to continue.

EFFECT OF THE AMENDMENT AND ITS ALTERNATIVE

ANNUAL SEASONAL AREA CLOSURES FOR RED HIND

ISSUES	NO ACTION	ANNUAL CLOSURE (DECEMBER-FEBRUARY) 3 AREAS
OVERFISHING	Continuing adverse impacts	Lessen adverse impacts
ECONOMIC IMPACTS	Long term negative impact	Long term benefits
HABITAT LOSS	No effect	No effect
MONITORING AND ENFORCEMENT	No effect	Easier to enforce
INEFFICIENT UTILIZATION	Continue adverse impact	Long term benefits
INADEQUATE INFORMATION	No effect	Improve
REGIONAL MANAGEMENT	No effect	Positive effect

TABLE I. RELATIONSHIP (+ OR -) OF PROPOSED ACTIONS AND THE FMP'S OVERALL OBJECTIVES

OBJECTIVES	PREFERRED OPTION: Close 3 Spawning Aggregations
Generate Data Base	++
Reverse decline in resources	++
Restore/maintain stocks of spawners	++
Prevent harvest of fish less than optimum size	++
Reduce conflict among users of resource	++
International cooperation in pan-Caribbean Management	+
Resolve ciguatera problem	

4.0 ENVIRONMENTAL CONSEQUENCES

This section is arranged by alternatives as they are presented in Section 2.0 above.

(A) Three Seasonal Area Closures for Red Hind

Closing the three known red hind spawning aggregation areas off the West coast of Puerto Rico possess no direct adverse impact on the quality of the physical environment where the aggregations occur. It is however a possible consequence of the measure that effort be relocated to other areas thus impacting the physical environment but to what extent this might occur is unknown. The long-term biological and economic benefits will probably not be offset by the shift in effort. Increase effort by both commercial and recreational fishers has a direct adverse effect on the habitat and on the biology of the species, among other reasons due to the effect of traps and anchors on the reef areas.

No environmental adverse effects are expected from this action. The short-term economic loss most likely be outweighed by the expected long-term economic gains. The proposed action might increase juvenile mortality in other areas but the long-term benefits -biological and economic- will probably not be offset by the shift in effort.

Fishers might know about other red hind spawning aggregations, but fishery-independent surveys have not identify any other aggregations.

Biological Effects

Protection of spawning stock alone does not ensure successful recruitment. The seasonal closure ensure, from a biological standpoint the availability of larvae and juveniles for recruitment. However, for a successful recruitment critical habitat needs to be preserved. Red hinds are more vulnerable to harvesting during the reproductive season (December-February) when they aggregate at specific sites to spawn. Elimination of fishing pressure during this critical period offers protection to the species and should allow for a sustainable fishery.

The long-term benefit of protecting spawning aggregations, by relieving fishing pressure during the time of highest vulnerability of the species, should result in the increase of reproductive output. That is, assuming that fishing pressure will not increase during the rest of the year and that the required grow-out habitat of the species is available, recruitment should increase.

The possibility exists that fishing effort be shifted to other areas and other species. However, during the three months of the proposed closure, December through February, it is mainly the groupers which aggregate for spawning. Other species will be protected as well in these proposed new closure areas.

Shifting effort:

Increased effort has been reported on the two proposed new closure areas at Bajo de Cico and Abrir La Sierra. These two areas, being farther away from shore, had been somewhat protected. Comments received at the Public Hearing indicate that the number of fishing vessels in these areas has increased and that recreational fishers are also fishing the aggregations. It is in response to the increased effort at these aggregations, especially in light of the fishery-independent data which shows that (a) the number of fish sampled has decreased, (b) the average size of fish sampled has decreased (Figure 8), (c) the size of fish at first vulnerability to the fishery is decreasing (smaller fish probably means less reproductive output), (d) sex ratio has decreased, (e) landings of red hind increase during spawning months (no species other than groupers are reported in quantities at the time of the spawning aggregations), and (f) that red hinds are more vulnerable at this time, that the Council is proposing this measure.

Comments received at the Public Hearing form commercial fishers who fish at night indicate that they would prefer the areas be opened to fishing during the night, but commented that they mostly fish areas south of Abrir La Sierra.

There is no way of preventing the harvest of red hinds at night except for completely banning fishing in the areas during the months of the spawning aggregations.

Damage to corals from anchors used by fishing vessels in the area during the period of the spawning aggregations will be diminished.

Fishers would most likely shift their effort to fishing outside the boundaries of the aggregations rather than impacting other sites as heavily as the aggregating areas. Fish caught in the out skirts of the closed areas will most likely be caught after spawning has taken place.

The re-definition of the closed area (Tourmaline Bank) could negatively impact other fisheries that benefited from the closure. It has not been established that other fisheries specific to this area are in trouble.

Other Fisheries in the Area:

Fishery-independent data (Rosario, 1996) show that the two most abundant species represented in sample catches are red hind and coney. Other species reported from the sampled stations off the West Coast, and for both the hook and line and the traps samples, include: graysby, sand tilefish, long jaw and long spine squirrelfishes, grunts, filefish, and butterfly fish (banded and four eye), among others caught less frequently (e.g., snappers.) The catches for both hook and line and traps were dominated by groupers (red hinds and coneys.) The maximum depth sampled by Rosario (1996) was 90 m.

Boardman and Weiler (1979) reported fishery-independent trap data for Tourmaline and Abrir La Sierra Banks for depths between 70 and 270 m. Three species of deep water snappers were predominant in the catches; Lutjanus vivanus (silk snapper), L. buccanella (blackfin) and Rhomboplites aurorubens (vermillion snapper.) The deep-water snapper fishery takes place at depths greater than those found in the proposed new closure areas.

Figure 3 of this regulatory amendment shows the trends in grouper and red hind landings from the west coast of Puerto Rico. There is probably a high proportion of red hinds reported by commercial fishers under the grouper category. The prohibition on harvesting of Nassau grouper came into effect in 1991 but the data does not allow for the inference of cause and effect in this case. That is, the decrease seen in the grouper landings (Figure 3) can not be attributed to the federal regulation prohibiting the harvest of Nassau grouper. In the same manner, the increase in red hind landings (Figure 3) can not be attributed to the shifting of effort or the increased pressure on red hind.

Socio-economic Effects

There is no information available on the recreational harvest of red hind. Information is needed on the effect of recreational fishing on juvenile red hind since most recreational boating activities take place in nearshore areas. These activities might be more directly affecting the condition of the habitat (e.g., anchoring effects. See Section 1.0 of EA) and thus, impacting the resource. The recreational fishers are also harvesting fish from the spawning aggregations, but no information is available regarding the size of the catch, the effort involved, or the biological parameters of the fish caught.

Protecting the spawning stock provides some insurance against recruitment failure. Some commercial fishers could experience a decrease in income unless they switch to fishing for other species during the closed period. In the long term the likely repopulation of shallower areas for fishing might result in an increased and sustainable income for the fishers. The majority of the commercial fishers are already involved in multiple fisheries.

The short-term economic loss that commercial fishers might face due to the closures are outweighed by the economic benefits accrued in the long run from the gradual increase in the number of red hind, and possibly in other species which occur in the proposed protected areas.

There are no data that indicate that there are other species as heavily exploited as the red hind during the months of closure in the aggregations sites off the west coast.

REJECTED MEASURE: Close only one or two of the considered areas for three months.

The Council would not be managing a fishery resource that is being overexploited if the additional aggregations are not protected. Protection is afforded to the species by allowing adult mature individuals the opportunity to spawn (generally larger individuals means higher reproductive output) and thus, reversing declines in stocks.

Effort has already been reported to be increasing at the spawning aggregations of Bajo de Cico and Abrir La Sierra. Additional effort shifted to these areas will not be completely averted.

Total landings of red hind have decreased by 60% in the West Coast of Puerto Rico between 1991 and 1994 (Figure 3.) Yet it is clear that highest landings are still recorded during the spawning months of January and February (Figure 4.)

REJECTED MEASURE: Close the area for red hinds but allow fishing for other species.

It is not possible for fishing to take place over a red hind spawning aggregation and selectively fish for other species. Fishing gear used in these areas does not discriminate by species. In addition, enforcement will be almost impossible if fishers are allowed in the closed areas.

REJECTED MEASURE: No action. Keep the same area of seasonal closure as is (Amendment 2 of the Reef Fish FMP, 1993).

Leaving the identified areas unprotected from intensive fishing effort could lead to the demise of the spawning aggregations. Red hind are very aggressive and easily caught when aggregated for spawning. No action would definitely contribute to a continued decline of red hind resource.

The argument against keeping the closed area as it is currently defined, is that most of the area is not actually protecting a spawning aggregation, but is unduly burdening the fishers targeting other species in the area. At the public hearing it was stated that most of the area closed at present includes fishing grounds for other species rather than red hinds. At present, the area is approximately 3 x 5 miles. It has been proposed that the area be made smaller and that in conjunction with that area, 1 or 2 other aggregations be protected.

Other Measures Considered and Rejected

1. Prohibit fishing for red hind island-wide during the three months of spawning (December - February).

This alternative was rejected because fishing gears are not selective and all red hinds caught would have to be returned to the water unharmed which might prove very difficult. High mortality is expected because the depth from which the red hinds are removed (37-90 m) do not allow the fish to deflate the swim bladder, unless kept in live-wells until the swim bladder deflates, thus reducing predation when returned to the sea. In addition, island-wide enforcement would be very difficult since there would be no way of proving, except when caught "red handed," that fish were caught in federal waters. This however could be avoided if local governments adopt the same regulation, i.e., closed season during December through February.

2. Close the three proposed areas off Mayagüez (Buoys 6 and 8, and Bajo de Cico) and establish a closed season for red hind in Puerto Rico and the U.S. Virgin Islands during December through February of each consecutive year.

The Council considers that at present this measure would cause an unnecessary extra burden to the commercial fishers in addition to the problems mentioned in 1 above with the high mortality of red hind due to the depths at which it is hooked.

3. Close the red hind aggregations only during daylight hours.

Fishers stated that red hinds do not bite at night. However, data from the FRL (A. Rosario, unpublished) show that a total of 765 red hinds have been sampled from the fishery-independent survey between 2 p.m. and 8 p.m. The mean size of these red hinds, caught with hook and line, was 265 mm (same average size as for red hinds caught during daylight hours.) Anecdotal information also suggests that red hinds do bite at night.

Commercial fishing for species other than red hind is done in the proposed closed areas. Specifically, night-fishing is done for snappers. Other species which are caught in the area include tunas, mackerel, shark, and dolphin fish. Data from the FRL do not show increased landings for any of these species during the months of the closure. These species are pelagic and there is no indication that they aggregate in the proposed area closures.

4. Prohibit the sale of red hind during the months of the closure.

The amount of red hind caught outside the spawning aggregations or imported from other areas into Puerto Rico is unknown. Prohibition of imported red hind is not warranted at this time. The available information does not show the need for this measure at present.

5. Close all aggregations around Puerto Rico and the U.S.V.I.

There should be a number of unknown aggregations and aggregations which might still be healthy. If fishing effort increases, other aggregations might need to be closed and monitored. The Council has decided to postpone closing other aggregations until more information becomes available.

The Council considered and rejected combinations of the above rejected measures, e.g., close all spawning sites and establish a closed season for Puerto Rico and the U.S.V.I., because these are not necessary at this time. However, if the declining trend continues, such stricter measures might be needed.

(B) Effects on Marine Mammals and Endangered Species

Federally listed species of relevance to the Reef Fish FMP are: (1) Leatherback turtle (Dermochelys coriacea), (2) Hawksbill turtle (Eretmochelys imbricata), (3) Green turtle (Chelonia mydas), (4) Loggerhead turtle (Caretta caretta), and (5) the West Indian manatee (Trichechus manatus). No marine mammals or threatened or endangered species are expected to be either directly or indirectly affected by the Amendment to the FMP. The Amendment to the Reef Fish FMP encourages the protection and conservation of the critical habitats used by juvenile and adult reef fish species (e.g., coral reef areas, seagrass beds) which are also habitats shared by many other species among which are the above listed species.

(C) Unavoidable Adverse Impacts

The Amendment to the FMP might have a small, short-term detrimental effect on the fishers' income, but it will be outweighed by the beneficial long-term increase in yield.

(D) Irreversible and Irretrievable Commitment of Resources

There are no expected irreversible or irretrievable commitments of resources.

5.0 LIST OF PREPARERS

Graciela García-Moliner
Caribbean Fishery Management Council

6.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

U.S. Department of Commerce, National Oceanic and Atmospheric Administration
- -Office of Ecology

U.S. Department of State
U.S. Department of Agriculture
U.S. Department of the Interior
- -U.S. Fish and Wildlife Service
- -National Park Service

U.S. Department of Transportation
- -U.S. Coast Guard

U.S. Environmental Protection Agency, Region II
Commonwealth of Puerto Rico
Government of the U.S. Virgin Islands

7.0 RESPONSE TO PUBLIC COMMENTS

A public hearing was held on March 7, 1996 and a summary of testimony presented is available for inspection at Council's office.

A second public hearing was held on June 19, 1996. No comments were received.

8.0 References

Boardman, C. and D. Weiler. 1979. Aspects of the life history of three deep-water snappers around Puerto Rico. Proc. Gulf. Carib. Fish. Inst. 32:158-172.