6.0 Conservation Recommendations

A. Ecosystem Level

The fisheries of the Islands contribute to the food supply, economy, and health of the Nation, and provides recreational and commercial fishing opportunities. The fisheries are dependent upon the survival of these resources, which can only be assured by the wise management of all aspects of the fishery, including habitat. Accordingly, activities that adversely affect habitat also will require action by the Councils. Increased productivity of stocks may not be possible without habitat maintenance and regulatory restrictions.

Recognizing that all species are dependent on the quantity and quality of their essential habitats, it is the policy of the CFMC to protect, restore, and improve habitats upon which commercial and recreational marine fisheries depend, to increase their extent, and to improve their productive capacity for the benefit of the present and future generations. This policy shall be supported by three objectives which are to:

1. Maintain the current quantity and productive capacity of habitats supporting important commercial and recreational fisheries, including their food base (This objective may be accomplished through the recommendation of no net loss and minimization of environmental degradation of existing habitat);

2. Restore and rehabilitate the productive capacity of habitats which have already been degraded; and

3. Create and develop productive habitats where increased fishery productivity will benefit society.

The CFMC has formed Habitat Committees and Advisory Panels for the Islands to bring to the Councils' attention activities that may affect the habitat of the fisheries under their management. The Councils, pursuant to the Magnuson-Stevens Act, will use existing authorities to support state and federal environmental agencies in their habitat conservation efforts and will directly engage the regulatory agencies on significant actions that may affect habitat. This may include commenting on specific actions, policies, or regulations that affect the habitat of species being managed.

Public hearings and the building of administrative records also may be conducted to assure an adequate disclosure of facts and public participation in actions that adversely affect habitat. The goal is to insure that habitat losses are kept to the minimum and that efforts for appropriate mitigation strategies and applicable research are supported.

B. Project-Specific Level

1. Docks and Piers

Docks and piers, whether built over or floating on the water, are generally acceptable methods of gaining access to deep water. General considerations include:

a. Docks and piers should be constructed so that waterflow restriction and blockage of sunlight on wetland surfaces is avoided or minimized;

b. Docks and piers should be of adequate length to reach navigational depths without increasing dredging needs; and

c. Docks and piers should be designed and located to avoid areas that support submerged aquatic vegetation, shellfish beds and harvest areas, and other fragile and productive habitats.

2. Boat Ramps

a. Sites should be located along shorelines that do not support wetland vegetation and where adjacent waters have adequate navigational depths. Acceptable sites may include existing marinas; bridge approaches and causeways (with highway agency approval) where construction access channels exist; and natural and previously created deep water habitats;

b. Preferably, sites should be restricted to areas that do not require dredging to gain access to navigable waters. When located in the vicinity of seagrass beds, adequate navigation channels must exist and should be clearly marked. Boat ramps should not be located in areas where boats will encroach on sensitive and productive habitats;

c. Ramps should not be located in areas where encroachment into wetlands is likely to occur. Sites should contain adequate upland area for parking and for boat launching/removal; and

d. Adequate waste collection facilities should be required at public facilities.

3. Marinas

All marinas adversely affect aquatic habitats to some degree. These effects can be minimized through proper location and design. In addition to applicable recommendations for boat ramps, bulkheads, and seawalls, the following apply:

a. Marinas should be located in areas where suitable physical conditions exist. For example, potential sites should be located close to navigable waters and in locations where marina-related activities would not affect living marine resource forage, cover, harvest, and/or nursery habitats. Attention also should be given to sediment deposition rates and maintenance dredging requirements;

b. Marinas should be located at least 1,000 feet from shellfish harvest areas, unless state regulations or other considerations specify differently;

c. Dry-stack storage is generally preferable to wet mooring of boats. Open dockage extending into deep water is generally preferable to basin excavation;

d. Mooring basins should be sited in uplands rather than wetlands, and they should be designed so that water quality degradation does not occur. This may require consideration of basin flushing characteristics and incorporation of other design features such as surface and waste water collection and treatment facilities;

e. Turning basins and navigation channels should not create sumps and other slack-water areas that could degrade water quality nor should they be located in areas where circulation is poor. Depths generally should not exceed those of adjoining waters and, where practicable, they should provide for light penetration that is capable of sustaining benthic plant life. Dissolved oxygen levels in channels and basins should be adequate for fish and macroinvertebrate survival;

f. Consideration should be given to aligning access channels and configuring marinas to take full advantage of circulation from prevailing summer winds;

g. Permanent dredged material disposal sites (for use in initial and maintenance dredging) that do not impact wetland areas should be identified and acquired. Suitable disposal alternatives include placing dredged material on uplands, and using dredged material to create/restore wetlands. Projects that lack permanent disposal sites should not be authorized if maintenance dredging is needed and disposal sites/options are not available;

h. Catchment basins for collecting and storing surface runoff should be included as components of the site development plan. Marine railways or upland repair facilities should be equipped with hazardous material containment facilities so that biocides such as marine paints, oil and grease, solvents, and related materials are not directly or indirectly discharged into coastal waters and wetlands;

i. Consideration should be given to parking and other support facilities when it appears that available uplands are not adequate to support such needs and wetland encroachment is anticipated;

j. Marinas with fueling facilities should be designed to include practical measures for reducing oil and gas spillage into the aquatic environment. Spill control plans may be needed when marina facilities are to be located in the vicinity of large, emergent wetland areas, shellfish harvest sites, and other fragile/productive aquatic sites; and

k. Facilities for collection of trash and potential marine debris should be required. Where vessels with marine toilets will be moored, pump out facilities and notices regarding prohibition of sewage and other discharges should be provided.

4. Bulkheads and Seawalls

Bulkheads are used to protect adjacent shorelines from wave and current action and to enhance water access. Applications for bulkheads usually specify construction in open water followed by placing fill material behind the structure. Bulkheads may adversely impact wetlands through direct filling; through isolation; and through exacerbation of wave scour. Adverse impacts may be reduced by applying the following criteria:

a. Except in cases of recent and rapid erosion, structures should be aligned at or shoreward of the normal high waterline. Structures should be constructed so that reflective wave energy does not scour or otherwise adversely affect adjacent EFH or wetlands. For example, in areas that support fringing wetlands consideration should be given to the use of breakwaters (with regular openings -- see item c., below) or placement of riprap at the toe of the bulkhead or along the waterward edge of eroding wetlands;

b. Where possible, sloping (3:1) riprap, gabions, or vegetation should be used rather than vertical seawalls; and

c. Shoreline protection devices that are located in areas having fringe wetlands should have openings that allow for fish ingress and egress and water circulation. Recommended spacing for structure openings is no less than one linear foot per five linear feet of structure.

5. Cables, Pipelines, and Transmission Lines

Wetland excavation is sometimes required for installing submerged cables, pipelines, and transmission lines. Construction also may require temporary or permanent wetlands filling. The following recommendations apply:

a. Wetland crossings should be aligned along the least environmentally damaging route. Submerged aquatic vegetation, shellfish beds, coral reefs, etc., must be avoided;

b. Construction of permanent access channels should be avoided since they disrupt natural drainage patterns and destroy wetlands through direct excavation, filling, and bank erosion. The push-ditch method, in which the trench is immediately backfilled, reduces the impact duration;

c. Excavated wetlands should be backfilled with either the same material as removed or a comparable material that is capable of supporting suitable replacement wetlands. Original marsh elevations should be restored and, where practicable, excavated vegetation should be

stockpiled, kept viable, and returned to the excavated site. After backfilling, erosion protection measures should be implemented where needed to prevent fish habitat degradation and loss;

d. Excavated materials should be stored on uplands. If storage in wetlands cannot be avoided, discontinuous stock-piles should be used to allow continuation of sheet flow. Where practicable, stockpiled materials should be stored on construction cloth rather than bare marsh surfaces. Topsoil and organic surface material such as root mats should be stockpiled separately and returned to the surface of the restored site;

e. In open-water areas, excavated materials should be deposited in discontinuous piles to preclude significant blockage of water movement. Back-filling is recommended if the excavated material would alter circulation patterns or interfere with fishing;

f. Use of existing rights-of-way should be recommended when use of these areas would lessen overall wetland encroachment and disturbance; and

g. Directional drilling, a technique that allows horizontal, sub-surface, placement of pipelines should be used in situations where normal trenching and backfill would cause unacceptable levels of habitat loss or alteration.

6. Transportation

State and federal highway agencies generally have the capability of conducting advanced planning with road, causeway, and bridge construction. To the extent possible, NMFS Branch Office personnel should participate in early planning efforts. Since highway projects are generally considered to be in the public interest and frequently require wetland crossings, identification of mitigation needs, and development of suitable mitigation plans should be undertaken early in the planning process. The following criteria should be considered:

a. Transportation corridors/facilities should avoid wetlands. Where wetland crossings cannot be avoided, bridging should be used rather than filling, and the least environmentally damaging route, preferably along existing rights-of-way and road beds, should be followed;

b. Disrupting or reducing fish and invertebrate migration routes should be avoided;

c. Structures should be designed to prevent shoaling and alteration of natural water circulation. Suitable erosion control and vegetation restoration should be implemented at wetland crossings; and

d. Transportation facilities should be designed to accommodate other public utilities, thus avoiding the need for additional wetland alteration. An example would be using bridges to support transmission lines and pipelines.

7. Navigation Channels and Boat Access Canals

Construction and maintenance of navigation channels and boat access canals may cause severe environmental harm. In addition to direct habitat losses associated with wetland and deepwater excavation and filling, these activities may significantly modify salinity and water circulation patterns. These changes could greatly modify the distribution and abundance of living marine resources. The following criteria should be followed:

a. Where possible, dredging should be minimized through the use of natural and existing channels;

b. Alignments should avoid sensitive habitats such as shellfish beds, finfish and invertebrate nurseries, submerged aquatic vegetation, and emergent wetlands;

c. Permanent dredged material disposal sites should be located in non-wetland areas. Where long-term maintenance excavation is anticipated, disposal sites should be acquired and maintained for the entire project life;

d. Boat access canals should be designed to ensure adequate flushing and should be uniform in depth or made progressively deeper in the direction of receiving waters. Where possible, they should be aligned to take advantage of wind and lunar tides;

e. Construction techniques that minimize turbidity and dispersal of dredged materials into sensitive wetland areas (e.g., submerged grasses and shellfish beds) are encouraged. Work should be scheduled to avoid periods of high biological activity such as fish and invertebrate migration and spawning;

f. Care should be taken to avoid adverse alteration of tidal circulation patterns, salinity regimes, or other factors that influence local ecological and environmental conditions;

g. Channels and access canals should not be constructed in areas known to have high sediment contaminant levels. If construction must occur in these areas, consideration should be given to the use of silt curtains or other techniques needed to contain suspended contaminants; and

8. Disposal of Dredged Material

Previous and on-going disposal of dredged material is a major contributor to wetland losses in marine and estuarine ecosystems. Recognizing that most navigation channels and access canals require periodic maintenance dredging, it is important that long-range plans be developed and that they provide for mitigation of unavoidable adverse environmental impacts. Implementing the following criteria would minimize adverse impacts associated with most dredged material disposal activities:

a. Dredged material should be viewed as a potentially reusable resource and beneficial uses of these materials should be encouraged. Materials that are suitable for beach replenishment,

construction, or other useful purposes should be placed in accessible non-wetland disposal areas;

b. Disposal sites that are located in unprotected coastal areas and adjacent to wetlands are especially susceptible to wind and water erosion. These forces can carry substantial quantities of dredged material into aquatic habitats. If located near wetlands, disposal site surfaces should be stabilized using vegetation or other means to eliminate possible erosion or encroachment onto adjacent wetlands;

c. Dredged material should be placed in contained upland sites or approved open-water locations where adverse impacts to living marine resources are minimal. When placed in open water, dredged material should be used to enhance marine fishery resources. For example, materials could be used to renourish eroding wetlands or to fill previous borrow sites;

d. The capacity of existing disposal areas should be used to the fullest extent possible. This may necessitate increasing the elevation of embankments to augment the holding capacity of the site and applying techniques that render dredged material suitable for export or for use in reestablishing wetland vegetation;

e. Where possible, outfalls should be positioned so that they discharge into the dredged area or other sites that lack biological/ecological significance. When evaluating potential upland disposal sites, the possibility of saltwater intrusion into ground water and surrounding freshwater habitats should be assessed by the construction/regulatory agencies. Groundwater contamination could necessitate redesign of disposal practices, with subsequent harm to living marine resources; and

f. Toxic and highly organic materials should be disposed in impervious containment basins located on upland. Effluent should be monitored to ensure compliance with state and federal water quality criteria and measures should be incorporated to ensure that surface runoff and leachate from dredged material disposal sites do not enter aquatic ecosystems.

9. Impoundments and Other Water-Level Controls

A. Wetland impoundments:

Wetlands may be impounded each year in the Caribbean for purposes such as aquaculture, agriculture, flood control, and hurricane protection. Projects range in size from minor, such as repair of existing embankments, to large-scale marsh management projects where constructing dikes and water-control structures may affect thousands of wetland acres.

Proposals to impound or control marsh water levels should contain water management plans with sufficient detail to determine the accessibility of impounded areas to marine organisms and the degree to which detrital and nutrient export into adjacent estuarine areas will be affected. Significant adverse impacts can be avoided or minimized with implementation of the following recommendations:

a. Proposals to impound or reimpound previously unimpounded wetlands are unacceptable unless designed to accommodate (1) normal access and wetland use by marine fish and invertebrates and (2) continuation of other biological interaction, such as nutrient exchange, and other similarly important physical and chemical interactions; and

b. Proposals to repair or replace water control structures will be assessed on a case-by-case basis.

B. Watershed Impoundments:

Water-development agencies sometimes propose impounding rivers, and tributaries for such purposes as flood control or creation of industrial, municipal, and agricultural water supplies. Activities of this type are usually unacceptable because associated alteration of the quality, quantity, and timing of freshwater flow into estuaries may cause large-scale adverse modification or elimination of estuarine and marine habitats. Such actions also may block fish and invertebrate migrations.

10. Drainage Canals and Ditches

Drainage canals may be important components of upland development. Their potential to shunt polluted runoff and fresh water directly into tidal waters requires intermediate connection to retention ponds or wetlands. This allows natural filtration and assimilation of pollutants and dampening of freshwater surges prior to discharge into tidal waters. Recommendations include:

a. Drainage canals that dewater or cause other adverse wetland impacts are unacceptable and should not be built;

b. Drainage canals and ditches from upland development generally should not extend or discharge directly into wetlands;

c. Constructing upland retention ponds and other water management features such as sheet-flow diffusers is encouraged. A retention pond or other pollution elimination/assimilation structure should be required if the effluent contains or may contain materials that are toxic to marsh vegetation or other aquatic life,

d. Excavated materials resulting from canal and retention pond construction should be placed on upland or used to restore wetlands;

e. Proposed drainage plans should be in accordance with comprehensive flood plain management plan(s) and applicants should be encouraged to consult with the EPA and appropriate state agencies to ensure that federal and state water quality standards are met;

f. Locating mosquito control ditches in wetlands should be discouraged. If built, they should be designed so that they do not drain coastal wetlands. They also should be designed to avoid water stagnation, and they should provide access for aquatic organisms that feed on mosquito larvae; and

g. Use of innovative techniques such as rotary ditching, spray dispersal of dredged materials, and open-water marsh management should be encouraged where appropriate.

11. Oil and Gas Exploration and Production

Exploration and production of oil and gas resources in wetlands usually have adverse impacts since excavation and filling are generally required to accommodate access and production needs. In open marine waters, dredging and filling is usually not necessary, but special stipulations are required to minimize adverse impacts to living marine resources. In addition to the above recommendations for navigation channels, access canals, and pipeline installation, the following apply:

A. In coastal wetlands:

a. Activities should avoid wetland use to the extent practicable. Alternatively, the use of uplands, existing drilling sites and roads, canals, and naturally deep waters should be encouraged. When wetland use is unavoidable, work in unvegetated and disturbed wetlands is generally preferable to work in high quality and undisturbed wetlands;

b. Temporary roadbeds (preferably plank roads) generally should be used instead of canals for access to well sites;

c. Water crossings should be bridged or culverted to prevent alteration of natural drainage patterns;

d. Culverts or similar structures should be installed and maintained at sufficient intervals (never more than 500-feet apart) to prevent blockage of surface drainage or tidal flow;

e. Petroleum products, drilling muds, drill cuttings, produced water, and other toxic substances should not be placed in wetlands;

f. If the well is productive, the drill pad and levees should be reduced to the minimum size necessary to conduct production activities; and

g. Defunct wells and associated equipment should be removed and the area restored to the extent practicable. Upon abandonment of wells in coastal wetlands, the well site, various pits, levees, roads, and work areas should be restored to preproject conditions by restoring natural elevations and planting indigenous vegetation whenever practicable. Abandoned well access canals should generally be plugged at their origin (mouths) to minimize bank erosion and saltwater intrusion, and spoil banks should be graded back into borrow areas or breached at regular intervals to establish hydrological connections.

B. In open estuarine waters:

Activities in estuarine waters should be conducted as follows:

a. Existing navigable waters already having sufficient width and depth for access to extraction sites should be used to the extent practicable;

b. Petroleum products, drilling muds, drill cuttings, produced water, and other toxic substances should not be placed in wetlands; and

c. Defunct equipment and structures should be removed.

C. On the continental shelf:

Activities should be conducted so that petroleum-based substances such as drilling mud, oil residues, produced waters, or other toxic substances are not released into the water or onto the sea floor. The following measures may be recommended with exploration and production activities located close to hard banks and banks containing reef building coral:

a. Drill cuttings should be shunted through a conduit and discharged near the sea floor, or transported ashore or to less sensitive, NMFS-approved offshore locations. Usually, shunting is effective only when the discharge point is deeper than the site that is to be protected;

b. Drilling and production structures, including pipelines, generally should not be located within one mile of the base of a live reef;

c. All pipelines placed in waters less than 300 feet-deep should be buried to a minimum of three feet beneath the sea floor, where possible. Where this is not possible and in deeper waters where user-conflicts are likely, pipelines should be marked by lighted buoys and/or lighted ranges on platforms to reduce the risk of damage to fishing gear and the pipelines. Pipeline alignments should be located along routes that minimize damage to marine and estuarine habitat. Buried pipelines should be examined periodically for maintenance of adequate earthen cover.

12. Other Mineral Mining/Extraction

a. Proposals for mining mineral resources (sand, gravel, shell, phosphate, etc.) from or within 1,500 feet of exposed shell reefs and vegetated wetlands, and within 1,500 feet of shorelines are unacceptable except when the material is to be used for oyster cultch; and

b. All other proposals will be considered on a case-by-case basis.

13. Sewage Treatment and Disposal

Urbanization and high density development of coastal areas has resulted in a substantial increase in proposals to construct sewage treatment and discharge facilities in coastal wetlands. Since many of these facilities utilize gravity flow systems for movement of waste water and materials, wetlands and other low-lying areas are often targeted as sites for placement of pipelines and treatment facilities.

Since pipelines and treatment facilities are not water dependent with regard to positioning, it is not essential that they be placed in wetlands or other fragile coastal habitats. The guidance provided in the section on "Cables, Pipelines, and Transmission Lines," also applies to sewage collector and discharge pipelines. The following guidance should be considered with other aspects of sewage treatment and discharge:

a. Discharges should be treated to the maximum extent practicable, including implementation of up-to-date methodologies for reducing discharges of biocides (e.g., chlorine) and other toxic substances;

b. Use of land treatment and upland disposal/storage techniques should be implemented where possible. Use of vegetated wetlands as natural filters and pollutant assimilators for large scale discharges should be limited to those instances where other less damaging alternatives are not available and the overall environmental and ecological suitability of such an action has been demonstrated;

c. Discharging into open ocean waters is generally preferable to discharging into estuarine waters since discharging into estuarine waters is more likely to result in living marine resources contamination and nutrient overloading. Discharge points in coastal waters should be located well away from shellfish beds, seagrass beds, coral reefs, and other similar fragile and productive habitats. Proposals to locate outfalls in coastal waters must be accompanied by hydrographic studies that demonstrate year round dispersal characteristics and provide proof that effluents will not reach or affect fragile and productive habitats.

14. Steam-Electric Plants and Other Facilities Requiring Water for Cooling or Heating

Facilities that require substantial intake and discharge of water, especially heated and chemically-treated discharge water, are generally not suited for construction and operation in estuarine and near-shore marine environments. Major adverse impacts may be caused by impingement of organisms on intake screens; entrainment of organisms in heat-exchange systems or discharge plumes; and through the discharge of toxic materials in discharge waters. There is a specific need to develop methodology for toxicity tests using local, Marine-tropical organisms. Protected Species Branch personnel should be notified of such projects early in the planning process since the operation of steam-electric plants often affects endangered species such as West Indian manatee. Projects that must be sited in the coastal zone and utilize estuarine and marine waters are subject to the following recommendations:

a. Facilities that rely on surface waters for cooling should not be located in areas such as estuaries, inlets, or small coastal embayments where fishery organisms are concentrated. Discharge points should be located in areas that have low concentrations of living marine resources, or they should incorporate cooling towers that employ sufficient safeguards to ensure against release of blow-down pollutants into the aquatic environment;

b. Intakes should be designed to minimize impingement. Velocity caps that produce horizontal intake/discharge currents should be employed and intake velocities across the intake screen should not exceed 0.5 feet per second;

c. Discharge temperatures (both heated and cooled effluent) should not exceed the thermal tolerance of the majority of the plant and animal species in the receiving body of water;

d. The use of construction materials that may release toxic substances into receiving waters should be minimized. The use of biocides (e.g., chlorine) to prevent fouling should be avoided where possible and least damaging antifouling alternatives should be implemented; and

e. Intake screen mesh should be sized to avoid entrainment of most larval and post-larval marine fishery organisms. Acceptable mesh size is generally in the range of 0.5 mm and rarely exceeds 1.0 mm in estuarine waters or waters that support diadromous, anadromous, catadromous, freshwater and marine fish eggs and larvae.

15. Mariculture/Aquaculture

The culture of estuarine and marine species in coastal areas can reduce or degrade habitats used by native stocks of commercially and recreationally important fisheries. The following criteria should be employed to reduce or eliminate adverse impacts:

a. Facilities should be located on upland. Tidally influenced wetlands should not be enclosed or impounded for mariculture purposes. This includes hatchery and grow-out operations;

b. Water intakes should be designed to avoid entrainment and impingement of native fauna;

c. Water discharge should be treated to avoid contamination of the receiving water, and should be located only in areas having good mixing characteristics;

d. Where cage mariculture operations are undertaken, water depths and circulation patterns should be investigated and should be adequate to preclude the buildup of waste products, excess feed, and chemical agents; and

e. Mariculture sites should be stocked with hatchery-reared organisms only. Non-native species should be certified to be disease free, and project design features that minimize escape or accidental release of cultured species should be required. The rearing of ecologically undesirable and exotic species is unacceptable since escape and accidental release of these species is virtually assured.

C. Mitigation

As a general rule, compensatory mitigation will be considered only after a project has been demonstrated to be water-dependent, has no feasible alternative, is clearly in the public interest, and

all significant impacts are found to be unavoidable. In all cases, mitigation shall comply with the definition of mitigation that is provided at 40 CFR 1508.20 of the Council on Environmental Quality Recommendations. Those recommendations define mitigation as a sequential process whereby impacts are avoided, minimized, rectified, reduced over time, or are offset through compensation. Despite increasing use of mitigation to offset wetland and other losses, there are situations (e.g., projects affecting large, high-quality seagrass beds) where the affected habitats are of such enormous value that the anticipated adverse impacts cannot be offset. In these situations mitigation should be used only after project relocation or abandonment are fully considered and rejected by the construction/regulatory agency. There is also considerable disagreement over the functional equivalency of created and natural wetlands and it should not be assumed that comparable or even larger sized replacement wetlands are necessarily equivalent with regard to habitat values and functions.

As a general rule, mitigation that restores previously existing habitats is more desirable and likely to succeed than that which seeks to create new habitat. The numerous impacted wetlands that exist in the Caribbean provide substantial opportunity for wetlands restoration. Restoration may be relatively simple, such as restoring tidal flows to an impounded wetland area, or more complex such as restoring dredged cuts and disposal areas. Restoration of destroyed emergent and, to a lesser degree, SAV is a feasible and recognized option when implemented with the services of experienced restoration personnel.

The creation of new wetland habitat involves conversion of uplands or, in some situations, submerged bottom to vegetated wetlands or another desirable habitat. Generation of wetland habitat should not involve converting one valuable wetland type to another. For example, building emergent wetlands in shallow water is unacceptable unless it can be demonstrated that the site is insignificant with regard to habitat or water quality function(s) or it previously supported wetland vegetation and restoration is desirable in terms of the ecology of the overall hydrological unit (e.g., estuary). Regardless of which option is used (restoration or creation), a ratio of at least two acres of mitigation for each acre of habitat destroyed should be recommended.

Four basic considerations involved in the planning for habitat generation are type of habitat to be created, and its location, size, and configuration. Each of these considerations must be applied to the specific ecological setting and in accordance with the following recommendations:

a. Habitat type - As a general rule the created habitat should be vegetatively, functionally, and ecologically comparable to that which is being replaced. The principal exception would be those cases where a different habitat is shown to be more desirable based on overall ecological considerations.

b. Location - Except in the case of overriding ecological considerations, the new site should be located as near as possible to the site that would be eliminated. In any event, the new site should be in the same estuarine system as the habitat that is being replaced. The replacement wetland should consider physical implications such as shoaling and existing circulation and drainage patterns.

NMFS considers the overall ecological and environmental implications of its recommendations, including upland impacts. Mitigation that may alleviate impacts to aquatic environments, but cause significant adverse impacts to important upland habitats should be carefully evaluated.

c. Size - The habitat to be restored or created should be at least twice the (areal) size of that which would be destroyed. This requirement is designed to offset differences in productivity and habitat functions that may exist between established project site wetlands and newly developed replacement wetlands. This size difference is also designed to address the possibility that the overall, long-term functional and ecological value of replacement habitats may be less than those of the impacted wetlands at the worksite.

d. Configuration - The configuration of replacement habitats is determined by the ecological setting and physical factors such as existing drainage and circulation patterns. Consideration should be given to maximizing edge habitat and to the needs of desirable biota that may inhabit the site.

Interest in the use of "mitigation banks" or created/restored wetlands that are intended for use in offsetting anticipated future wetland losses is increasing nationwide. Because of the complexity of developing and administering mitigation banks, guidance concerning their creation is beyond the scope of this document. NMFS Caribbean Region Habitat Conservation Division Field Office personnel that are participating in such efforts should consult early with other NMFS office personnel that have undertaken or are involved in such efforts since reliance on existing mitigation banking agreements may be beneficial. Habitat Conservation Division Field Office personnel also should notify other participating agencies that signatory authority for mitigation bank agreements rests with the Regional Administrator. In all cases, consideration of mitigation banks should be guided by the principle that no net-loss of wetlands would be incurred.

D. Habitat Conservation Programs

Involvement by federal and state agencies in habitat conservation programs are noted as follows.

Office of Coastal Zone Management (OCZM), Marine Sanctuaries Program (MSP), NOAA. This program manages and funds the marine sanctuaries program (MSP). On-site management and enforcement are generally delegated to the states through special agreements. Funding for research and management is arranged through grants.

This program was authorized under Title III of the Marine Protection Research and Sanctuaries Act (MPRSA) of 1972. Its purpose is to preserve or restore the conservation, recreational, ecological, or aesthetic values of localized area "... as far seaward as the outer edge of the continental shelf, ...(and in) other coastal waters whether the tide ebbs and flows ..." (MPRSA, Section 302a). In effect, the MSP is a coastal water counterpart to the more familiar national park, forest, wildlife refuge, and wilderness systems. Site management and administrative responsibility for a sanctuary may either be retained by OCZM or delegated with necessary funding support to other appropriate management units.

National Marine Fisheries Service (NMFS). The enactment of the Magnuson-Stevens Act provides for exclusive management of fisheries seaward of state jurisdiction. This includes both specific fishery stocks and their habitat. The process for developing FMPs is highly complex. It includes plan development by various procedures through fisheries management councils. NMFS implements approved plans. The Coast Guard (CG), NMFS, the goverment of the Commonwealth of PR, and the goverment of the Territory of the USVI under agreements, enforce regulations implemented by FMPs. FMPs for reef fish, Caribbean spiny lobster, queen conch, and corals and associated flora and fauna are in effect.

National Park Service (NPS). National parks and monuments are under the jurisdiction of NPS. Management, enforcement, and research are accomplished in house. The system of national parks and monuments operated by the NPS, in the broadest terms, preserve for all times scenic beauty, wilderness, native wildlife, indigenous plant life and areas of scientific significance and antiquity {16 U.S.C. (1)}. Although the NPS includes several marine areas, their distinctly land-based orientation makes them somewhat less likely to include new marine areas within their system.

Minerals Management Service (MMS). This agency has jurisdiction over mineral and petroleum resources on the continental shelf. The MMS along with the U.S. Geological Survey is charged with administering mineral exploration and development on the Outer Continental Shelf (OCS), pursuant to the OCS Lands Act (OCSLA), as amended in 1978 [43 U.S.C. (1331 et seq.)]. The MMS serves as the administrative agency for leasing submerged federal lands.

Fish and Wildlife Service (FWS). FWS assists with environmental impact review, develops biological resource evaluations, and administers the endangered species program with the NMFS. The FWS also manages national refuges for wildlife.

Geological Survey (USGS). The USGS has conducted considerable research in nearshore areas and assisted or cooperated with other institutions and agencies to facilitate logistics and support of research. The USGS also is charged with supervising mineral development operations on the OCS. Further, the USGS must ensure oil company compliance with regulations and lease stipulations once a lease is sold. This represents a key management authority for ensuring protection of nearshore communities. Although these authorities are not comprehensive, they are significant because of the widespread interest in current OCS oil and gas development and its potential impacts.

Coast Guard. The 1978 Waterways Safety Act charges the CG with marine environmental protection. The CG is the general enforcement agency for all marine activity in the federal zone. Among the duties are enforcement of sanctuary and fishery management regulations, managing vessel salvage, and coordinating oil spill cleanup operations at sea.

U.S. Army Corps of Engineers. The COE contracts and regulates coastal engineering projects, particularly harbor dredging and beach renourishment projects. The COE also reviews and is the permitting agency for coastal development projects, artificial reefs, and offshore structures.

Environmental Protection Agency. This agency has a general responsibility for controlling air and water pollution. Disposal of hazardous wastes and point-source discharge permitting are EPA functions. Certain mineral and petroleum exploration and production activities are managed by EPA. Environmental research germane to waste disposal and pollution also are funded.

Federal environmental agencies such as the NMFS, MMS, FWS, and the EPA also analyze projects proposing inshore and offshore alterations for potential impacts on resources under their purview. This is similar to the function of the CFMC's Habitat Committee. Recommendations resulting from these analyses are provided to the permitting agencies (the COE for physical alterations in inshore waters and territorial sea, the MMS for physical alterations in the OCS or the offshore Exclusive Economic Zone (EEZ) and EPA for chemical alterations). Even though the COE issues permits for oil and gas structures in the EEZ, they only consider navigation and national defense impacts, thus leaving the rest to the Department of Interior, in a nationwide general permit.

EPA is the permitting agency for chemical discharges under the National Pollution Discharge Elimination System program of the Clean Water Act for chemicals used or produced in the Islands (i.e., drilling mud, produced water or biocides) and then released, or under the Ocean Dumping Regulations of the Marine Protection, Research and Sanctuaries Act if the chemicals are transported into the Islands for the purpose of dumping. When discharge or dumping permits are proposed, federal and state fish and wildlife agencies may comment and advise under the Fish and Wildlife Coordination Act and the National Environmental Policy Act (NEPA). The CFMC may do likewise under the Magnuson-Stevens Act and NEPA.

E. Recommendations for Improving Habitat Information

The chief concern related to living marine resources is how human activities impact fishery productivity. Research is needed to provide knowledge of the ecological processes that affect energy flow leading to fishery productivity. This understanding of ecological processes must then be linked with information on the health, distribution, and abundance of ecologically important organisms. By understanding the ecological linkages to the production of fishery stocks, managers of fisheries and habitat will be better able to manage living marine resources.

1. Research Needs

Research needed to provide the information necessary to protect, conserve and restore aquatic habitats has been identified in a NMFS Habitat Research Plan (HRP) by Thayer et al. (1996). The HRP, depicted in Figure 1, systematically guides habitat research in four areas: (1) ecosystem structure and function; (2) effects of alterations; (3) development of restoration methods; and (4) development of indicators of impact and recovery. Additionally, the plan emphasizes a fifth area -- the need for synthesis and timely information dissemination to managers. Following is a brief synopsis of each of the five research areas identified in Thayer et al. (1996).

Area 1: Ecosystem Structure and Function - This key area involves research to understand the structure and function of natural ecosystems, their linkages to one another, and the role they play in

supporting and sustaining living marine resources (e.g., their distribution, abundance, and health). Research should include studies on the relationship between habitat and yield of living marine resources, including seasonal and annual variability and the influence of chemical and physical changes on these relationships. Resulting information should provide a foundation for predicting organism and habitat response to perturbation, as well as for predicting recovery or restoration success.

Area 2: Effects of Habitat Alterations - This area involves research to quantify the responses of habitats and fishery resources to natural and man-made alterations. Research should include cause-and-effect studies designed to evaluate responses of fishery resources and habitats to physical and chemical modifications of coastal and estuarine systems. Resulting information should provide a basis for determining the degree of impact, the prediction of recovery rates, and the most effective restoration procedures and protective measures.

Area 3: Habitat Restoration Methods - This area involves research designed to improve the current methods to clean up, restore or create productive habitats, as well as the development and evaluation of new, innovative techniques. Studies should include analyzing the success of sediment sequestration; assessing bioremediation techniques; developing and evaluating new habitat restoration techniques; evaluating the role and size of buffers; and determining the importance of habitat heterogeneity in the restoration process. Resulting information should add to the scientific basis for predicting recovery and stability of restored and created systems. Perhaps most important, the research should generate guidelines for improving management practices and restoration plans.

Area 4: Indicators of Impacts and Recovery - This area involves research aimed at the development of indicators to simplify the process of determining whether an ecosystem, habitat, or living marine resource is affected or is recovering. The development of indicators is critical for judging the status of a habitat or living marine resource and the need for corrective action. Studies should include time-dependent population analyses and contaminant-level follow-up evaluations for sediment, biota and water. This type of research will help managers identify habitat status or "health"; standardize indicators for specific habitats through comparisons across geographic gradients and scales; and develop recommendations on the temporal efficacy of chemical "cleanup" techniques and most appropriate measures to assess success. Such guideposts will be used to develop and improve management practice approaches.

Area 5: Synthesis and Information Transfer - This area involves the transfer of technology and information through the use of all available sources and the application of user-friendly information bases. The use of geographic information systems (GIS) is encouraged, as GIS provides the opportunity to amass large quantities of complex data which provides the potential for making relational observations. Information synthesis and transfer must be provided in a useable format.

In addition to the above research area needs, specific information needs on a species-by-species basis are reflected in the summary habitat tables presented in Section 4 of this amendment. All information provided in the summary habitat tables is an essential ingredient of the above research areas. Thus, any and all blanks contained in the tables represent research that is needed to better understand, define and describe EFH for managed species in the U.S. Caribbean.

2. CFMC's Information and Research Needs

The specific information and research needs identified for the US Caribbean are listed below for each FMP in place. Each FMP includes a section which lists the research needs to monitor the fishery and determine the effectiveness of the management measures that have been implemented by the Council. The CFMC's Operations Plan lists the very specific research that needs to be conducted in support of the successful management of sustainable fisheries.

The most important tool in protecting EFH is the availability of habitat maps that allow for a quantitative description of the areas (i.e., seagrass beds, algal plains, submerged coral reefs, etc.). Toward this goal, the cooperation among agencies is necessary and, as shown in Appendix I (Volume I) is proceeding in the right direction. In addition, in support of the EFH initiative other agencies and programs (such as the CZMP in both Puerto Rico and the US Virgin Islands) have and will be directly collaborating with the Council.

Research needs are identified throughout Section 4.0 and are succinctly summarized in the following paragraphs. Section 5.1 identifies research needs to determine the impact of fishing gear on EFH in more detail.

Reef fish FMP

1. Identification, mapping and quantification of shelf and slope habitats.
2. Distribution and abundance of fish eggs, larvae, juveniles, and adults.
3. Identification, description and mapping of natural fish nursery areas.
4. Identification, description, and mapping of spawning areas.
5. Impact of gear on habitat (applies also to Coral FMP).
6. Identification of recreational fishing/boating activities on species abundance (per life history stage), and habitat (anchoring).

Coral FMP

1. Identification, mapping and quantification of shelf and slope habitats.
2. Impacts of gear, (traps and nets) on habitats (coral reefs, sea grass beds, etc.)
3. Identification of recreational fishing /boating activities on species abundance (per life history stage), and habitat (anchoring).

Spiny lobster FMP

1. Identification, mapping and quantification of shelf and slope habitats.
2. Distribution and abundance of lobster larvae, juveniles, and adults.
3. Identification of natural nursery areas.
4. Identification of migration paths to spawning areas. Identification of spawning areas.
5. Impact of gear (traps, nets) on habitats (Coral FMP, Reef fish FMP).

6. Identification of recreational fishing /boating activities on species abundance (per life history stage), and habitat (anchoring).

Queen Conch FMP

1. Identification, mapping and quantification of shelf and slope habitats.
2. Distribution and abundance of queen conch eggs and larvae.
3. Identification of juvenile habitats.

Identification of recreational fishing /boating activities on species abundance (per life history stage), and habitat (anchoring).

The following research needs have been identified by the CFMC in order of priority for each FMP and include biological, environmental, and socio-economic research needs. Researchers might find this useful in developing research proposals around these topics which the Council has identified as being important in fully complying with the requirements of the Magnuson-Stevens Act regarding EFH.

REEFFISH FMP

High Priority - Short and Long Term

Closed areas have been established for the red hind and the mutton snapper. However, no monitoring of the spawning aggregations that are intended to be protected in these areas is being carried out. A monitoring program should be set up as soon as possible. This could be through the use of divers who could conduct visual censuses of the area three times a week during the months of area closures and once a month during the rest of the year. Individual fish should be tagged at the spawning site and length, weight and sex ratios (either from stripping or through cannulation) determined. (A master fisher, with a special permit could be contracted to assist the scientists in the study.)

Characterization of bottom topography of the known spawning aggregation grounds.

Assessment of the effect of recreational harvest on reeffish at spawning aggregations.

Surveys should be conducted to identify other spawning-aggregation sites of groupers and snappers in the Reef Fish FMP management unit. These surveys should be based in the topographic description and the characteristics described from the known spawning sites (e.g., apparent association between the red hind *Epinephelus guttatus* and the reef building coral *Montastrea annularis*)

Identification of species in seasonally closed areas.

Identification of species in proposed marine conservation districts.

Socio-economic studies for trap reduction program and/or harmonization of trap mesh size.

Assessment of gear impact on fish habitat (e.g., nets).

Medium Priority - Short and Long Term

Validation of growth curves (age at length) via the use of tetracycline for red hind, coney and other groupers, as well as for the mutton snapper and other snappers.

Low Priority - Long Term

Collect more biological information by species, particularly concerning fecundity, growth, and mortality.

Continue to standardize data collection, entry, and storage as much as possible. Document and initiate universal procedures for data collection and entry in the US Caribbean. Expand NMFS data collection programs and data files to routinely update and include new Caribbean data, especially "state-federal" landings for the USVI and Puerto Rico.

CORAL FMP

High Priority

Characterization of bottom in areas considered for marine reserves. This includes visual census of marine reserve biotopes and monitoring of selected areas; before, during and after closure, if there is any area that could be re-opened to public access in the future.

Assessment of all anthropogenic activities affecting corals.

Assessment of anchor damage and other recreational activities on reefs.

Baseline study on recreational use of coral reef areas (e.g., areas visited, number of boats, etc.)

Medium Priority

Growth, recruitment, and replacement rates of coral species in the fishery management unit.

Low Priority

Assessment of corals and associated species mortality due to harvesting, handling, and shipping.

Monitoring of scientific work being conducted at reefs.

SPINY LOBSTER FMP

High Priority - Short Term

The diver-based spiny lobster fishery in Puerto Rico should be studied in terms of total effort, areas fished, and size composition of landings, by month, to determine if a closed season is needed for this fishery.

Also, there is a need to assess the taking of spiny lobster by recreational fishers. Survey should include charter boats, SCUBA diving schools, head boats, beach diving, and others.

High Priority - Long Term

Growth and mortality studies are needed for Puerto Rico and the USVI to produce yield-per-recruit models, among other needs.

Fishery independent sampling of lobster size-frequency distributions is needed to better estimate spawning potential.

Setting collectors for juvenile spiny lobster could enhance recruitment of lobster to nursery areas. These areas should be sampled on a weekly/monthly basis to determine whether this practice should be expanded throughout the local range of the spiny lobster.

Medium Priority - Short Term

More information is needed on frequency of female spawning by size class.

Low Priority - Short and Long Term

To continue standardizing, as much as possible, data collection, entry, and storage.

CONCH FMP

High Priority - Short Term

The FMP was approved in 1997. Therefore, monitoring of the commercial and recreational catch needs to be done immediately since bag limits have been established. Reduction of these bag limits is contingent upon the status of the fishery. (This is needed on a short-term and long-term basis.)

A database of commercial fishers involved in the conch fishery is of extreme importance at this time. A total of 319 commercial fishers use SCUBA gear (Caraballo and Torres Rosado, 1989) yet few report their catch statistics. An estimate of effort by fisher, boat, area, time is needed to evaluate the queen conch fishery.

Recreational fishing for queen conch needs to be assessed in the USVI since bag limits have been established in federal waters for this fishery.

High Priority - Long Term

Growth and mortality studies are needed for the areas of Puerto Rico and the U.S.V.I. to produce yield-per-recruit models.

More information is needed on frequency of female spawning by size class.

Studies conducive to the re-seeding of areas should be undertaken, such as:

1. Identification and information on natural nursery areas,

2. release techniques need to be improved to increase survival of juveniles,

3. studies conducted toward improvement of the quality of hatchery-reared stocks.

Medium Priority

Collection of landings, fishing data of other conch species, such as *Strombus pugilis*, among others.