

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

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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	18E11.2	67E22.4
B	18E11.2	67E19.2
C	18E08.2	67E19.2
D	18E08.2	67E22.4

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	18E06.5	67E26.9
B	18E06.5	67E23.9
C	18E03.5	67E23.9
D	18E03.5	67E26.9

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	18E15.7	67E26.4
B	18E15.7	67E23.2
C	18E12.7	67E23.2
D	18E12.7	67E26.4

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. There 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 from 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 Abir 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 Irrecoverable 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.