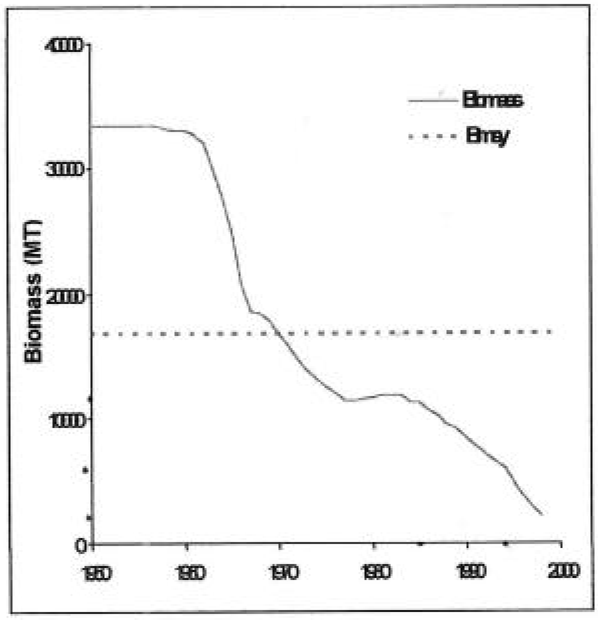
PETITION FOR THE LISTING OF THE ATLANTIC WHITE MARLIN AS A *THREATENED* OR *ENDANGERED* SPECIES

The Biodiversity Legal Foundation (BLF) and James R. Chambers hereby petition to list as *threatened* or *endangered* the Atlantic white marlin, *Tetrapturus albidus* Poey (1860), throughout its known range, and to designate *critical habitat* under the Endangered Species Act, 16 U.S.C. '' 1531-1544 (ESA). This petition is filed under 5 U.S.C. ' 553 (e), 16 U.S.C. ' 1533, and 50 C.F.R. '' 424.14, 424.10 which give interested persons the right to petition for issuance of a rule. The National Marine Fisheries Service (NMFS), within the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce, has jurisdiction over this petition under 16 U.S.C. ' 1533 (a) of the ESA.

The Atlantic white marlin merits listing as a *threatened* or *endangered* species under the ESA because its population has declined to the point that it is now **threatened with extinction** throughout its range. As discussed in detail in Section VIII, below, the best available scientific information has documented a severe population (or stock) decline caused by commercial over-fishing by many nations (targeting swordfish and tunas). Increasingly severe overfishing has been allowed to exist for over 30 years by the International Commission for the Conservation of Atlantic Tunas (ICCAT), which claims management authority for all Atlantic tunas and tuna-like fishes. The population's decline has been documented thoroughly by ICCAT's scientific advisors, the Standing Committee for Research and Statistics (SCRS). Stock assessments conducted by the SCRS represent the consensus of the world scientific community. According to the SCRS's latest stock assessment conducted in July of 2000 (SCRS/00/23, reproduced in Appendix 1), the population's abundance was last at its long-term sustainable level in 1980. By the end of 1999, its abundance had declined to only 13 percent of its sustainable level. Depicted below is the record of 40 years of decline (source: WHM-Fig.4 , SCRS/00/04B).



WHM-Fig. 4. Biomass trajectory estimated for white marlin with single combined index.

The cause: fishing mortality (fishing pressure) had been allowed to rise dramatically to 8 to 10 times the sustainable level by the end of 1999. At this rate of decline, the species will become *functionally* or *ecologically extinct* well within the foreseeable future (in less than five years) unless dramatic remedial action is taken both nationally and internationally, as we recommend herein. Based on the detailed record developed by the SCRS for ICCAT, it is clear that the existing international and domestic regulatory mechanisms and programs controlling fishing have long been inadequate to conserve white marlin. Domestically, this is the responsibility of the Secretary of Commerce acting though NMFS. The domestic and international fishery management bodies have failed to limit catches sufficiently and protect key habitats (i.e., prime spawning and feeding areas) in order to maintain the white marlin population at its long-term sustainable level (ICCAT's stated management objective). Failure to maintain a healthy white marlin population undermines the objectives of the Atlantic Billfish Fishery Management Plan (FMP) (SAFMC, 1988) and fails to comply with the basic requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The latter stipulates that populations of fishery resources are to be maintained at their optimum yield (an abundance greater than the long-term sustainable level) and bycatch (the incidental capture of unintended, unwanted or prohibited species) is to be avoided and minimized.

I. Petitioners

The Biodiversity Legal Foundation (BLF) is a science-based, non-profit organization dedicated to the preservation of all native wild plants and animals, communities of species, and naturally functioning ecosystems. Through visionary education, administrative, and legal actions, the BLF endeavors to encourage improved public attitudes and policies for all living things. The BLF has tracked changes in the biological status of numerous imperiled marine and estuarine species over the past 10 years.

James R. Chambers is a fisheries biologist with 36 years of professional experience. He is the principal of Chambers and Associates, a scientific consultancy specializing in conserving marine fish and their essential habitats. For the final two years of his 30-year federal government career, he was responsible for management of Atlantic swordfish and billfish in the Highly Migratory Species Management Division in NMFS headquarters. He holds a M.A. degree in Marine Science from the Virginia Institute of Marine Science, College of William and Mary.

II. Statutory Framework: the Endangered Species Act and the Administrative Procedure Act

This section of the petition briefly reviews the purposes of the ESA, the listing and critical habitat designation process, substantive protections provided by the ESA, and the provision of the Administrative Procedure Act (APA) that allows people to petition for the issuance of a rule.

A. Purposes of the Endangered Species Act

While the Endangered Species Preservation Act of 1966, Pub. L. No. 86-699, 80 Stat. 926, and the Endangered Species Conservation Act of 1969, Pub. L. No. 91-135, 83 Stat. 275, laid the framework for federal efforts to conserve endangered species, Congress recognized in 1973 that existing law Asimply d[id] not provide the kind of management tools needed to act early enough to save a vanishing species.@ S. Rep. No. 307, 93rd Cong., 1st Sess. 3 (1973). Accordingly, in enacting the ESA, Congress intended to Awiden the protection which can be provided to endangered species.@ H. R. Rep. No. 412, 93rd Cong., 1st Sess. 1 (1973). AAs it was finally passed, the Endangered Species Act of 1973 represented the most comprehensive legislation for the preservation of endangered species ever enacted by any nation.@ <u>Tennessee Valley Authority v. Hill</u>, 437 U.S. 153, 180 (1978).

Congress understood that A[t]hroughout the history of the world, as we know it, species of animals and plants have appeared, changed, and disappeared,@ but at the same time, Congress believed that the disappearance of species appeared to be accelerating. H. R. Rep. No. 412, 93rd Cong., 1st Sess. 4 (1973). As the Committee on Merchant Marine and Fisheries noted, this belief provided Aan occasion for caution, for self-searching and for understanding. Man=s presence on the Earth is relatively recent, and his effective dominion over the world=s life support systems has taken place within a few short generations. Our ability to destroy, or almost destroy, all intelligent life on the planet became apparent only in this generation. A certain humility, and a sense of urgency, seem indicated.@ *Id*.

In light of this concern, Congress intended that the ESA Aprovide a means whereby the ecosystems upon which *endangered* species and *threatened* species depend may be conserved, [and] to provide a program for the conservation of such *endangered* species and *threatened* species**Y**.@ 16 U.S.C. ' 1531(b). In turn, *conserve* was expansively defined as the Ause of all methods and procedures which are necessary to bring any *endangered* species or *threatened* species to the point at which the measures provided pursuant to [the ESA] are no longer necessary.@ *Id*.

1. The Listing and Critical Habitat Designation Process

AThe listing process under Section 4 is the keystone of the Endangered Species ActY The proper operation of this section is critical to the implementation of the Act, as it determines which species receive the protections of the Act.@ H. R. Rep. No. 567, 1982 U.S.C.C.A.N. 2810, 2819.
Several sections of the regulations implementing the ESA (50 C.F.R.) are applicable to this petition. Those concerning the listing of the Atlantic white marlin as a *threatened* or *endangered* species are:

424.02(e) *Endangered species* means a species that is in danger of extinction throughout all or a significant portion of its range. (m) *Threatened species* means any species that is likely to become an *endangered* species within the foreseeable future throughout all or a significant portion of its range. (k) *Species* includes any species or subspeciesYand any distinct population segment of any vertebrate species that interbreeds when mature.

424.11(c) "A species shall be listed . . . because of any one or a combination of the following factors:

2. The present or threatened destruction, modification, or curtailment of habitat or range;
3. Overutilization for commercial, recreational, scientific, or educational purposes;
4. Disease or predation;
5. The inadequacy of existing regulatory mechanisms; and
6. Other natural or manmade factors affecting its continued existence."

Four of the factors set out in section 424.11(c) are applicable to the Atlantic white marlin: overutilization for commercial purposes, predation, inadequacy of existing regulatory mechanisms and other natural or manmade factors affecting its continued existence. These are discussed in detail in Section IX, below.

Based on the documentation provided below, petitioners contend that the provisions of 50 C.F.R. compel the expeditious listing of the Atlantic white marlin as *threatened* or *endangered* throughout its known historic range.

To the maximum extent practicable, within 90 days after receiving the petition of an interested person to add a species to the lists of *endangered* and *threatened* species, the Secretary shall make a finding as to whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted. 16 U.S.C. ' 1533 (b)(3)(A). If the petition is found to present such information, the Secretary shall promptly commence a review of the status of the species. *Id*.

Within 12 months after receiving a petition that is found under section 4(b)(3)(A) to present substantial information indicating that the petitioned action is warranted, the Secretary shall make one of three findings: that the petitioned action is not warranted, that the petitioned action is warranted, in which case the Secretary publishes the proposed regulation in the Federal Register, or that the petitioned action is warranted but precluded. 16 U.S.C. '1533(b)(3)(B).

Within the one-year period beginning on the date the general notice is published regarding a proposed regulation, the Secretary shall publish in the Federal Register, if a determination as to whether a species is *endangered* or *threatened*, or a revision of *critical habitat*, is involved, either a final regulation to implement the determination, a final regulation to such revision or a finding that such revision should not be made, notice that the one-year period is being extended, or notice that the proposed regulation is being withdrawn. *Id.* at ' 1533 (b)(6)(A). If the Secretary finds with respect to a proposed regulation that there is a substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination or revision concerned, the Secretary may extend the one-year period for not more than six months for the purposes of soliciting additional data. *Id.* at ' 1533 (b)(6)(B)(i).

A final regulation designating *critical habitat* of an *endangered* species or a *threatened* species shall be published concurrently with the final regulation implementing the determination that such species is *endangered* or *threatened*, unless the Secretary deems that it is essential to the conservation of such species that the regulation implementing such determination be promptly published, or *critical habitat* of such species is not determinable, in which case the Secretary, with respect to the proposed regulation to designate such habitat, may extend the one-year period by not more than one additional year, but not later than the close of such additional year the Secretary must publish a final regulation, based on such data as may be available at that time, designating, to the maximum extent prudent, such habitat. 16. U.S.C. ' 1533 (b)(6)(C).
By statute, *critical habitat* is defined as:

(7) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and

(8) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species.

Id. at ' 1532(5). The determination of *critical habitat* shall be based on the best scientific data available. 50 C.F.R. ' 412.12.

The Secretary, in designating *critical habitat*, shall identify any significant activities that would either affect an area considered for designation as *critical habitat* or be likely to be affected by the designation, and shall, after proposing designation of such an area, consider the probable economic and other impacts of the designation upon proposed or ongoing activities. 50 C.F.R. ' 424.19. The Secretary may exclude any portion of such an area from the *critical habitat* Aif the benefits of such exclusion outweigh the benefits of specifying the area as part of critical habitat.@ *Id.* However, the Secretary Ashall not exclude any such area if, based on the best scientific and commercial information available, he determines that the failure to designate that area will result in the extinction of the species concerned.@ *Id.*

Regulations implementing section 4 provide additional procedural considerations. *Critical habitat* shall be specified to the maximum extent prudent and determinable at the time a species is proposed for listing. 50 C.F.R. ' 412.12. A designation of *critical habitat* is not prudent when one or both of the following situations exist: the species is *threatened* by taking or other human activity, and identification of *critical habitat* can be expected to increase the degree of threat to such species, or the designation of *critical habitat* would not be beneficial to the species. *Id.* at ' 412.12(a)(1). *Critical habitat* is not determinable when one or both of the following situations exist: information sufficient to perform required analyses of the impacts of the designation is lacking, or the biological needs of the species are not sufficiently well known to permit identification of an area as *critical habitat*. *Id.* at ' 412.12(a)(2).

In determining what areas are *critical habitat*, the Secretary Ashall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection.@ 50 C.F.R. ' 412.12(b). Such requirements include, but are not limited to: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. *Id.*

When considering the designation of *critical habitat*, the Secretary shall focus on the principal biological or physical constituent elements within the defined area that are essential to the conservation of the species. *Id.* Known constituent elements shall be listed with the *critical h*abitat description. *Id.* Primary constituent elements may include, but are not limited to, roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dry land, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types. *Id.*

2. Substantive Protections Provided by Listing

Once a species is listed, the ESA contains several different substantive protections for listed species. Section 4(f) of the ESA requires that the Secretary prepare a *Recovery Plan* for the species, unless he finds that such a plan will not promote the conservation of the species. 16 U.S.C. ' 1533(f). In developing and implementing such a plan, the Secretary shall, to the maximum extent practicable, incorporate in each plan Aa description of such site-specific management actions as may be necessary to achieve the plan=s goal for the conservation and survival of the species.@ 16 U.S.C. ' 1533(f)(1)(B)(i).

Under Section 7 of the ESA, each federal agency AshallY insure that any action authorized, funded, or carried out by such agency Y is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the SecretaryY to be criticalY.@ *Id.* at ' 1536(a)(2). ADestruction or adverse modification@ is defined by a regulation as Aa direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.@ 50 C.F.R. ' 402.02.

D. Administrative Procedure Act

The APA requires each federal agency to Agive an interested person the right to petition for the issuance, amendment, or repeal of a rule.@ 5 U.S.C. 553(e).

III. Legal Status of Atlantic White Marlin

3. Present Protection or Regulation

Existing legal protection for Atlantic white marlin at both the national and international level is inadequate to conserve the species or prevent its slide toward extinction. Following is a discussion of its limited protection at each level.

7. International

ICCAT, which claims management authority over tunas and tuna-like fishes of the Atlantic Ocean, considers the Atlantic white marlin stock (or population) to be *overfished* and that *overfishing* has taken place for over three decades (SCRS/00/23, SCRS/00/04B). These terms and other technical aspects of fishery stock assessment are discussed in detail in Section VIII., below. ICCAT is described in more detail in Section V.B.2., below. The disturbing results of the latest Atlantic marlin stock assessment (conducted in 2000) are reproduced in Appendix 1 (SCRS Fourth Billfish Workshop Report, SCRS/00/23) and summarized in the Executive Summaries for White Marlin (SCRS/00/04B) and Blue Marlin (SCRS/00/03B), both reproduced in Appendix 2. In view the severity of the population declines of Atlantic white marlin (see Appendix 2, WHM-Fig. 4) and Atlantic blue marlin (see BUM-Fig. 3), ICCAT has adopted what are to be considered binding recommendations calling for additional landings reductions by its members to reduce the excessive and still escalating level of fishing mortality for both stocks (see WHM-Fig. 5 and BUM-Fig. 4). Specifically, it has recommended that, beginning June 1, 2001, all of its 31 member nations reduce their white marlin landings by 67 percent and blue marlin landings by 50 percent from each member's 1999 landings levels, and that all live billfish be released. (However, as discussed below, reduction in reported landings does not mean that white marlin mortality will be reduced sufficiently to keep the species from meriting listing.) Retention of billfish unavoidably killed is permitted provided they are not sold. Several artesianal fisheries with minor landings were exempted from these limits. (Annex 7-13, reproduced in Appendix 4).

2. United States

2

The Atlantic white marlin is not listed as *threatened* or *endangered* under the ESA. However, it was first listed as *overfished* in 1997 by the Department of Commerce (NMFS, 1997) as required by the Magnuson-Stevens Act (16 U.S.C. ' 1801) as amended by the Sustainable Fisheries Act of 1996 (SFA) (Pub. L. 104-297). (The most recent Secretarial listing of *overfished* species is contained in NMFS, 2001c.) Billfish are reserved solely for the recreational sector (no commercial sale, landings or possession) under the Atlantic Billfish FMP. However, as will be discussed below, most documented billfish mortality (approximately 99 percent) is caused by commercial fishing as bycatch - marine species that are caught unintentionally and often discarded, usually dead or dying. The current minimum recreational size limit is 66 inches lower jaw fork length (LJFL) for white marlin and one marlin (white or blue) landed per vessel per day. At the 2001 ICCAT meeting, the U.S. agreed to limit its recreational billfish landings to 250 marlin per year (a figure somewhat larger than its recent documented landings). ICCAT's new recommendations are to be implemented and self-enforced beginning June 1, 2001.

4. Relevant Laws and Conventions

There are several international conventions and national laws that are important to the management of Atlantic white marlin. They, and the entire U.S. fishery management regime, are discussed in detail in Amendment 1 to the Atlantic Billfish FMP (NMFS, 1999a). These include:

8. International
   _ International Convention for the Conservation of Atlantic Tunas
   _ United Nations Convention on the Law of the Sea (U.N. Agreement) Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

9. United States
   _ Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. '' 1801 *et seq*.
   _ Endangered Species Act of 1973, 16 U.S.C. '' 1531 *et seq*.
   _ Sustainable Fisheries Act of 1996 (Pub. L. 104-297)
   _ Atlantic Tunas Convention Act, 16 U.S.C. '' 971 *et seq*.
   _ Fish and Wildlife Act of 1956 (Pub. L. 84-1024)
   _ National Environmental Policy Act (Pub. L. 91-190)
   _ Administrative Procedure Act, 5 U.S.C. '' 706 *et seq*.

5. Major Fishery Management Programs
   _ International Commission for the Conservation of Atlantic Tunas (ICCAT)
   _ ICCAT's Standing Committee on Research and Statistics (SCRS)
   _ Highly Migratory Species Management Program, NMFS, NOAA, U.S. Department of Commerce

6. Major Programmatic Documents
   _ Report of the Fourth ICCAT Billfish Workshop - Billfish Detailed Report (Appendix 1);
   _ 2000 White Marlin - SCRS Executive Summary (Appendix 2);
   _ Report of the Third ICCAT Billfish Workshop - Billfish Detailed Report, 1998;
   _ Report of the Second ICCAT Billfish Workshop - Billfish Detailed Report, 1992;

- Recommendation by ICCAT to establish a plan to rebuild blue marlin and white marlin populations, 2001 (Appendix 4);
- Fishery Management Plan for the Atlantic Billfishes, 1988;
- Amendment 1 to the Atlantic Billfish Fishery Management Plan, 1999;
- 2001 Stock Assessment and Fishery Evaluation for Atlantic Highly Migratory Species;
- 2001 Report to Congress, Status of Fisheries of the United States;
- Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks;
- Draft Amendment 1 to the Fishery Management Plan for Atlantic Swordfish;
- Managing the Nation's Bycatch: Programs, Activities, and Recommendations for the National Marine Fisheries Service;
- Final Supplemental Environmental Impact Statement, Regulatory Amendment 1 to the Atlantic Tunas, Swordfish and Sharks Fishery Management Plan, Reduction of Bycatch, Bycatch Mortality, and Incidental Catch in the Pelagic Longline Fishery;
- National Standards Guidelines, 50 CFR Part 600 subpart D *et seq*.;
- Atlantic Billfish Fishery Management, 50 CFR Part 644 *et seq*.;
- Highly Migratory Species Management, 50 CFR Part 635 *et seq*.; and
- Atlantic Swordfish Fishery Management, 50 CFR Part 630 *et seq*.

IV. Description of Atlantic White Marlin

7. Taxonomy

The scientific name of the Atlantic white marlin species is *Tetrapturus albidus* Poey (1860). Common names include white marlin or Atlantic white marlin and locally spikefish or aguja blanco. Other species of the genus *Tetrapturus* include striped marlin (*T. audax*), longbill spearfish (*T. pfluegeri*), shortbill spearfish (*T. angustirostris*), Mediterrenaen shortbill spearfish (*T. belone*) and roundscale spearfish (*T. georgii*). These species are classified within the family, Istiophoridae or billfishes. Others in the billfish family include blue marlin (*Makaira nigricans*), black marlin (*M. indica*) and sailfish (*Istiophorus platypterus*). The Istiophoridae are classified in the suborder Scombroidei, which also includes the swordfish (*Xiphias gladius* - sole member of the family Xiphiidae) and the tunas (family Scombridae).

8. Physical Appearance

The white marlin is a sleek, powerful fish of the open ocean colored deep blue on the upper half of its body and silvery-white on its lower half, armed with a long, sharp-pointed bill (for feeding and defense) and having a long tapered dorsal fin. Like all the Istiophoridae, the bill is formed by the prolongation of the snout and upper jaw, from which the family derives its name. In white marlin, its length (measured from the eye) is about twice the distance from the eye to the posterior edge of the gill cover. Marlin lack teeth except as larvae when their bodies are greatly different with large heads, a shortened trunk and small ovate tails. Their bodies grow to be long, streamlined, and powerful. The caudal fin is large, stiff and lunate (deeply forked). A pair of longitudinal keels on each side of the caudal peduncle increases its strength and thrust. White marlin have a long first dorsal fin which extends from the nape two-thirds the length of the trunk in a typical falcate outline. Its body is colored dark blue on its dorsal surface, pale on the sides and white on its belly. The lateral line is not readily visible, nor are its tiny lanceolate scales. For an illustration see Bigelow and Schroeder (1953).

White marlin grow to at least 9.2 feet. (280 cm) total length (TL) and 181 pounds (82 kg) although few reach a weight of 125 pounds. Females grow larger than the males (Nakamura, 1985, Mather *et al*., 1975). There are no morphological features or color patterns to differentiate the sexes. White marlin females mature on average at about 45 pounds and a length of 61 inches LJFL while males mature at about 40 pounds and about 55 inches LJFL (de Sylva and Breeder, 1997). White marlin first become vulnerable to commercial fisheries at about 30 pounds (NMFS, 1999a). They may live for 25 to 30 years of age (NMFS, 1999a) producing dramatically larger numbers of eggs with increasing size.

V. Significance

9. Ecological Importance

The Istiophoridae (billfishes) are apex or top predators of the open ocean. They are some of the largest and swiftest animals in the sea and display behavioral, anatomical, and physiological adaptations for a mobile open-sea existence. White marlin, at a maximum weight of perhaps 200 pounds, are the smallest of the world's four marlin species. Maximum sizes of the others are perhaps 3,000 pounds for blue marlin, 2,500 pounds for black marlin and 550 pounds for striped marlin. White marlin are slightly smaller than Pacific sailfish and about double the maximum size of Atlantic sailfish and the various spearfish. Swordfish can weigh more than 2,200 pounds. However, they are so different in many other respects from the other billfish, that they are the only species in a completely separate family (Xiphidae). Both black and striped marlin are found only in the Pacific and Indian Oceans, while blue marlin and swordfish are found in all three oceans.

Each Istiophorid species has evolved to fill a specific niche centered on best exploiting the available prey and occupying somewhat different habitats in search of that prey. A pelagic and oceanic species, white marlin usually swim above the thermocline in waters with surface temperatures of more than 22°C. They frequent the higher latitudes of the northern and southern hemispheres only during their respective warm seasons, phased six months apart (as illustrated in WHM-Fig. 1. And BUM-Fig1 reproduced in Appendix 2). Unlike blue marlin, white marlin are found only in the Atlantic Ocean and adjacent seas (SCRS/00/23). They are epipelagic, being found primarily in the upper 300 to 600 ft (100 to 200 m) of open-sea areas, and neritic (utilizing the waters over the continental shelf), and are also found in coastal waters seasonally. White marlin can be found off the American East Coast from Nova Scotia to Brazil, and on the eastern side of the Atlantic Ocean from southern Europe (including the Mediterranean Sea) to South Africa (NMFS, 1999a). While their abundance has declined by more than 90 percent, we are aware of no published studies documenting a collapse in their range. Anecdotal evidence (see statement by Dr. Safina, below) suggests their inshore abundance has diminished with the decline in their abundance. They now appear to be found predominantly in only their essential habitats.

Their key spawning and fall feeding areas are located at the extremes of their range, as will be discussed below. Concentrations of white marlin are seen in the summer and the early fall in the Middle Atlantic Bight, the northern Gulf of Mexico, and off La Guaira, Venezuela.

White marlin migrate thousands of miles annually throughout the tropical, subtropical, and temperate waters of the Atlantic Ocean and its adjacent seas. As adults, they feed at the top of the marine food web. Their food resources (small fishes and invertebrates such as squid that can be swallowed whole) are distributed in patches and occur at relatively low densities compared to prey for more generalized (lower trophic level) feeders. The foraging and movement patterns of white marlin and other billfish reflect the distribution and scarcity of appropriate prey in the open seas; these species therefore must cover vast expanses of the ocean in search of sufficient food resources (Helfman *et al.*, 1997). Consequently the distribution of billfish is often correlated with areas with higher densities of prey, such as current boundaries, convergence zones, and upwelling areas. White marlin (like blue marlin and swordfish) are solitary hunters, not schooling species, as are the tunas. However, all these top predators can become concentrated in areas with dense aggregations of prey, which are found in these prime feeding locations.

10. Fisheries Importance

White marlin are sought as a premiere big game species in the United States, in the Caribbean region and throughout their Atlantic Ocean range (IGFA, 2001). According to the SCRS (Appendix 1), white marlin are also taken commercially by longline, entanglement or gillnet fisheries and by purse seine fisheries which target swordfish and the larger tunas, especially in the western Atlantic. A small number are taken by directed artisanal fisheries using small craft in the Caribbean and along the South American coast. They are also caught incidentally (as bycatch) in tropical tuna longline fisheries that use shallow gear deployment.

The highest reported catches of white marlin by the world's industrial fleets have occurred historically in the western central Atlantic (including the Gulf of Mexico and Caribbean), across the central Atlantic in a broad band on either side of the equator lying between Africa and South America, and in a large area off Brazil extending eastward to well beyond the Mid-Atlantic Ridge and nearly to Africa. Historical catch distributions are portrayed graphically by quarter in WHM-Fig.1 of the Executive Summary for the most recent SCRS stock assessment report (SCRS/00/04B in Appendix 2. The historical white marlin catch by ICCAT member countries is quantified in WHM-Table 1, which has also been reproduced in Appendix 2.

The historical catch of white marlin by the U.S. commercial and recreational sectors is portrayed graphically in Fig. 2.1.14 of Amendment 1 to the Atlantic Billfish FMP (NMFS, 1999a). A dramatic decline in recreational landings is obvious beginning in the late 1980s. This decline was the result of voluntary efforts by this sector to promote conservation of the declining billfish populations. The conservation-oriented decline in blue marlin landings by the recreational sector, as portrayed in Figure 2.1.13, began even earlier. During the same period, bycatch of marlin by the commercial sector actually increased. It did so in proportion to the increasing effort (total hooks fished per year) (NMFS, 1999a).

1. Recreational Fisheries

Many anglers consider marlin as the premiere big game fish, worldwide, and billfish anglers are the elite of the recreational fishing community (Ditton, 2000). From the days of authors Ernest Hemmingway and Zane Grey, and the other pioneers of the sport of big game fishing early in the 20^{th} century, catching a large billfish has been considered by many as the ultimate feat in angling. They are big and fast, fight heroically, and jump spectacularly. Consequently, they are wonderful adversaries to play on relatively light sport fishing tackle, which gives the advantage to the fish. To succeed in conquering a large marlin on sport fishing tackle requires the utmost skill and luck on the part of the angler and crew. To have caught one is generally the ultimate achievement in an angler's life. Accordingly, their existence value to the worldwide angling community is inestimable but enormous. This community and those who simply care about conserving the top predators (the "lions and tigers of the seas") numbers well over one quarter of a million. There are over 230,000 billfish anglers in the United States alone (ASA, 1996); annually, they spend an estimated 2,137,000 days billfishing (Ditton and Stoll, 1998). As will be discussed in detail below, they also spend billions of dollars annually to enjoy the excitement of just seeing and fighting such magnificent fish. U.S. billfish anglers spent an estimated $2.13 billion in 1995 in pursuit of their sport (ASA, 1996). This is many times more, by orders of magnitude, than billfish bring annually when sold commercially, as discussed below. Most anglers consider themselves to be strong advocates for conservation of the Atlantic billfish resources (NMFS, 1999a). Today, virtually all billfishing by sport fishers is "catch-and-release." According to government surveys and estimates by sport fishing organizations, anglers release more than 90 percent of the marlin and sailfish they catch. These statistics are discussed in detail below.

Billfish are pursued for sport at "hot spots" throughout their ranges in the Atlantic, Pacific and the Indian Oceans and adjacent seas. Top Atlantic billfish destinations include the Azores, Madeira, Canary Islands, Bom Bom, Ghana, Brazil's Royal Charlotte Bank, Venezuela's La Guaira Bank, the Puerto Rico Trench, the North Drop off the Virgin Islands, the Bahamas, Bermuda, the DeSoto Canyon, Cape Hatteras, and the canyons of the U.S. mid-Atlantic. The all-tackle world record white marlin weighed 181 pounds. Like several other line-class world record white and blue marlin, it was caught off Vitoria, Brazil - a probable prime southern hemisphere spawning ground for both blue and white marlin - at the end of the southern hemisphere's spring spawning season (in early December of 1979).

The white marlin is the primary billfish caught from Cape Hatteras, north. They are caught in the greatest number off the U.S. mid-Atlantic coast and are thus a mainstay of this important billfish fishery (Mather, *et al.*, 1975). The sailfish is the prime species caught off both coasts of Florida, and all three species (white marlin, blue marlin and sailfish) are important seasonally throughout the Gulf coast, particularly above submarine canyons (e.g., De Soto) and deep drop-offs of the continental shelf. The rare spearfish are encountered infrequently.

The world=s largest sport fishery for the white marlin occurs in the summer from Cape Hatteras, NC, to Cape Cod, MA, especially between Oregon Inlet, NC, and Atlantic City, NJ. Successful fishing occurs up to 80 miles offshore over submarine canyons and the edge of the continental shelf, extending from Norfolk Canyon in the mid-Atlantic to Block Canyon off eastern Long Island (Mather, *et al.*, 1975). Concentrations are associated with rip currents and weed lines (fronts), and with bottom features such as steep drop-offs, submarine canyons and shoals (Nakamura, 1985). The spring peak season for white marlin sport fishing occurs in the Straits of Florida, southeast Florida, the Bahamas, and off the north coasts of Puerto Rico and the Virgin Islands. (As discussed below, we believe these are their primary spawning grounds.) In the Gulf of Mexico, (post-spawning) summer concentrations are found off the Mississippi River Delta, at De Soto Canyon and at the edge of the continental shelf off Port Aransas, TX, with a peak off the Delta in July, and in the vicinity of De Soto Canyon in August. In the Gulf of Mexico adults appear to be associated with blue waters of low productivity, being found with less frequency in more productive green waters. While this is also true of the blue marlin, there appears to be a contrast in the factors controlling blue and white marlin abundances, as higher numbers of blue marlin are caught when catches of white marlin are low and vice versa (Nakamura, 1985; Rivas, 1975).

Worldwide, billfishing is increasing in popularity. This has stimulated a huge demand for bigger and better vessels (sportfishers), the largest selling for several millions of dollars, the most sophisticated electronics available (computers for viewing charts and real-time navigating, sea surface temperature charts downloaded from satellites, sonar, radar, and communication equipment) and all manner of very expensive fishing tackle. Costs to purchase and equip a boat for offshore fishing probably averages about $300,000 and ranges from about $100,000 to several million dollars for the long-range sportfishers that travel (or are carried or towed by their mothership) around the globe with the seasons to various "hot" destinations. Operating and maintenance costs for the average sportfisher runs about $150,000 per season. The larger vessels have full-time captains and a crew whose salaries add $150,000 to $300,00. The range in annual operating and maintenance costs are even larger (depending on size of vessel).

The popularity of recreational fishing has stimulated an enormous demand for boats, engines, electronic equipment, and a large variety of (very expensive) fishing tackle. According to the IGFA (2001), 79 percent of new boat purchasers plan to fish. In 1999, there were 35 million fishing trips in the U.S. Atlantic. Most (23 percent) were to Florida's east coast. The next most popular (14 percent) was New Jersey's coast (IGFA, 2001). According to *Patrick Healey, Executive Vice President of the Viking Yacht Co., speaking for the Marine Manufacturers Association (as reported at* www.marlininternational.com/conserva.htm*),* **the recreational boating and fishing industries put $60 billion annually into the U.S. economy. However, he goes on to say, this is "being squandered by the commercial fishing industryY.No fish, no fishing boatsY.The future of the industry looks pretty bleak."**

Many serious anglers also fly with their own specialized equipment to the "hot" destinations around the world and charter top captains and their sportfishers for a week or much longer. Such adventures are frequently described in feature articles published monthly in the world's top big game fishing magazines (*Marlin, Sport Fishing,* the *Big Game Fishing Journal,* and *Salt Water Sportsman)* all of which are read internationally. World records for game fish (marine and freshwater species) are awarded and the extensive list is published annually by the International Game Fish Association (IGFA, 2000). IGFA has representatives in many countries worldwide.

Two decades ago, most billfish were brought to the dock to be "hung" and weighed as well as photographed and admired by crowds. The publicity value to charter captains and marina operators was substantial. Now, in an effort to help the dwindling stocks recover, a very high percentage of the fish caught by all U.S. recreational fishermen (including tournaments) are revived and voluntarily released usually with a tag. In 1995, tournament anglers from many nations reported releasing over 92 percent of the billfish they had caught (NMFS, 1997f). The release ethic has spread since then and tournament billfish anglers now report releasing 99 percent of their billfish catches (Ditton, 2000).

The conservation ethic is also spreading. Many traveling anglers will not book a trip with charter crews that do not practice catch and release. And sportfishing fleets at destinations that still have yet to see the benefits of fully adopting this ethic (e.g., Cabo San Lucas Mexico, Hawaii and the Cayman Islands), are shunned by many traveling anglers. Many tournaments are now even adopting a total-release format, which is a significant commitment since it requires independent observers on board each boat. Points are awarded not on the basis of total weight of dead billfish, but on number of releases by species. The major game fishing magazines rarely if ever run pictures of hanging billfish, preferring photos whenever possible that show living fish about to be released. The growing adoption recently of circle hooks (which can penetrate only in the corner of the fish' mouth and thus avoid potentially lethal "gut hooks" or damage to the throat or gills that can be caused by swallowing a bait containing a traditional J-hook) is an additional indicator of the strong conservation ethic that exists throughout the billfish community, worldwide. As noted above, most billfish anglers consider themselves as strong advocates for conservation and they practice conservation in their own fishing. In many areas of the world, there is now a high level of peer pressure throughout the billfishing community against landing any billfish, and killing a white marlin is rare.

Short-term survival of recreationally-caught Atlantic blue marlin (revived as typically practiced by big game fishing community) has been studied recently and, in this limited case, was found to be 88 percent (Graves *et al*., in press). Of eight blue marlin (150 to 425 lbs.) caught off Bermuda and monitored using pop-off satellite tags, all appeared normal for the five days monitored. The ninth fish was injured during the fight and not expected to live, but tagged to see if it could recover. There have been no post-release survival studies of white marlin caught recreationally (or commercially). However, their survival should be at least as high as that observed in the much larger and stronger blue marlin, particularly as circle hooks replace J-hooks and eliminate the chance for internal injury. According to Hinman (2001), who surveyed fishery scientists that conducted the few billfish catch-and-release studies done to date, "The consensus is that the post-release mortality is probably in the neighborhood of 10 to 15 percent." Hinman also reported results of other tagging studies done: "six blue marlin tracked with no mortalities; 11 striped marlin tracked with all surviving; one mortality among eight sailfish tracked; 23 blue marlin tracked in several different studies, with three deaths."

A controversial study was conducted in the fall of 2000 by the Pfleger Institute of Environmental Research that indicated much higher than normal post-release mortality (Domeier, in press). It was based on 122 striped marlin tagged and released by anglers in Magdalena Bay, Baja, California. Of 40 fish played normally (using 30-pound tackle with similar drag settings), revived and tagged with pop-off satellite tags (set to release if the fish died and sank), 13 or 32 percent apparently did not survive. Many of these were bleeding when released; however, a few fish released strong and healthy also apparently died. The study (especially the methods/equipment employed) has yet to be subjected to full peer review (beginning with its presentation at the World Billfish Symposium in Cairns, Australia, as this document is being prepared). So, its results must be considered only preliminary. Indications from the symposium are that the author may have now changed some pivotal assumptions that radically change the final results thus bringing them more in line with previous studies' findings.

However, a relatively high mortality figure may prove to be an accurate portrayal of the short-term mortality to marlin caught by using live bait with traditional J-hooks as is commonly practiced in some areas, particularly along the Pacific coast of Mexico and in South Florida's "sailfish alley." A long "drop back" is employed to give the billfish ample time to turn the bait in its mouth and to swallow it. If it is swallowed deeply (as is likely), the hook can lodge (initially) in the stomach or throat where it can do great damage to these tissues and to the heart. It can also tear loose (repeatedly) and lodge farther up the throat causing serious injury and producing short fights. Rapid mortality may also result. In contrast, circle hooks can lodge only in the corner of the mouth (the hinge) producing no chance for serious injury. Hook-up percentages are at least comparable. Circle hooks should be used for all fishing (recreational and commercial) where the bait is likely to be swallowed deeply by billfish. J-hooks are appropriate when trolling with dead bait or lures, in which there is no "drop back" or deep swallowing. The clear message should be that to avoid serious injury to the fish you are going to release, use only circle hooks if fishing with live baits. This is a good example of how the recreational and commercial fishing communities can further reduce their billfish mortality. NMFS and the industries themselves should promote and encourage such changes, as the recreational fishing community is now doing. We are confident that as more studies are conducted in the future, we will see that circle hooks eliminate most serious injury and (by also avoiding prolonged fight times by proper tackle selection) can promote high (90 percent or better) post-release survival rates.

Post-release survivorship in tagged bluefin tuna (a similar, more powerful large pelagic species) has also been examined. It was found to be excellent with 97 percent survival for 2 to 30-day deployments of "pop-up" satellite tags on 20 giant bluefin that were caught by anglers (using circle hooks), brought on board for tag implant surgery and subsequently released (Block, *et al*. 2001). However, in addition to being another example of the advantages of using circle hooks, this high survival rate may also be a reflection of the fact that bluefin are just more hardy than are marlin.

We made an effort to estimated the post-release mortality that might be caused by the 230,000 U.S. billfish anglers (ASA, 1996). Assuming an average rate of 0.25 billfish caught per day of fishing, a total of 2,137,000 days spent fishing per year (Ditton and Stoll, 1998), and a (high) post-release mortality rate of 15 percent (Hinman, 2001), yields a total post-release mortality of just over 80,000 billfish per year, worldwide. Of course, this includes not only the white marlin of the Atlantic but also the blue marlin, sailfish and spearfishes of the Atlantic Ocean and the blue marlin, striped marlin, black marlin, sailfish and spearfishes of the Pacific and Indian Oceans. A little more than half the effort is probably devoted to the Atlantic (we assumed 60 percent or 140,000 anglers) and within it, white marlin represent about 19 percent of the billfish catches (from tournament catch percentages in Table 2.1.8, NMFS, 1999a) for a total potential post-release mortality of roughly 9,000 white marlin per year. This is a significant amount. It represents about 7 white marlin killed per 100 anglers per year from the large Atlantic recreational billfishing sector. The total number potentially killed (9,000) is compared, below, to estimates of post-release mortality that might be produced by U.S. longline vessels.

Under the U.S. Atlantic Billfish FMP (SAFMC, 1988), marlin, sailfish and spearfish are reserved solely for the recreational fishing sector. The total available Atlantic billfish resource, including all white marlin, is thus dedicated by U.S. law entirely to the recreational fishing sector. The recreational rod-and-reel fishery is subjected to minimum size and trip limits (63 Fed. Reg. 14030, March 24, 1998; 63 Fed. Reg. 51859, September 29, 1998). This fishery and its management are described in detail in Amendment 1 (NMFS, 1999a).

2. Commercial Fisheries

As is so with blue marlin, most white marlin landings are incidental to swordfish and tuna longline fisheries (Prince *et al*., 1991). Marlin, sailfish and spearfish are caught incidentally by all nations whose commercial vessels are targeting swordfish and the larger tunas. The location of the primary commercial fisheries and the gear used is depicted in Fig. 1 of the SCRS Executive Summaries for both white and blue marlin (Appendix 2). The vessels used generally range from large (80+ ft. in length) to very large (300 ft. or more). They are using three primary gear types - drift or pelagic longlines, drift entanglement nets or gillnets and purse seines, as described below.

Longlines, as much as 80 miles in length with up to 1,000 baited hooks, are used by the fleets from more than 31 nations throughout much of the species' range. When set out in parallel, such drift longlines are the equivalent of "underwater minefields" catching everything with a mouth large enough to swallow a 2-inch baited hook or even swim past them and become foul-hooked. U.S. longline vessels range from small (30 ft.), used for short trips like those along the east coast of Florida, to over 100 ft. for the "distant water fleet" fishing during the warmer months on the Grand Banks and beyond to the east (site of the movie, "The Perfect Storm") and during the winter, near the Equator. Such vessels must steam for 10 days from San Juan, Puerto Rico, just to reach these tropical fishing grounds located in the swordfish's primary spawning area (see Appendix 5). The longlines set by smaller vessels are generally 20 to 25 miles in length while those used by the distant water fleet are 40 to 80 miles in length. See Amendment 1 to the Billfish FMP (NMFS, 1999a) for a description of the U.S. longline fleet, its gear and operations. Longlines are responsible for 92.1 percent of the total reported Atlantic white marlin mortality (SCRS/00/23).

Entanglement or drift gillnets are often referred to as "curtains of death." They have large mesh made of clear, nearly invisible monofilament in which many different species of marine life become ensnared and die. Because of their high rate of bycatch (the incidental capture of unintended, unwanted or prohibited species) international agreements now ban the use of such high seas drift nets, which have been as much as 70 miles in length. A "loophole" in the 1992 United Nations agreement still allows their use if less than 2.5 km long.

Purse seines are small mesh nets used to encircle a large mass of fish and then closed or "pursed" by drawing the bottom of the net together. The heavy net is brought on board using a power block and eventually the fish are dipped out of the net as its is reduced to a small pocket. Large, powerful fish such as tuna and marlin injure themselves severely as they crash wildly into each other in the closing space. Purse seines off west Africa, particularly, have often been set around floating objects called "fishery aggregating devices" that attract large numbers of juveniles of many pelagic species. Thus, they too are well known to produce very high bycatch mortalities to non-target but important species, including billfish.

There are also many small-scale coastal subsistence-type fisheries taking marlin. Small boats and handlines are used in the Caribbean (Manooch, 1991) and off Mexico in the Gulf of Mexico and in the Caribbean off Cozumel Island (SCRS/92/77); artisanal fisheries occur off Venezuela and Jamaica (SCRS/00/74, SCRS/92/73), Brazil (SCRS/96/91) and Ghana (SCRS/92/75); and handline and longline fisheries occur off Barbados (SCRS/92/71).

Atlantic blue marlin will be discussed throughout this document because the two species are closely linked by many factors (such as their life history and their catch by commercial vessels), and because the population decline of white marlin is mirrored by that of blue marlin lending additional credence to each population's stock assessment.

Those nations reporting the highest landings of white marlin (in MT) during 1999 from the North Atlantic include: Chinese Taipei (96), Japan (70), EC-Spain (65), Venezuela (42) and Barbados (34). In the South Atlantic, the highest landings were reported by Chinese Taipei (368), Brazil (157) and Japan (22) (SCRS/00/23). Assuming the average white marlin weighs 45 lbs. dressed weight (dw) as calculated below, the total number of white marlin reported caught and killed by the major fishing nations are as follows: in the North Atlantic - Chinese Taipei (4,700), Japan (3,400), EC-Spain (3,200), Venezuela (2,000) and Barbados (1,700). In the South Atlantic - Chinese Taipei (18,000), Brazil (7,700) and Japan (1,000). Landings for the total Atlantic first appeared in the early 1960s, reached a peak of almost 5,000 MT (or about 245,000 white marlin) in 1965 (five years after longlining was introduced), declined to about 1,000 MT (or 49,000 individual fish) per year during the period 1977-1982, and have fluctuated between about 940 and 1,700 MT (or 46,000 to 83,000 white marlin) through 1999 (SCRS/00/23). Landings for the North Atlantic generally show a trend similar to that of the total Atlantic and have followed the intensity of the offshore longline fisheries (SCRS/00/23).

In just 30 years, pelagic longlines have changed the nature of the fishery of swordfish, tunas and billfish - collectively referred to as highly migratory species (HMS). Once a sustainable fishery that focused on large individual fish with little bycatch (NMFS, 1997a), the HMS fishery is now characterized by 50 percent bycatch rates, severely depleted fish populations and shrinking average fish sizes (the average swordfish caught commercially weighs 88 lbs. compared to 300-400 lbs. at the turn of the 20th century (NMFS, 1997a)). By 1999, the total white marlin landings had declined to 908.5 MT - a reduction of 81 percent compared to peak landings in 1965 (SCRS/00/23). This decline has clearly occurred due to the decline in the population's abundance, not because of a change in fishing location or decrease in effort by the commercial fleets. Their effort has in fact increased during this period and the locations fished have not changed significantly (SCRS/00/23). Reported blue marlin catches reached a peak of 4,206 MT in 1990, and by 1999 had declined to 3316 MT - a 21 percent reduction (SCRS/00/23). Again, this decline reflects a smaller blue marlin population rather than a change in fishing locations or reduction in fishing effort, as noted above. The 1999 catch of blue marlin was almost four times that of white marlin (SCRS/00/23). This difference is probably a reflection of their relative population sizes. Both are caught incidentally, and if anything, white marlin are thought to be less selective in their choice of foods, and thus might be more easily caught, than are blue marlin.

According to ICCAT's data, the commercial fishing fleets of the world cause 99.21 percent of the reported annual Atlantic billfish mortality and 99.89 percent of the reported Atlantic white marlin mortality (see Table 1, below). There are currently 31 members of ICCAT. They are listed on ICCAT's website (www.iccat.es). Many other nations' vessels fish illegally side-by-side with ICCAT member nations (e.g., Belize and Honduras, see ICCAT sanction resolution 99-8). They are not members of ICCAT and do not abide by its catch limits. (However, many ICCAT members such as Spain, France and other EU and northern African states also do not always abide by ICCAT's limits.) Neither do they report their catches. All except the U.S. vessels routinely retain and sell billfish (SCRS/00/23) even though they taste oily, are tough and thus have low commercial value as a commodity in comparison to higher value swordfish and the large tunas, which all fleets target. However, marlin flesh is prized in many Asian countries.

Internationally, Atlantic large pelagic fisheries are managed by ICCAT. It has claimed responsibility for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. It was established in 1969 at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas that was signed in Rio de Janeiro, Brazil, in 1966. About 30 species are of direct concern to ICCAT: Atlantic bluefin, yellowfin (*T. albacares*), albacore (*T. alalunga*) and bigeye tuna (*T. obesus*); swordfish; billfishes such as white marlin, blue marlin, sailfish and spearfish; mackerels such as Spanish mackerel (*Scomberomorus maculatus*) and king mackerel (*Scomberomorus cavalla*); and, small tunas like skipjack (*Katsuwonus pelamis*), black skipjack (*Euthynnus alletteratus*), frigate tuna (*Auxis thazard*), and Atlantic bonito (*Sarda sarda*). According to its website "Through the Convention, it is established that ICCAT is the only fisheries organization that can undertake the range of work required for the study and management of tunas and tuna-like fishes in the Atlantic. Such studies include research on biometry, ecology, and oceanography, with a principal focus on the effects of fishing on stock abundance. The Commission's work requires the collection and analysis of statistical information relative to current conditions and trends of the fishery resources in the Convention area. The Commission also undertakes work in the compilation of data for other fish species that are caught during tuna fishing ("bycatch", principally sharks) in the Convention area, and which are not investigated by another international fishery organizationY. The Convention is open for signature, or may be adhered to, by any Government which is a Member of the United Nations or of any specialized agency of the United Nations. Instruments of ratification, approval, or adherence may be deposited with the Director-General of the Food and Agriculture Organization of the United Nations (FAO), and membership is effective on the date of such deposit. Currently, there are 31 contracting parties." The delegations from all member countries, except the United States, are dominated entirely by large-scale commercial fishing interests (e.g., dealers, importers, exporters, fleet owners and seafood processing and marketing firms). ICCAT is thus a "thinly veiled" union of commercial fishing interests, as its performance record attests (see Appendix 9).

10. Comparison of Catch and Economic Values

ICCAT figures indicate that the international recreational fishing community is responsible for less than 1 percent of the reported billfish mortality, Atlantic-wide, as tabulated below.

Table 1. Total Reported Atlantic Billfish Catch and Discards in Relation to the Catch of the International Sport (Rod and Reel) Fishing Sector in metric tons (MT)

	Total Caught	Dead Discards	Landed by Rod & Reel	R&R as % of Total Caught
Blue Marlin (1999)	3,316 MT	81 MT	44 MT	1.32 %
White Marlin (1999)	908 MT	56 MT	1 MT	0.11 %
Sailfish/Spearfish (1998)	1,730 MT	0 MT	2 MT	0.12 %
Totals	5,954 MT	137 MT	47 MT	0.79 %

Source: ICCAT reports
Blue Marlin and White Marlin - July 2000 Billfish Workshop Report (SCRS/00/23)
Sailfish/Spearfish - Executive Summary, Report of the SCRS on Sailfish-Spearfish (Oct 1999)

For white marlin, international anglers are responsible for only 0.11 percent of the reported Atlantic-wide fishing mortality. Commercial vessels from at least 14 ICCAT member nations are responsible for the remainder - 99.89 percent.

U.S. commercial vessels fishing anywhere in the Atlantic Ocean are prohibited from possessing, retaining, or selling any billfish. The industry refers to these as "regulatory discards." Live billfish must be cut free in a manner intended to promote their survival. U.S. commercial vessels' reported regulatory "dead discards" are listed above. These estimates under-represent the actual mortality, because U.S. longline vessels do not fully report all marlin catches, dead discards or releases, as discussed below. This situation is described at length in the plaintiff's pleading in the pending lawsuit (Civ. No. 1:99-01692, D.C. Cir. 1999) brought by the National Coalition for Marine Conservation against the Secretary of Commerce regarding the agency's failure to minimize billfish bycatch as required by the Magnuson-Stevens Act.

Under-reporting of billfish bycatch by commercial vessels is a problem. Less than five percent of longline trips are monitored by independent observers (2.9 percent in 1998). As public concern has risen over the effects of longlines in decimating populations of billfish, small swordfish and other oceanic species (*threatened* and *endangered* sea turtles, marine mammals, etc.) under-reporting may have increased in the past several years, as noted below.

Appendix 6 contains a published interview with a former longline vessel captain describing how U.S. longline vessels routinely under-report the extent of their kill of marlin, sailfish and sub-legal swordfish. It is entitled "Fed-up commercial longliner reveals nightmarish killing on high seas" (*Florida Sportsman*, 2000). The former longliner points out that they were discouraged by the vessel owner from reporting the bycatch of billfish and other species. "Don't write down nothing. It just adds fuel to the fire." is how it was described. He went on, "I used to fish with a guy who insisted on bringing marlin and sailfish in and cutting their throats; we'd send 'em away bleeding so they wouldn't mess with our gear [get re-hooked]. Hundreds of 'em. It happens all the time. I've done it, and I feel bad about it. That was back [10 years ago] when I first started. I was kind of green. Anything that would mess with the gear, they would kill it."

NMFS has compared the catch reported in mandatory logbooks by U.S. longline vessels with catches on which independent observers were present (Cramer, 1999). To get a more accurate estimate of billfish bycatch than relying solely on commercial vessels' logbook reports, NMFS applied the ratio of observed bycatch to total (logbook) reported effort expended (number of hooks fished) by sampling area and quarter to produce estimates of annual billfish mortality (bykill) (see Cramer, 1996d, 1999; and Cramer and Adams, 1998-2000). Longline vessels were found to consistently under-report the number of small swordfish they discarded (because they were less than 41 lbs. live weight or 33 lbs. dw - the legal minimum size for commercial sale) by a factor of two to four times the number that should have been reported (Cramer, 1999). In other words, the longline vessels caught and discarded two to four times as many baby swordfish as they reported discarding (female swordfish mature at 150 lbs., on average (Arocha, 1999)). According to longliners themselves, over 90 percent of these young fish would have been dead already (*Florida Sportsman, 2000*; p. 35, NMFS, 1997a). The rest would likely die shortly thereafter as a result of the severe trauma (jaws and gills torn apart) inflicted by the heavy longline gear (p. 15, RFA, 1999). The estimated under-reporting of billfish is much greater than for small swordfish. Longline vessels frequently under-reported the number of white marlin that should have been caught by a factor of 10 to 24 times, blue marlin by a factor of 8 to 26 times, and sailfish by a factor of 9 to 26 times. The higher the catch of billfish, the greater was their under-reporting (Table 1., Cramer, 1999). Clearly, existing legal penalties, observer requirements, and law enforcement are not adequate to ensure accurate reporting of catch and apparently, many do not. However, part of the explanation is due to the fact that billfish are being encountered by observer trips less frequently and thus producing more variability in their estimated catch rate as compared to the more numerous swordfish. We suspect that the actual number of billfish under-reported is probably closer to the swordfish under-reporting rate (i.e., two to four times). Since reporting all fish caught is a legal requirement for all HMS permit holders, there is no valid excuse for any under-reporting.

Using the above approach (based on observer bycatch rates by reporting area times the total number of hooks fished), NMFS estimated that in 1995, the U.S. commercial vessels' bykill was 3,658 white marlin. NMFS also estimated a bykill of 2,190 blue marlin and 2,739 sailfish (Cramer and Adams, 1999). The U.S. fleet size would then have been somewhat less than 300 active vessels directly involving about 1,200 crew members (Section 4.4.2, NMFS, 1997a). We recognize that these types of bycatch estimates are not precise since they are based on interception rates of relatively infrequent events collected during less than five percent of longline vessels' trips that were observed and expanding these interception rates to the entire fleet. However, they are the best scientific and commercial data available and they do show at least order of magnitude trends over time. We believe these estimates for 1995 are reasonably accurate or at least they are relatively consistent with those of previous years. After the mid-1990s, the longliners' reporting appears to have changed. With the rise in public concern over the damage being done, there is evidence (see Table 6.7 of NMFS, 2000a) that the amount of marlin bycatch that was reported by longliners had decreased substantially each year and at a higher rate of decline than the documented decline in the two marlin populations, which will be discussed in detail in Section VIII. Accordingly, we think 1995 may be the last year for which there exist relatively reliable data on billfish catch and bycatch that has been reported by U.S. longline vessels.

In contrast, the available information suggests that the recreational fishing sector, numbering in the hundreds of thousands of participants, causes much more limited direct mortality (due to landings) to the Atlantic white marlin population. In 1999, tournament anglers reported catching 2,683 marlin in 118,488 hours of effort. A total of 177 blue marlin and 36 white marlin were boated (NMFS, 2001a). In 2000, preliminary NMFS data from tournaments indicate that 106 blue marlin and 8 white marlin were landed (Buck Sutter, personal communication, August 23, 2001N). Non-tournament anglers (on charter boats or private vessels) also catch and must occasionally take billfish. The number landed is unknown. But it is thought to be low particularly for white marlin (which are small and thus not impressive trophies and not particularly good to eat). Moreover, it appears that the number of billfish purposely killed is diminishing each year with the expansion of a conservation ethic throughout the recreational fishing community enforced by peer pressure at the dock and in the media. Unintentional (post-release) mortality is another matter that is, at best, not yet well-documented.

Accordingly, based on the best scientific information available, we believe that the recreational fishing sector is responsible for landing an insignificant number of Atlantic white marlin each year in comparison to the commercial sector's dead discards. There were 8+ white marlin landed by the U.S recreational sector in 2000. At a minimum, there were an estimated 3,658 white marlin discarded dead by the U.S. commercial sector as recently as 1995 (Cramer and Adams, 1999). Thus, the commercial sector is responsible for about 99.8 percent of the direct annual mortality to white marlin caused by U.S. fishers, and the (international but largely U.S.) recreational sector is responsible for landing and thus purposely killing roughly 0.2 percent. U.S. commercial vessels are estimated to have killed more than 450 times as many white marlin as did the recreational sector in the most recent year for which data are available.

As noted previously, the nation's approximately 140,000 Atlantic billfish anglers are also potentially responsible for post-release mortality of approximately 9,000 white marlin (assuming a high a post-release mortality rate of 15 percent, Hinman, 2001). The combined total mortality caused by the large recreational sector (140,000 anglers) would thus be about 9,008+ white marlin per year.

If 30 percent of the white marlin routinely caught by U.S. longline vessels are already dead and if the yearly total of such dead discards is 3,658 as estimated by NMFS (Cramer and Adams, 1999), then about 12,200 would have been released "alive." We have no estimate of post-release mortality from longlines, so we can only speculate. Considering the trauma experienced by these fish, the post-release survival rate may be quite low. The billfish may have deeply swallowed and thus have been injured severely by the offset J-hook used predominantly (probably exclusively) by longline vessels targeting swordfish. Some billfish may have spent as much as 16 hours on the line. The care given to "live releases" ranges from poor to abysmal, as noted above and in Appendix 6. Accordingly, we conservatively estimate that less than half will survive. (The actual situation could well be that few survive.) If half survived, U.S. longline vessels might be responsible for at least 6,100 additional white marlin deaths per year due to post-release mortality, or a (minimum) total mortality of about 10,000 white marlin per year. This total is 1,000 fish more than that caused by the (international) recreational sector, as estimated above. If few white marlin actually survive, the U.S. commercial sector could be responsible for a total mortality of nearly 16,000 white marlin or almost double that caused by the recreational sector. The U.S. longline fleet totals just over 200 permit holders and involves (at an average of 4 crew per vessel) 800 crew members whereas the recreational billfish sector totals roughly 140,000 anglers and crew.

Because of a very high prices paid for tuna primarily by the Japanese seafood market and for swordfish primarily by the U.S. and European markets (the major importers), all of the large pelagics have been driven to historically low population levels by decades of excessive fishing (see SCRS Executive Summaries and the Detailed Reports for each species managed by ICCAT). This has been exerted by the industrial fishing fleets of many nations using non-selective gears (e.g., longlines, entanglement or gillnets and purse seines) that efficiently catch the economically valuable target species but also kill large numbers of non-marketable species (known as bycatch). Typically, half the fish caught on U.S. longlines are discarded and 55 percent of these are already dead (Hinman, 1998). For a detailed listing of U.S. longline bycatch, see Table 5 of Draft Amendment 1 to Swordfish FMP (NMFS, 1997a). The fate of Atlantic marlin is thus tied directly to the prices paid for large tunas and swordfish. Commercial fishing that incidentally kills billfish will continue until it is no longer profitable to fish for swordfish and tunas. Bluefin tuna are by far the most valuable commercially, often drawing bids of $10 to $20 per pound dw (dressed weight or headed, tailed and gutted) to the U.S. fisherman at the dock. Bluefin are followed in commercial value by swordfish, bigeye tuna (*T. obesus*) and yellowfin tuna (*T. albacares*) at roughly $4 to $8 per pound dw, all varying with supply. Billfish bring a relatively low price of about $1 per pound dw (see NMFS, 1999a, Table 2.1.11).

A single large bluefin tuna can sell for tens of thousands of dollars. According to the Associated Press (Jan. 5, 2001), at the first auction of 2001 at Tsukiji, Tokyo's main seafood market, a single 444-pound bluefin carcass sold for an astounding price of the equivalent of $173,600 or $391 per pound. Bluefin is popularly served raw as sashimi or sushi in restaurants where a plate of slices can command a bill of more than $100. The demand for high quality bluefin created by a willingness to pay such high prices has produced a "gold rush" mentality in pelagic fisheries, worldwide. This has threatened the survival of all the large, commercially valuable pelagics (swordfish, bluefin, bigeye and yellowfin tuna) as well as the other large pelagic species, such as white and blue marlin, that are caught and die as lower value commercial bycatch on the same gear.

U.S. commercial landings of Atlantic large pelagic species totaled $56 million in 1999 (Table 5.7, NMFS, 2001a). This is composed of the following: swordfish - $19 million, bluefin tuna - $15 million, yellowfin tuna - $12 million, bigeye tuna - $5 million and sharks and their fins - $5 million.

The annual total dockside value of Atlantic marlin sold commercially by all ICCAT member nations is estimated at about $18.2 million (see Appendix 7). Together, the "flags of convenience" or rogue nations might land a smaller amount. Thus, the total commercial landings are probably less than $30 million per year.

In contrast, the international recreational fishery for Atlantic billfish (prominently including white marlin) generates much greater economic values (even at their currently low population levels) than does the commercial fishery for Atlantic billfish. The recreational fishery even generates much larger economic values than the total landed value of all Atlantic HMS species caught by the entire U.S. commercial fleet. And it does this without intentionally killing or seriously injuring the vast majority of animals caught (releases self-reported at 99 percent (Ditton, 2000)). Including tournaments and travel by anglers to popular billfish destinations, the international recreational billfish fishery in the Atlantic Ocean must be worth several billion dollars per year, as discussed below. White marlin represent a primary basis for this internationally important and extremely valuable Atlantic-wide fishery. Examples of the billfish fishery's economic values follow.

Recreational fishing is a multi-billion dollar, worldwide industry. In the United States alone, there are 230,000 billfish anglers (3.6 percent of all U.S. anglers fish for billfish), and their annual expenditures are estimated at $2.13 billion (ASA, 1996). Growth is flat in recreational fishing for demographic reasons, but saltwater fishing is in a growth mode (Ditton, 2000). Angler consumer surplus estimates for billfish vary from $550 to $1,200 per trip (SCRS/96/156[rev.]), indicating the net economic benefits from the recreational fishery are significant.

Tournament fishing has also grown dramatically. Approximately 300-400 billfish tournaments are held annually along the U.S. Atlantic coast, including the Gulf of Mexico and Caribbean (p. 2-8 of NMFS, 1999a). Prize money ranges from $50,000 to over one million dollars with bonuses of $500,000 or more for record-sized fish and large side bets by participants called Calcuttas. As an example, the winner of the Big Rock Marlin Tournament (Morehead City, NC) held in June 2001 received $942,100. For weighing-in a 515 lb. blue marlin, the crew will collect more money than the winner of the U.S. Open Golf Tournament. This tournament ended with 3 blue marlin boated (killed and weighed) and 47 billfish releases (19 blue marlin, 18 white marlin and 10 sailfish) for a 94 percent release rate (*Marlin*, 2001). No white marlin were killed. This is a representative tally for most "kill" billfish tournaments. Top producing tournaments in the Caribbean region include Venezuela and Puerto Rico. The March 1999 International La Guaira Billfish Shootout in Venezuela, held during the peak of their blue marlin season, set a record with a total of 256 blue marlin, 46 sailfish, 13 white marlin and four spearfish released by 118 anglers fishing on 40 boats. It broke the all-time tournament record of 190 blue marlin, set a decade ago at the Club Nautico de San Juan's International Billfish Tournament. The 2000 Shootout, held in September during the peak of their white marlin season, produced 343 white marlin releases and 16 blues.

The white marlin is the top species for billfishing from Cape Hatteras NC to the eastern tip of Georges Bank (off Cape Cod, MA) from June through October each year. It is generally the primary focus of the four large mid-Atlantic billfish tournaments: the $500,000 mid-Atlantic White Marlin Open in Cape May, NJ; the $500,000 Ocean City (MD) Billfish Tournament, the Big Rock Billfish Tournament and the Pirates Cove-Oregon Inlet Billfish Tournament, NC.

Fisher and Ditton (1992) completed an inventory of 359 billfish tournaments held in 1989 along the U.S. Atlantic coast, including the Gulf of Mexico, as well as Puerto Rico and the U.S. Virgin Islands. A total of 1,984 billfish anglers were surveyed, with 1,171 anglers responding. Respondents reported spending an average of $1,601 (excluding tournament fees) for a billfish fishing trip that lasted an average of 2.59 days, with an average of 13 trips taken each year. The average amount spent annually on billfish tournament fees was $1,856, or $546 per tournament, giving a $2,147 total expenditure per angler per trip. The total annual expenditure estimates generated from the Fisher and Ditton study indicated that in 1989, billfish tournament anglers spent an estimated $180 million in attempting to catch billfish (tournament and non-tournament trips), giving an average equivalent expenditure of $4,242 for each fish caught or $32,381 for each billfish landed (NMFS, 1999a). Ditton (1996) reported that the annual net economic benefits for the group surveyed was over $2 million. Fisher and Ditton estimated that there were 7,915 U.S. tournament billfish anglers, which translates to a $262 annual consumer's surplus per billfish angler.

Ditton and Clark (1994) provided a description of the economics associated with recreational billfish anglers participating in at least one of 14 billfish tournaments held in Puerto Rico between August, 1991 and October, 1992. A total of 885 resident (of an estimated 1,475 resident billfish participants) and 154 non-resident anglers (82 were from the mainland United States or U.S. Virgin Islands; 72 were from other countries) were surveyed. Trip expenditures per resident averaged $711 per trip (average of 21 trips/year) and $3,945 for non-resident anglers fishing in Puerto Rico (average 7 billfish trips/year in Puerto Rico). Resident angler expenditures averaged $1,963 per billfish caught, while expenditures for non-residents averaged $2,132 per billfish caught. Ditton and Clark (1994) estimated the net economic benefits per trip at $549, yielding total annual net economic benefits of $18 million. Total resident and non-resident (U.S. citizens and foreign countries) angling expenditures were over $21 million and $4 million, respectively.

The economic activity generated by billfish tournaments alone is orders of magnitude greater than the commercial landings of Atlantic billfish by the international community. An analysis of four major U.S. billfish tournaments involving 1,000 boats was recently developed and presented to the U.S delegation at the last ICCAT meeting by IGFA Director, Steve Sloan (see Appendix 7). His analysis shows that the economic activity generated by the 1,000 participants in just four East Coast tournaments was $214.5 million. This is more than 11 times the dockside value of all marlin reported landed by all ICCAT members over the course of a full year throughout the entire North and South Atlantic Oceans ($18.2 million). There are 300-400 billfish tournaments held each year in the U.S. Atlantic Coast and the Caribbean (NMFS, 1999a).

Big game fishing also generates substantial economic activity and employment for local economies. For example, the regional economic impact generated annually by several billfish fisheries is estimated as follows: Manzanillo, Mexico - $9.1 million (Chavez, 2000); Costa Rica - $28 million (Ditton and Grimes, 1996), Puerto Rico - $38 million (Ditton and Clark, 1994); and the Baja, Mexico - $70 million (Ditton, *et al*. 1996). These values are separate from economic activity associated with airline travel, which is also substantial but accrues elsewhere. Since sport fishing for billfish is almost entirely a catch-and-release fishery, these economic benefits flow in perpetuity, if the populations are maintained at a healthy level.

The Caribbean in general, and several sites in particular, such as the Virgin Islands, Puerto Rico and Venezuela, are known worldwide as "billfish capital of the world." The true value of this regional asset is inestimable, especially so in light of the fact that the billfish community now voluntarily releases nearly all (self-reported at 99%, according to R. Ditton, 2000) the billfish they catch thus perpetuating the basis for the fishery indefinitely. However, the tourism, jobs and economic benefits depend entirely on the existence of billfish concentrations. Anglers will travel long distances, often with their own boats and crews, but only to destinations where billfish or other big gamefish catch rates are high. However, as will be shown later, commercial overfishing (primarily longlines) targeting the more valuable (and numerous) swordfish and tunas is driving Atlantic-wide white marlin populations (and to a slightly lesser degree, blue marlin) rapidly toward extinction.

While billfish in general and Atlantic white marlin in particular are extremely valuable economically and to society as important fisheries, we recognize that the economic values they represent have no bearing on whether the species should be listed as *threatened* or *endangered* under the ESA.16 U.S.C. '1533(b)(1)(A) (the Secretary Ashall@ make the listing determination Asolely on the best scientific and commercial data available to himY.@). Such a determination must be made strictly on the basis of the biological status and trends of the population, as will be discussed in detail below. Thus, we are not including the economic information above as a factor that must be considered under Section 4, but rather, only as supplemental information that is provided so that the public, in reviewing this petition, will be aware of the economic value of conserving this species. It is clear that if the NMFS were to consider economic factors in the listing decision, such an action would violate the ESA. However, such factors are required to be considered when designating *critical habitat*, as we are also requesting.

VI. Distribution

11. General Range

White marlin are found in warm waters throughout tropical and temperate portions of the Atlantic Ocean and its adjacent seas (Caribbean, Mediterranean and Gulf of Mexico); however, they seem less abundant in the eastern Atlantic. In the western Atlantic, they are found generally from Cape Cod, Massachusetts, to about Buenos Aires, Argentina. On the east, they are found from about northern Portugal to South Africa (including the Mediterranean Sea). For a map of their range, see Mooney-Seus (1997). As a highly migratory pelagic species, they are found predominantly in the open ocean over deep water, near the surface and always in the vicinity of major ocean currents where their prey is concentrated. For a map depicting the major surface currents of the North Atlantic Ocean, see Appendix 5. From our familiarity with a broad range of information, we believe that white marlin spawning occurs in the spring of each hemisphere (thus is staggered six months apart) and is located in precise areas adjacent to major surface currents centered in the Caribbean region for the northern hemisphere and off the coast of Brazil just north of Rio de Janeiro for the southern hemisphere. (As will be discussed below, we believe there are actually two separate white and blue marlin sub-populations inhabiting the northern and southern hemispheres, just as is already broadly recognized with swordfish.) As temperatures increase in the summer and early fall, adult white marlin migrate toward the poles in search of prey, which is more abundant at the higher latitudes. Until they grow larger and are better able to tolerate colder temperatures, the juveniles remain in nursery areas in the tropics and subtropics. As winter approaches, the adults are pushed from their fall feeding grounds by cold temperatures. They re-appear in the sub-tropics and tropics in time for spawning the following spring. (Blue marlin, sailfish and swordfish all follow the same pattern.)

B. Migrations and Occurrence

The white marlin is an oceanic, epipelagic species that occurs only in the Atlantic Ocean (NMFS, 1999a). It inhabits almost the entire Atlantic from 45°N to 45°S in the western Atlantic and 45°N to 35°S in the eastern Atlantic (Nakamura, 1985). Thus, its range does not extend southward far enough to allow its migration around the southern tips of either South America or Africa and consequently, they are not found in the Pacific, Indian or Southern Oceans. The species is thus confined to deep waters of the Atlantic Ocean.

In the tropics, white marlin usually occur above the thermocline in deep (depths greater than 100 m), blue waters with surface temperatures above 22°C and salinities of 35 to 37 ppt. They are usually in the upper 20 to 30 m of the water column, but may dive to depths of 200 to 250 m where the thermocline is deep. In higher latitudes, such as between New Jersey and Virginia, they were found commonly in shallow coastal waters (de Sylva and Davis, 1963).

In the western North Atlantic, as reported by Bigelow and Schroeder (1953), white marlin were once common in Cuban and Bahamian waters and off southern Florida. In the summer they were also found regularly in abundance off Delaware Bay and in lesser numbers off southern New England.

The annual distribution of white marlin (and the other large pelagics) is tied to their two basic needs - feeding and reproduction. White marlin spawn in the spring in tropical and sub-tropical waters, and move to higher latitudes during the summer (Nakamura, 1985; Mather *et al.*, 1975). Of course, the adults need to be in their spawning areas during the spring and early summer in order to reproduce.

Concentrations of white marlin in the northern Gulf of Mexico and from Cape Hatteras to Cape Cod are probably related to feeding rather than spawning (Mather *et al.*, 1975).

In the northern hemisphere, white marlin spawning concentrations are known to occur in the Straits of Florida (Baglin, 1979); the Greater Antilles, probably beyond the U.S. Exclusive Economic Zone (EEZ), although the locations are unconfirmed (Mather *et al.*, 1975); and in the western Bahamas, the northern Caribbean and off Puerto Rico (de Sylva and Breder, 1997). Spawning occurs in deep, subtropical oceanic waters having high surface temperatures and salinities (20 to 29°C and over 35 ppt). The spawning season probably occurs only once a year, primarily from March to mid- June (de Sylva and Breder, 1997) or April and May (Baglin, 1979). It has been believed that there are at least three important spawning areas in the western north Atlantic: northeast of Little Bahama Bank off the Abaco Islands, northwest of Grand Bahama Island, and southwest of Bermuda. Recent evidence from 10 years of longline catch records (Appendix 8) indicate high concentrations of adult white marlin occur during March to mid-June in the larger passages between many of the islands of the Caribbean. These probable spawning area "hot spots" will be discussed at length below.

During the remainder of the year, white marlin (like the other large pelagics) need to feed as heavily as possible to (a) support their high daily activity rate, (b) fuel their rapid growth, and (c) provide the energy needed by the females to produce large numbers of eggs prior to spawning. Because their prey is more abundant in colder environments of the higher latitudes (toward the poles in each hemisphere), after spawning adult white marlin migrate to seek it out. Thus, after spawning they are found predominantly during the warmer months (summer and fall) at the extremes of their range. From June through October, white marlin are found increasingly concentrated along the edge of the North American continental shelf and the Gulf Stream from Cape Hatteras to the eastern tip of Georges Bank (see White Marlin Quarters 2 through 4 in Appendix 8). With the onset of winter, declining water temperatures eventually drive the fish out of their prime feeding areas and back to the tropics. In the western North Atlantic, they migrate south toward the Caribbean region again probably following the edges of the continental shelf and the Gulf Stream or the Loop Current in the Gulf of Mexico (see Appendices 5 and 8).

We believe the sub-population of white marlin inhabiting the South Atlantic Ocean follows a similar pattern with the changing of the seasons. During the southern hemisphere's spring and early summer (the fall and early winter of the northern hemisphere), white marlin spawn off Brazil (particularly in the area of a large submerged bank, the Royal Charlotte Bank, located off Cabo Frio northeast of Rio de Janeiro). Next, they move south along the edge of the continental shelf toward colder waters off southern Brazil until winter drives them out and back toward the equator again. This seasonal movement is evident in the changing catch locations depicted in WHM-Fig 1. (Appendix 2)

White marlin thus undergo extensive movements, although not as extreme as those of the much larger blue marlin, bluefin tuna and swordfish. Prince, *et al*. (SCRS/00/56) reviewed the status of tagging studies to date, as follows. NMFS's Cooperative Tagging Center (CTC) and The Billfish Foundation (TBF) together have tagged 41,177 white marlin, of which 837 (2.0%) have been reported recaptured. Additionally, the South Carolina Marine Resources Division and NMFS's Shark Tagging

Program have tagged 505 white marlin, of which seven have been reported recaptured. The majority of the releases took place in the months of July through September (the prime recreational fishing season) in the western Atlantic off the East Coast of the United States. Releases of tagged white marlin also occurred off Venezuela, in the Gulf of Mexico, and in the central western Atlantic. The majority of recoveries occurred in the same general area as the original capture. However, a substantial number of individuals were found to have moved between the mid-Atlantic coast of the United States and the northeast coast of South America. Although one individual moved to within 100 nautical miles of the equator, no trans-equatorial (north-south) movements have ever been documented for the species (SCRS/92/60). This is an important point to remember when considering whether there are two separate sub-populations.

Trans-Atlantic (east - west) movement of white marlin is apparently quite rare. Overall, only 1.1 percent of documented white marlin recaptures have made trans-Atlantic movements. The first trans-Atlantic movement for this species was recorded in 1993 between the U.S. Virgin Islands and Morocco (Cramer and Prager, SCRS/92/69). The longest minimum distance traveled was 3,150 nautical miles for a white marlin at large for 576 days (1.6 yr), and the longest recorded time at-large is 11.8 years.

In the northern hemisphere, spawning occurs from March through mid-June, and is apparently centered in the western Bahamas, the Straits of Florida (between Florida and Cuba) and the Greater Antilles including Puerto Rico (de Sylva and Breder, 1997). According to Nakamura (1985), spawning off Cuba is concentrated in May. Based on ichthyoplankton sampling for eggs and larvae, which are difficult to identify to species, spawning grounds are believed to be somewhat constant year-to-year.

Based on the catch by U.S. longliners of high concentrations of adults during their peak spawning period, as evidenced by mandatory logbook reports, the white marlin's primary spawning sites in the northern hemisphere also include the large "passages" between the islands of the Caribbean chain (Greater and Lesser Antilles), an area southeast of St. Croix (centered about 16°N latitude by 65°W longitude), and two large areas located well east of the Lesser Antilles along the edges of two major current systems (the North and South Equatorial Currents) which flow toward the Bahamas and into the Caribbean Sea. The first such area is centered at about 15°N latitude by 50°W longitude and the second at 10°N latitude by 55°W longitude. All these same areas or "hot spots" also appear to be the primary spawning areas of north Atlantic swordfish (see figure on p. 319 in Arocha, 1997, reproduced in Appendix 5) as well as Atlantic blue marlin and to a lesser degree western Atlantic sailfish (Appendix 8). From a decade of longline catch records documented and mapped by Mace (1997), these putative spawning area "hot spots" are used consistently every year. Maps showing these "hot spots" by quarter in 1994 and 1995 for all three billfish species are reproduced in Appendix 8.

Primary nursery areas would be those edges of the continental shelf in the Caribbean Sea (for example the coastal waters off Venezuela), the sheltered waters of the Caribbean Islands, the Gulf of Mexico, the western Bahamas, the Straits of Florida, and the southeast coast of the United States - areas that lie "down current" from the spawning "hot spots." We believe that white marlin thus spend their first two years in these nursery areas moving (along the edges of the major currents) progressively farther north in the summer-fall as they grow older.

During the late summer and fall and until temperatures drop, the adult white marlin concentrate for feeding along the edge of the continental shelf in the northern Gulf of Mexico and from about Cape Hatteras to the eastern tip of Georges Bank (see Mace, 1997). Not coincidentally, these areas are located along the edges of major currents (particularly the leading edges of warm core rings or eddies of the warm current that "break away" and spin onto the shelf) where productivity is high and prey is concentrated - the Loop Current in the Gulf, the Florida Current and the Gulf Stream. See Appendix 8 for Dr. Mace's maps showing the "hot spots" that develop predictably with the seasons.

According to Arfelli (1986), white marlin in the southern hemisphere spawn just northeast of Rio de Janeiro between 17° - 21° S latitude and 37° - 42° W longitude during that hemisphere's late spring and early summer (November to March). This is the Royal Charlotte Bank area, a large submerged shelf located off Cabo Frio and Vitoria, Brazil. The South Equatorial Current between the Gulf of Guinea on the east and a western extension, the Brazil Current, which flows south along the coast of South America may well be used by the southern white marlin sub-population as its primary spawning grounds. As shown in ICCAT maps (Fig. 10, SCRS/00/23), these are the areas where the ICCAT members' commercial vessels congregate. Sport fishing "hot spots" for the largest billfish in the South Atlantic include their probable prime spawning and/or feeding areas - particularly the large submerged bank off Vitoria, Brazil, on the west - where major oceanic currents meet steeply rising submerged "banks."

Thus, there is good reason to believe, as with swordfish, that each hemisphere of the Atlantic Ocean has a separate stock or sub-population of white marlin (and blue marlin). These stocks or sub-populations neither overlap geographically nor interbreed. As further evidence, according to NMFS (1999a), there has been no verifiable record of a trans-equatorial movement by a tagged white marlin. Each hemisphere's sub-population appears to move toward their widely separated spawning areas during each hemisphere's spring, thus their migrations toward the tropics are phased six months apart. The two major Atlantic white marlin spawning areas are centered on the Caribbean region in the northern hemisphere and the Royal Charlotte Bank off Brazil in the southern hemisphere. These two areas are 5,000 miles apart. Therefore, the spawning of each sub-population is widely separated in both distance and time of year. As will be discussed below, genetic studies have been unable to differentiate between the northern and southern hemispheres' populations of white marlin (and blue marlin and between Atlantic white marlin and Pacific striped marlin). The absence of detectable genetic differences has been used by the SCRS as a primary basis for concluding the two sub-populations of white marlin and blue marlin are each a single (total Atlantic) stock. Based on information that apparently has not been considered by the SCRS, we believe there are two separate sub-populations. Recognizing this possibility, the SCRS has modeled all three - a total Atlantic population and two separate hemispheric sub-populations.

VII. Habitat and Ecosystem Relationships

3 A. Overview

Within their broad Atlantic Ocean range, white marlin are found in close association with the edges of major (warm) surface currents over deep water or where such currents flow (usually as large-scale gyres or eddies) against the steep edges of continental shelves, islands or submerged banks creating upwellings. In such area, nutrients are brought to the surface thus stimulating higher levels of phytoplankton growth, which fuels an explosion of life in the entire local marine food web. Accordingly, such areas appear "alive" with huge numbers of prey species (e.g., a variety of smaller fishes and squid) and predators (billfish, tunas, sharks, dolphin, porpoise, whales, sea birds). Preferred feeding areas include deep drop-offs, submarine canyons, and shoals (Nakamura, 1985). Apparently, white marlin spawn in many of the same specific areas of the Caribbean region that are also used by blue marlin, sailfish and swordfish. However, the larger species (blue marlin, swordfish and bluefin tuna which can all grow to over a ton) are able to migrate farther north to feed in the fall, apparently because they are better able to withstand the colder temperatures where prey is more abundant. Sailfish, at less than half the size of white marlin, have the smallest range of all the large pelagics.

4 B. Physical Characteristics

A detailed description of the physical characteristics of white marlin habitats lying within the U.S. EEZ is contained in Chapter 4 of Amendment 1 to the Atlantic Billfish FMP (NMFS, 1999a) and therefore it need not be repeated here. The habitats described represent many of those upon which white marlin (of the northern hemisphere) depend for their survival. However, they are also representative of those habitats and oceanic systems in the southern hemisphere on which that sub-population depends for its survival, as well. Chapter 4 also presents a lengthy discussion of "essential fish habitat" (EFH) within the meaning of the U.S. Sustainable Fisheries Act for white marlin (and for blue marlin and sailfish). Accordingly, it is limited to a small subset of biologically essential habitats throughout the entire range of each stock, i.e., to only those that lie within the boundary of the U.S. EEZ. Consequently, most of the key spawning areas for white marlin (and the other billfish species) are not included as EFH in NMFS' Billfish FMP Amendment. However, the description of various types of EFH are considered to be generally quite <u>representative</u> of the important characteristics of the truly essential habitats of white marlin of both the North and South Atlantic Oceans, and are so included here by reference.

5 C. Biological Characteristics

White marlin are among the top or apex predators within a complex community of large pelagic species typical of Atlantic oceanic and continental shelf ecosystems. These include blue marlin, sailfish, swordfish, bluefin tuna, bigeye tuna and yellowfin tuna; their own predators (makos, other large pelagic sharks and killer whales); and a vast variety of prey species.

The large pelagics including white marlin appear to feed on whatever prey is most readily available. Since billfish lack teeth (except in the larval stage), they are limited to the size of animals that can be swallowed whole. The most important prey items of adult white marlin, at least in the Gulf of Mexico, are squid, dolphin, hardtail jack, mackerels, flyingfish, and bonitos. Other food items found inconsistently and to a lesser degree include cutlassfishes, puffers, herrings, barracudas, moonfishes, triggerfishes, remoras, (small) hammerhead sharks, and crabs. Along the central Atlantic coast, food items include round herring and squid. Jacks and other fishes are consumed as well (Nakamura, 1985). The most frequent stomach contents in 53 specimens from the northeastern Gulf of Mexico, off Florida and off Mississippi, included little tunny, bullet tuna, squid, moonfish, barracuda and puffers (Davies and Bortone, 1976).

Although they are generally solitary (like swordfish and all other marlin), white marlin sometimes are found in small, usually same-age groups. But normally, white marlin form a "pack" only when they concentrate to feed on large schools of prey.

The prominent bill distinguishes all marlins, sailfishes and swordfish. It is hypothesized that this bill is an adaptation for speed (because it lowers the resistance of the water to the billfish's body), that it is used for defense (or offense, which has been witnessed for swordfish) against predators like sharks, and that is used for feeding. In the latter case, the billfish are thought to use the bill to slash through a school of prey then circle back to eat the dead or dazed animals at their leisure. This seems probable for swordfish whose bill is very large a sharp on both sides - a formidable tool or weapon! However, recent underwater video filming of marlin attacking trolled lures or baits show they simply rush their intended prey (usually up from behind or sometimes from the side) and engulf it, rather than using their bill to disable it.

Body shapes and physiological mechanisms of billfish reflect the adaptations to continual and fast swimming, anatomical characteristics that are shared with other large pelagic species. White marlin are counter shaded and silvery, features which provide camouflage in the pelagic realm. The billfish generally have stiff, streamlined bodies that are round or slightly compressed in cross section (fusiform). The large pelagics particularly billfish are the fastest fish in the ocean. Their very large lunate-shaped tails provide the thrust needed to achieve swimming speeds in bursts in excess of 50 miles per hour. Streamlining is enhanced by depressions or grooves on the body surface into which the fins can fit during such burst swimming. They have efficient respiration and food conversion capabilities and a high percentage of red muscle and lipids necessary for continuous, rapid swimming. Billfish have evolved a special respiratory mode known as ram gill ventilation that is believed to conserve energy compared to the more common mechanism whereby water is actively pumped across the gills. Ram gill ventilation requires that the fish swim continuously with the mouth open while water flows across the gill surfaces, but it offers advantages in efficiency suited to the highly mobile lifestyle of the billfish (Helfman *et al.*, 1997).

White marlin and the other billfish also exhibit physiological adaptations that enable them to vertically extend their hunting or feeding ranges. Modified eye muscles, which have lost the ability to contract, produce heat when stimulated by the nervous system, locally warming both the brain and eye tissues. This modification allows billfish and large tunas to hunt in cold (generally deeper) water without experiencing a decrease in brain and visual function (Helfman *et al.*, 1997).

All billfish and even giant bluefin tuna are themselves vulnerable to predation. According to Mather *et al.* (1975), the only predators of adult white marlin may be sharks and possibly killer whales (*Orca orca*). The shortfin mako shark (*Isurus oxyrinchus*) and longfin mako (*I. paucus*) inhabit the same range as white marlin, and they are known to attack large pelagics. Makos are one of the few large ocean predators that attacks and kills animals larger than itself, apparently sometimes working in tandem and rushing their prey out of the darkness from below. Even huge blue marlin (at up to perhaps 3,000 pounds) and bluefin tuna (at more than 2,000 pounds) are vulnerable to such attacks by (much smaller) mako sharks. Killer whales, while rarely encountered, are very capable predators. They are known to disable large, swift pelagic species (particularly giant bluefin) by attacking (often severing) the narrow part of the victim's trunk just forward of the tail. Once immobilized and helpless, the huge animal can then be devoured piece-by-piece by the pack. Large blue marlin are also potential predators. One large individual was found to contain a whole adult white marlin.

VIII. Population Status and Trends

ICCAT's scientific advisory committee, the SCRS, conducts the stock assessments for ICCAT. In the case of billfish, the most recent was conducted and approved at the Fourth Billfish Workshop held in Miami, Florida, during July 2000. Participants are listed in Appendix 3 of SCRS/00/23. It is a truly international scientific committee. The SCRS considers available scientific information in arriving at a consensus view for its recommendation to ICCAT.

A. Stock Identification

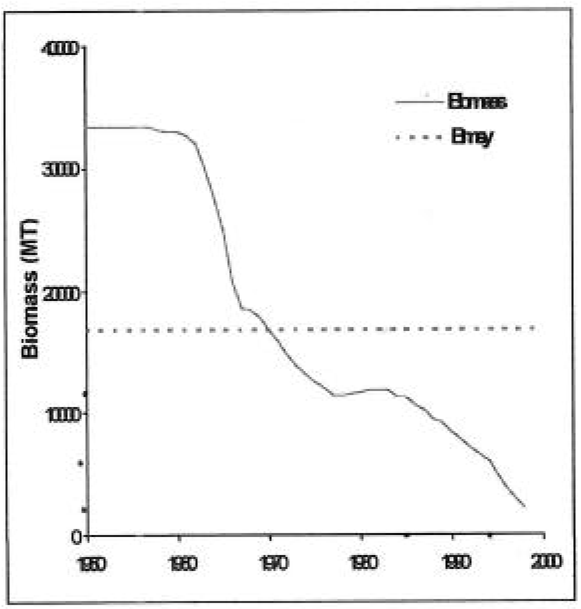
It is unclear whether there are two separate white marlin stocks or a single population in the Atlantic, and so the SCRS has in the past assessed both possibilities. Historically, the SCRS stock hypotheses for white marlin assessments had been a North and South Atlantic stock (divided at 5°N), as well as a single (total) Atlantic stock. In 1995, the SCRS gave priority to the total Atlantic hypothesis. In 1996 and again in 2000, the SCRS reviewed and discussed additional data on genetic mitochondria DNA analysis, as well as tag release-recapture data, and concluded that these data were most consistent with a total Atlantic hypothesis. In addition, the SCRS concluded that the North/South separation was arbitrary for this tropical species (SCRS/00/04B).

The SCRS currently assumes a single Atlantic-wide stock of white marlin (and blue marlin) for its stock assessments (SCRS, 2000). As noted in its Detailed Report (SCRS/00/23), the 1996 SCRS based this conclusion on the following: "(l) the species is distributed across the proposed north/south stock boundary throughout all four quarters of the year; (2) spawning is broadly distributed throughout the tropical and subtropical Atlantic in space and time; (3) tag recoveries demonstrate trans-Atlantic movement, as well as movement across the 5° North latitude; and (4) analysis of white marlin mitochondrial DNA revealed no significant heterogeneity between North Atlantic and South Atlantic samples."

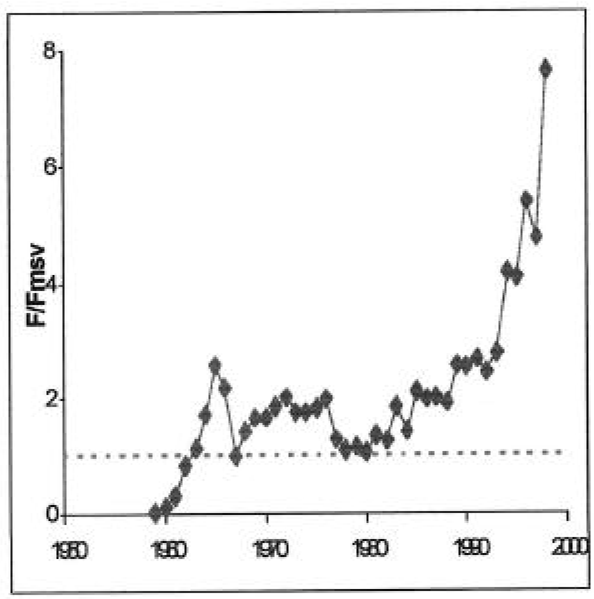
The most recent genetic evidence shows there is no significant difference between the two hemispheres' stocks of Atlantic white marlin (SCRS/00/54). Specifically, "the null hypothesis of a single, Atlantic-wide, genetic stock of white marlin could not be rejected" (SCRS/00/23). However, this does not mean that there is a single Atlantic-wide stock. Periodic strays could produce such a homogenous gene pool in two widely separated sub-populations (Magnuson, *et al.*, 2001; Dr. Lee Morgan, personal communication, June 22, 2001). This is especially true in the case of two sub-populations such as these whose spawning is apparently separated both by distance (spawning areas located the Caribbean region and off central Brazil) and time (spawning phased six months apart), as discussed previously. What this does mean is that genetic characteristics cannot be used to separate the two hemispheres' populations of white marlin. In fact, they also cannot be used to separate north and south Atlantic sub-populations of blue marlin (SCRS/00/54; SCRS/00/23).

12. Stock Assessment Results

The most recent stock assessment projections by the SCRS for Atlantic white marlin are reproduced below, which were taken from SCRS/00/04B, reproduced in Appendix 2.



WHM-Fig. 4. Biomass trajectory estimated for white marlin with single combined index.



WHM-Fig. 5. Relative fishing mortality trajectory estimated by FISHLAB logistic production model application to white marlin catch and composite CPUE series.

Billfish stock assessments have been conducted by the SCRS in 1992, 1996 and 2000. The results of the stock assessments have been portrayed as graphs showing trends in the population's abundance (above, left) and in fishing pressure (above, right) exerted on the population year-by-year since the early 1960s. The stock's abundance or biomass (B) is estimated in relation to the abundance that would be needed to produce the Maximum Sustainable Yield (MSY). (Biomass means the total weight (or number) of fish in a population.) This biomass is referred to as B_{MSY} and is represented as the horizontal dotted line in the figure above, left. Similarly, fishing pressure or as it is known, the fishing mortality rate (F), is estimated relative that the rate of fishing mortality that would produce the MSY. This fishing mortality rate is referred to as F_{MSY} and is represented as a horizontal dotted line in the figure on the right. If all other factors are constant (such as natural mortality and habitat conditions), fishing mortality determines subsequent population abundance. Responsible fishery managers seeking to maintain the stock at its maximum sustainable yield abundance level would therefore seek to keep the stock's biomass at B_{MSY} by restricting fishing mortality to no more than F_{MSY}. Maintaining the population abundance at its B_{MSY} level is ICCAT's stated management objective for each species managed. However, after more than 30 years, ICCAT has succeeded only in thoroughly documenting these stocks' demise, as shown in the above figure and in Appendix 9.

To put the B_{MSY} level in perspective, the following are important abundance and fishing pressure thresholds. Starting at the top of the figure (above left), a virgin (unfished) stock's biomass is generally at least two times the abundance level of its B_{MSY} (or B/B_{MSY} = 2.00+). This is the maximum size a population can achieve. It is shown as the abundance prior to 1960 in the figure on the left.

At a variable point between the unfished stock's abundance level and the B_{MSY} level lies the "Optimum Yield" (OY) level. According to the Magnuson-Stevens Act, all U.S. managed fish stocks are to be maintained at their OY level of abundance. The abundance required to achieve OY includes not only the biomass needed to provide the maximum sustainable yield (MSY) to fishermen, but also that additional biomass needed to maintain ecosystem health (e.g., predator-prey relationships) and to maximize recreational opportunity (sufficient numbers and normal age class distribution so there are also some trophy-sized fish), where appropriate. This concept is discussed below in relation to the Billfish FMP (SAFMC, 1988).

The next important abundance level is the B_{MSY} level. This is the key fishery management level as most other terms are measured in relation to it. If the population declines below B_{MSY} it is formally considered to be *overfished*. If fishing pressure (fishing mortality or F) exceeds that which would produce the MSY (or F_{MSY}), *overfishing* is occurring. Put differently, as NMFS uses the term, the Maximum Fishing Mortality Threshold (MFMT) is equal to F_{MSY} and fishing pressure or fishing mortality is not to exceed it (NMFS, 1999a).

Below the B_{MSY} level is another important abundance level used in fishery management - the Minimum Stock Size Threshold (MSST). For white marlin, NMFS considers 85 percent of B_{MSY} to be its MSST (NMFS, 1999a). This is the abundance level that if penetrated would trigger remedial action by fishery managers. In essence, the population is allowed to fluctuate above and below the B_{MSY} level, but not drop lower than the MSST level (or B/B_{MSY} = 0.85).

A population is considered *growth overfished* if its biomass is driven below B_{MSY} down to 50 percent of B_{MSY} (or B/B_{MSY} = 0.50). *Growth overfished* means the yield in landings could be greater if individuals in the stock were allowed to grow a little more before being caught. *Growth overfishing* is certainly reason for concern and requires remedial action, but the situation has not become critical for this population's existence, as there are still sufficient spawners to maintain the population.

The next important abundance threshold is 50 percent of B_{MSY} (or B/B_{MSY} = 0.50). As the stock's abundance declines further and this threshold is penetrated, the stock is considered to be *recruitment* *overfished*. This means there are becoming too few adults alive for reproduction to maintain the population. Consequently, this is a very serious biological benchmark demanding dramatic action by the responsible fishery manager. ICCAT has knowingly allowed the biomass of white marlin, as well as blue marlin and bluefin tuna, to be driven far below this level for over two decades.

The next and most ecologically important abundance level is the "point of no return" meaning once exceeded, the population will continue to spiral towards extinction even if all fishing were to stop. If its abundance declines to this level, the population becomes *functionally extinct* or *ecologically extinct*. This does not mean that every individual has died. With a lifespan of 25 to 30 years, final extinction of the species may not occur for several years beyond the point at which the population is doomed. It does mean that the population is incapable of sustaining itself and thus it will soon vanish, forever. At this abundance level there is no longer any possibility for the population's recovery since natural mortality due to predators, starvation and disease (more than one million young die for every adult that survives to reproduce again) will ensure that the few young produced will not survive in sufficient number to carry on the population. Unfortunately, we do not know the exact point at which the white marlin population will become *functionally extinct*, and the only way to find out is simply unacceptable. It apparently will be passed shortly - in less than 5 years - if the population is allowed to continue its steep rate of decline toward extinction, as can be seen in WHM-Fig. 4, above.

Extirpation or final extinction arrives as the last remaining individual dies. In the case of long-lived species, including white marlin, this may take several years after the population has reached *functional extinction*.

The term, *commercial extinction*, means only that commercial exploitation is no longer profitable. Thus, the term bears no relation to a population's biological status or to reference points like *functional extinction*. (For example, a species like bluefin tuna might well increase in commercial value as it became increasingly rare.) Its use derives strictly from the economics of supply vs. demand.

In its previous Billfish Workshops (1992 and 1996) where stock assessments are developed and approved, the SCRS wisely modeled and tracked population trends for not only a total Atlantic stock but also a North Atlantic sub-population (for both white and blue marlin). Unfortunately, there was insufficient time at the most recent workshop (held in July of 2000) to model separate northern sub-populations of either marlin. (We assume there were no other motives for not conducting the sub-population stock assessments.) Thus, we currently have only Atlantic-wide population estimates for each. An immediate need exists to model the status of the northern sub-population of white marlin, and in an email message to the Acting Assistant Administrator for Fisheries (May 14, 2001), we requested that NMFS do so (see Appendix 10).

A non-equilibrium production model, ASPIC, has been used to assess the status of this species. The 1996 stock assessment (SCRS, 1996) indicated that at the end of 1995 the total Atlantic white marlin biomass was about 23 percent of B_{MSY} (or $B/B_{MSY} = 0.23$), that fishing mortality was about 2 times F_{MSY}, and that *overfishing* had been occurring for about three decades. At the same time, the biomass of the north Atlantic sub-population was estimated to be 32 percent of its B_{MSY} and fishing mortality was 2.36 times its F_{MSY}. For a graphic portrayal, see WHM-Figs.3. and 4 of the 1998 SCRS Report, WHM - Executive Summary, Doc #27, which is reproduced in Appendix 3. Whether considering the entire population or the north Atlantic sub-population, these biomass estimates and their steep rate of decline indicate a stock at great risk. Biomass is well into the *recruitment overfished* zone and approaching the *functionally extinct* threshold. Moreover, the steep, steady rate of decline over a period of several years suggests strongly that the population(s) would continue to edge toward *functional extinction* unless there were immediate and substantial reductions in fishing mortality. The decline in abundance of the north Atlantic white marlin sub-population is particularly disturbing (see WHM-Fig 4.). Its decline has been both severe and steady. In 1960, north Atlantic white marlin biomass was estimated at 2 times its B_{MSY} (equivalent to an unfished, virgin stock). By the end of 1995, its abundance had declined by 84 percent. But it was not until1996 that ICCAT first recommended a reduction - it was only a token (25 percent to be completed by 1999).

A new assessment was carried out in 2000 (on landings data through 1999) using similar methods to the previous assessment, but with data sets that had been revised extensively in response to concerns raised since the 1996 assessment. The SCRS also considered a few alternative models and data sets, including cases in which much of the historical data were disregarded or down-weighted. The latest stock assessment indicates a much more plausible historic population trend for both Atlantic white and blue marlin than those produced previously for the total Atlantic population hypotheses (1998 SCRS Reports, White Marlin and Blue Marlin Executive Summaries, both reproduced in Appendix 3). Accordingly, we are confident that the newest assessment presents a much more accurate historical picture of what is actually happening to these populations (of both white and blue marlin).

The 2000 stock assessment indicates that by the end of 1999, the biomass of the total Atlantic white marlin stock had declined to less than 15 percent of B_{MSY}, that fishing mortality was nearly 8 times higher than F_{MSY} and rising rapidly, that *overfishing* has been taking place for over three decades, and that the stock's biological capacity for replenishment was (ominously) much lower than previously thought (page 15, SCRS/00/23). Actually, the results of the primary stock assessment runs examined (FISHLAB and ASPIC base case described on page 14 of the Draft Detailed Report) were even more pessimistic. They indicated the biomass had declined to 11 to 13 percent of B_{MSY} and fishing mortality had increased to about 8 to 10 times F_{MSY} (Table 28, SCRS/00/23). Apparently, total Atlantic white marlin biomass is actually somewhere between 11 and 13 percent of its B_{MSY} level, and fishing pressure well above 8 times F_{MSY}. If a separate north Atlantic sub-population model had been run, it might well have indicated a similar or even lower level of abundance. According to the SCRS's previous stock assessment (using data through 1995), the northern white marlin population's biomass was estimated to be 32 percent of the sustainable level ($B_{MSY} = 0.32$), fishing pressure was more than double the sustainable level ($F_{MSY} = 2.37$), and it had continued to decline since 1980 at approximately the same moderately severe rate (see Ex. Sum., Appendix 2).

The SCRS reports biomass in terms of a stock's estimated total weight (in metric tons headed and gutted or dw). However, we are also interested in the number of fish involved. The latest stock assessment estimated the total Atlantic white marlin's MSY biomass was 16,690 MT or 36.8 million pounds dw, and that the stock's biomass was 13 percent of its MSY biomass (Table 26, SCRS/00/23).

Accordingly, the total white marlin biomass at the end of 1999 was thought to be about 2,170 MT or 4.8 million pounds dw. NMFS has indicated in Table 3.1.1. of Amendment 1 to the Atlantic Billfish FMP (NMFS, 1999a) that the average length of white marlin at capture is about 67 inches or 170 cm LJFL. By applying the length-weight conversion relationship as published in Prager, *et al*. (1995), we find that the average weight of white marlin at capture is roughly 60 pounds live weight or about 45 lbs. dw. Thus, the SCRS biomass estimate indicates there were **only about 100,000** white marlin of recruitment age or greater that remained alive at the end of 1999 throughout the entire Atlantic Ocean. (These estimates do not include eggs, larvae or juveniles smaller than the size at which white marlin first become vulnerable to the fishery - 30 pounds. However, the young have a high natural mortality rate due to predation, starvation, disease, etc. and thus represent only potential contributors to the population's future spawning stock.) Since 18 months of additional mortality has since occurred, the number left alive today would be even less considering the fishing mortality rate is 8 to 10 times higher than the sustainable level. By comparison, there would have been slightly more than 800,000 white marlin or eight times as many alive in 1970 when the population was last at its MSY biomass level (ICCAT's stated management objective), and just over 1 million or ten times as many would exist if the population was rebuilt to its optimum yield level (assuming NMFS is correct that the population's optimum yield is 1.3 times its MSY level - see Chapter 3. of Amendment 1). Maintaining populations at their optimum yield level is the U.S. standard required by the Magnuson-Stevens Act.

Thus, increasingly severe *recruitment overfishing* of white marlin has been occurring on a grand scale and it has been allowed to occur for decades. The biomass decline has certainly reached beyond the critical point. Based on the latest 2000 SCRS population trend projections as depicted above (WHM-Fig. 4), *functional extinction* can be expected in the foreseeable future. The cause continues to be unrestrained commercial overfishing (targeting other species). Rather than reducing fishing pressure by means of large quota reductions that should have been imposed by ICCAT, fishing mortality has been allowed to accelerate rapidly - from 2 times F_{MSY} at the end of 1995 to 8 to 10 times F_{MSY} by the end of 1999 (see WHM - Fig. 5). Fishing mortality rates are thus far too high to allow for any recovery under either the north Atlantic or total Atlantic stock hypotheses. And they are rising dramatically, not falling.

It is important to recognize that the Atlantic blue marlin is being affected in a nearly identical manner, but to a slightly lesser degree, than is the Atlantic white marlin. This mirror-like pattern of population decline with increasing levels of overfishing provides credence to the latest stock assessments, of both species.

As another independent and confirming indicator that biomass is really declining as the population models are predicting, Atlantic white marlin landings declined by 44 percent between 1995 and 1999. Similarly, blue marlin landings declined by 28 percent over the same period (SCRS/00/23). However, this does not reflect landings reductions as a result of ICCAT's token quota reductions, as the ICCAT and SCRS reports state (see p. 15 of SCRS/00/23). For both marlin stocks, fishing effort (targeting swordfish and large tunas, not billfish that are caught incidentally) had increased dramatically during the same period. In the case of white marlin, fishing pressure **rose** from 4 times the sustainable level to 8 to 10 times that level - a huge increase (Run FL 1 and Run 1, Table 28, SCRS/00/23). Therefore, these large declines in reported landings must simply indicate there are markedly fewer white and blue marlin remaining alive with each passing year. These declines in reported landings give substantial additional credence to the population modeling results that show similar steep biomass declines, and by the fact that the results for blue marlin are virtually identical to those of white marlin.

Another important factor is the stock's productivity (MSY and its capacity for replenishment) is now recognized by the SCRS to be much lower than was thought, previously. At the 1996 stock assessment workshop, MSY for Atlantic white marlin was considered to be near 2,200 MT. But, following analyses at the 2000 SCRS meeting, MSY was estimated to be less than 1,300 MT - 41 percent lower. This means recovery will be much more difficult for this species than the scientific community had thought, previously. (Unfortunately, as discussed below, population models underestimate the severity of a stock's decline and overestimate a depressed stock's recovery.)

Not surprisingly, the same situation is also true of Atlantic blue marlin, which are taken as bycatch by the same non-selective commercial fishing gear as white marlin. Following on the next page are the SCRS figures showing the abundance decline and the increase in fishing pressure experienced by blue marlin, both of which parallel those of white marlin. Since 1981 (when the stock was last at its MSY level), total Atlantic blue marlin biomass has also declined dramatically. The rate of decline increased, beginning about 1989, and since then it too has declined at a consistent rate each year. By the end of 1999, it had fallen to an estimated 40 percent of its B_{MSY} as depicted below. It appears to be on the same downward slope as the white marlin's decline with no lessening evident in its rate of decent. Moreover, during the 1990s, fishing mortality on blue marlin accelerated rapidly. By the end of 1999, it had risen to 4 times its F_{MSY} and it was still rising. Depicted below is the SCRS plot showing the increase in fishing mortality. (See also Figs.VII3.a.1.3 showing biomass declines and VII.3.a.1.4. for fishing mortality increases, which can be found in the SCRS 2000 Detailed Report.).

The blue marlin's capacity for replenishment is also now recognized to be much lower than previously thought. Its estimated MSY has been reduced from 4,500 MT estimated for it in 1996 to 2,000 MT in 2000 - 56 percent lower. Accordingly, their recovery potential is also dramatically lower than previously thought.

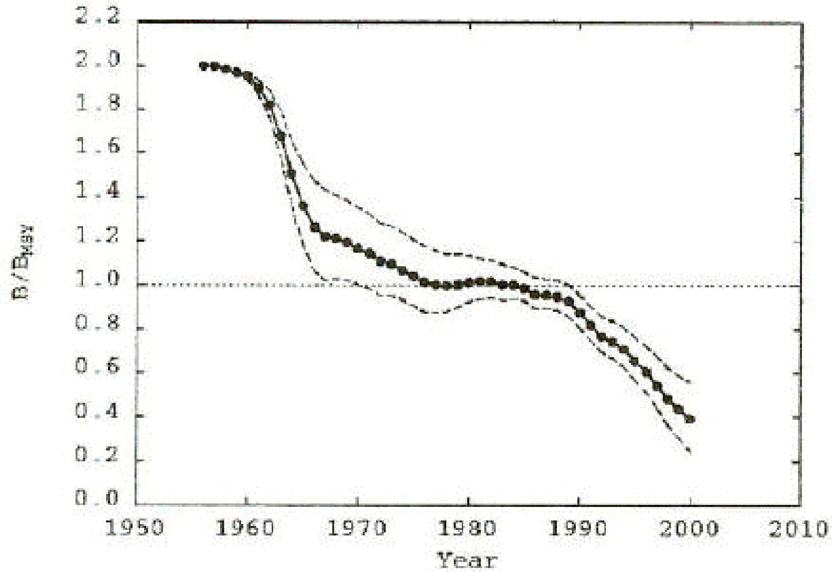
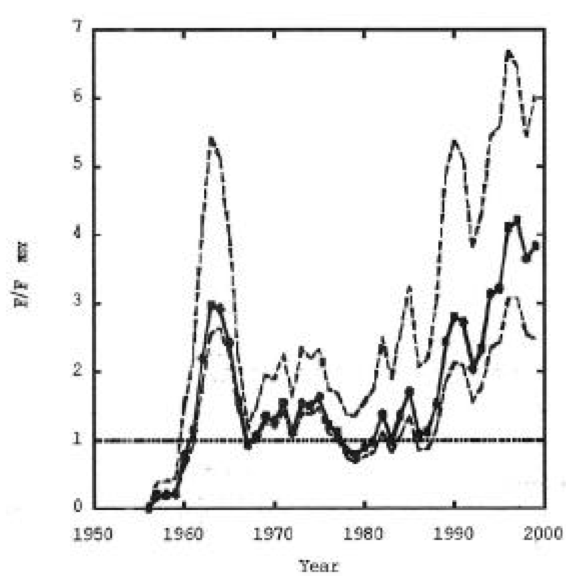


Figure VII.3.a.1.3. Atlantic blue marlin estimated median relative biomass trajectory (center, dark line) with approximate 80% confidence range (light lines) from bootstrapping the base case stock assessment.



BUM-Fig. 4. Atlantic blue marlin estimated median relative fishing mortality trajectory (center, dark line) with approximate 80% confidence range (light lines) from bootstrapping the base case stock assessment.

Not everyone agrees with the most recent SCRS stock assessments for white and blue marlin. The Japanese delegation to ICCAT has formally disagreed with the results (Doc. No. 49). It did so in spite of the fact that three of its scientists participated in the entire Fourth Billfish Workshop during which the stock assessment was adopted by the SCRS. Moreover, the SCRS's recommendations to ICCAT were arrived at on the basis of consensus. There were no disagreements (on the stock assessment results and SCRS's recommendations) raised during the 2000 SCRS Billfish Workshop. At the ICCAT meeting, the U.S. delegation immediately produced a thorough and persuasive rebuttal (Doc. No. 54) to the Japanese policy position. The U.S. rebuttal is clearly science-based. Japan later produced another short paper (Doc. No. 98) reiterating its disagreement with the results, but failing again to provide any convincing scientific basis for such a position. All three documents are reproduced in Appendix 11. It is important to realize in this context that the Japanese know that to reduce mortality of white marlin (and blue marlin) sufficiently to allow them to recover to the ICCAT-stated management objective (MSY) will require their distant water fleets targeting the large tunas to make major changes in where and how much they will fish. Thus, their argument about the results of the stock assessment may be motivated by economic concerns rather than a disagreement on scientific facts or their interpretation. It is also typical of how ICCAT, whose delegations are dominated by large-scale commercial fishing interests (especially dealers and fleet owners), has completely failed to conserve the species it purports to manage, bowing instead to continued commercial over-exploitation in virtually every case.

Blue marlin, white marlin, swordfish and to a lesser degree sailfish all appear to share the same highly-specific spawning areas, nursery areas and primary feeding areas throughout their lives. (Many of their essential habitats in the North Atlantic Ocean, including the Caribbean Sea and Gulf of Mexico, have been mapped and appear in Appendix 8, as noted previously.) They also depend on the same migratory pathways along (the edges of) major oceanic currents (see Appendix 5). And they are caught and die on the same commercial gear being increasingly deployed in their most critically important habitats, as depicted in Figures 9 and 10 in the Detailed Report (SCRS/00/23). Essentially, they are being hunted every day of their lives by a virtual armada of large, industrial-scale commercial fishing vessels numbering in the thousands. These commercial fleets from more than 30 nations now know where each target species will be found at every season throughout the year (for spawning, migration or feeding), and they simply intercept them in their essential habitats where they are concentrated and most vulnerable. For example, the largest U.S. longline vessels (and those of other nations) fish on north Atlantic swordfish on their primary spawning grounds located east of the Lesser Antilles (see Fig. 4.9.2. from F. Arocha's Ph.D. dissertation of 1997, as reproduced in Appendix 5) and smaller U.S. vessels concentrate year-round on juvenile swordfish in their primary nursery grounds surrounding Florida, as mapped by Cramer (1996) and reproduced in Appendix 12. The Spanish fleets have been purse-seining thousands of tons of very young bigeye tuna in their nursery area in the Gulf of Guinea. Recently, approximately 75 percent of their landings have been composed of juvenile bigeye weighing less than ICCAT's minimum size limit (about 7 lbs.). Bigeye tuna are capable of growing to more than 500 pounds. Alternatively, if they were allowed to grow large and spawn at least once, the economic benefits would be very substantial (estimated by the SCRS at 25 percent increase in yield (1998 SCRS Bigeye Tuna Ex Sum, Doc 001-a), and the population would not be trending toward *recruitment overfishing* (biomass now below 60 percent of MSY, see Appendix 9). Such waste is atrocious. That it is not prevented by ICCAT is unconscionable and inconsistent with the purposes of ICCAT.

It is important to emphasize that if the commercial fleets were targeting marlin, as their populations declined, fishing pressure would eventually be discontinued at the point it became unprofitable (*commercial extinction*). However, they are not targeting marlin. The problem for white and blue marlin, neither of which are particularly good to eat, is they are being caught on gear intended for swordfish and the larger tunas (bluefin, bigeye and yellowfin), which taste much better and are thus much more valuable, commercially. Without a change in where commercial fishing occurs, the kill of marlin will continue until it is no longer economically profitable for the various commercial fleets to fish for swordfish and the large tunas. This is a "death sentence" for marlin.

How long will the target species last? The populations of Atlantic yellowfin tuna (B/B_{MSY} = 1.0), Atlantic bigeye tuna (B/ B_{MSY} = 0.60), and north Atlantic swordfish (B/ B_{MSY} = 0.65) are all much more healthy from a population standpoint (i.e., their biomass is much closer to MSY). In addition, judging from catch history, their populations are all much larger (more numerous) than are those of either marlin species. Therefore, they can be subjected to a high level of commercial exploitation for a number of years before they too approach *functional extinction* or fishing on them simply becomes unprofitable. Unfortunately, white marlin (and blue marlin) will not be able to last that long (see WHM-Fig 4, 2000 SCRS Ex. Sum., Appendix 2)

C. Risk of Extinction

According to the latest stock assessment results, the Atlantic white marlin population is rapidly nearing extinction (as discussed above). It may even have passed the "point of no return" or the threshold of *functional extinction*. We have no way to know exactly where this threshold lies on this species' abundance gradient, but the best available scientific and commercial data strongly suggest that the white marlin population is close. Its abundance (as a total Atlantic stock and as a north Atlantic sub-population) is very low and continuing a rapid decline, at least through 1999.

Consider the SCRS's population trend graph provided to ICCAT in its 2000 White Marlin - Executive Summary, WHM - Fig. 4, reproduced above and in Appendix 2. **If one simply extends the biomass decline at the same constant rate it has experienced for the last 15 years, one will immediately see that in the absence of dramatic intervention, Atlantic white marlin biomass will approach zero in less than 5 years**. See also Figures 43 and 46 of the Draft Detailed Report (SCRS/00/23). WHM - Fig. 4 shows that in the 13 years between 1985 and 1998, the total Atlantic white marlin biomass (B/ B_{MSY}) declined by about 60 percent relative to its MSY level. This equates to a yearly rate loss of about 4.5 percent. In 1994, due to the escalating fishing mortality depicted in WHM - Fig. 5, the rate of decline began to increase. Between 1994 and 1998, the relative biomass (B/ B_{MSY}) fell an additional 24 percent or 6 percent of its MSY biomass each year. At the end of 1999, the SCRS estimated the population's biomass was only 13 percent of its MSY level (B/ B_{MSY} = 0.13). At this rate of decline, the Atlantic white marlin population has little time left. Specifically, we would project from the SCRS projections that the Atlantic white marlin population **will become *functionally extinct* in less than five years**, unless action is taken immediately to eliminate the high rate of fishing mortality to as near zero as possible. (We are not saying that every last white marlin will be dead by that point, but that those remaining alive will be too few to sustain a viable population through their limited reproductive capacity. Once they too die off, the species will reach extirpation or final extinction.) This is about the same endpoint (2003) that could have been recognized by ICCAT in 1996 using the SCRS population projections for either the total Atlantic or the north Atlantic sub-population in the 1996 SCRS Detailed Report to ICCAT (WHM-Fig. 4). Thus in 1996, ICCAT was informed by its SCRS's report that this population was declining toward extinction by about 2003. The 25 percent reduction in landings adopted finally by ICCAT beginning in 1997 was totally inadequate. (Such a token reduction was not recommended to ICCAT by its scientific advisors. The SCRS recommended the release of all live marlin, which was adopted by ICCAT in 2001.) As we can see from the latest assessment results, the token 25 percent recommendation had no perceptible effect in slowing the species' rapid decline. For the same reason, it is doubtful that ICCAT's recent recommendation to reduce landings by 67 percent will be sufficient now to reverse the downward trend and rebuild the stock to its MSY level. This point will be discussed in detail below. At approximately 13 percent of $B_{MSY,}$ this stock may be near or beyond the "point of no return" and thus incapable of recovery (i.e., it is possibly already *functionally extinct*).

In this regard, it is important to recognize that population models consistently underestimate the severity of the population decline as it falls rapidly (see Figure 1 in Weeks and Berkeley, 2000, reproduced in Appendix 13), and overestimate their ability to recover (Hutchings, 2000, reproduced in Appendix 14). Thus, the situation for white marlin is probably even worse than we think, if that is possible. Hutchings states "Here I show that there is very little evidence for rapid recovery from prolonged declines, in contrast to the perception that marine fishes are highly resilient to large population reductions**Y**my analysis of 90 stocks reveals that many**Y**have experienced little, if any, recovery as much as 15 years after 45-99% reductions in reproductive biomass. Although the effects of overfishing on single species may generally be reversible[1], the actual time required for recovery appears to be considerable." Amendment 1 to the Atlantic Billfish FMP states "Sparse distributions and stock trajectories that have not exhibited pronounced or sudden upturns over the last 25 years suggest that billfish are not capable of rapid repopulation and may not be able to recover quickly from a depleted state." The greatly lowered reproductive potential (reduced MSY) now recognized for white (and blue marlin) adds additional urgency to the need for immediate action to reduce fishing mortality to close to as close to zero as possible.

In conservation biology it is generally accepted that, if model projections are to be used for making decisions, then modeling thresholds should be set high enough to adequately account for environmental and demographic uncertainties, and particularly for depensatory effects (irreversible accelerated decline) when populations have reached low numbers (Thompson, 1991). There is no established single threshold that by itself can, or should, be used with an extinction model to indicate how serious the risk of extinction actually is. But, as an established practice, it is recognized that *functional extinction* occurs when the population drops below the level where the loss of sufficient spawning stock makes absolute or final extinction inevitable. The question that decision-makers must confront is how much time is available before extirpation forecloses all options - i.e., before a population crosses the *functional extinction* threshold.

The World Conservation Union (IUCN) recommends that risk analyses consider multiple characteristics of a population, particularly its current state (e.g., population size, structure, and dynamics), distribution (number of sub-populations, connectivity, area, etc.), environmental effects, rate of decline, and any acceleration evident in that rate of decline (Akcakaya *et al.*, 2000; Mace and Lande, 1991; Musick, 1999a). An international group including the American Fisheries Society (AFS), the IUCN, NMFS, the Canadian Department of Fisheries and Oceans, the Committee on the Status of Endangered Wildlife in Canada, and the Japanese government, is working to define criteria appropriate for determining the risk of extinction for marine fishes. The key criteria under consideration are: rarity, specialization in habitat requirements, restriction to a small range, and population decline (Musick, 1999a).

The AFS has been active in developing a policy on determining extinction risk in freshwater and now marine fish (Musick, 1999a). A number of papers have recently been published on the subject of establishing criteria for assessing risk of extinction in marine fish (Huntsman, 1994; Hudson and Mace, 1996; Musick, 1998; Musick, 1999a; Musick *et al*., 2000a; and Musick *et al*., 2000b). AFS scientists recently reviewed the risk of extinction in some marine fishes of North American waters (Musick, *et al*., 2000c). They found that populations within at least 82 species or subspecies were vulnerable to extirpation and 22 may be vulnerable to global extinction. Apparently, large pelagic species of the Atlantic Ocean were not reviewed.

In its policy statement on determining risk of extinction in marine fish (Musick, 1999a, reproduced as Appendix 15), the AFS proposed that five key parameters be considered. It suggested ranges of values for each (see Table 3) in order to characterize the productivity or resilience of a stock or Distinct Population Segment (DPS) (Fed. Regis. 1966.61(26):4,722). (Values need not be established for every parameter.) Using the proposed AFS approach for these parameters whose values are known or can be estimated, Atlantic white marlin would be judged to have Low to Medium Productivity or resilience. This assessment is based on our best approximation of the parameters proposed by the AFS, as follows:

Parameter	Estimate	Source	Productivity
Intrinsic Rate of Increase (r)	0.10	SCRS/00/23	Low
Growth Coefficient (k)	NA	NA	
Fecundity	5×10^5	NMFS, 2000a	High
Age at Maturity (T_{mat})	2 - 3	NMFS, 2000a	Medium
Maximum Age (T_{max})	25 - 30	NMFS, 2000a	Low

NA - Not Available

We estimate the age at maturity for white marlin, which is unknown, by interpolating from known values for the smaller sailfish - 3 yrs (Beardsley *et al*., 1975) and the larger blue marlin - 2-4 yrs (SCRS, 1997). The range in values for the intrinsic rate of increase (r) in Atlantic white marlin used in various models at the 2000 Billfish Workshop are quite broad. They range between 0.07 (indicating Low Productivity) and 0.77 (indicating High Productivity). However, the model relied upon finally by the SCRS (single combined index, run FL1, Table 28, SCRS/0023) used a value of 0.10.

Once the distinct population segment's (DPS) resilience has been estimated (Low to Medium for Atlantic white marlin), its population decline can be compared to **provisional** decline thresholds provided in the proposed AFS policy statement (see Table 4 of Musick, 2000a). The suggested decline threshold for a Low Productivity DPS is 85 percent decline in biomass of mature individuals over the longer of 3 generations or 10 years. For a Medium Productivity DPS, the suggested threshold is 95 percent. We estimate that white marlin mature at between 2 to 3 years, thus three generations would be 6 to 9 years. The AFS guidance states "If the decline equals or exceeds the threshold for the appropriate productivity category, the DPS would be automatically listed as *vulnerable* and flagged for further study by expert scientists, who may decide to upgrade the level of threat to *threatened* or *endangered*, or downgrade the status, if appropriate. These expert evaluations should incorporate all available, pertinent information on the biology of the DPS in question." The (total) Atlantic white marlin DPS experienced a decline of about 72 percent in the most recent 10-year period (the greater of 3 generations or 10 years). Thus, the provisional AFS thresholds for Medium and Low Productivity categories are not exceeded. From this analysis, one would conclude that the Atlantic white marlin DPS is not *vulnerable* much less *threatened* or *endangered*. In fact, if the Atlantic white marlin were to become extinct, it would still not meet the provisional AFS criteria for even a *vulnerable* designation. After using the AFS scheme to assess risk to other similar large pelagic species of the Atlantic, we found that: (1) all would also be placed in the Medium to Low Productivity category, and (2) their decline within 3 generations were 56 percent for Atlantic blue marlin, 59 percent for north Atlantic swordfish, and 86-89 percent for western north Atlantic bluefin tuna, all based on SCRS biomass estimates. Only bluefin tuna are close to, but do not exceed, the proposed AFS threshold value suggested.

Based on our analysis above, we conclude that the proposed AFS system for determining risk clearly does not apply well to the wide-ranging Atlantic white marlin or for that matter to the other large pelagic species. In our opinion, its use (alone) significantly under-estimates the risk of extinction for these species that migrate over vast ocean distances. Apparently, this is especially true for billfish (including swordfish) that are solitary hunters that must find each other in a vast ocean for spawning to be successful. Schooling pelagic species like the tunas are thought to remain together (both males and females of similar age and size) throughout their entire lives making finding a mate at the moment of spawning much easier. Therefore, populations of solitary hunters such as billfish would be expected to become vulnerable to both reproductive failure (*recruitment overfished*) and to *functional extinction* sooner (at a higher biomass level) than would be expected of a schooling species. Accordingly, the risk of *functional extinction* to white marlin and the other billfish may occur sooner or at higher biomass levels than that for the tunas.

According to the SCRS's most recent stock assessment, the biomass of (total) Atlantic white marlin (see WHM-Fig. 4) has declined by more than 92 percent from an essentially "unfished" condition. That healthy population last existed in the early 1960s (when longlining began in the Atlantic). Between 1970 (four years after ICCAT's formation) when the stock's biomass was last at its estimated MSY level (ICCAT's stated management objective) and the end of 1999, its biomass had declined by about 87 to 90 percent (B/B_{MSY} = 0.10 to 0.13). Fishing mortality was very high (at least 8 and perhaps 10 times the F_{MSY} level) and rising rapidly. We need to keep in mind that a year and a half of additional mortality has now occurred. Therefore, the Atlantic white marlin's biomass is now even less than 11 to 13 percent of its B_{MSY} level estimated for it at the end of 1999.

Since about 1983, the rate of decline in its biomass has been quite constant, with a slightly greater decline evident since 1994. **If the population simply declines at the same rate that it has during the past decade, Atlantic white marlin abundance will reach zero by the year 2005 or sooner**. (See WHM-Fig 4 reproduced above and in Appendix 2 and Figs. 1, 41, 43 and 46 of the SCRS/00/23, reproduced in Appendix 1.) We believe this will happen unless dramatic changes are made in where commercial vessels fish, as we are recommending herein. Thus, *functional extinction* is less than four years away. This one scientific fact demonstrates clearly that this population (and its northern sub-population) are at great risk of extinction in a very short period of time (years) - certainly within the foreseeable future (as the term is used in the ESA). ICCAT's current plan is to next reassess the stock in July of 2002 with decisions by ICCAT on possible additional management actions to be made by December 2002. If the existing mortality reductions are insufficient to dramatically slow the decline (and we will show below that they are "too little too late"), the Atlantic white marlin population may well have become *functionally extinct* by the time ICCAT next considers the issue.

The AFS recognizes the following categories of risk: *endangered,* high risk of extinction in the wild in the immediate future (years); *threatened,* not *endangered* but facing risk of extinction in the near future (decades); *vulnerable* (special concern), not *endangered* or *threatened* severely but at possible risk of falling into one of these categories in the near future; *conservation dependent,* reduced but stabilized or recovering under a continuing conservation plan; *not at risk,* not at apparent risk of extinction**Y**.The AFS categories deal with extinction risk and not growth or recruitment overfishing except where recruitment overfishing may threaten the DPS with extinction." (Musick, *et al*., 2000c, Appendix 18). Based on these criteria, the SCRS' population projections indicate that the Atlantic white marlin has reached at least the point at which it has become *threatened* with extinction.

We recognize that the SCRS biomass trajectories are estimates with broad confidence limits. However, the long-term trend of their estimates and the looming danger are absolutely clear. U.S. and ICCAT fishery managers are supposed to follow a "risk-averse" or precautionary approach to managing marine fish populations (Fox, 1994; FAO, 1995; SFA; Mace, 1997b; Serchuk, *et al*. 1997; Restrepo, *et al*., 1998; and ICCAT, 2001a). If that is the case, there is obviously no time to waste if we are to save this population (or two sub-populations). The best scientific information available tells us plainly that this stock (or stocks) is severely imperiled and threatened with extinction within a few years, at most. It is even possible that the Atlantic white marlin population has already passed the threshold of *functional extinction*.

For many years a number of highly respected scientists have been closely following the management and stock assessments of Atlantic highly migratory species, including white (and blue) marlin, by both NMFS and ICCAT. Their views are telling (their original correspondence is contained in Appendix 19.)

Dr. Carl Safina, the National Audubon Society's Vice President for Marine Conservation and author of the highly acclaimed book, *Song for the Blue Ocean*, recently said this about the situation: "Most people forget how common marlin once were. Off Montauk, charter boats ran half-day marlin trips during the 1960s. The decline of marlin in the last twenty years has been stunning. White marlin were still very common off Long Island during the 1980s, and it was not unusual to see several during the course of a day fishing only fifteen miles from inlets. Often they were seen much closer. In 1983, when I first started fishing offshore, I saw approximately 30 marlin one day only fifteen miles from Fire Island Inlet. That was considered a good day then, but not exceptional by previous standards. We never saw another day like it again. For all practical purposes, the only management that has affected this species is the failure of ICCAT to prevent its demolition. It is now a rare fish in areas where it was once abundant." In regard to the SCRS stock assessments and ICCAT's management of the resource, Dr. Safina's had this to say: "The scientific assessments of steep and continuing decline are quite evident on the ocean, so both scientific and casual lines of information point to a species in severe trouble. The very high fishing mortality calculated by the tuna commission's scientific committee provides not only the reason for the decline but points to the commission's lack of commitment and inability to solve the problem."

Dr. Steven Berkeley, currently with the Hatfield Marine Science Center of Newport, OR, has been deeply involved in this subject since the 1980s when he conducted research and helped develop the Atlantic Billfish and Atlantic Swordfish FMPs. He had this to say about the status of blue and white marlin and ICCAT's management: "ICCAT has never taken its responsibility for managing blue and white marlin very seriously because these species are of only minor commercial importance. Even conducting a stock assessment for these billfishes was difficult to get ICCAT to support because of this, and as a result, the first ICCAT billfish assessment was not conducted until 1992. Results of this stock assessment indicated that both blue and white marlin were severely overfished, and had been for several decades. Subsequent stock assessments (1996, 2000) supported these conclusions, and indicated that both stocks have been spiraling downward unabated since the 1960's. Although ICCAT has recommended modest reductions in landings for both species, these reductions, even if realized, will not be sufficient to prevent further declines, *let alone* allow for rebuilding. Since most fishing mortality on these species comes as bycatch in tuna longline fisheries, rebuilding marlin stocks will almost certainly require restrictions on tuna fisheries, actions that ICCAT will be reluctant to recommend. Thus, absent development of more selective fishing gear or a change of heart at ICCAT, the prospects for rebuilding Atlantic marlin populations seem bleak."

So, we see that the white marlin population in each hemisphere (whether a single stock or two) has declined to an extremely low abundance, overall. As the remaining white marlin follow ancestral migration routes to their specific spawning, nursery and feeding grounds, they become concentrated for short periods in relatively small areas at the same season each year. Those who fish for them in such areas may well experience an abundance of fish for a period and presume that the population is therefore quite healthy. This would certainly be the opinion of those who fish the "hot" (seasonal) destinations like La Guaira, Venezuela or the mid-Atlantic. However, such "hot spots" are small in size and (exclusive of nursery areas) occupied for relatively short duration. They are, however, entirely predictable year-to-year. These local aggregation areas on the species' annual migratory route, and on

which the billfish tournaments depend, are referred to as the "season" for a particular destination or a "hot bite." But, these aggregation areas are really
their most critical habitats (spawning, nursery and feeding areas) on which the species depends for its survival. They are, in fact, their final refuges toward which a species collapses as its population size shrinks. We know that when the population was robust (30 years ago or more) fishermen would see large numbers of marlin much closer to shore, as noted by Dr. Safina, above. Now, they are rarely sighted during the season and only in their essential habitats. This is the picture of a species in great danger, one clearly threatened with extinction in the near term.

IX. Factors Contributing to Population Decline

A species shall be listed as *threatened* or *endangered* under the ESA "if the Secretary determines, on the basis of the best scientific and commercial data available after conducting a review of the species' status, that the species is endangered or threatened because of any one or a combination of the following factors" (50 CFR '424.11(c)). The best scientific and commercial information available (from ICCAT and its SCRS) makes it abundantly clear that Atlantic white marlin should be listed on the basis of four of the five specified factors: (A) overutilization for commercial purposes, (B) inadequacy of existing regulatory mechanisms, (C) predation, and (D) other natural and manmade factors affecting its continued existence, as discussed below.
9

A. Overutilization for Commercial Purposes

Unfortunately for white marlin and all the large pelagics, their worst enemy is no longer one from the deep. Now, their primary predator is human - in the form of industrial-scale commercial fishing fleets operated by many nations not only throughout these species' entire ranges, but also increasingly in their critical habitats - their spawning, nursery and feeding areas. All the large pelagics, including white marlin, are being hunted every day of their lives by this traveling horde of hundreds of commercial vessels. It is no wonder that after 40 years of overfishing, which is still being condoned by ICCAT, populations of most large pelagic species are being driven increasingly toward extinction, some closer than others, but all continuing downward. See Appendix 9 for graphic presentations of the population trends over the past 40 years that have been developed by the SCRS for all the large pelagic species of the Atlantic Ocean. They include Atlantic white marlin, Atlantic blue marlin, north Atlantic swordfish, western north Atlantic sailfish/spearfish, western north Atlantic bluefin tuna and Atlantic bigeye tuna. This is the key information ICCAT has had on which to base all its relevant decisions. The cause of the continued decline has been excessive commercial exploitation.

As noted previously, commercial fishing is responsible for at least 99.89 percent of the current reported mortality of Atlantic white marlin. Recreational tournaments are responsible for the remainder - 0.11 percent (see Table 1). Non-tournament sport fishermen (individuals and charter boats) take a few additional white marlin, but their number is likely quite small and insignificant in view of the very high release rate - 99 percent as self-reported (Ditton, 2000) - increasingly observed in U.S. and international billfish fisheries.

The primary commercial gear-types used are drift or pelagic longlines, drift entanglement nets or gillnets and purse seines. These gears are non-selective, meaning they cannot prevent catching and killing a large diversity of marine life with which they come in contact. As described above, they effectively catch not only the target species having high commercial value (swordfish and the larger tunas), but also kill a wide variety of other species, including *threatened* and *endangered* sea turtles, marine mammals and billfish. For a detailed listing of the thousands of animals caught on U.S. longlines in 1995, see Table 5 of RFA (1999). It also presents a detailed description of the effects of commercial fishing on swordfish, other billfish, tunas and sharks. See also Hinman (1998) and "Ocean Roulette: Conserving Swordfish, Sharks and other Threatened Pelagic Fish in Longline Infested Waters" by Ken Hinman, President of the National Coalition for Marine Conservation (NCMC), for a detailed examination of the practice of pelagic longlining and its effects on billfish and many other imperiled species in the Atlantic Ocean (NCMC, 1998) both presented in Appendix 17. See Amendment 1 to the Atlantic Billfish FMP (NMFS, 1999a) and the 2001 Stock Assessment and Fishery Evaluation for Atlantic Highly Migratory Species (NMFS, 2001a) for a detailed description of the Atlantic fisheries affecting white marlin and the other pelagics.

Longline gear takes 92 percent of white marlin reported landed by all ICCAT members in the Atlantic Ocean in 1999 (SCRS/00/04B). Most white and blue marlin caught on longlines could be saved since about 70 percent of white marlin (and 75 percent of blue marlin) are still alive when brought to the vessel (p. 3-71 of NMFS, 1999a). Following release, their subsequent survival rate is unknown since there have been no studies of post-release survival from longlines, gillnets or purse seines. Without having post-release survivorship studies on these or related species, we can only guess at the number and hope that it is 100 percent. Such studies (for both commercial and recreational fisheries) are an area of needed research.

"We now know that far more fish are caught and killed every year than our oceans are able to produce," said Dr. Jack Musick, head of the Vertebrate Ecology and Systematics programs at the Virginia Institute of Marine Science, and lead author for the AFS study on ocean species at risk of extinction (Musick *et al*., 2000c). "Contrary to prevailing scientific opinion ten years ago, it now appears that fishing may well drive marine fish species to extinction."

In summary, of all the ICCAT-managed stocks that are found off the U.S. coast, those in the most immediate danger from commercial over-exploitation are Atlantic white marlin, western Atlantic bluefin tuna, and Atlantic blue marlin, followed closely by Atlantic bigeye tuna, north Atlantic swordfish and perhaps western Atlantic sailfish/spearfish (see Table 2.1, NMFS, 2001). ICCAT and the SCRS's detailed stock assessments make this fact absolutely clear. Atlantic white marlin are the most seriously imperiled of this group and face a high level of continuing and ongoing threats from commercial over-exploitation.

B. Inadequacy of Existing Regulatory Mechanisms and Programs

Atlantic billfish management strategies are guided by international (ICCAT) and national mechanisms (the Atlantic Billfish FMP and indirectly the Atlantic HMS FMP). Two recent actions have

changed the U.S. focus of billfish management in the Atlantic Ocean. On the national level, passage of the 1996 Magnuson-Stevens Act initiated fundamental changes in U.S. fishery management policy, shifting emphasis to precautionary management strategies. In September 1997, NMFS listed marine fishery resources that were considered to be *overfished*,
including Atlantic blue and white marlin. This agency action triggered a suite of management requirements including development of a rebuilding plan for *overfished* stocks, and reduction in bycatch and bycatch mortality. (Bycatch is defined by the Magnuson-Stevens Act as the catch of species that are not sold or retained and includes animals discarded because their retention is prohibited or because they are not valuable economically.) In the international arena, ICCAT made its first-ever binding recommendation for Atlantic blue and white marlin in 1997, requiring (token) landing reductions of at least 25 percent from 1996 levels by the end of 1999. The United States sponsored a resolution at the 1998 ICCAT meeting resulting in a recommendation to develop stock recovery scenarios following the next assessment for Atlantic blue and white marlin in 2000. The ICCAT recommendations adopted this year (Appendix 4) are the result of the latest stock assessment. However, they are simply not enough to stem the rapid slide of white marlin toward extinction. Following are descriptions of the national and international regulatory mechanisms and a discussion of their inadequacies.

1. United States

As noted elsewhere, the Magnuson-Stevens Act governs the conservation and management of U.S. fisheries. For most species, regional fishery management councils make fishery management recommendations to the Secretary of Commerce, who reviews and can approve them. However, in the case of HMS, the Secretary has direct management responsibility (16 U.S.C. ' 1852(a)(3)). Therefore, the Secretary, acting through NMFS, must ensure that fishery management plans (FMPs) for these species contain the required provisions (*Id.* ' 1853(a)) and comply with the national standards (*Id.* ' 1851(a). Because white (and blue) marlin had been declared by the Secretary to be *overfished* in 1997 (NMFS, 1997e), the Magnuson-Stevens Act (*Id.* ' 1854(e)) requires NMFS to develop plans to rebuild the fisheries to a level capable of producing the OY. It also requires NMFS to institute conservation and management measures that "to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." (16 U.S.C. '' 1851 (a)(9), 1853(a)(11)). Since the primary source of white (and blue) marlin mortality is bycatch (or more properly bykill) on pelagic longlines, the bycatch provisions of the Act are particularly important here.

a. Failure to Address Magnuson-Stevens Act Requirements

Unfortunately, NMFS has failed to meet its legal responsibility to minimize marlin bycatch and the mortality of bycatch that cannot be avoided, to the extent practicable. In sharp contrast to its actions concerning juvenile Atlantic swordfish (the bycatch of which NMFS actively sought to reduce), the agency entirely failed to evaluate promising measures in its Draft Amendment 1 to the Billfish FMP (or elsewhere) that could have reduced marlin bycatch (e.g., no-longlining zones or "closures" in their primary habitats - mid-Atlantic and Caribbean). In its comments on the agency's draft FMPs on Billfish and HMS, the public observed that virtually nothing had been done in either document to reduce white or blue marlin bycatch on longlines. (Copies of letters from the National Coalition for Marine

Conservation, Ocean Wildlife Campaign and the National Audubon Society are included in Appendix 20.) At the conclusion of its rulemaking process, NMFS could hope for perhaps a 9 and 15 percent reduction in white and blue marlin dead discards, respectively, assuming no effort redistribution. That marginal
improvement does not constitute minimizing marlin bycatch to the extent practicable. Accordingly, the agency was sued (National Coalition for Marine Conservation v. Daley, Civ. No. 1:99-01692 (D.C. Cir. 1999) - one of 130 lawsuits brought against the agency that are currently pending).

In partial settlement of this lawsuit, NMFS recently closed three areas to pelagic longline fishing (65 Fed. Reg. 47214-47238, Aug. 1, 2000) - the East Coast of Florida year-round and two blocks near the De Soto Canyon, seasonally. These areas include the primary nursery areas of swordfish (depicted in Fig. 12, Cramer, 1996a) and thus they reduce juvenile swordfish mortality. But, they do little for white (or blue) marlin. NMFS has yet to reduce marlin bycatch by implementing or even proposing no-longlining zones in any of the primary habitats of white (or blue) marlin in the U.S. EEZ (see Appendix 8). The agency's failure to meaningfully reduce such bycatch violates the requirements of the Magnuson-Stevens Act and undermines the objectives of the Atlantic Billfish FMP, as discussed below, to the continuing detriment of these depleted species, which the statute charges NMFS with conserving.

b. Biomass Decline Undermines the Atlantic Billfish FMP

The objectives of the Atlantic Billfish FMP (SAFMC, 1988) are to: "A. Maintain the highest availability of billfishes to the U.S. recreational fishery **Y** B. Optimize the social and economic benefits to the nation by reserving the billfish resource for its traditional use**Y**"It stipulates that the greatest overall benefit to the nation will result from reserving to the extent possible, billfish occurring in the EEZ to the U.S. recreational fishery." The population of each Atlantic billfish species (white marlin, blue marlin, sailfish and longbill spearfish) is to be managed to achieve the optimum yield from the recreational fishery. According to the Billfish FMP, "Optimum yield in the billfish fishery is defined as the greatest number of billfish that can be caught by the recreational fishery in the U.S. EEZ."

The Sustainable Fisheries Act (SFA)(Pub. L. 104-297) redefined optimum yield to mean "the amount of fish which (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and **recreational opportunities**, and taking into account the protection of marine ecosystems; (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, **as reduced by any relevant economic, social, or ecological factor**; and (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery" (emphasis added). Therefore, for the Atlantic billfish fishery, which is allocated entirely to the recreational sector, the relevant economic and social factors are to "maintain the highest availability of billfish to the U.S. recreational fishery." The relevant ecological factor is for fishery managers to provide sufficient billfish population abundance and normal size-class distribution so as to also maintain healthy predator-prey relationships in the marine ecosystem. Managing the fishery to maximize both objectives is appropriate and desirable since the billfish fishery is almost entirely (approaching 99 percent) a catch-and-release fishery. Therefore, under the SFA, the biomass or abundance level that must be maintained to produce the OY for the recreational fishery is an abundance greater than that which will produce the maximum sustainable yield. In other words, the greater the stock's abundance, the better will be the billfish fishery. Maximizing abundance to comply with the OY definition is thus entirely consistent with the primary objective of the Billfish FMP.

It also follows that any activity (such as high levels of bycatch mortality caused by domestic and foreign commercial longline vessels) that prevents Atlantic billfish populations from remaining at their OY level undermines the basic tenet of the Billfish FMP. As noted above, NMFS considers white marlin OY to be 30 percent greater than its MSY biomass level. However, the species' biomass at the end of 1999 was estimated to be only 13 percent of the MSY biomass and declining rapidly due to excessive commercial fishing mortality (8 to 10 times the sustainable level). Thus, it is clear that the white marlin is being managed in a manner that is inconsistent with the requirements of the Sustainable Fisheries Act. Implementation of this statute has not provided sufficient regulatory protection for white (or blue) marlin.

2. International

In addition to domestic regulation by NMFS, HMS including white marlin also are managed internationally by the International Commission on the Conservation of Atlantic Tunas (ICCAT), an international body of which the United States is a member. ICCAT meets annually to issue recommendations that set quotas and impose other measures in an attempt to manage species that cross national boundaries. Pursuant to the Atlantic Tunas Convention Act (ATCA), the Secretary then issues regulations to carry out ICCAT recommendations accepted by the United States (16 U.S.C. ' 971d(c)(1)(A)). ATCA forbids domestic regulations that "have the effect of increasing or decreasing any allocation or quota of fish or fishing mortality level to the United States agreed to pursuant to a recommendation of" ICCAT, but does not prohibit other unilateral management actions, such as closed areas, that do not increase or decrease the U.S. quota (*Id.* ' 971d(c)(3)). Once an allocation, quota, or fishing mortality level is agreed to pursuant to an "international fishery agreement" such as ICCAT, the Magnuson-Stevens Act requires that NMFS "provide fishing vessels of the United States with a reasonable opportunity to harvest such allocation, quota, or at such fishing mortality level." (16 U.S.C. '1854(g)(1)(D)). The Magnuson-Stevens Act also requires NMFS to "diligently pursue, through international entities (such as [ICCAT]) . . . international fishery management measures" comparable to those in the domestic FMP (*Id.* ' 1854(g)(1)(F)).

a. Decades of Overfishing Sanctioned by ICCAT

The existing regulatory mechanisms at both the national and international level discussed above are clearly insufficient to maintain Atlantic white marlin and the other large pelagic species at the sustainable levels specified in U.S. law and in the international convention (ICCAT Convention) governing these fisheries. Overfishing using non-selective gear types is seriously affecting all the large pelagic species (Appendix 9) and threatening their long-term survival. In the greatest danger are Atlantic white marlin. The primary reason is that ICCAT has failed to limit fishing mortality by enforcing or even imposing the necessary catch limits in order to conserve the stocks for which it has claimed management authority since its formation in 1966. In fact, ICCAT has sufficient authority to set proper quotas based on sound scientific advice and to enforce its quotas with sanctions. Rather than to do so, it has simply chosen to allow overfishing to continue with little to no restraint. ICCAT's own data portray the year-by-year failure of its regulatory mechanisms and fishery management decision-making. It consistently

violates its own stated management objective - to maintain stocks at their MSY abundance level. It is clear that this is a case of the "fox guarding the henhouse" with the predictable disastrous results for the resource. In its 35 years of existence, ICCAT has succeeded only in documenting the demise of all those species over which it has claimed conservation and management authority.

Atlantic white marlin are in danger of extinction well "within the foreseeable future" as used in the ESA. Specifically, if current population declines are not reversed by taking dramatic action now, as we recommend, Atlantic white marlin will become extinct, or at least *functionally extinct*, in less than five years, and Atlantic blue marlin in about ten years. (See WHM-Fig 4. and BUM-Fig.3 in Appendix 2.) Western Atlantic bluefin tuna are being held on the edge of extinction (spawning stock biomass estimated to be 14 to 17 percent of MSY) by an unsound ICCAT-imposed "monitoring" quota that is preventing that stock's recovery. (It is ostensibly being allowed by ICCAT only to provide information on year-class strength for use in stock assessments, which in reality can be provided using non-lethal means such as tagging and surveillance by aircraft). While ICCAT does not claim management authority over sharks, we know from the scientific evidence for this large group of species that most of the "large coastal group" and probably most of the "pelagic group" have experienced population declines at least as severe as have Atlantic billfish, swordfish and the larger tunas (see Table 2.1 of the HMS SAFE Report).

b. ICCAT Quota Reductions Will Not Prevent a Slide to Extinction

Will ICCAT's recent quota reductions stop the decline and rebuild Atlantic marlin populations? ICCAT's previous quota reduction provides a good indication. In 1997, ICCAT adopted a recommendation to reduce white and blue marlin landings (not catch) by at least 25 percent from 1996 levels, starting in 1997, to be accomplished by the end of 1999. The clearly stated purpose was to reduce mortality to help the declining stocks recover. 1996 was a year of very high Japanese landings and relatively low U.S. catch (in the U.S., billfish are reserved solely for the recreational fishery) which tended to place most of the conservation burden on U.S. anglers who we have shown are obviously not the cause of the problem. As required by ATCA, the U.S. government implemented ICCAT's recommendation by issuing regulations. Specifically, it chose to increase size limits on the fish that could be retained by recreational vessels (63 Fed. Reg. 14030, March 24, 1998; 63 Fed. Reg. 51859, September 29, 1998). NMFS chose to do nothing to simultaneously limit the mortality caused by its commercial vessels (such as implementing area closures), which are responsible for a majority (99.8 percent) of the reported mortality.

The latest Billfish Workshop was conducted in the summer of 2000 using reported catch and effort data through 1999. The shocking stock assessment results are summarized above. Were ICCAT's landings reductions sufficient? No. Did the stock recover? No. Did the reductions arrest the Atlantic white marlin stock's biomass decline? No. Did they produce any reduction at all in its rate of decline?

No. If anything, the decline appears to have actually accelerated (see WHM-Fig. 4, of the Executive Summary). Did ICCAT landings reductions

return the fishing mortality rate to the sustainable (F_{MSY}) level? No. Did its landings reductions result in an overall decline in fishing pressure by the international fleets of ICCAT's member nations? No. Fishing mortality actually increased dramatically between 1996 and 1999. It is estimated by the SCRS that in 1996, fishing pressure was four times the F_{MSY} level. But by the end of 1999, it had grown to nearly eight times the F_{MSY} level (see WHM-Fig. 5 of the Executive Summary). Fishing mortality was last at the sustainable level (F_{MSY}) in 1980. Did ICCAT's very limited reductions do any good at all for this population? Apparently not. Were they then just too small to have an effect? Yes, assuming they were even implemented by all members.

After being presented with the results of the 2000 stock assessment showing white marlin abundance had declined to a dangerously low level, ICCAT adopted additional restrictions. This is referred to by ICCAT as its "rebuilding plan." Unfortunately, they were not to enter into force until June 1, 2001, according to ICCAT Executive Secretary (Appendix 21). Since the next stock assessment is not scheduled until the summer of 2002 (and it will be using fishery data only through 2001), there will be only six months for the landings reductions to be expressed in increased biomass. Too little time will have elapsed to see any effect of the most recent landings reductions (if there even are any). Therefore, the next stock assessment will likely tell us nothing new, and there is no point in waiting for its results to be made known. Time is of the essence. We need to act now, before it is too late.

Landings (not catch or mortality) of white marlin are to be reduced by 67 percent (and blue marlin by 50 percent) and commercial sale is prohibited (except for some artesianal fisheries having no significant impact). Will these measures, if actually implemented by all ICCAT members, reduce mortality sufficiently to allow the population of Atlantic white marlin to recover to the F_{MSY} level? For the following reasons, the best available scientific and commercial data indicate that the actions are "too little, too late" to prevent the stock(s) from sliding into *functional extinction.* Our basis for this conclusion is as follows:

11. Fishing mortality is not being reduced enough to stop the population decline. If every still-living white marlin caught by commercial vessels is released and survives in good shape, fishing mortality will be reduced by no more than 70 percent. (An estimated 69.9% of white marlin caught on U.S. longlines in 1995 were released "alive" (p. 3-71, NMFS 1999a). Accordingly, fishing mortality will be reduced from about 8 times the F_{MSY} level to no less than 2.3 times the F_{MSY} level. Yet this is still more than double the sustainable level. Thus it will slow, but not stop, the biomass decline. And of course, this reduction in mortality is far too little to produce a rebuilding of the population. It is also important to understand that not every white marlin released will likely survive. (Post-release survival of white marlin is unknown but may not be very high considering the trauma inflicted by spending hours on a longline, entangled in a gillnet or battered by other fish confined in a tightening purse seine.) Therefore, under ICCAT's current "rebuilding plan," the fishing mortality will actually be even higher than 2.3 times F_{MSY}.

Moreover, the start of the "rebuilding" was delayed until June of 2001. With only two to three years left (from the end of 1999) before its biomass functionally reaches zero, Atlantic white marlin will simply not be able to survive this continued high level of fishing mortality. Too few adults will remain alive to perpetuate the population. Accordingly, it will spiral to extinction.

12. Essential habitats such as spawning areas are still being targeted, rather than avoided. Marlin are taken as bycatch, not as the target species. Unless the commercial fleets make dramatic changes in <u>where</u> they will fish, in order to avoid areas of high marlin concentration (i.e., their prime spawning and feeding areas identified above), white (and blue) marlin will continue to be caught by longline gear in like proportion to the target catch. For those caught on longlines, three in ten white marlin will already be dead (p. 3-71, NMFS 1999a). The areas of high billfish bycatch are, unfortunately, also areas of high target species catch, particularly swordfish. The reason is that such areas are also the swordfish's primary spawning areas or they are areas rich in the prey to which all the large predators are drawn. Commercial fishers will certainly not leave the most productive fishing grounds, voluntarily. Based on an extensive history, the international commercial fleets can be expected to change the locations they target only if they can exploit even richer fishing grounds elsewhere. That is not likely in view of worldwide fishery declines in spite of increasing fishing effort and technical sophistication. International commercial fleets targeting the large pelagics have never demonstrated self-restraint specifically to conserve a stock. Quite the opposite is true. Their unsustainable fishing practices and group decision-making at ICCAT attest to this truth. Consequently, we remain convinced that under ICCAT's current regulatory regime, the commercial fleets of many nations will continue to fish with longlines and other non-selective gear concentrated in these species' key spawning and feeding grounds. Moreover, they will do so until the much more abundant target species also become too scarce to make a profit. Unfortunately, that will be well beyond the point at which Atlantic white marlin are driven over the edge of extinction. The same is true of Atlantic blue marlin.

13. ICCAT member nations have a long history of ignoring ICCAT recommendations. Several prominent fishing nations (e.g., Spain, Portugal, Cuba, Uruguay, Brazil, and other European Union members) routinely exceed their quotas by large margins (e.g., Section 6.1, 1998 SCRS Detailed Report on Swordfish) and ignore minimum size limits (e.g., Spain and other EU countries) imposed to provide some measure of protection to juveniles (1998 SCRS, Doc. 14-A, and Section 6.2, 1998 SCRS Detailed Report on Swordfish). This occurs particularly flagrantly with regard to those species, which are the most valuable commercially - bluefin tuna, swordfish and bigeye tuna. Such routine overages are well known throughout ICCAT, and have made a mockery of ICCAT's management for many years. More importantly, ICCAT has consistently refused to enforce its recommendations with sanctions (i.e., quota reductions, trade embargoes) on such large-scale, flagrant violators. We have no reason to believe that such behavior will not simply continue.

14. Since ICCAT's current recommendations require only that its members reduce <u>reported</u> landings of white and blue marlin, its is possible (in view of the routine behavior noted above)

that violators will simply adjust downward the numbers they report to ICCAT. (Up until now, all ICCAT members had no reason not to accurately report their landings since there was never a penalty for any overages or undersize fish.) In this way it will appear that they are in compliance with landings reductions when in fact they can continue to fish where and how they do now. This is entirely possible since independent verification by observers does not exist on the vast majority of ICCAT members' vessels (the U.S. has only recently raised its observer coverage to near 5 percent). Reporting accurate data has been on the "honor system" - clearly a shaky proposition based on many ICCAT members' past performance (consistently large quota overages and minimum size violations) and economic motivation.

15. The fishing mortality caused by non-ICCAT member nations is totally unreported but increasingly thought to be substantial and growing. Some have suggested this illegal fishing may approach the ICCAT members' total reported catch (S. Sloan, personal communication). (The SCRS has attempted to incorporate an estimate of such mortality in its models, but at best it can only be roughly approximated.) These nations are unconstrained by any ICCAT restrictions. Without tough sanctions, these rogue nations have no reason to reduce their illegal catch of white marlin or any other species. Their fishing pressure will simply continue (targeting the more abundant species - swordfish and large tunas - until they too are exterminated), unless such nations are brought into the ICCAT community and they allow themselves to be bound by its recommendations - a remote possibility since no broad disincentives have yet been imposed by ICCAT members.

C. Predation

As a population declines and it edges close to extinction, every individual becomes increasingly important to the species' reproductive capacity and its continued survival. Therefore, predation by sharks and other large ocean carnivores is becoming a more significant threat to the species' survival the closer white marlin come to the "point of no return" or *functional extinction*.

D. Other Natural or Manmade Factors Affecting its Continued Existence

It is broadly recognized that the problem of overfishing extends also to prey species, on which white marlin and all the large pelagic species depend for their survival. If the prey is removed by excessive fishing, the top predators' populations will be seriously affected as well. Overfishing is known to be occurring at all levels of the marine food chain, beginning with the most valuable commercially (generally the top predators) and once they have been depleted also including all intermediate levels as well. This pattern of increasing exploitation and resource depletion, known as "fishing down the food chain," has been in progress for 300 years. According to the 2001 Report to Congress on the Status of U.S. Fisheries (NMFS, 2001c), the population status of fully two thirds of the more than 900 stocks managed by the federal government, and now evaluated annually by NMFS, is unknown. Most of the unknown stocks occur in the primary areas inhabited by white marlin, and a large majority of the primary prey of white marlin are included in the "unknown" category. However, two important prey species, Atlantic bluefish and squid, are listed as *overfished*. Thus, the white marlin population is being affected by not only by commercial overfishing, particularly in its essential habitats, but also potentially threatened by increased starvation rates due to overfishing also on its primary prey species.

Deployment by the U.S. Navy of a low-frequency active sonar (LFAS) system in ocean waters constitutes another looming manmade threat to the continued existence of the dwindling population of Atlantic white (and blue) marlin, as well as other endangered forms of marine life (e.g., marine mammals and tuna). The effects of strong sonar signals is proposed as a series of tests over several years involving signal emitters attached to whales. However, the effects on fishes' lateral line systems is also unknown. White marlin (as well as the rare bluefin tuna and blue marlin) often concentrate in the same areas for feeding on the same prey aggregations as do whales. Like most fish, white marlin are dependent on their highly sensitive lateral line systems to detect subtle pressure waves indicating the presence of both prey and potential predators. This system is their equivalent to most air-breathing animals' hearing systems. Damage to a white marlin's lateral line system could obviously affect its ability to find prey and simultaneously render them helpless to predators. Thus, even short-term damage could prove fatal. The fact that the sonar testing will be deployed in prime feeding areas (e.g., the Azores have been proposed) means that many white marlin and the other large pelagic species may experience substantial collateral damage, which apparently has not yet even been considered by either NMFS or the U.S. Navy.

X. Benefits of an Endangered Species Act Listing

The listing of the Atlantic white marlin under the ESA, as recommended herein, would greatly strengthen federal and international fishery management programs and recovery efforts for this species. Among other benefits discussed below, it would:

- Mandate and encourage the preparation and implementation of a comprehensive U.S. recovery plan for the Atlantic white marlin throughout its historic range;

- Give federal agency officials an added mandate to implement additional time and area closures to commercial fishing in the species' essential habitats in U.S. EEZ waters and to seek international agreements to immediately reduce overall fishing mortality to levels that will stop the population decline and prevent overexploitation of the species;

- Help to conserve and assist in rebuilding to sustainable levels other federally- and internationally-managed large pelagic species, which share the same key habitats and are affected by the same commercial fishing operations, including swordfish (*X. gladius*), blue marlin (*M. nigricans*), sailfish (*I. platypterus*), longbill spearfish (*T. pfluegeri*), bluefin tuna (*T. thynus*) and bigeye tuna (*T. obesus*);

- Stimulate a more effective public information and education program on behalf of the Atlantic white marlin, thereby building public support internationally for conservation of it and all the large pelagic species; and

- Result in increased funding—through federal, state, and international cooperative agreements and additional federal funding sources—for research, monitoring, law enforcement and management.

A. Listing as *Threatened* or *Endangered* Required

Based on the information discussed above, we recommend that Atlantic white marlin be listed under the ESA as a *threatened* or *endangered* species throughout its known range. Either designation will dramatically raise the importance of immediately taking those additional steps needed both in the United States and internationally to halt the population's rapid decline and to begin its rebuilding to a sustainable level, as required by U.S. law and by the ICCAT Convention. It will force the U.S. government to immediately develop and implement a meaningful recovery plan for white marlin in U.S. EEZ waters and beyond, and involve U.S. fishermen targeting the large pelagic species throughout the Atlantic Ocean.

The population is steadily approaching *functional extinction* within years (not decades) as depicted by the SCRS's population projection. Yet, there is still time to save the species if reasonable actions are taken promptly. The primary cause of the white marlin decline is documented as excessive commercial exploitation in their key habitats, but targeting other species. ICCAT's recent recommendation to release all live billfish is a good first step, but not nearly enough at this point to save the species. If the use of non-selective commercial gear is prohibited in the white marlin's primary habitats and this second major source of mortality is also eliminated, the species may be biologically capable (because of its high fecundity) of recovery to a healthy population level quite rapidly.

Our recommended actions are summarized in Section X. B., below. We also recommend that a research project be initiated immediately by NMFS (in cooperation with ICCAT/SCRS members) to identify and map the primary spawning and nursery areas of white marlin (and the other large pelagic species whose populations are in deep decline), particularly those in the northern hemisphere. As noted earlier, we recommend that NMFS complete the North Atlantic white (and blue) marlin stock assessment as soon as possible and use its results to guide additional actions, as needed.

Equitable and responsible actions by the United States will provide an important example for the international community and give additional legitimacy to parallel U.S. efforts to seek international agreements as well. An ESA listing will provide a significant inducement for the U.S. government (at the diplomatic level) and the U.S. delegation to ICCAT to immediately seek international agreements on an emergency basis to further reduce mortality by prohibiting commercial fishing in their spawning areas and enforcing ICCAT's restrictions with appropriate sanctions. Alternatively, a continuation of half measures and "foot dragging" - the past and still current ICCAT approach - will doom Atlantic white marlin (and Atlantic blue marlin among other species) to extinction. Bold international action is needed immediately. The United States must provide the leadership.

The major threat to the Atlantic white marlin is commercial over-exploitation by many nations increasingly being located in the large pelagic species' prime spawning (and feeding) areas. Some of these areas are located in U.S. EEZ waters. Others are in the EEZ waters of other nations, and some of the most important are in international waters (see Appendix 8 and SCRS 2000 WHM-Fig 1. in Appendix 2). Commercial fishing vessels (from many nations including the United States), which are targeting other more valuable species (swordfish and the large tunas), are responsible for the majority of the documented kill of Atlantic white marlin. Of this, U.S. commercial vessels are thought to be responsible for roughly 5 percent of the total mortality (NMFS, 1999a). U.S commercial vessels are already prohibited from keeping billfish, and ICCAT has prohibited the retention and sale of all live billfish by all its member nations (starting June 1, 2001). But, the unavoidable bycatch mortality (30 percent of white marlin are already dead and many "released" will likely die from the trauma they have experienced) will continue until the international fleets abandon their practice of targeting swordfish and tuna in their key spawning (and feeding) areas, which we believe are also the essential habitats of white marlin (and blue marlin). In addition to listing Atlantic white marlin as a *threatened* or *endangered* species under the ESA, the specific conservation measures we recommend be taken are as follows:

13. U.S. Leadership

All commercial fishing affecting white marlin may not need to be halted, only that causing the bulk of the problem and then, perhaps, only in their key habitats. Aggressive U.S. leadership is urgently needed now to address the problem. Without such U.S. leadership, reliance on ICCAT member nations to conserve the species is an illusion. The United States must take the lead by reducing the major sources of white marlin bycatch mortality within the U.S. EEZ and by immediately seeking international agreement to reduce overall fishing mortality to levels that will stop the decline and ensure a recovery.

Pelagic longline bycatch accounts for more than 98 percent of reported U.S.-caused white marlin mortality (SCRS/00/23, Table 2). However, the U.S. government has done nothing to reduce the bycatch of this extremely overfished species despite the clear direction of the Magnuson-Stevens Act to minimize bycatch and the mortality of bycatch that can not be avoided to the extent practicable. As a consequence, indiscriminant longline fishing continues to drive this population ever closer toward extinction.

Bycatch mortality is occurring primarily in this species' key spawning and feeding areas - the "hot spots" referred to earlier. Specified below are those located within the U.S. EEZ that should be closed to commercial fishing for HMS. The total area contained within these "hot spots" is less than 2 percent of the total area fished predominantly by the U.S. longline fleet. Consequently, their closure will not affect a large portion of the ocean areas fished by longliners - only that portion which is the most important to white marlin. However, reducing bycatch in the primary U.S. EEZ "hot spots" will significantly reduce fishing mortality on white marlin over a large percentage of their most important habitats. This will contribute substantially to the population's recovery. The relative amount of bycatch reduction possible by closing these 'hot spots" could be quantified readily by using the GIS maps prepared by NMFS' Dr. Pamela Mace based on U.S. longline logbook data for 1994 and 1995 (Appendix 8, White Marlin, Quarters 2 and 3). A rough approximation is that more than 85 percent of the white marlin interception would be eliminated by adopting the seasonal longline closure areas in U.S waters recommended below. Applying 85 percent mortality reduction to the 3,658 white marlin that NMFS estimates were killed by U.S. longline vessels in 1995 (Cramer and Adams, 1999), would eliminate the deaths of over 3,100 white marlin per year. It would do so by affecting only about 2 percent of the U.S. longline vessels' normal fishing area. It is certainly time for the commercial sector to start shouldering some of the load of conservation that until now has been borne by the recreational sector. It has established a very high standard for the commercial sector by reducing its mortality to a handful of white marlin per year.

If there are actually two separate sub-populations of Atlantic white marlin (i.e., a North Atlantic and a South Atlantic population), which is clear to us as discussed previously and below, this recommended U.S. action will have a profound effect on recovery of the northern sub-population. Therefore, the societal and economic benefits of the northern sub-population's recovery will flow largely to the U.S. and the nations of the broader Caribbean region.

From tagging returns and 10 years of detailed catch history data from U.S. longline vessels (as mapped by Dr. Mace), we know that this sub-population spends a majority of its life history in U.S waters and those of our neighbors to the south in the Caribbean region. Dr. Mace's maps make this point very well. It is confirmed by years of tagging returns. Except for occasional strays, tagging returns show that the range of the northern white marlin sub-population does not overlap that of the southern sub-population. Of the 41,177 northern hemisphere white marlin that have been tagged, not one has been recovered in the southern hemisphere. The epicenters of the two hemispheres' spawning areas are separated by 5,000 miles. Moreover, they are used during the spring in each hemisphere thus occupied six months apart. White marlin in the North Atlantic Ocean are concentrated along the mid-Atlantic and northern Gulf of Mexico "hot spots" in our fall when the white marlin of the South Atlantic Ocean are moving toward the coast of Brazil in preparation for their spawning in that hemisphere's spring.

The United States has the authority independently to protect key habitats (i.e., spawning areas and important feeding areas) in its EEZ waters. ATCA, the federal statute authorizing U.S. implementation of ICCAT's recommendations, does not prevent complementary action in U.S. waters. In particular, there is no prohibition against closing any areas to U.S. fishing vessels as a means to assist in conserving and rebuilding a population. In fact, ICCAT has recommended the use of area closures to protect essential habitats, and NMFS has recently closed several areas to reduce longline bycatch of very small (sub-legal) swordfish.

The United States has a duty to properly manage fishing in its own waters to help conserve Atlantic white marlin. U.S commercial fishing vessels should be prohibited from using non-selective gear in white marlin "hot spots" located in U.S. EEZ waters (see below and Appendix

8), and existing closures should be continued. (This will also provide a good example for the international community to follow. It is a prerequisite for seeking further international reductions in mortality.) Therefore, the United States should immediately take the necessary steps to prohibit commercial vessels from fishing for any large pelagic species in the key habitats of white marlin which are located in the U.S. EEZ, as follows:

_ Prime spawning areas in U.S. EEZ waters - prohibit commercial fishing for large pelagic species in the "hot spot" located southeast of St. Croix; maintain the existing year-round prohibition on such commercial fishing in the Straits of Florida;

_ Prime feeding areas in U.S. EEZ waters - prohibit commercial fishing for large pelagic species between the 100 and 1,000 fathom depth contours (a) from Cape Hatteras (35° N latitude) to the eastern tip of Georges Bank (approximately 66° 10' W longitude) from June 1 through October; and (b) from the U.S. border with Mexico (26° N latitude) to the east of the De Soto Canyon (85° 30' W longitude) from May 1 through October. These seasonal/area closures should be in addition to those areas already closed by NMFS by rule issued August 1, 2000 (FR 47214), which reduced bycatch mortality primarily for juvenile swordfish. Such areas do contain smaller "hot spots" that are seasonally important feeding areas for white marlin juveniles and adults, particularly the east coast of Florida and Straits of Florida. However, the "hot spots" within these existing closure areas are not the main concentration areas for white marlin. Consequently, they provide relatively little protection for white marlin from continued high bycatch mortality due to longlines.

It is obvious that white marlin recovery requires an international strategy as well. Therefore, the United States should also exert leadership within ICCAT by seeking international agreement to further reduce the level of fishing mortality on Atlantic white marlin sufficiently to ensure with a high probability of success that the stock is returned to a healthy level (MSY) within 10 years. To do so, fishing mortality must be reduced severely and their prime spawning areas closed to large-scale commercial fishing. The areas (in at least the North Atlantic) that should be closed are very small in relation to the total area fished routinely by U.S. and international commercial interests. For example, the closure areas in U.S. EEZ waters that are recommended herein (see below) represent less than 2 percent of the total area fished predominantly by U.S. longline vessels (see Appendix 8 and Figs 4-8 of Cramer, 1996, reproduced in Appendix 12). The United States should seek international agreement to:

_ Immediately reduce Atlantic white marlin fishing mortality (not landings) to that level needed to stop the population's rapid decline and cause it to rebuild to ICCAT's stated management objective (the MSY level) with a high degree of certainty within 10 years. Fishing mortality (F) must be reduced to well below the F_{MSY} level and as close to zero as possible. A schedule for compliance and milestones should be specified and independently monitored. Independent observers should be included. The population (and sub-populations) should be monitored bi-annually, and quotas adjusted as needed to maintain the rebuilding schedule.

_ Prohibit all large-scale commercial fishing in the primary spawning areas of Atlantic white marlin (or those specific areas occupied by adult white marlin during their spring spawning periods in each hemisphere); identify such areas from existing maps and related information cited in this petition until more complete (Atlantic-wide) maps and charts become available; undertake a research effort to further identify the primary spawning, nursery, and feeding areas of white marlin and the other large pelagic species concentrating on those species in greatest danger of population collapse (i.e., white marlin, blue marlin, and bluefin tuna); implement additional seasonal closures, as needed; and allow artesianal, subsistence and recreational fisheries to continue, provided their level of mortality continues to be insignificant.

_ Provide incentives for all nations that are fishing in the Atlantic for large pelagics to join ICCAT and be bound by its recommendations, and

_ Enforce compliance with ICCAT recommendations by committing to and employing trade sanctions and other available disincentives.

11. Summary

The most up-to-date scientific information available indicates that the Atlantic white marlin (*Tetrapturus albidus*) is, at the very least, threatened with *functional extinction* throughout its Atlantic Ocean range. From the extensive record developed by the SCRS, ICCAT's scientific advisory committee, it is clear that: (a) ICCAT has allowed the species to be *overfished* by commercial vessels from many nations for the last three decades; (b) fishing mortality is about 8 to 10 times higher than the sustainable level and still rising rapidly; (c) the abundance of the population has declined to a dangerously low level - less than 15 percent (perhaps 11 to 13 percent) of its maximum sustainable yield level (ICCAT's stated management objective); (d) it is still declining at a rate that, without intervention, will bring it to *functional* or *ecological extinction* in less than five years (perhaps in as little as three years); (e) the white marlin population is being subjected to increasing threats to its continued survival from a variety of both natural and manmade sources; and (f) the U.S. domestic and international fishery management decision-making system has been inadequate to prevent this and other large pelagic species' inexorable slide toward extinction.

The fishery management system is controlled by ICCAT and, for the United States, by NMFS and NOAA. Faced with the latest stock assessment results, ICCAT adopted a "billfish rebuilding plan" that was implemented June 1, 2001. It essentially prohibits retention of billfish for sale - a good first step, but "too little, too late" to save white marlin. At most, it will slow but not stop the population's decline. The international fleets, including U.S. vessels, are targeting other more economically valuable species (swordfish and the larger tunas), whose populations are much more abundant than are white (or blue) marlin. White marlin will not be able to sustain this continued incidental mortality or last much longer, according to the SCRS's population projections. Both marlin are caught as bycatch, with 30 percent of white marlin already dead. It will simply continue until the fleets are prevented from fishing in the species' primary spawning and feeding areas.

In conclusion, petitioners assert that the discussion above requires listing of *Tetrapturus albidus* as *threatened* or *endangered* under the ESA. Further, petitioners formally request immediate action by the U.S. government through emergency rulemaking to rapidly develop and implement an adequate species recovery plan involving both domestic and international strategies, as described above. The recovery plan should require that:

_ key white marlin spawning and feeding areas in U.S. EEZ waters be closed to commercial vessels fishing; and

_ the United States exert leadership internationally by seeking agreement (through ICCAT) to further reduce fishing mortality sufficiently to allow the stock to recover to its MSY level within ten years, and by prohibiting commercial fishing in its primary spawning grounds.

Finally, we request that *critical habitat* of Atlantic white marlin be designated on an expedited basis, as recommended herein, and protected to the degree possible.

Dated: August 31, 2001

Respectfully submitted by the following co-petitioners:

D. C. "Jasper" Carlton

For

Biodiversity Legal Foundation
198 West Sycamore Lane
Louisville, CO 80027
(303) 926-7606

and

James R. Chambers
Chambers and Associates
9814 Kensington Parkway
Kensington, MD 20895
(301) 949-3003

Copy: Donald L. Evans, Secretary of Commerce
Gale A. Norton, Secretary of the Interior