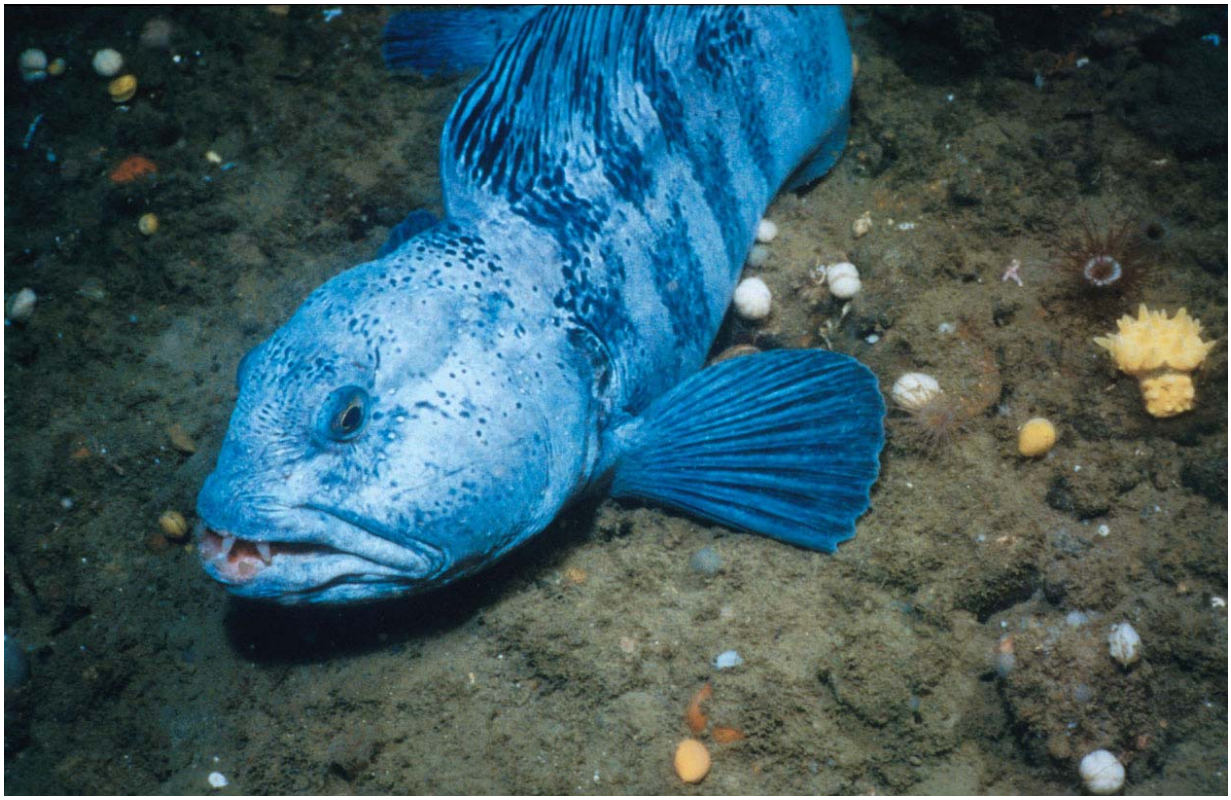
BEFORE THE SECRETARY OF COMMERCE

PETITION FOR A RULE TO LIST THE U.S. POPULATION OF ATLANTIC WOLFFISH (*Anarhichas lupus*) AS AN ENDANGERED SPECIES UNDER THE ENDANGERED SPECIES ACT



OCTOBER 1, 2008

Petitioners: Conservation Law Foundation, Dr. Erica Fuller and Dr. Les Watling

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Peter Auster and Paul Donaldson, National Undersea Research Center, University of Connecticut

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Thanks also to the staff at the Census of Marine Life who plotted the National Marine Fisheries survey data and mapped Atlantic wolffish abundance over time and substrate. We are also extremely grateful to the individuals at the Northeast Fisheries Science Center and National Marine Fishery Service who promptly complied with our document requests and diligently answered our emails.

Finally, Erica Fuller would like to thank Roger Fleming and Alison Rieser, who as her professors at the University Of Maine School Of Law helped her to conceive of and develop this Petition and have since provided much advice and friendship over the years.

Electronic Copy of this Petition Available at: http://www.clf.org/wolffish

Executive Summary

Atlantic wolffish (*Anarhichas lupus*) face extinction in U.S. waters from overutilization in commercial and recreational fisheries, destruction and modification of their habitat, and inadequate regulatory measures. The federal Endangered Species Act, 16 U.S.C. §§1531 *et seq.* ("ESA"), requires the protection of a species if it is either endangered or threatened. 16 U.S.C. § 1533(a)(1). A species is defined as "endangered" if it is "in danger of extinction throughout all or a significant portion of its range," 16 U.S.C. § 1532(6), and "threatened" if it is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20). The unusual biology of Atlantic wolffish make it particularly vulnerable to extinction throughout a significant portion of its range as it is highly susceptible to harvest and disturbance by fisheries and depends upon rapidly disappearing areas of undisturbed, rocky substrate for survival and successful reproduction. Once widespread in U.S. waters as far south as New Jersey, the distribution of Atlantic wolffish in U.S. waters in the last ten years has dramatically contracted as its abundance has declined. The isolated populations that remain today are particularly sensitive to destruction of habitat and fishing harvest, and have little chance of recruitment from populations elsewhere in the species' range. In short, the U.S. population of Atlantic wolffish cannot survive under current fishing practices or a regulatory regime that affords it no protection. It should be listed as endangered under the ESA.

The protections of the ESA should be extended to all Atlantic wolffish found in U.S. waters of the northwest Atlantic. Petitioners request that the National Marine Fisheries Service ("NMFS") make a determination that the U.S. population of Atlantic wolffish is a distinct population segment ("DPS") that warrants listing as endangered under the ESA as there is substantial scientific and commercial information supporting such action. Alternatively, Petitioners request that NMFS determine that one or more of the subpopulations of Atlantic wolffish encountered in the Jeffreys Ledge/Stellwagen Bank area, the northeast peak of Georges Bank area, and the Great South Channel area are distinct population segments that warrant listing under the ESA.

This Petition describes the highly unusual life history and biology of Atlantic wolffish, the distribution and status of the species, and reviews threats to its continued existence. The primary threats identified are overutilization in the commercial and recreational fishing sectors, and habitat destruction and modification caused by bottom trawling and dredging. The best available scientific and commercial data indicates that trawling and dredging are particularly harmful to the hard bottom substrates that Atlantic wolffish require to nest, spawn, and hatch their young. In addition, the Petition explains that existing laws and regulations afford the Atlantic wolffish no protection domestically and no protection in Canada, and are inadequate to halt the likely extinction of the species in a significant portion of its range. The proximate, direct threats to U.S. Atlantic wolffish noted above are exacerbated by additional environmental factors that likely contribute to declines in Atlantic wolffish abundance in U.S. waters, including warming ocean temperatures and ecosystem shifts due to the general freshening of shelf waters as well as a general loss of biodiversity in large marine ecosystems. In sum, the Petition describes how the application of the ESA listing factors to the U.S. population of Atlantic wolffish fully supports the listing as an endangered species under the ESA.

Petitioners request that NMFS designate critical habitat for the U.S. population of Atlantic wolffish concurrent with the listing under the ESA. Petitioners provide detailed references to the scientific literature as well as NMFS's own determinations that the species is particularly dependent on hard bottom strata and rocky areas for extended times of the year in order to reproduce. The Petition provides mapping of scientific survey trawl data that cross-references known locations of Atlantic wolffish in Northwest Atlantic waters (established through the time series of Canadian, U.S. and Massachusetts surveys) with hard bottom strata. When these maps are analyzed in light of the known sedentary nature of individual Atlantic wolffish, areas of critical habitat that are likely the last refuges of the species in U.S. waters become obvious. While the critical habitat necessary to protect the species may require enlargement as scientific knowledge of the species improves and/or the species begins to expand with a successful recovery program, the areas that require immediate critical habitat designation in order to protect the species have been identified.

Petitioners describe several conservation measures which are warranted for the protection of the species, including those previously identified by NMFS in 2004 when Atlantic wolffish were placed on the Northeast Region's *Species of Concern* list. - time/area closures for fisheries that take wolffish as bycatch, total allowable catch limits, and efforts to restore habitat.[1]

The most important conservation measures for recovery must reduce direct wolfish mortality - occurring as a result of commercial and recreational fishing - and must protect the biological and structural integrity of Atlantic wolffish critical habitat in U.S. waters. The implementation of targeted, long term area closures to reduce the catch of Atlantic wolffish and protect it from the adverse habitat impacts of mobile fishing gears known to be fished on or near the ocean floor, such as dredges, bottom trawls, and many mid-water trawls will be crucial. Many of these closures can overlay existing groundfish management closure boundaries, thus helping to minimize the impacts to fishermen.

A second layer of protection must provide possession prohibitions, catch-and-release protocols, and education programs applicable to all commercial and recreational fishermen operating in the Gulf of Maine. Key to the success of all of the protective measures will be development of appropriate and effective monitoring and enforcement mechanisms.

This Petition demonstrates that listing the U.S. population of Atlantic wolffish as endangered under the ESA is immediately necessary to prevent its extinction in U.S. waters. NMFS, through its Proactive Conservation Program, has already identified Atlantic wolffish as a species at risk with vulnerable life-history characteristics. The best available commercial and scientific data indicate that a listing of the U.S. population of Atlantic wolffish as endangered under the ESA is warranted at this time.[2] Based on the threats that confront the species, a listing is the only

[1] *The National Marine Fisheries Service Proactive Conservation Program: Species of Concern in the Northeast Region* (Maine through Virginia) at 9-10. http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/SOC%20Final%20report-web.pdf (last viewed on July 24, 2008).

[2] The Atlantic wolffish species as well as two closely related wolffish species found in Atlantic Canada face a high risk of extinction over a significant portion of their range in the northwestern Atlantic due to present fishing practices, habitat destruction, and inadequate regulatory measures. In U.S. waters, only the Atlantic wolffish (*A.*

remaining approach that will provide the protections necessary to avoid the extinction of the distinct population segment of Atlantic wolffish remaining in United States jurisdiction.

lupus) has been recently caught or sampled in research survey trawls. The spotted wolffish (*A. minor*) was previously reported as a rare stray in the Greater Gulf of Maine. Two of the four species of this Genus found in Atlantic Canada, the spotted (*A. minor*) and northern wolffish (*A. denticulatus*), are both listed as *threatened* under the Canadian Species At Risk Act ("SARA"). The Atlantic wolffish, although meeting the abundance criteria for *endangered* under SARA, was listed as a species of *Special Concern* based on objections by Canada's fishery agency. COSEWIC Species At Risk, Atlantic Wolffish, accessed at: http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=652 (last accessed 8-27-08); Declaration of Dr. Richard Haedrich at ¶ 8, Appendix II (hereinafter "Haedrich Declaration at ¶ xx").

Notice of Petition

The Conservation Law Foundation, Dr. Erica Fuller, and Dr. Les Watling (collectively "Petitioners") hereby formally petition the Secretary of Commerce ("Secretary"), through the National Marine Fisheries Service ("NMFS"), within the National Oceanic and Atmospheric Administration ("NOAA"), to list the United States distinct population segment ("U.S. DPS") of Atlantic wolffish (*Anarhichas lupus*) as an endangered species pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b)(3)(A), Section 553(3) of the Administrative Procedures Act ("APA"), 5 U.S.C. § 533(e) and 50 C.F.R. § 424.14(a). Petitioners also petition the Secretary to designate critical habitat for Atlantic wolffish concurrent with listing to ensure its recovery. See 16 U.S.C. § 1533(a)(3)(A) and 50 C.F.R. § 424.12 The Office of Protected Resources within NMFS has jurisdiction over this petition, 16 U.S.C. §1533(a), and has previously identified the Atlantic wolffish as a species at risk with vulnerable life-history characteristics. 69 Fed. Reg. 19975 (Apr. 15, 2004) (initial listing as a Species of Concern 2004); 71 Fed. Reg. 61022 (Oct. 17, 2006) (reconfirmed 2006).

The ESA mandates listing a species that is either endangered or threatened. 16 U.S.C. § 1533(a)(1). The ESA purposefully defines species broadly to include "any subspecies of fish or wildlife or plants and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16). The Act does not require that a subspecies is formally designated as a separate species in the scientific literature; rather, a distinct population segment ("DPS") of a vertebrate species may be protected, as a species, under the ESA. Additionally, a species may also be comprised of several DPS's in which all or some of them warrant listing under the ESA. The Atlantic wolffish is identified in the scientific literature as a single species, *Anarhichas lupus*, for which discrete populations have also been recognized by fisheries biologists including but not limited to those at NMFS.[3] Petitioners request that the entire U.S. population of Atlantic wolffish be designated a DPS and listed as an endangered species.

Atlantic wolffish are seriously imperiled in U.S. waters. Over the last twenty years, the species has experienced changes that meet international and U.S. conservation standards for endangerment including dramatic declines in incidence and abundance as well as a significantly contracted range. The species is imperiled due to overutilization caused directly and indirectly by commercial and recreational fishing, habitat loss caused by fishing with destructive bottom trawl and dredging gear, and inadequate regulatory measures. Warming ocean temperatures and shifts in marine populations (Frank *et al.*, 2006; Greene *et al.*, 2007)[4] may also affect the continued existence of Atlantic wolffish in U.S. waters and thus contribute to its risk of extinction. The U.S. DPS is discrete as defined by the U.S. international boundary with Canada and as defined by its physical isolation from other populations of Atlantic wolffish in Atlantic Canada. The U.S. DPS is also significant because loss of this population would result in a

[3] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (revised December 2006).* NEFSC – Resource Evaluation and Assessment Division. Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 8-27-08). (Archived Jan 2000, Mayo) (identifying populations on Georges Bank Browns Bank-Scotian Shelf area, Jeffreys Ledge and the Great South Channel).

[4] Citations to scientific literature are provided in short form in the text. Please refer to Appendix I for the full citation. The literature cited is also provided with some exceptions based on length or availability by Petitioners on the CD that is provided with this Petition.

significant gap in the range of the taxon and in the loss of a subpopulation that exhibits unique characteristics indicative of genetic differences. As such, this population should be designated a DPS under the NMFS's and U.S. Fish and Wildlife Service's joint ESA "Policy Regarding the Recognition of Distinct Vertebrate Population Segments" ("DPS Policy"). 61 Fed. Reg. 4722 (Feb. 7, 1996).

NMFS has also established precedent for, and relied on, the use of a geopolitical boundary as the sole factor for defining a marine population as a DPS when it used the U.S. Exclusive Economic Zone to define the "U.S. DPS" of the smalltooth sawfish, *Pristis pectinata*. Final Rule, 70 Fed. Reg. 69464 (Nov. 16, 2005). At the time of its listing, the smalltooth sawfish was present in waters of both the north and south Atlantic and Pacific Oceans, and similar to the Atlantic wolffish, NMFS knew little about the smalltooth sawfish's life history, nothing about its genetics, and had limited abundance data across its range, although the data NMFS did have showed dramatic declines in abundance.[5] The designation of a U.S. DPS of Atlantic wolffish, similar to that of the U.S. DPS of smalltooth sawfish, is necessary to honor Congressional intent to safeguard "for the benefit of all citizens, the Nation's heritage in fish, wildlife, and plants." 16 U.S.C. § 1531(a)(5).

This DPS population meets several of the evaluation criteria necessary for a listing as endangered under the ESA, including present and threatened destruction of its hard-bottom habitat by some fishing gears, overutilization from the commercial and recreational fishing, inadequate regulatory measures, and possibly other environmental and ecological factors placing stress on remaining populations in the U.S. Petitioners request that NMFS make a determination that the U.S. population of Atlantic wolffish is a distinct population segment and, based on the threats that confront this DPS under several of the ESA listing factors, list it as endangered, or alternatively as threatened, under the ESA. If NMFS determines that the best science does not support the conclusion that the entire U.S. population is a recognizable DPS, Petitioners request in the alternative that NMFS evaluate whether one or more of the three subpopulations identified in U.S. waters is a DPS, and if so, to list that or those subpopulations as endangered, or alternatively threatened, under the ESA. Finally, if NMFS finds that none of these populations qualifies as a DPS, Petitioners ask NMFS to evaluate whether the species *Anarhichus lupus* is endangered or threatened across all or a significant portion of its range under one or more of the ESA listing factors.

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[5] *Smalltooth Sawfish (Pristis pectinata).* NOAA Fisheries, Office of Protected Resources. Found at: http://www.nmfs.noaa.gov/pr/species/fish/smalltoothsawfish.htm (last viewed 8-27-08).

Petitioners

Conservation Law Foundation

The Conservation Law Foundation is a non-profit, public interest advocacy organization that uses the law, science, and economics to protect New England's environment, public health, and communities. For more than forty years, CLF has worked continuously on behalf of its members to restore and protect the health of vital ocean ecosystems and their associated marine resources in the northwestern Atlantic Ocean. The Conservation Law Foundation and its members, 90 percent of whom live in New England, are concerned with the preservation of endangered species and the effective implementation of the Endangered Species Act. CLF members include scientists, fishermen, recreational divers, consumers of seafood, and many other citizens, who are concerned about the health and survival of the marine species, including the Atlantic wolffish. CLF works to promote sustainable fisheries, habitat protection, and responsible ocean management particularly in the U.S. EEZ and the waters off the states of Maine, New Hampshire, Massachusetts, and Rhode Island. CLF has offices in Maine, Vermont, New Hampshire, Massachusetts, and Rhode Island.

Dr. Erica Fuller

Erica Fuller is a veterinarian and a practicing attorney at the Boston law firm of Todd and Weld LLP. She is interested in the protection of biodiversity, especially species at risk of extinction and the preservation of marine ecosystems in the Gulf of Maine. She sails, consumes seafood, and takes her children to the ocean, a place where she hopes that her children will have the same opportunities to enjoy a healthy and biodiverse ocean ecosystem that she has had.

Dr. Les Watling

Les Watling is a marine biologist and presently an Emeritus Professor of Oceanography in the School of Marine Sciences at the University of Maine as well as a Professor of Zoology at the University of Hawaii. His expertise is in the study of benthic ecosystems and the factors which affect those ecosystems including natural as well as human-caused variables. Dr. Watling has personal experience in the effects of bottom tending mobile gear in the Greater Gulf of Maine and has witnessed first hand the destruction of habitat in the Stellwagen Bank National Marine Sanctuary – the home to one of the last remaining U.S. Atlantic wolffish subpopulations. He has published extensively on continental shelf habitats, deep water corals, fish assemblages in the Gulf of Maine including those with Atlantic wolffish and the destruction of bottom habitats by mobile fishing gear.

Under Section 4(b) of the ESA and 50 C.F.R. § 424.14(a), Petitioners Conservation Law Foundation, Erica Fuller, and Les Watling have the right to petition for a listing on the Endangered Species List as "interested persons" and request the designation of critical habitat to ensure the recovery of the Atlantic wolffish. In addition, the Administrative Procedures Act ("APA") requires each federal agency "to give an interested person the right to petition for the issuance, amendment, or repeal of a rule." 5 U.S.C. § 553(e).

Table of Contents

Acknowledgements i

Executive Summary ii

Notice of Petition v

Petitioners vii

Species Information and Evaluation of Current Status

I. Introduction 1
- A. The Legal Framework of the Endangered Species Act 2
- B. The Present Situation Mandates Listing the Atlantic Wolffish under the ESA 3

II. Present Legal Status of the Atlantic Wolffish 6

III. Atlantic Wolffish: Historic Range, Present Range and Stock Structure 8

- A. Worldwide Distribution and Status 8
  - 1. Worldwide Distribution 8
  - 2. Worldwide Status 9
- B. Canadian Distribution and Status 9
  - 1. Canadian Distribution 9
  - 2. Canadian Status 10
- C. United States Distribution and Status 11
  - 1. Historic Distribution and Present Range 11
- D. Migrations 13
- E. Population Structure 14

IV. Natural History and Biology of the Atlantic Wolffish 15

- A. Taxonomy 15
- B. Species Description 15
- C. General Life History 16
- D. Longevity and Growth 17
- E. Reproduction and Development 17
- F. Habitat Requirements 19
- G. Diet 21
- H. Predators 21
- I. Recruitment 22
- J. Natural Mortality 22

V. Population Trends for Atlantic Wolffish in the United States 23

A. Abundance Declines Relative to Generation Time....23
B. Calculating Rates of Decline....24
C. Overview of Data Sources for U.S. Atlantic Wolffish Population Assessments...25
D. Stock Assessments for U.S. Atlantic Wolffish....25
E. State of Fishery-Independent and Fishery-Dependent Data for U.S. Atlantic Wolffish....26
1. Survey Data: Fishery-Independent Data....26
2. Commercial Fishery-Dependent Data: "Landings" Data....30
3. Recreational Fishery-Dependent Data....30
4. Assessing Fishing Impacts on Atlantic Wolffish....30
F. Relative Abundance and Geographic Range Contraction of U.S. Atlantic Wolffish....34

VI. Distinct Population Segment Analysis....35

A. Introduction....35
B. Criteria for Designation of Distinct Population Segments under the Joint DPS Policy....36
C. Discrete Population Segments of Atlantic Wolffish Exist in U.S. Waters....37
D. The Discrete Populations are Significant....38
E. The U.S. Population of Atlantic Wolffish is Discrete....39
1. The U.S. Population of Atlantic Wolffish is Geographically Isolated from the Canadian Population....39
2. The U.S. Population is Discrete Based on Physiological and Behavioral Factors....44
3. The U.S. Population is Delimited by an International Governmental Boundary with Differing Regulatory Mechanisms and Therefore is Discrete....45
F. The U.S. Population of the Atlantic Wolffish is Significant....47
1. The U.S. Population is Significant because Loss of this Population would create a Significant Gap in the Range of the Taxon....47
2. The U.S. Population is Significant because it Displays Differing Physical and Behavioral Characteristics Indicative of Genetic Differences....48
G. Conclusion....48

VII. The U.S. DPS of the Atlantic Wolffish Meets the Definition of an Endangered Species under the Endangered Species Act....49

A. The Endangered Species Act's Listing Evaluation Criteria....49
B. Present or Threatened Destruction, Modification or Curtailment of Habitat or Range....50
C. Overutilization through Commercial and Recreational Fishing....54
D. Disease or Predation....57
E. Inadequate Regulatory Mechanisms....57
F. Other Natural or Manmade Factors Affecting the Atlantic Wolffish....59

G. Conclusion 59

VIII. NMFS Must Designate Critical Habitat under the ESA 59

IX. Conservation Measures Recommended 61

X. Conclusion 63

Appendix I Literature Cited 64
Appendix II Declaration of Dr. Richard L. Haedrich 74
Appendix III Declaration of Dr. Les Watling 78
Appendix IV Rate of Decline Calculations (Dr. Richard L. Haedrich) 86
Appendix V Census of Marine Life Analysis 88
Appendix VI CLF Multispecies Amendment 16 Scoping Comments (12/29/06) 105

Species Information and Evaluation of Current Status

I. Introduction

The Conservation Law Foundation, Dr. Erica Fuller, and Dr. Les Watling (collectively "Petitioners") submit this petition to the Secretary of Commerce ("Secretary") and the National Marine Fisheries Service ("NMFS") requesting that Atlantic wolffish be listed as an *endangered* species under the federal Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.* ("ESA"). Atlantic wolffish (*Anarhichas lupus*) face extinction in U.S. waters from overutilization by commercial and recreational fisheries, destruction and modification of their critical habitats, and inadequate regulatory measures.

The unusual biology of Atlantic wolffish make it particularly vulnerable to extinction in the foreseeable future because of its susceptibility to harvest, and its dependence upon rapidly disappearing areas of undisturbed rocky substrate for reproductive success. Once widespread in U.S. waters as far south as New Jersey, the distribution of Atlantic wolffish has dramatically contracted as its abundance has declined. The isolated populations that remain in U.S. waters are particularly sensitive to fishing pressures and further losses of habitat, with little chance of recruitment due to the sedentary nature of the species and the relatively large distances between these populations.

For the purposes of defining populations, this Petition identifies areas of U.S. waters[6] in the northwest Atlantic along ecological boundaries demarcated by dominant features. The "Greater Gulf of Maine," also known as the "150-fathom line" because of its relatively consistent depth, includes the waters from Nantucket Shoals and Cape Cod to Cape Sable Island off southern Nova Scotia, with the eastern boundary framed by 70 degrees W longitude and a natural seaward rim formed by Nantucket Shoals, Georges Bank and Browns Bank (Collette and Klein-MacPhee 2002). The Greater Gulf of Maine is often viewed as its own unique ocean ecosystem. Scientists and regulators often further divide Greater Gulf of Maine waters on the U.S. side of the international border with Canada (known as the "Hague Line") along ecological boundaries into the "Gulf of Maine," "Southern New England," the "Great South Channel," and "Georges Bank." The waters on the Canadian side of the Hague Line include the bulk of the northeast peak of Georges Bank, Browns Bank and the Scotian Shelf. Fisheries regulators commonly use these same geographical or ecological areas to define various subpopulations or "stocks" of fish species such as the Gulf of Maine Atlantic cod and Georges Bank Atlantic cod of the species Atlantic cod, *Gadus morhua*. These ecological boundaries work well to define individually identified subpopulations of Atlantic wolffish in the Greater Gulf of Maine as well.

This Petition describes the biology and natural history of Atlantic wolffish, as well as the status and distribution of the species. An analysis of existing populations in U.S. waters establishes that the current status of the Atlantic wolffish warrants protection under the ESA. The status of the species is analyzed as one population, a U.S. DPS, composed of all remaining Atlantic wolffish in U.S. waters. The Petition also reviews the primary threats to the continued existence of the Atlantic wolffish in U.S. waters, particularly the impacts of modern fishing

[6] Petitioners use the phrase "U.S. waters" to include U.S. territorial waters as well as the U.S. Exclusive Economic Zone ("EEZ").

practices. The Petition explains why domestic and international law is inadequate to address threats from continued overutilization and habitat destruction and cannot prevent the likely extirpation of the Atlantic wolffish in U.S. waters. The Petition provides "substantial scientific or commercial information indicating that the petitioned action may be warranted" and thus triggers the statutory requirements for NMFS to begin a status review of the Atlantic wolffish and to list the species as endangered under the ESA. 16 U.S.C. § 1533(b)(3)(A).

A. The Legal Framework of the Endangered Species Act

The ESA requires the protection of a species if it is endangered or threatened. 16 U.S.C. § 1533(a)(1). A species is "endangered" if it is "in danger of extinction throughout all or a significant portion of its range," 16 U.S.C. § 1532(6), and "threatened" if it is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20).

Congress recognized that existing laws were not providing the management tools necessary to save a species prior to extinction. S. Rep. No. 307, 93rd Cong., 1st Sess. 3 (1973).[7] In an effort to widen the protection for vanishing species and the ecosystems upon which they depend, Congress passed the ESA. "And as 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." *Tennessee Valley Authority v. Hill*, 437 U.S. 153, 180 (1978). In recognition of the accelerated pace at which species were disappearing, Congress intended through the ESA to both "provide 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...." 16 U.S.C. § 1531(b). The ESA was amended in 1978 to make clear that Congress intended the protections of the ESA to extend to subspecies including subspecies of fish. *See* DPS Policy at 4722. Moreover, Congress directed federal agencies to use "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.*

The first step in the protection of a vanishing species is a listing under Section 4 of the ESA which makes it possible for the species to gain the protections of the ESA. 16 U.S.C. §1533. This Petition sets in motion a process pursuant to Section 4 of the ESA that places defined time requirements on NMFS. Specifically, NMFS must issue an initial 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). NMFS must make this initial finding to "the maximum extent practicable, within 90 days after receiving the petition." *Id*. Petitioners need not demonstrate that listing is warranted; rather, Petitioners must only present

[7] Prior legislative efforts were 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.

substantial information demonstrating that such listing *may* be warranted.[8] "Best scientific and commercial data available" is the sole basis for this finding.[9] 16 U.S.C. § 1533(b)(1)(A).

Within one year of finding that the listing may be warranted, the Secretary and NMFS must complete a status review of the species and publish either a proposed listing rule or their determination that listing is not warranted. 16 U.S.C. § 1533 (b)(3)(B). NMFS has an additional year to finalize the proposed rule. 16 U.S.C. § 1533 (b)(6)(A). The ESA strongly encourages the designation of critical habitat concurrent with the listing as threatened or endangered. 16 U.S.C. § 1533(a)(3)(A). Once listed under the ESA, all federal agencies must ensure that their actions do not jeopardize the continued existence of the species or adversely modify its critical habitat. 16 U.S.C. § 1536(a)(2).

In addition to the procedural timelines outlined above, there are jurisdictional requirements and non-discretionary duties set forth by the ESA. Jurisdiction for a purely marine species such as Atlantic wolffish rests with the Secretary of Commerce, who in turn has delegated the responsibility to NMFS. 16 U.S.C. § 1532 (15); 50 C.F.R. § 402.01(b). The Office of Protected Resources within NMFS is responsible for the final determination.[10] Under section 4 of the ESA, NMFS has a non-discretionary duty to list a species under the ESA if a species or DPS of a species meets one or more of the following five evaluation factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. 16 U.S.C. § 1533(a)(1). Additionally, once listed, NMFS is required to take affirmative steps to provide for the recovery of the species. 16 U.S.C. § 1533(f).

B. The Present Situation Mandates Listing the Atlantic Wolffish under the ESA.

Atlantic wolffish are a unique member of the Gulf of Maine marine family. Known by fishermen and scientists alike for their ferocious disposition and formidable teeth, they also have life history characteristics that make them extremely unusual (Collette and Klein-MacPhee 2002). Notable characteristics include internal fertilization and large eggs brooded exclusively by the males as a "nest" under rocks for four to nine months. *Id*. Wolffish are the largest members of the blennylike fishes and an apex predator in the benthic ecosystem in which they live. *Id*. In the northwestern Atlantic, Atlantic wolffish are reported to live twenty years, reach lengths of 1.8 meters, and weigh 18-20 kg (total weight) on average. *Id*. They are not habitat "generalists," requiring hard bottom habitats for reproductive success and for survival. *Id.*

[8] 50 C.F.R. § 424.14(b)(1) (defining "substantial information" as "that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted.")

[9] The ESA requires that listing decisions be based "*solely* on the best scientific and commercial data available." 16 U.S.C. § 1533(b)(1) (emphasis added). This language precludes the consideration of economic impacts. This is in contrast to the designation of critical habitat, which is made on "the basis of the best scientific data available *and* after taking into consideration the economic impact." 16 U.S.C. §1533(b)(2) (emphasis added).

[10] "Welcome to the Office of Protected Resources," NOAA Fisheries. Found at: http://www.nmfs.noaa.gov/pr/ (last viewed 9-15-08).

Wolffish use a series of crushing plates of teeth to feed on crustaceans and are considered important regulators of sea urchin and green crab density. They annually lose their entire set of teeth. *Id*. Atlantic wolffish are generally solitary and are highly sedentary as evidenced by a tagging study performed off Newfoundland which found the majority of releases had not migrated more than eight km even after five to seven years (Templeman 1984). Scientists believe juveniles settle in the vicinity of the same areas where they are born (Collette and Klein-MacPhee 2002). As an apex predator in its ecosystem (Steneck 2004), the loss of Atlantic wolfish could also have cascading effects through the system and result in the loss of biodiversity and trophic dysfunction in the system. All of these unusual life history characteristics and specific habitat requirements support the demonstration that the Atlantic wolfish is unique and that the loss of this species throughout it southernmost range would be significant.

In 2003, the Northeast Fisheries Science Center ("NEFSC"), a scientific research arm of NMFS, reviewed the resource status of the Atlantic wolffish and concluded that Atlantic wolffish were "overexploited and in a severely depleted state."[11] In reaching this conclusion, NEFSC relied on two key measures: the abundance and biomass of the species. Abundance, as measured by commercial landings, had "declined sharply" from 1984 to 1998.[12] In 1998, the commercial landings of 300 metric tons ("mt") were the lowest recorded amount since the early 1970's. Biomass, as measured by NEFSC spring bottom trawl survey biomass index, had shown a "consistent downward trend since the late 1980's."[13] Biomass had fluctuated for twenty years (1968-1988) between 1.0 kg/tow and 2.0 kg/tow; however the 1997-1999 indices were less than 0.2 kg/tow representing only 8 percent of the 1968-1988 average and "the lowest in the time survey series."[14] These conclusions formed the basis for the Atlantic wolffish listing as a Species of Concern by NOAA's Proactive Conservation Department in 2004. In 2006, NEFSC updated the status of the Atlantic wolffish, again noting precipitous declines in both abundance and biomass in the last 5-year time block.[15] Despite its knowledge that abundance and biomass of the Atlantic wolffish have declined sharply and its decision to list the wolffish as a Species of Concern, NMFS has enacted no substantive protections for the species and the mere listing as a Species of Concern provides none.

Data obtained from NMFS since the 2003 Status of the Resource Report, which includes subsequent trawl data covering the years between 1998 and 2004 and subsequent commercial landings data through 2007, provides mounting evidence of this precipitous decline.[16] Although scientists noted a sharp decline in commercial landings in 1998, when 300 mt was the lowest

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[11] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev. 2006).* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 8-27-08).

[12] Idoine, J. *Atlantic Wolffish – Status of Fishery Resources off the Northeastern US for 1998*. Northeast Fisheries Science Center. Found at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm115/wolf.pdf (last viewed 8-27-08).

[13] *Id.*

[14] *Species of Concern—Atlantic wolffish*. NOAA National Marine Fisheries Service (2007). Found at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticwolffish_highlights.pdf (last viewed 8-27-08).

[15] Cadrin, S. X., and K. Sosebee. *A Historical Perspective on the Abundance and Biomass of Northeast Demersal Complex Stocks from NMFS and Massachusetts Inshore Bottom Trawl Surveys, 1963-2002*. Northeast Fisheries Science Center Reference Document 06-06. Found at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0605/ (last viewed 8-27-08).

[16] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev. 2006).* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 9-17-08).

recorded value for commercial landings, recent data reveals steady declines to a new low of 65 mt in 2007.[17] Additionally, the declines in abundance described in Section V of this Petition indicate that from the peak year of 1983 through 2004 there was a three-generation decline of 94.9 percent of the historic population.[18]

In 2006, scientists at NEFSC and the Census of Marine Life – Gulf of Maine Area Program ("CML") mapped population trends for Atlantic wolffish in five-year time increments over historic population density using survey trawl data.[19] This mapping shows an overall decrease in density of Atlantic wolffish throughout the Greater Gulf of Maine, including the loss of entire populations and a severely contracting range. Notable is the lack of even a single individual sampled during a spring survey trawl over the seven years from 1998-2005 in the latitudes south of the northernmost tip of Cape Cod including the Great South Channel where wolffish were historically abundant.[20] The extinction of the Atlantic wolffish now appears likely in that area. The best evidence indicates that in just twenty years the Atlantic wolffish range in U.S. waters has contracted down to a few relict populations. The largest of these subpopulations is in the waters over Jeffreys Ledge and Stellwagen Bank in the western Gulf of Maine where the data suggests there may be a population along the margins of the Western Gulf of Maine Closure Area.[21] Another possible remaining subpopulation is on the northeast peak of Georges Bank, a small portion of which is under U.S. jurisdiction. Finally, it is possible a third subpopulation may still exist in the Great South Channel.

In conclusion, recent trends in abundance, incidence and biomass data indicate the species is rapidly disappearing in U.S. waters and strongly suggest it will be extinct in the foreseeable future unless dramatic remedial action is taken.

In addition to declines of abundance in U.S. waters, there are dramatic and sustained Atlantic wolffish population declines elsewhere throughout the northwest Atlantic Ocean for similar reasons. Atlantic wolffish, historically most abundant in waters off Newfoundland and Labrador, experienced a 91 percent decline in two generations from 1978-1994 (O'Dea and Haedrich 2002). Despite the limited indirect protections afforded by the Canadian Atlantic

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[17] *Id.* Most recent commercial landings data (through 2007) found at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.

[18] Dr. Richard Haedrich at Memorial University in St. John's, Newfoundland, calculated declines in abundance using NEFSC spring and fall survey trawl data. The calculations assume a conservative age at maturity of 6 yrs (Canadian Department of Fisheries and Oceans (DFO) documents indicate 10-11 years) and a generation time of 10.2 years. Haedrich Declaration at ¶¶ 4 & 5. See Appendix IV. For landings data, also see: NOAA Fisheries, Office of Science & Technology, Fisheries Statistics Division (ST1). Found at: http://www.st.nmfs.noaa.gov/st1/index.html.

[19] *See* http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/animation/spring/ and http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/animation/fall/ for NEFSC mapping and Appendix V for CML mapping.

[20] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev.. 2006).* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 8-27-08). ("abundance appears to be highest in the southwestern portion of the Gulf of Maine from Jeffreys Ledge to the Great South Channel, at depths of 80 to 120 m.")(Archived 2000, Mayo)

[21] Further research may show that this is two sub-populations on Jeffreys Ledge and Stellwagen Bank; however, at this time scientists surmise one contiguous population (personal communication with Peter Auster at University of Connecticut).

groundfish moratorium imposed in 1992 to protect Atlantic cod stocks in certain Canadian waters, the mature biomass of Atlantic wolffish has not improved based on a 2002 Stock Status Report.[22] The contracting geographic range and the loss of populations in the northwestern Atlantic has been predominantly caused by commercial overfishing, both as a consequence of an earlier directed fishery in western Greenland, and later from indirect incidental catches in Canadian and U.S. fisheries.[23] Abundance of the Atlantic wolffish species has dropped precipitously throughout all or a significant portion of its range in the northwestern Atlantic Ocean.

Continued declines caused by overfishing, habitat loss and disturbance, and inadequate regulatory protections make extinction of the Atlantic wolffish in U.S. waters likely in the foreseeable future. Indications that a fifteen-year moratorium on groundfishing in Canadian waters has not resulted in an increase in mature biomass of Atlantic wolffish is a clear warning sign. NMFS must take immediate proactive measures to ensure that the U.S. population of Atlantic wolffish is protected from extinction, and that nesting and spawning habitat necessary for their recovery is conserved. The prompt listing of Atlantic wolffish under the ESA as endangered can ensure that both of these important actions occur.

II. Present Legal Status of the Atlantic Wolffish

The Office of Protected Resources in NMFS's Northeast Region Office designated the Atlantic wolffish as a *Species of Concern* four years ago. 69 Fed. Reg. 19975 (April 15, 2004). The rationale for the designation was that insufficient information existed at that time to warrant a listing. NMFS documents associated with the listing state that the "stock remains overexploited and severely depleted."[24] To date, the Atlantic wolffish have not had a further status review nor has the species been the subject of a proposed rule. This designation as a *Species of Concern* was republished in 2006 without any change in regulatory status. 71 Fed. Reg. 61022 (October 17, 2006). Recognition as a *Species of Concern* affords the Atlantic wolffish no protection and is not a "listing" under the ESA.

In November of 2006, the New England Fishery Management Council ("Council") and NMFS requested scoping comments regarding the potential inclusion of Atlantic wolffish in the Northeast Multispecies Fisheries Management Plan ("Groundfish FMP") through the proposed amendment to that plan known as "Amendment 16." 71 Fed. Reg. 64941 (Nov. 6, 2006). Petitioner CLF supported this action. A planned 2007 stock assessment of Atlantic wolfish, however, was not undertaken and Atlantic wolffish have not been included in Amendment 16, which is currently under development. As a result, Atlantic wolffish fishing is not directly regulated under the Groundfish FMP, nor indirectly by any other regulatory scheme established by the Council, NMFS, the Atlantic States Marine Fisheries Commission, or any individual state. It is not clear whether Atlantic wolfish may have indirectly benefited as a result of management

[22] DFO Stock Status Report A3-31 (2002).
[23] Although overfishing is considered the main cause of the collapse of cod stocks in that area, another articulated factor contributing to the lack of recovery may be the infusion of cold, Arctic-derived low salinity waters which causes changes in abundance of phytoplankton, zooplankton, and fish populations (Frank *et al*., 2006).
[24] *Species of Concern—Atlantic wolffish*. NOAA National Marine Fisheries Service (2007). Found at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticwolffish_highlights.pdf (last viewed 8-27-08).

measures implemented to regulate other species, or whether new measures currently under consideration by the Council and NMFS in Amendment 16, such as reductions in fishing effort to reduce mortality of other groundfish stocks, will also reduce the impacts to Atlantic wolffish in the Gulf of Maine. What *is* clear is that current regulations are not designed, nor are they adequate, to protect populations or restore the critical hard bottom habitats of Atlantic wolffish, and that aggressive protection of the species can wait no longer.

The international situation is not much better. Canada's Species at Risk Act, S.C. 2002, c. 29 ("SARA"), which only came fully into force on June 1, 2004, also affords the Atlantic wolffish no protection. SARA uses a system of categories similar to the ESA, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) administers listings similar to NMFS and FWS. The analysis is not, however, entirely similar. COSEWIC analyzes a species' status for the purpose of a listing using "scientific knowledge" considered alongside "community knowledge" and "aboriginal knowledge," making the designation political as well as scientific (SARA Art. 15(2); SARA Registry 2004). Even though Atlantic wolffish have experienced significant declines in abundance in Canadian waters from their high in the 1970's, and met the criteria for endangerment under SARA, the species was only designated as a Species of Special Concern by COSEWIC in 2000.[25] This designation, much like the U.S. listing of Atlantic wolffish as a Species of Concern, affords the Atlantic wolffish no protection in Canadian waters.

The rationale for the designation as a Species of Special Concern stated in COSEWIC documents was "the species is likely to become threatened if factors suspected of negatively influencing the persistence of the species are neither reversed nor managed with demonstrable effectiveness."[26] Atlantic wolfish in Canada, however, is not protected by such active protection and management. Although there was a partial moratorium on groundfishing imposed in 1992, the sectors that are allowed to fish in the Canadian waters of the Greater Gulf of Maine have no restrictions such as a total allowable catch ("TAC") limit for the Atlantic wolffish. The COSEWIC 2002 Status Report for the Atlantic wolffish states that there is "no TAC for this resource and it is generally fished as a bycatch with fleet landings regulated not to exceed historical levels. Under the Conservation Harvesting Plan, there is a 20% wolffish bycatch regulation for the mobile fleet in 4X from April 1st to September 1, 2002 and 10% during the remainder of the year to March 31, 2003." (DFO Stock Status Report A3-31 (2002)). Canadian documents recognize that low landings, which reflect low fishing effort since 1992, have not resulted in an increase in mature biomass. *Id*. Canadian recovery mandates that are applicable to other wolffish species because they are listed as threatened species under SARA, are purely voluntary with respect to Atlantic wolffish, as a Species of Special Concern.[27]

In sum, the legal protections afforded the Atlantic wolffish are inadequate to conserve the species and prevent its ultimate extinction in the United States. Atlantic wolffish are unprotected

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[25] Atlantic Wolffish – Species at Risk Public Registry. COSEWIC Atlantic wolffish Species of Special Concern. Available at: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=652 (last viewed 8-27-08); Haedrich Declaration at ¶ 8.

[26] COSEWIC's Assessment Process and Criteria (April 2006). COSEWIC. Found at: http://www.cosewic.gc.ca/pdf/assessment_process_e.pdf (last viewed 9-26-08).

[27] *E.g.*, Recovery Strategy for Northern Wolffish (*Anarhichas denticulatus*) and Spotted Wolffish (*Anarhichas minor*), and Management Plan for Atlantic Wolffish (*Anarhichas lupus*) in Canada (Fisheries and Oceans Canada 2007) at 56.

despite their precipitous decline in abundance and contraction in distribution. Because the species is not managed in the U.S. pursuant to a fisheries management plan and is not otherwise directly regulated, it is not even afforded the minimal protections that other, more abundant fish species receive as part of a fishery management plan – i.e., annual catch limits, bycatch caps, and specific habitat protections. The designation of Atlantic wolffish as an *endangered* species under the ESA and the concurrent designation of critical habitat is essential to provide the legal protection necessary to prevent their extinction in the foreseeable future.

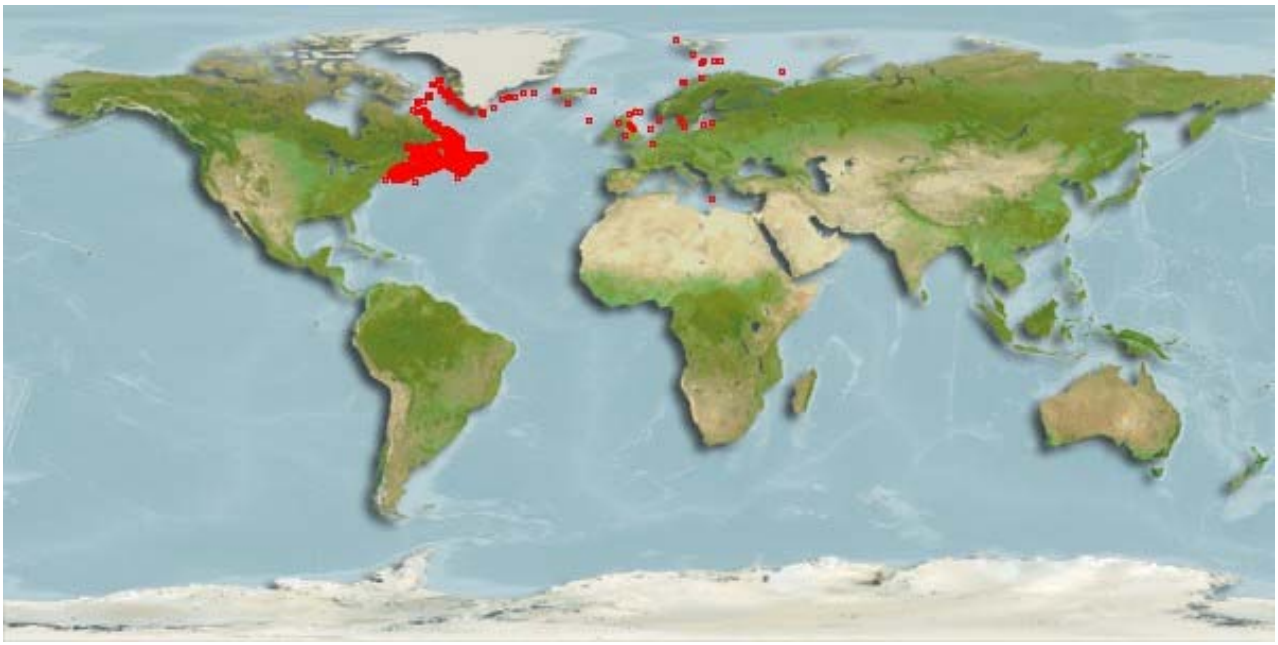
III. Atlantic Wolffish: Historic Range, Present Range and Stock Structure

A. Worldwide Distribution and Status

1. Worldwide Distribution

The worldwide distribution of the Atlantic wolffish is limited to the North Atlantic Ocean, extending from the Northwest Atlantic Shelf region off North America, to Greenland, Iceland and the waters off Northern Europe (Figure 1). The wolffish is a cold water fish that inhabits hard-bottom habitats (i.e., rocky; depth 5 to 500 feet) of the continental shelf (Bigelow and Schroeder 1953; Collette and Klein-MacPhee 2002). The abundance of the Atlantic wolffish is currently depressed throughout this historic range with corresponding local range contractions.

Figure 1: Worldwide Distribution of the Atlantic Wolffish (recent half century)
Source: Ocean Biogeographic Information System, Census of Marine Life.
Dataset Title: Government of Canada, Fisheries and Oceans Canada, Maritimes Region, Science Branch. Dataset Title: East Coast North America Strategic Assessment Project
Online Resource: http://www.iobis.org/



In the northeastern Atlantic, the historic distribution of Atlantic wolffish encompasses waters off the coasts of Iceland in the Norwegian Sea, the Faeroes (Denmark), Spitzbergen, the White Sea and Murman coast, south to the British Isles, the northwestern coast of France and Ireland.

In the northwestern Atlantic, Atlantic wolffish have been found historically in the waters off western Greenland and southern Labrador, in the Strait of Belle Isle and the Gulf of St. Lawrence, off the eastern and western coasts of Newfoundland and over the Grand Banks of Newfoundland, and south to the Scotian Shelf, the Gulf of Maine, and Georges Bank. In their most southerly reaches, Atlantic wolffish have been surveyed in waters as far south as New Jersey (Bigelow and Schroeder 1953); however, recent survey data indicates that the range has since contracted and the species is no longer present south of Massachusetts (Scott and Scott 1988; COSEWIC 2002; Collette and Klein-MacPhee 2002). The U.S. population represents the most southern reach of this species throughout its range.

2. Worldwide Status

Over the past half century, both fisheries landings data and research surveys point to substantial declines in abundance and incidence of Atlantic wolffish throughout its worldwide range. Documents that indicate the status of the Atlantic wolffish in all waters of the northeastern Atlantic are not available but a partial picture can be put together from regional studies. In the eastern portion of the range, Iceland has maintained yearly records of the status of the species for over two decades. The State of the Marine Stocks in Iceland Waters indicates Atlantic wolffish declines. This document states: "The index of fishable biomass and recruitment indices [of Atlantic wolffish] in the groundfish survey in March decreased considerably from 2003 to 2004 and remained low in 2005 and 2006. The index of fishable biomass is now similar to that in 1995 when it was the lowest since the survey commenced in 1985." Armed with this information, the Marine Research Institute (scientists appointed by the Ministry of Fisheries in Iceland to make recommendations on quotas) recommended lower quotas in 2006/2007, and a closure of the major spawning areas to fishing off western Iceland during the spawning season (autumn and winter).[28]

B. Canadian Distribution and Status

1. Canadian Distribution

Presently, Atlantic wolffish are predominately found in Canadian waters with the highest abundance found on the deep shelf off northeastern Newfoundland and Labrador.[29] See Figure 2.

[28] "English summary of the State of Marine Stocks in Icelandic waters 2006/2007 – Prospects for the Quota Year 2007/2008." Marine Research Institute. Found at: http://www.hafro.is/Astand/2007/engl-sum-07.pdf (last viewed 9-15-08).

[29] *East Coast North America Strategic Assessment.* Fishery-independent groundfish data for the east coast of North America from Cape Hatteras to the US/Canadian border and for Bay of Fundy through the Scotian Shelf. Time period is 1970-95. For OBIS Schema concept details see http://www.iobis.org/tech/provider/. Found at: http://www.iobis.org/OBISWEB/ObisMeta.jsp?sourceID=38 (last viewed 8-27-08).

Figure 2: Historic Distribution of Atlantic wolffish in the Northwest Atlantic
Source: Ocean Biogeographic Information System, Census of Marine Life.
Dataset Title: Government of Canada, Fisheries and Oceans Canada, Maritimes Region, Science Branch. Dataset Title: East Coast North America Strategic Assessment Project
Online Resource: http://www.iobis.org/

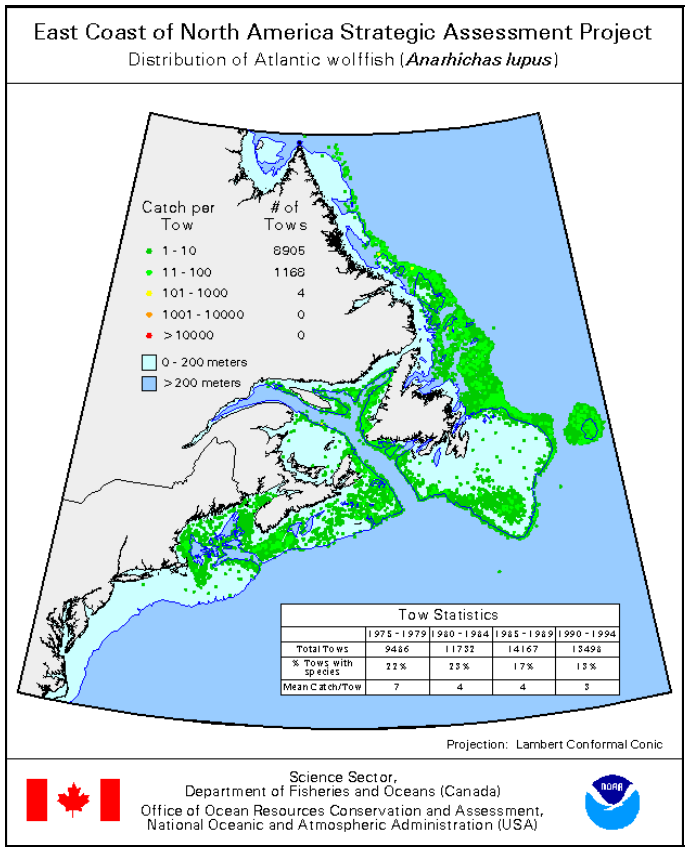


Fig. 2 indicates the historic distribution of Atlantic wolffish in the northwest Atlantic. A 2002 DFO Stock Status Report A3-31(2002) states that presently "[i]n the Maritimes, wolffish are most prevalent in the approaches to the Bay of Fundy, Browns, Roseway and LaHave banks, the northeastern portion of the Scotian Shelf adjacent to the Laurentian Channel and in the waters off western Newfoundland."

2. Canadian Status

COSEWIC has documented alarming declines in abundance, size and range of Atlantic wolffish in the Canadian Maritimes since 1978. The 2000 COSEWIC Executive summary for the Atlantic wolffish, one of the documents prepared during the Canadian designation as a Species of Special Concern, states:

> Scientific surveys from most parts of the western Atlantic range indicate declines in abundance over the last 20 years. Since 1978, catch rates in Newfoundland waters are down by 91% over two wolffish generations, and for all Canadian waters, numbers are down by 87%. Mean size has also declined over time, and is now smaller than the size at maturity off Newfoundland. Numbers have declined steadily, the number of locations where the species occurs has declined, and the range where the species is abundant may be shrinking. Slow growth, a nesting habit, and limited dispersal make rescue unlikely. Nearby extra-territorial populations [U.S. population] are experiencing the same difficulties as Canadian ones. Bottom trawling and dredging have probably damaged habitat. Future monitoring will be difficult.

COSEWIC Executive Summary pp iv and v (O'Dea and Haedrich 2002).

The 2002 DFO Stock Status Report for Atlantic wolffish on the Scotian Shelf, Georges Bank and in the Bay of Fundy (4VWX and 5YZe - waters immediately adjacent to the U.S. population of Atlantic wolffish) indicated similarly dramatic declining population trends based on the research trawl survey series that began in 1970. Although Canadian fishing effort and mortality were reduced to less than half of levels that existed prior to the 1992 cod fishing moratorium, the number of mature Atlantic wolffish reported in 2002 was "… presently near the lowest observed in the series." DFO Sci. Stock Status Rep. A3-31 (2002) at 3. Although the number of immature fish (defined as less than 55cm.) had been above average since 1985, it is important to note that the number of adults (defined as greater than 55cm.) had not rebounded even with diminishing fishing mortality. DFO concluded that natural mortality for wolffish must have increased, but failed to identify the causes. Other trends identified in the DFO report include declining mean weight per tow (close to the lowest in the series), declining condition of large wolffish (>70cm), and a declining proportion of positive annual survey sets in areas where the species was known to occur (lowest values in the entire series evidenced in the years after 2000). The sampling associated with this data base has been performed with the identical survey trawl gear since inception of the survey series, and has not been subject to change in gear as has occurred in other areas.

The COSEWIC scientific report, which accompanied the Canadian designation as a species of Special Concern, states: "[t]he total population of this large, solitary, slow-growing, late-maturing, nest building benthic fish has declined significantly since the 1970's. Apparent threats are related to fishing and habitat alteration, perhaps compounded by environmental change." COSEWIC Assessment and Status Report on the Atlantic wolffish in Canada at iii. The Status Report documents declines in frequency of occurrence, abundance and geographic range (COSEWIC Status Report; O'Dea and Haedrich). From the late 1970's to the mid 1990's, the number of Atlantic wolffish in Canadian waters declined by 87%. The percentage of annual survey stations (throughout all Canadian waters) where Atlantic wolffish were landed (based on DFO survey trawl data which reports the positions of all stations where a species is taken) declined from near 35% in 1978 to approximately 10% in 1994. Finally, in Newfoundland where Atlantic wolffish had previously been captured at 88% of the survey stations where the species was expected (in other words, within known depth and temperature preferences) up until approximately 1985, the incidence had declined to a mere 33% by 1993. *Id*. at 6.

Most of the concerns for Atlantic wolffish highlighted in Canadian waters are even more pertinent to this species in U.S. waters.

C. United States Distribution and Status

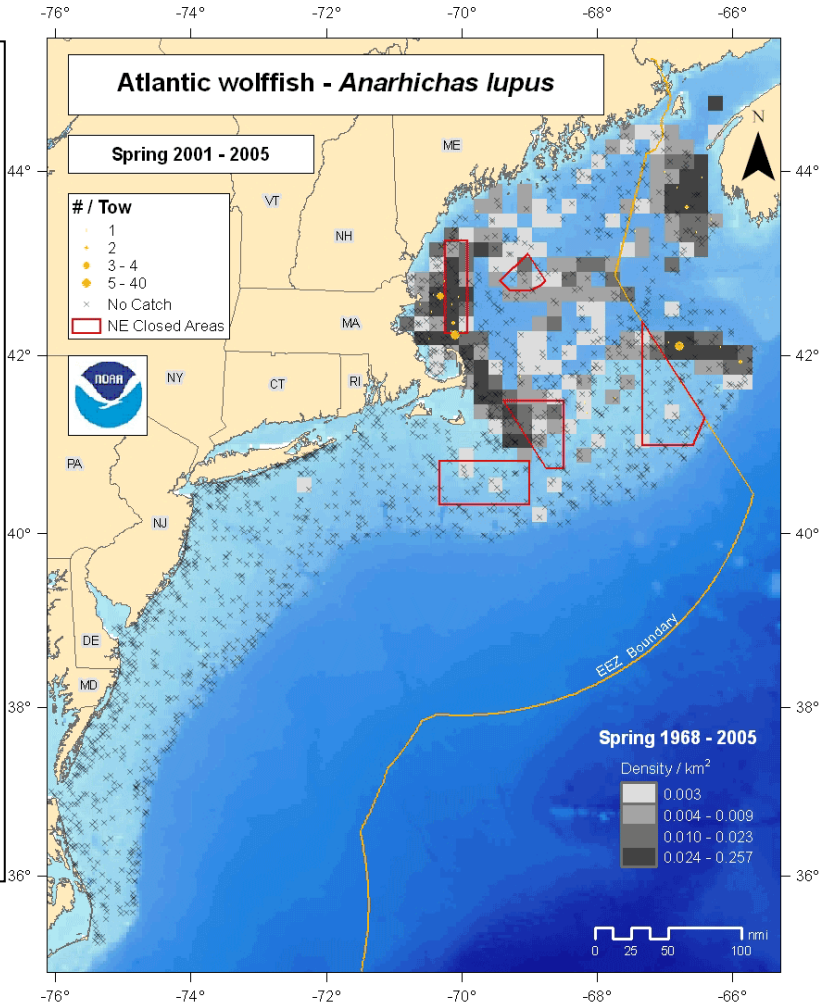
1. Historic Distribution and Present Range

Atlantic wolffish were once widely distributed and abundant west of the Scotian Shelf throughout the entire Gulf of Maine and on Georges Bank southwards to New Jersey (Collette and Klein-MacPhee 2002). They were caught with frequency along inshore Maine coastal waters

and along coastal rocky spots off Gloucester and Nahant. [30] Significant landings (224,000 pounds in 1945) occurred off Cape Cod.[31]

The current distribution (i.e., 2001-2005) is severely contracted when compared against the historic range revealed by surveys beginning in 1963 (Figure 3) and the literature. The highest reported abundance of the species in U.S. waters historically was from Jeffreys Ledge to the Great South Channel (Nelson and Ross, 1992). Other reported areas of abundance in the Gulf of Maine region were in what are now Canadian waters on the northeast peak of Georges Bank and Browns Bank. Scientists believe that populations in the western Gulf of Maine are discrete and isolated from those Canadian populations on Browns Bank and the Scotian Shelf (Idoine 1998b). *See* Section VI.

Figure 3: Atlantic wolffish distribution (2001-2005) in U.S. waters (yellow circles, diameter scale) is mapped over the complete historic data series from 1968 through 2005 (squares, gray-scale). Note that during this most recent time period (2001-2005), wolffish have disappeared from the Great South Channel and points further south.
Source: Status of Fishery Resources off Northeastern US – Atlantic Wolffish
Dataset Title: Distribution Maps – Spring Survey (2001-2005)
Online Resource: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/animation/spring/



Relative species abundance and distribution from NEFSC bottom trawl survey by time block and relative species density for the full time series.

[30] Bigelow and Schroeder, 1953
[31] *Id.*

D. Migrations

Atlantic wolffish are sedentary. According to Bigelow and Schroeder (1953), relatively uniform seasonal catch rates indicate that localities where Atlantic wolffish are found are the localities where they live year round. Available research indicates that adult Atlantic wolffish are found in deep water throughout all seasons, and that egg masses are collected also seasonally in deep waters between 100-130m (Collete and Klein-MacPhee 2002, citing McKenzie and Homans 1938, and Powles 1967), making it likely no mass migration in association with reproduction. However, other research indicates that in some localities Atlantic wolfish may undertake a seasonal migration (although the evidence does not point to a major migration among suitable habitat patches, or to and from seasonal breeding or feeding areas in the Gulf of Maine region) (see Keats *et al*. 1985; Templeman 1984, Nelson and Ross 1992; Collette and Klein-MacPhee 2002). For example, studies off Newfoundland (Keats *et al*. 1985) indicate that some adults may migrate to the shallower inshore waters to mate and that males guard egg-containing nests for up to several months before returning to deeper water. The varied results of studies from different regions suggest that different localities may support local races with distinct life history patterns. *See* Section E below.

Adult wolffish form male-female pairs during the breeding season (Collette and Klein-MacPhee 2002; COSEWIC; Gill 1911), but are otherwise solitary fish, which are not known to school or aggregate during any part of their life history (Bigelow and Schroeder 1953). The period of breeding for Atlantic wolffish in the Gulf of Maine is probably in the late summer through fall period, based on retrieved eggs and studies in Europe (Bigelow and Schroeder 1953); retrieved eggs and larvae indicate hatching during the January-February period (Bigelow and Schroeder 1953; Collette and Klein-MacPhee 2002, citing McKenzie and Homans 1938).

The fall and spring research survey trawls (1963-2005) conducted by NMFS do differ in their detection of abundance of wolffish seasonally (Keith 2006), but do not indicate a seasonal shift in geographic distribution. In many years, the spring surveys have caught about two to three times more Atlantic wolffish per trawl than fall surveys, suggesting that some aspect of fish behavior or ecology influences the efficiency with which they are sampled. These differences may correspond to periods when the fish are actively foraging (spring) and periods when many of the adults are guarding nests in areas sheltered from trawls by large rocks or boulders, or are hidden in rock outcroppings (fall). Because of the small size of the individuals that get sampled in the spring surveys, there is some sense that these surveys potentially catch juveniles foraging for new territory.[32] During the fall nesting period foraging excursions may also be limited because this is when the animals lose and re-grow their teeth. A study of tagged fish in Newfoundland showed that most wolffish were recovered within 8 km of the capture point after a period of 5 to 7 years (Templeman 1984), supporting the premise that Atlantic wolffish exhibit a life history pattern in which home range fidelity is characteristic.

In conclusion, the best available science demonstrates that Atlantic wolffish do not typically range very far from where they were spawned. A number of authors have discussed the possibility that there may be some migration within various Atlantic wolffish populations associated with feeding, reproduction, and water conditions such as depth and temperature

[32] Haedrich Declaration at ¶ 9.

preferences (Collette and Klein-MacPhee 2002). Nevertheless, the field observations of movements in Atlantic wolffish are varied and do not indicate that seasonal migrations are a prominent part of Atlantic wolffish biology in the Gulf of Maine region.

E. Population Structure

Discrete local populations (or subpopulations) of Atlantic wolffish have been theorized based on different life history studies (O'Dea and Haedrich 2002; CMER Research Topics 2005). Subpopulations seem likely considering the site tenacity suggested by tag-recapture studies in nearby Newfoundland (*see* Section D above) and the strong preference of this species for localized rocky habitat areas (Bigelow and Schroeder 1953). Thus, this species is perhaps best described as a meta-population in the U.S., comprised of a network of subpopulations occupying dispersed habitat patches, or islands. The individual components of this meta-population may well be genetically distinct races, but additional work is needed (*c.f.,* fish literature: Ruzzante *et al.* 2000, Hutchinson *et al.* 2001, Waples *et al.* 2004, Was *et al.* 2008; amphibian literature: Newman and Squire 2001, Zamudio *et al.* 2007). However, for the purposes of this petition, the "species" in U.S. waters will be described as a U.S. population comprised of local subpopulations defined by the geographic areas over which they inhabit.

Mark-recapture, otolith analysis, and genetic studies are all important for elucidation of population structure in fishes. Unfortunately, none of these methods have been used at this time to assess Atlantic wolffish subpopulations in the U.S. waters. Personal communications with Kim Damon-Randall at the Northeast Protected Species Office indicate that fin clip tissue samples necessary to perform genetic studies were collected and stored in the Northeast Regional Office ("NERO") in Gloucester, MA for a period of time before they were directed to Dr. Peter Auster at the University of Connecticut. Further analysis and a larger tissue sample size would be necessary to show distinct subpopulations by genetic means.[33] Recognizing the importance of improving the understanding of the wolffish population structure, NEFSC and NERO jointly proposed genetic analysis of the Atlantic wolffish as a 2005 CMER Research Topic considering this information "crucial to a comprehensive review of the status of this species." To date, Petitioners understand that that work has not commenced nor is there a current firm commitment to undertake that work.

[33] Personal emails from Kim Damon-Randall, the Northeast Proactive Conservation Program Coordinator on January 5, 2006; January 13, 2006; and June 2006. Ms. Damon-Randall indicated to Erica Fuller that she had checked with a geneticist at USGS in 2004 and 2006 regarding whether any DNA Microsatellite markers had been developed for any species in the *Anarhichadidae* family as evidenced through an entry in GenBank or PubMed, and that none were developed as of that time.

IV. Natural History and Biology of the Atlantic Wolffish

A. Taxonomy

Common Name:	Atlantic wolffish
Other Common Names:	Ocean Catfish, Ocean Whitefish
Scientific Name:	*Anarhichas lupus*
Authority:	Linnaeus, 1758
Class:	*Actinopterygii* (Ray finned fishes)
Subclass:	*Osteichthyes*
Order:	*Perciformes*
Suborder:	*Zoarcoidei* (the blennylike fishes)
Family:	*Anarhichadidae*
Genus:	*Anarhichas*
Species:	*lupus*

B. Species Description

The Atlantic wolffish are sedentary, solitary, demersal fish with life history characteristics unique even among Gulf of Maine Fishes (Collette and Klein-MacPhee 2002). Respected by fishermen and scientists for their ferocious disposition and formidable teeth, they are also known for their unusually large egg size, prolonged incubation, male egg brooding behavior, probable internal fertilization, and the annual loss of their entire set of teeth (Collette and Klein-MacPhee 2002). The wolffish are the largest members of the suborder *Zoarcoidei* (the blennylike fishes) and reach 1.8m in the western Atlantic (Robins *et al.* 1986) and 2.5m in the world (Nelson 1994) with an average weight of 18-20 kg.

Among other things, Atlantic wolffish are distinguished by their teeth, coloring and fin arrangements. Wolffish dentition consists of large prominent top and bottom canine teeth that form tusks and a central band of molar teeth on the roof of their mouth as well as flattened grinding teeth caudally. This species has a robust elongate but laterally compressed body which varies in color (Collette and Klein-MacPhee 2002). The color of Atlantic wolffish varies from slate blue to olive green and purplish brown, with differing numbers (10-15) of distinct dark transverse bars on the body (COSEWIC, Whitehead *et al*., 1986; Scott and Scott, 1988). Color reportedly varies according to the depth where harvested and as an adaptation to the substrate upon which the individual was living. (Bigelow and Schroeder 1953) (reporting the bodies of Atlantic wolffish taken off the coast of Massachusetts as purplish brown, while those taken off Georges Bank as dull olive green surmising the purple and brown fish were present in “red seaweeds” and the olive grey fish on the “clean bottom”). Atlantic wolffish have a blunt snout with a rounded forehead. Fin arrangement includes a dorsal fin ray of uniform height with rounded corners extending from the nape to the caudal fin base, a short anal fin, a poorly developed caudal fin, and two large rounded pectoral fins. Other distinguishing features of Atlantic wolffish include the absence of pelvic fins, poorly developed scales over the entire body

with none on the head, and the lack of a swim bladder (Gill 1911; Collette and Klein-MacPhee 2002).

Atlantic wolffish have a unique role in the ecosystem due in part to their highly specialized teeth, which enable them to crush their prey. In their most cranial aspect, the Atlantic wolffish have a row of six large conical canine tusks in the maxilla, and four similar teeth in the mandible. There are also clusters of five or six smaller canines behind them, randomly spaced and intervening between rows. The hard palate and the vomer are each armed with three plates of rounded, crushing teeth. Additionally the upper and lower jaws have a double row of about four pairs of large, rounded back molars united (but not fused) into a solid plate (Gill, 1911 and Collette and Klein-MacPhee 2002). Observations made in submersibles indicate that the Atlantic wolffish, upon sighting a sea urchin, will turn on its side, grasp the urchin with its hook-shaped canines, and with a violent side-to-side motion remove the urchin from the shell as the shell is crushed (Collette and Klein-MacPhee 2002). The canine teeth are believed to grasp the food, while the rounded teeth on the palate and vomer are used to crush hard skeletons and prey. The food may be completely crushed before it reaches the stomach, or, as other studies suggest, it may pass fairly intact into the small intestine; whole small crabs and intact sandollars have been found within the intestines of wolffish (Collette and Klein-MacPhee 2002). Most of digestion occurs in the large intestine with the shells ultimately expelled through a large anus (Collette and Klein-MacPhee 2002).

Atlantic wolffish teeth, worn down by the violent grinding and crushing action which occurs during feeding, are replaced annually (Collette and Klein-MacPhee 2002). Both males and females experience a two to three month period in which the fish either fasts or eats soft-bodied animals while waiting for new teeth to become fully functional (Barsukov 1959). Scientists have speculated that Atlantic wolffish may fast during this time of tooth replacement so as not to damage the developing teeth, and that the fasting time encompasses the spawning and brooding periods. However, there may be a great deal of individual variation in timing of tooth replacement in U.S. waters of the northwest Atlantic as evidenced by dive observations: "Nine adult and late juvenile Atlantic wolffish captured on Georges Bank in early December 1994 exhibited a wide range of tooth replacement stages from the presence of scattered old broken teeth, to the absence of all teeth, to the presence of new teeth in various stages of development, including scattered red teeth" (R. Roundtree, pers. obs. reported in Collette and Klein-MacPhee 2002). As an adaptation to this extended fasting period that coincides with brooding the nest, Atlantic wolffish are reported to have among the lowest resting metabolism of marine fish (Liao and Lucas 2000).

C. General Life History

In the marine ecosystems that characterize the northwest Atlantic shelf, Atlantic wolffish are members of a demersal fish assemblage which occupies a wide range of ecological niches and is an apex predator in kelp forest ecosystems (Steneck *et al*. 2004). Atlantic wolffish prefer depths between 50 and 150 m of water and temperature ranges between 4 and 6 degrees Celsius although wider ranges in both depth and temperature are reportedly tolerated. Although generally solitary, members of the species form male-female pairs in the spring, and, in some localities, may have limited migrations seasonally to shallower waters in order to spawn (see

Section III.D above). Some of the more unusual characteristics of their life history include extremely large eggs, a prolonged incubation period during which the nests are guarded exclusively by the males, probable internal fertilization, and the annual loss of their entire set of teeth.

D. Longevity and Growth

Atlantic wolffish reach lengths of 1.5 meter ("m") in Gulf of Maine waters, although most mature fish landed in the last ten years are less than 1 m and 18 kilograms ("kg"). The all-tackle game fish record is a 23.58 kg Atlantic wolffish caught on Georges Bank in June 1986 (Collette and Klein-MacPhee 2002). The mean length at age in the Gulf of Maine is 4.7 cm total length ("TL") at age 0, and 98 cm TL at age 22 (Collette and Klein-MacPhee 2002, quoting Nelson and Ross 1992). A comparison of age growth studies shows similar sizes at similar ages in Norway and Iceland, with an average TL at year one of 13.6 cm, and an average TL at age four of 21.8-28.7 cm (Jonsson 1982). Although males are reported to grow faster than females in Iceland and Norway, studies of the northwestern Atlantic population are insufficient to determine male-female growth rate differences (Nelson and Ross 1992).

The age at maturity for Atlantic wolffish ranges from six years of age in the Gulf of Maine (Collette and Klein-MacPhee 2002) to ten or eleven years in colder Canadian waters (DFO Documents). For the purposes of reporting on Atlantic wolffish in U.S. waters, Petitioners will use six (6) years as a conservative estimate of age at maturity. Additionally, although Atlantic wolffish in the Gulf of Maine grow faster than those in colder waters (such as Iceland) growth slows down at five to six years of age from a diversion of resources to sexual development (Nelson and Ross 1992). The best available science also indicates that a conservative estimate of the life span of the Atlantic wolffish in the Gulf of Maine is twenty-two (22) years (Collette and Klein-MacPhee 2002).

E. Reproduction and Development

Spawning times vary depending upon latitude, depth and temperature. Eggs (5.5 to 6.8 mm) are laid in a large mucous mass 10-14 cm in diameter (Jonsson 1982), and deposited at the sea bottom where it is tended by the female for a period of hours. Subsequently the male mate guards the eggs for some period of weeks or months, probably until the eggs hatch (Collette and Klein-MacPhee 2002; Keats *et al*. 1985).

Different temperature and depth preferences, as well as differences in "spawning times suggest that discrete regional populations may be the rule" (COSEWIC). DFO Stock Status Report A3-31(2002) provides information on the variability of spawning dates in the Maritimes and in other colder water regions; wolffish in Newfoundland are known to spawn in September, while those in the White Sea spawn in July, and those in Iceland spawn in January and February. In the Gulf of Maine, Atlantic wolffish are reported to spawn from midsummer to late winter, with peak spawning September and October (Jonsson 1982).

Female wolffish have paired ovaries in the dorsal half of the abdomen, while males have a pair of elongate testes ventral to the kidneys (Falk-Petersen and Hansen 1991). Females

produce a variable amount of eggs, with a documented relationship between length and age of the female to the number of eggs produced (Templeman 1986b). Ripe females develop a pot-bellied appearance 3-5 months prior to spawning which becomes pronounced 1-2 weeks before spawning, due to a gradual increase in the size of their eggs (Johannessen et al. 1993). Reports vary between 338 eggs in a seven year old 25-cm female, to 5,000 eggs in a nine year old 60-cm female, and up to 12,000 eggs for an 80-90 cm female (Collette and Klein-MacPhee 2002). Females appear to be group-synchronous with the possibility of several generations present and spawning at one time (*Id*.).

The sequence of Atlantic wolffish pre-spawning events suggests internal fertilization (Collette and Klein-MacPhee 2002). One to two days prior to spawning, the female commences to rest motionless on the ocean floor during a side-laying phase. This side-laying phase is followed by a 3-6 hour labor phase. Copulation occurs at the end of the labor phase, after a 2-10 mm opening into the oviduct appears. Next, the female enters a resting phase lasting 8 to 15 hours during which eggs apparently become inseminated within the body cavity. At the end of the resting phase, the fertilized eggs are extruded during a brief extrusion phase lasting 3 to7 minutes. At this point the eggs become firmly attached to one another by mucus, the female curls up around the mass of eggs for 6 to10 hours, and then the mucus dissolves.

After the pre-spawning events, the eggs are hidden under rocks and boulders in nests, and guarded exclusively by an adult male from three to nine months (Collette and Klein-MacPhee 2002). The length of time from spawning to hatching is variable, dependent upon temperature and external stimuli. *Id.*

Studies in Europe provide what limited information is available regarding egg and larval development (Collette and Klein-MacPhee 2002). The time necessary for proper egg development varies depending upon water temperature, with 5-7 degrees Celsius optimal. Prolarvae hatch between 17-20 mm in length and remain close to the bottom until the yolk sac is absorbed. The prolarval stage, which lasts 3 hours to 6 days, has a remnant yolk sac and an oil globule attached. Other features of this prolarval stage include large eyes, small teeth, completely differentiated fin folds, and pigment bands.

A short pelagic larval stage follows the prolarval stage, lasting 10-15 days, after which the fry (TL >28mm) move back to the bottom, absent the yolk sac, with a bigger body, and more developed teeth, coloring, and territorial behavior; however the total pelagic stage may last longer depending upon water temperature, and is spent near the area where the eggs were initially laid (Collette and Klein-MacPhee 2002). Other reports indicate that juveniles are pelagic between 20 and 40 mm and settle back to the floor at more than 50mm total length (Falk-Petersen and Hansen 1990, 1991). These differences may reflect difference among local races.

Distribution of various life stages of Atlantic wolffish in the Greater Gulf of Maine area suggests that Atlantic wolffish breed where they are found (Collette and Klein-MacPhee 2002). Scientific reports indicate that both larval and juvenile stages are found in the channel between Browns Bank and Cape Sable, near Seal Island (Nova Scotia), on German Bank and off its slope, off Lurcher Schoal, off Machias (Maine), on Jeffreys Bank (off Penobscot Bay) and in Massachusetts Bay a few miles off Gloucester (Collette and Klein-MacPhee 2002). Additionally,

larvae have been collected in the northwest Atlantic from January to March (Bigelow and Schroeder 1953), and scuba observations off the coast of Nova Scotia reported recently hatched larval wolffish in October and November (Keats *et al*. 1986b). In conclusion, there appears to be a strong relationship between where adults are found and where juveniles and larvae are found, with the greatest concentration of juveniles in the Gulf of Maine occurring approximately 50 km off-shore (31 miles or 27 nm) over Jeffreys Ledge (Collette and Klein-MacPhee 2002).

F. Habitat Requirements

The Atlantic wolffish is a bottom-living (benthic), cold water (-2.0--11.0° C) fish whose principal habitat is hard bottom, including large rocks, boulders and rocky outcroppings (Scott and Scott 1988; Collette and Klein-MacPhee 2002). In the Gulf of Maine, Atlantic wolffish are usually found at depths between 80 and 120 m and water temperatures ranging from -1.3--10°C (Nelson and Ross 1992; Collette and Klein-MacPhee 2002). Historically, these benthic fish have lived at a wider variety of depths including tide pools (Gill 1911) and very deep water (600 m) off western Greenland (Collette and Klein-MacPhee 2002). Atlantic wolffish living in the most southern range in U.S. waters have adapted to living at the warmest ambient summer water temperatures in the range (Bigelow and Schroeder 1953).

In an effort to further explore the types of substrate that have supported Atlantic wolffish populations in the Gulf of Maine region, Petitioners reviewed a habitat analysis performed by the Census of Marine Life ("CML").[34] CML used NMFS (NOAA) and DFO data mapped over a substrate layer assembled by the Conservation Law Foundation and WWF-Canada for classifying the region's seascapes (Crawford and Smith 2006).[35] In this analysis, locations where one or more Atlantic wolffish were sampled are identified (i.e., "positive" trawls for wolffish) and mapped over the substrate type known to be in that location. Combined NMFS and DFO trawl samples were used for this substrate evaluation, and a few locations lacking substrate classification were excluded. The proportion of positive tows was then calculated by determining the ratio of positive tows for a given substrate type to the total number of trawls for that substrate (Figures 4 and 5).

This analysis showed that highest rate of occurrence of Atlantic wolffish was over hard-bottom gravel and till strata - with fifty percent of the tows positive for the species occurring over this substrate (Figure 5).[36] The occurrence rate over such hard strata was more than double that of any other substrate type. These calculations support dive observations and other scientific literature which all indicate that rocky substrate is the required and preferred habitat for the Atlantic wolffish.[37]

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[34] Reproduced at Appendix V.

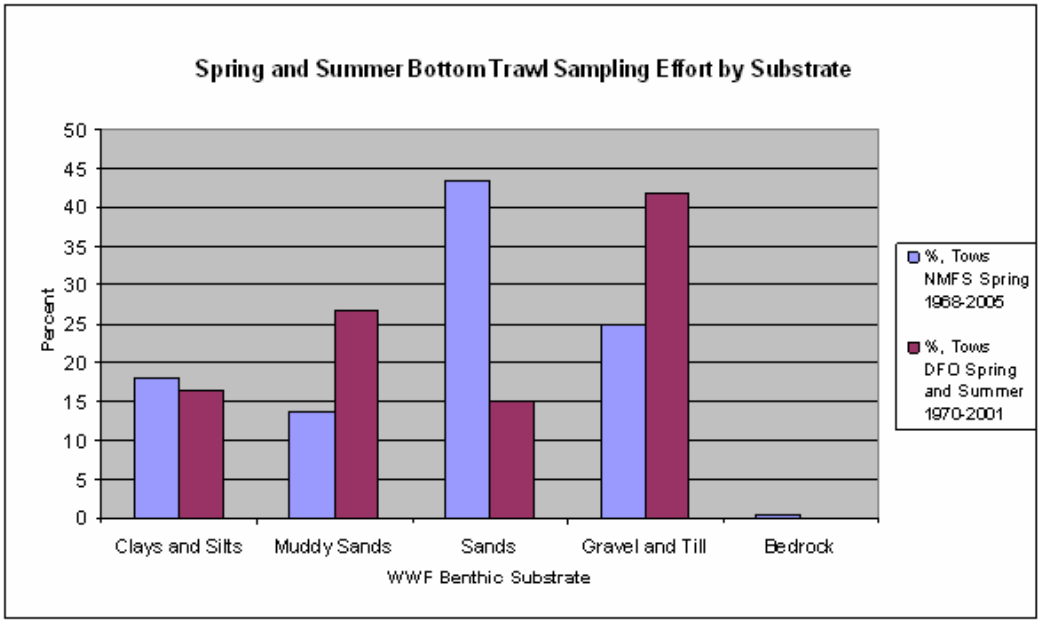
[35] Chapter 8 of Crawford and Smith (2006) details the compilation of a substrate data layer for the Greater Gulf of Maine region and Scotian Shelf, and illustrates the integration of substrate data and other physical data for the classification of *seascapes.*

[36] Crawford and Smith (2006) classified bottom types in five broad categories. Rocky, boulder and cobble bottom strata were classified as "Gravel and Till." *See* Table 8-4 and p. 121. Personal communication with Dr. John D. Crawford (2008).

[37] Petitioners recognize that there are limitations of this analysis, particularly related to the use of a coarse substrate classification system. Limitations include incomplete benthic substrate sampling for the US Gulf of Maine region, and the use of interpolation to generate a complete substrate map with a resolution of 5 geographic minutes square.

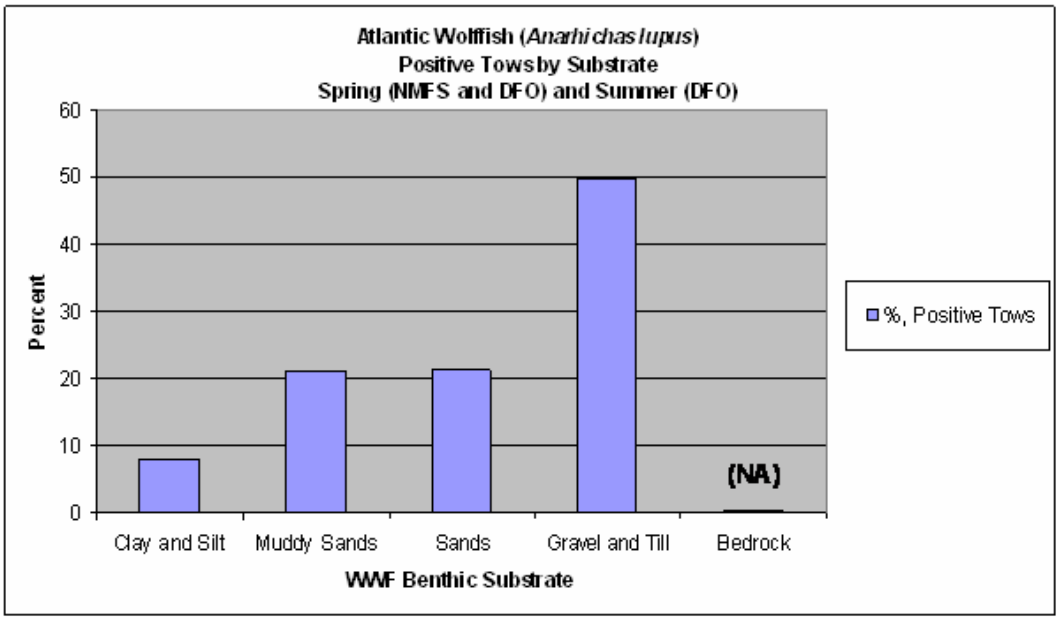
The hard-bottom habitats required by Atlantic wolffish also support macro-benthic invertebrate communities (e.g., sponges, corals and bryozoans) that enrich the three-dimensional structure of the bottom. These invertebrate communities are destroyed with just one or a few passes of a bottom trawl net and recovery may take many years. Watling Declaration at ¶¶ 6-9. These living "ecosystem engineers" are a particularly significant part of the habitat for young Atlantic wolffish because the biogenic structures provide shelter from predation in early life stages (*see* Watling and Norse 1998; Lindholm *et al.* 1999 and 2001; Collie *et al.* 2000). The damage to this aspect of the Atlantic wolffish habitat through extensive trawling has probably impacted the growth and survival of young Atlantic wolffish throughout their range. Watling Declaration at ¶¶ 10-13, Haedrich Declaration at ¶10.

Figure 4: Spring and Summer Bottom Trawl Sampling Effort by Substrate
Source: Census of Marine Life, Gulf of Maine Area Program
Dataset Title: Spring (NEFSC, DFO) and Summer (DFO)
Online Resource: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/



This was a course classification scheme, classifying relatively large areas as a single bottom type even though there may be heterogeneity within squares.

Figure 5: Atlantic Wolffish (*Anarhichas lupus*) Positive Tows by Substrate
Source: Census of Marine Life, Gulf of Maine Area Program
Dataset title: Spring (NMFS and DFO) and Summer (DFO)
Online Resource: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/



G. Diet

Atlantic wolffish feed almost exclusively on hard-shelled benthic invertebrates such as mollusks, crustaceans and echinoderms (Bigelow and Schroeder 1953). Analysis of wolffish stomach contents include sea urchins, welks, cockles, sea clams, brittle stars, crabs, scallops and other shellfish in addition to an occasional redfish (Collette and Klein-MacPhee 2002; Templeman, 1985). As an apex predator in the kelp forest ecosystem (Steneck *et al.* 2004), the Atlantic wolffish is believed to be a key player in the regulation of the density and spatial distribution of lower trophic level organisms such as green sea urchins, crabs, and giant scallops (O'Dea and Haedrich 2002). Although young Atlantic wolffish eat primarily echinoderms, mature wolffish eat mollusks and crustaceans as well as echinoderms. Large piles of crushed shells have been documented in front of the nesting areas of egg-guarding males (Collette and Klein-MacPhee 2002).

H. Predators

Based on stomach contents analyses, predators of the Atlantic wolffish include the Greenland shark, Atlantic cod, gray seals, spiny dogfish, thorny skate, red hake, pollock, haddock and sea raven (Collette and Klein-MacPhee 2002). Within US waters, the spiny dogfish,

sea raven and cod were the most frequent predators of the 3-10 cm juveniles, with the sea ravens as the only identified predators of wolffish greater than 25 cm (Roundtree 1999).

I. Recruitment

Petitioners could not find any specific information on recruitment in U.S. waters, For reasons set forth elsewhere in this Petition, most scientific opinion treats subpopulations of Atlantic wolffish as discrete units without much intermixing. *E.g.*, Collette and Klein-MacPhee 2002)(western Gulf of Maine populations probably discrete from Canadian populations on Browns Bank or Scotian Shelf); Bigelow and Schroeder 1953 (juveniles probably settle near hatching locality).

J. Natural Mortality

The best known source of natural mortality in Atlantic wolffish is predation by other fishes and by gray seals. As noted above, stomach contents analyses have been used to identify a large variety of fish-predators on juvenile wolffish, with spiny dogfish, sea raven and Atlantic cod being the dominant Atlantic wolffish predators in U.S. waters (Collette and Klein-MacPhee 2002).

The population of spiny dogfish expanded considerably between about 1980 and 1993, with the estimated total biomass increasing by roughly 5 fold.[38] The relatively rapid increase in the spiny dogfish population began several years before the same research survey trawls revealed the onset of a precipitous decline in the relative abundance (biomass index) of Atlantic wolffish (1983 to 1995). The increase in abundance of spiny dogfish could have contributed to increases in natural mortality in Atlantic wolffish but additional research is needed.

The abundance of the thorny skate, another known predator, was also relatively high during the 1983 period when the recent Atlantic wolffish crash began, but the relative abundance of this predator has declined substantially since that time. This predator may have added to the cumulative impact on the Atlantic wolffish population during the 1980's but is expected to be less now. Predation by Atlantic cod (Gulf of Maine and Georges Bank) is likely to have diminished over the past century as cod populations have been declining for decades.

The gray seal population appears to be on the rise in the northwest Atlantic generally. There was estimated 3-fold increase over the 8 year period ending in 2001 for Maine.[39] It is possible that the growth of this population has also contributed to increased natural mortality in Atlantic wolffish, but this also needs to be confirmed through stomach contents or other data on food habits. Petitioners are not aware of an analysis of abundance trends in the sea raven, another of the fish identified as a significant predator on wolffish. Additional studies of these possible

[38] *NEFSC Spring Survey Data, Status of Fishery Resources off Northeastern US – Spiny dogfish*. Found at: http://www.nefsc.noaa.gov/sos/spsyn/op/dogfish/ (last viewed 8-27-08).

[39] *Gray Seal (Halichoerus grypus): Western North Atlantic Stock*. Found in: Waring, Gordon T. et. al. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments* – 2006 (2nd Edition). Found at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm201/121-125.pdf and http://www.nefsc.noaa.gov/nefsc/publications/tm/tm201/ (last viewed 8-27-08).

sources of natural predation on wolffish will be required before firm conclusions are reached about their impact.

V. Population Trends for Atlantic Wolffish in the United States

A. Abundance Declines Relative to Generation Time

The population decline rate, expressed relative to generation time, is an important international standard for conferring endangered status on animal populations (International Union for Conservation of Nature: IUCN Red List standard A). Haedrich Declaration at ¶ 6. Based on the population declines calculated in this Petition, the U.S. population of Atlantic wolfish would be ". . . considered to be facing an extremely high risk of extinction in the wild"[40] and warrants designation as Critically Endangered under IUCN criteria. *Id.* at ¶ 8. This IUCN standard is used in Canada as part of the analysis under SARA prior to a species designation. This designation as Critically Endangered is specifically based upon the following quantitative criterion:

> "An observed, estimated, inferred or suspected population size reduction of 90% over the last 10 years or three generations, whichever is the longer…."[41]

From 1983 through 2004 (i.e., 22 years beginning at the point of precipitous decline), the rate of decline for the U.S. population of Atlantic wolffish corresponded to approximately 95% over three generations (estimated at 30 years; Figure 6). Based on these decline rates, the Atlantic wolffish would also qualify as Endangered in Canada (under COSEWIC). Haedrich Declaration at ¶ 8.

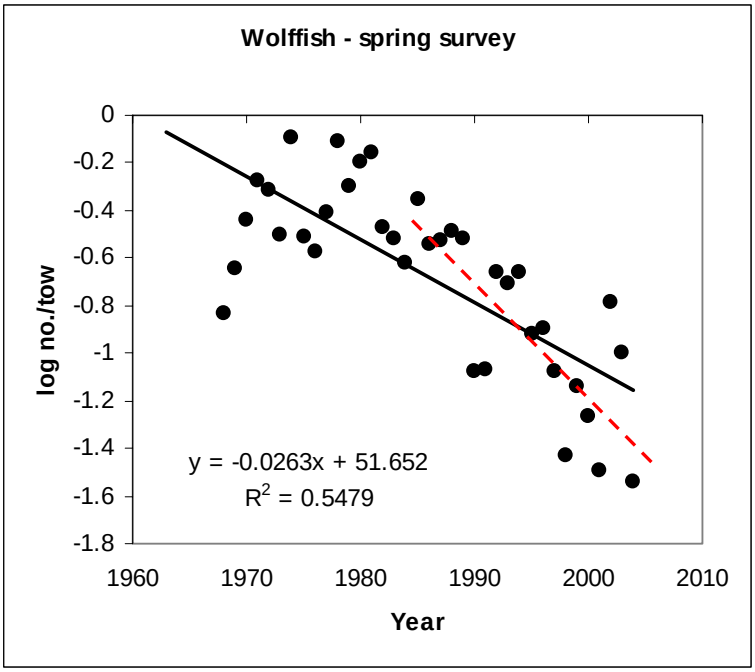


Figure 6: Declines in occurrence (log n fish per trawl) as a function of year. The slope for the best fit line for the entire spring survey (black line) was negative 0.26. For the period beginning in 1983 (red dashes), the decline rate was substantially higher with a slope of negative 0.042.
Source: Haedrich, Appendix IV
Dataset source: NMFS

[40] *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 6.2 (December 2006). Found at: http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf (last viewed 8-27-08).
[41] *IUCN Red List of Threatened Species, 2001 Categories & Criteria (version 3.1)*. Found at: http://www.iucnredlist.org/info/categories_criteria2001 (last viewed 8-27-08).

B. Calculating Rates of Decline

The convention for determining whether a species can be considered at risk depends on the population decline over a specified period of time, usually 10 years or three generations. The latter is preferred as being more biologically appropriate.

The rate of decline (%) can be computed for a given biologically appropriate time period (t) according to the following equation:

Equation (1) $\text{rate} = 100 \times (1 - 10^{(bt)})$

For a population that is in decline, the log plot of relative abundance (or catch per unit effort) as a function of time will have a negative trend (Figure 6). The slope (b) of the best fit trend line is used in the exponent for computing rate above. For the period of sharp decline in the US population of Atlantic wolfish, the b was -0.042 (Figure 6, red line).

The most biologically appropriate time period for the wolffish (IUCN) is three generation times, or t=3 x g:

Equation (2) $\text{rate} = 100 \times (1 - 10^{(b3g)})$

The data needed to calculate generation time (g) of Atlantic wolffish in US waters are available, so the decline rate can be calculated over the standardized and internationally recognized time span of three generations.

Calculation of generation time (g)

A generation time (g) of 10 years was calculated according to the formula:

Equation (3) $g = \text{age at maturity} + 1/\text{mortality}$

As previously noted, age at maturity for Atlantic wolffish in U.S. waters was taken as six (6) years (Collette and Klein-MacPhee 2002), although age at maturity does vary some over the global range with slightly later maturation in colder parts of the range.

The mean natural mortality rate (m) was estimated at 0.25 based upon the reported maximum life span of twenty-two (22) years in the Gulf of Maine (Collette and Klein-MacPhee 2002). Over a 22 year period, a hypothetical starting population of 100 essentially drops to zero (i.e., less than 1 fish). This corresponds to an annual mean survival rate of about 75%. Data on age-specific mortality are not yet available. This estimate of mortality is based on the best available science and is conservative as it is solely an estimate of natural mortality, and does not reflect mortality resulting from commercial or recreational fishing and/or other human impacts.

A decline rate of approximately 95% over three generations (30 years) was calculated based on Equation (2), using the generation time estimated above and the slope (b) of the best fit line for the spring survey data from 1983 through 2004 (Figure 6). Calculations based on the

entirety of the spring survey data set (b=-0.0260) yield similar results with a slightly smaller three generation decline (84%), or an 89% decline for the full 37 year period.

For Atlantic wolffish, these calculations of population trends relative to generation times in this long-lived, slow growing fish, are foreboding. Even the slightly lower declines, estimated from the whole survey data set, put this species at serious risk of extinction in the wild according to internationally recognized criteria (IUCN Critically Endangered Criterion A2). Haedrich Declaration at ¶ 8. Habitat damage and direct mortality from bottom-contacting fishing methods continues throughout most of the U.S. range of the Atlantic wolffish. Haedrich Declaration at ¶ 10; Watling Declaration at 10-12. Additionally, data on average weight of these fish from research trawls show a clear downward trend toward smaller sizes – a pattern now documented for many other fishes subjected to fishing pressure (*e.g.*, Olsen *et al.* 2004). Over the thirty-seven (37) years of the spring research survey data, the mean size of an Atlantic wolffish in the U.S. has declined by more than a third, from 4.4kg to 2.8 kg—a 36% decrease.

C. Overview of Data Sources for U.S. Atlantic Wolffish Population Assessments

Data on Atlantic wolffish populations are available in the form of commercial landings records and from the standardized research survey trawls conducted by NMFS and others. In addition to the federal research survey trawls, Massachusetts, New Hampshire, and Maine have conducted research survey trawls in state coastal waters. The latter, the fishery-independent research survey data, provide the best picture of trends in relative abundance. The commercial landings records are influenced by a host of variables and are less informative for Atlantic wolffish than the standardized surveys.

D. Stock Assessments for Atlantic Wolffish

There has never been a directed fishery as such for Atlantic wolffish in the U.S, although landings have been significant from Massachusetts to Maine historically (Bigelow and Schroeder 1953). Atlantic wolffish landings in U.S. waters have always been primarily incidental to directed catches in other fisheries, particularly the multi-species groundfish complex and the recreational fishery. For these reasons, quantitative stock assessments, which are typically triggered by the management needs of a directed fishery, have not been done for Atlantic wolffish. There are no biomass projections available for the Atlantic wolffish, and most of the important life history parameters that are used in stock assessments are not well known for this species.[42] A qualitative stock assessment review of Atlantic wolffish was last completed by NMFS in 1985.[43] Ten years later, in 1995, Atlantic wolffish were identified as a species with "research needs, working group or special topic report."[44] Nevertheless, a formal stock

[42] Personal communications with NMFS (Chad Keith of NEFSC) indicated that no stock assessment has been performed on this species and that NOAA still does not have spawning stock biomass projections or the necessary life history data for the wolffish (*see* http://www.nefsc.noaa.gov/sos/).

[43] Northeast Fisheries Center. "Status of the Fishery Resources off the Northeastern United States for 1986." NOAA Technical Memorandum NMFS-F / NEC-43. Found at: http://www.st.nmfs.noaa.gov/tm/nec_image/nec043image.pdf (last viewed 9/15/08).

[44] Stock Assessment Review Committee. "Report of the 19th Stock Assessment Workshop (19th SAW)." NEFSC Ref. Doc 95-08. Referenced at: http://www.nefsc.noaa.gov/publications/series/crdlist.htm (last viewed 9/15/08).

assessment review was not conducted. In November 2006, the New England Fishery Management Council and NMFS requested scoping comments regarding the potential inclusion of the Atlantic wolffish in the Northeast Multispecies FMP under Amendment 16 to the Northeast Multispecies (Groundfish) Fishery Management Plan. 71 Fed. Reg. 64941 (Nov. 6, 2006). At the same time, NMFS announced that NEFSC would do an earlier than planned 2007 stock assessment of the Atlantic wolffish. *Id*. However, a 2007 stock assessment of Atlantic wolffish was not performed and Atlantic wolffish have not been included in the Groundfish Multispecies FMP.

E. State of Fishery-Independent and Fishery-Dependent Data for U.S. Atlantic Wolffish

As stated above, the two principal means for measuring population trends in marine fishes are research vessel survey data (i.e., fishery-independent), and commercial catch and effort data (i.e., fishery-dependent).

1. Survey Data: Fishery-Independent Data

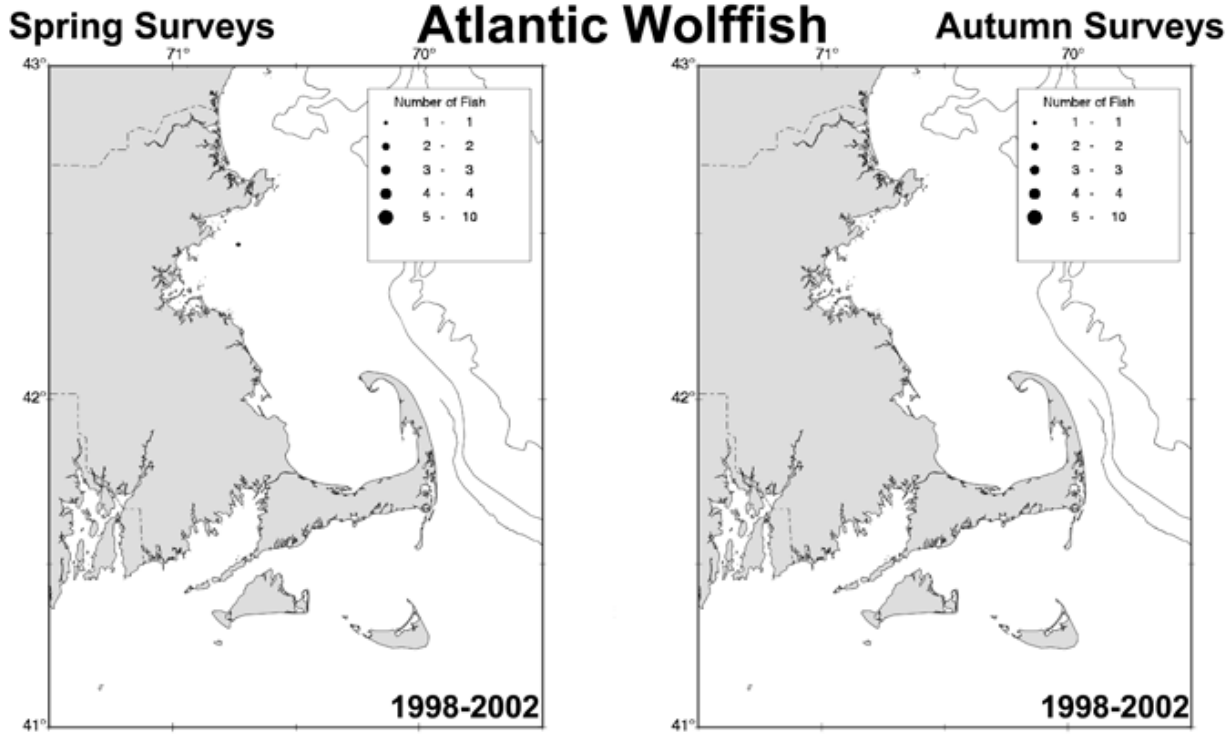
NEFSC, a research arm of NMFS, has conducted a bottom trawl survey program in the northwest Atlantic for both spring and fall for approximately forty years. The autumn survey was initiated in 1963, and the spring survey in 1968.[45] "The [NMFS] surveys employ standard gear and sampling procedures following a stratified random sampling design and thus provide a valuable time series of data for monitoring resource trends." (Sosebee *et al.*, NEFSC 2006) In addition, several states also conduct monitoring programs using bottom trawl surveys to document the inshore status of species. Because bottom-tending gear is used, the data is most appropriate for a demersal species like the Atlantic wolffish. The NEFSC research survey data for Atlantic wolffish show a slow increase in relative abundance until the mid 1980's when a pronounced downward trend began. See Figures 8 & 9 below.

The fishery-independent research trawl surveys carried out by NMFS and DFO in the Northwest Atlantic Shelf waters are the best longitudinal surveys of bottom-living fishes anywhere in the world. Nevertheless, survey trawls, like other sampling procedures, are not without limitations. There are a number of variables that can influence the efficiency with which the trawls sample particular fish. The trawls may be more efficient over certain bottom types than others. For example, areas with large rocks or boulders may be under-sampled compared to sandy or muddy bottom. Fish behavior may vary with season, or with age, and this too can influence the survey results. As important as the possible effects of these variables may be with a particular survey, they are not likely to explain long-term abundance trends detected based upon a standardized sampling methodology. There may be some underreporting of Atlantic wolffish from rocky habitat areas but the sampling does reveal the strong association of Atlantic wolffish with hard bottom habitat (Figures 4 & 5), an association also known through direct observations (e.g., diving, ROV). Sampling biases that stem from differences in trawl frequencies over different bottom types or different localities have been corrected here and elsewhere, i.e., effort correction (*e.g.*, Crawford and Smith 2006).

[45] There is a winter survey not used for the purposes of this Petition, which was begun in 1992.

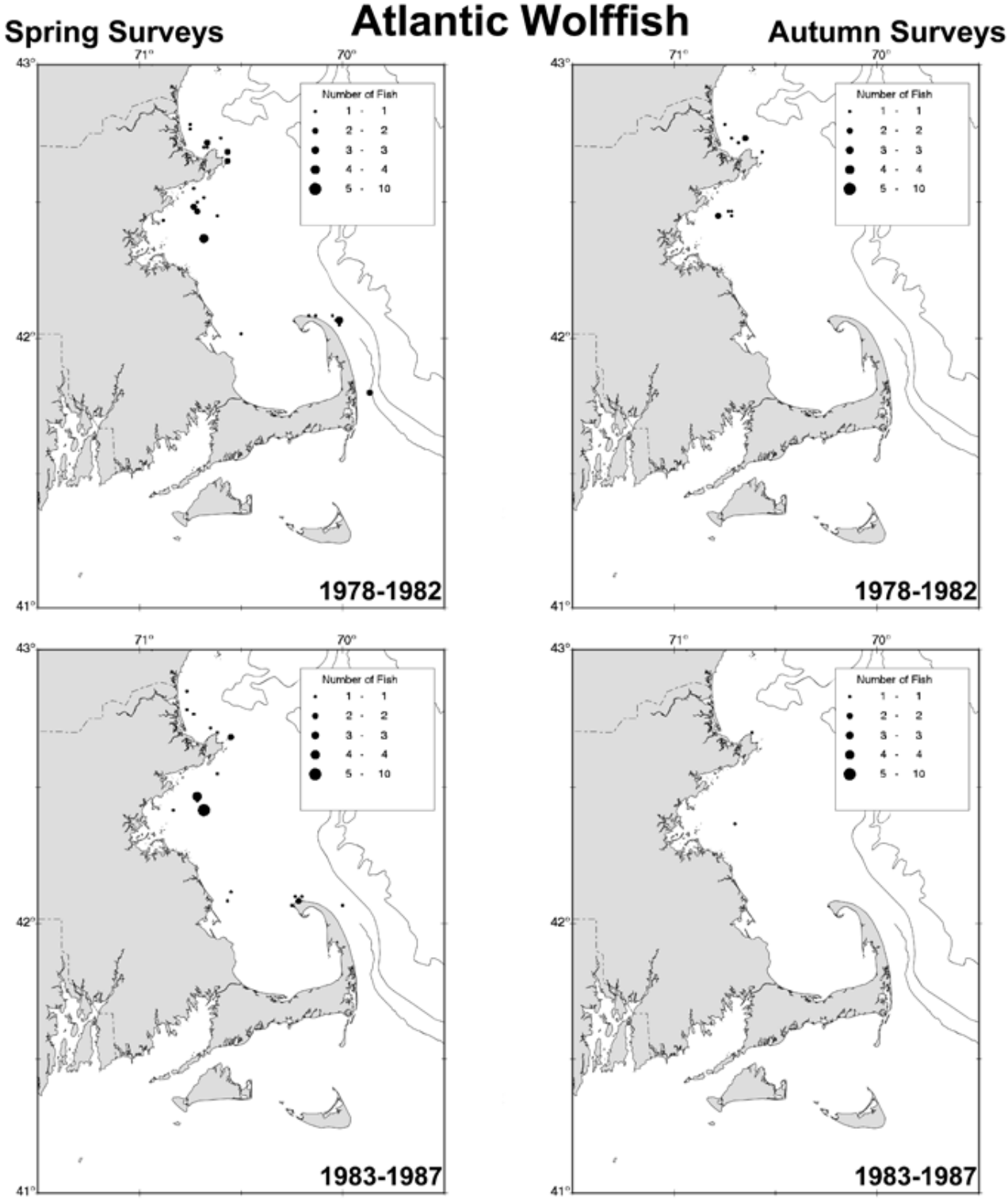
In addition to national research trawl surveys performed in the U.S. and Canada by NMFS and DFO, some states perform research trawl survey. The Massachusetts Division of Marine Fisheries ("MaDMF") has conducted random, stratified spring and summer bottom trawl surveys since 1978. These trawls are conducted in water depths from seven (7) meters to 147 meters on the inshore continental shelf, with approximately 100 stations sampled in each survey. These MaDMF surveys reflect an even more precipitous decline in Atlantic wolffish abundance in Massachusetts inshore waters than the NMFS trawl surveys reflect. As the figures below indicate, in the 1998-2002 time series of MaDMF surveys, only one (1) Atlantic wolffish was caught in the spring surveys and none were caught in any of the fall surveys.

Figure 7: Distribution of Atlantic wolffish in the Massachusetts Inshore Spring and Autumn Bottom Trawl Surveys 1998-2002, 1978-1982, 1983-1987, 1988-1992, 1993-1997.
Source: A Historical Perspective on the Abundance and Biomass of Northeast Demersal Complex Stocks from NMFS and Massachusetts Inshore Bottom Trawl Surveys, 1963-2002, K.A. Sosebee and S.X. Cadrin (NEFSC Ref. Doc. 06-06)
Dataset title: NEFSC Spring and Autumn Surveys
Online Resource: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0605/



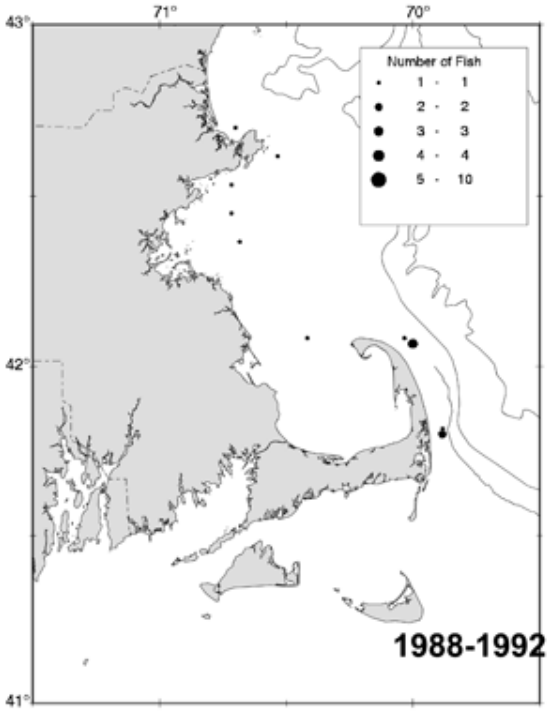
By way of comparison, in earlier surveys, Atlantic wolffish were caught in significantly greater abundance in both the state spring and the autumn surveys.

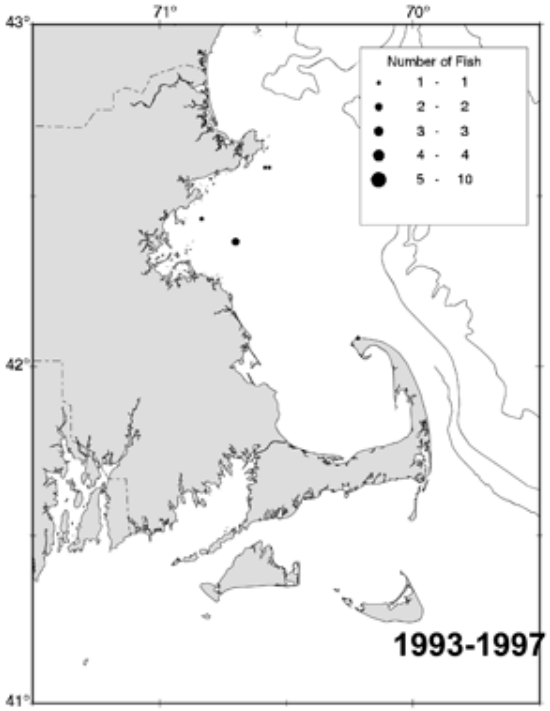
Atlantic Wolffish



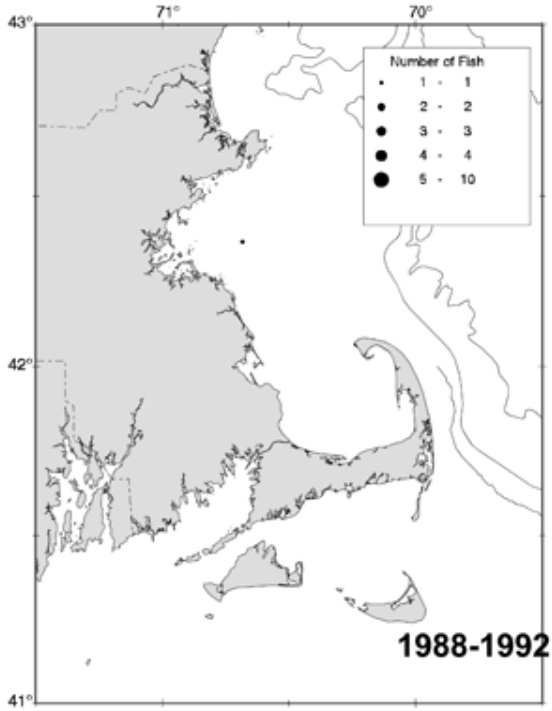
Atlantic Wolffish

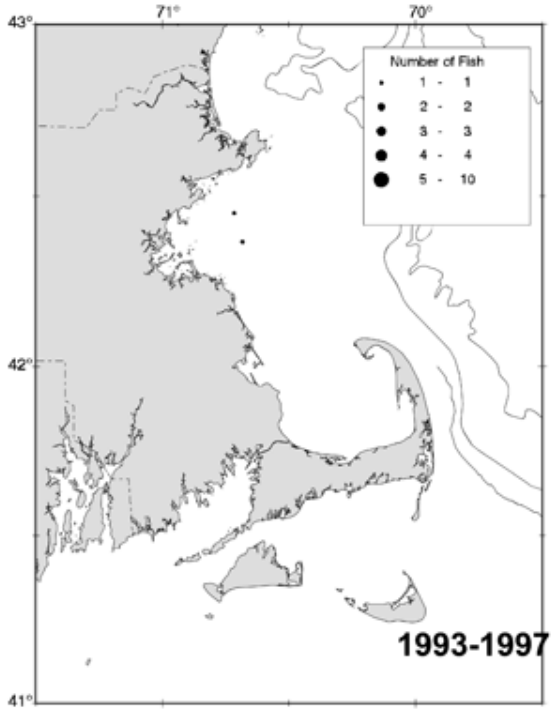
Spring Surveys





Autumn Surveys





Similarly, the states of New Hampshire and Maine have conducted joint survey trawls in New Hampshire and Maine coastal waters twice a year from the fall of 2000 to the present. The results of these surveys from 2000 through Spring 2005 are publicly available.[46] These survey trawls reflect over 100 trawls in the spring and fall in depths ranging from 5 to 80 fathoms.[47] Based on these surveys, no Atlantic wolffish were caught until the Fall 2004 survey when one individual was captured.[48]

2. Commercial Fishery-Dependent Data: "Landings"

By itself, data on the weight of a targeted fish species brought to shore in commercial fisheries (i.e., landings) is not considered sufficient to assess abundance trends because it is influenced by a number of factors including prices paid for the fish, fishing effort, and regulations (closed areas, trip limits, etc.). Additionally, fisheries landings data do not account well for fish caught as incidental catch in other fisheries. When fish are caught as incidental catch, they may be discarded (i.e., thrown overboard) or taken as bycatch and sold. There is no bycatch data available for Atlantic wolffish in U.S. waters, nor is there reliable data on discards. The latest commercial landings data that does exist puts U.S. commercial landings at 65 metric tons in 2007, down from a high in 1983 of 1,200 metric tons.[49]

3. Recreational Fishing-Dependent Data

U.S. stock assessments of recreational fishing landings state that recreational fishing pressure on Atlantic wolffish is small. *E.g.*, Status of Fishery Resources off the Northeastern US-Atlantic Wolffish (rev. 2006)("Recreational catches of wolffish are insignificant.")[50] This analysis appears to be based on earlier stock assessment conclusions without any effort to independently verify or update this analysis. Based on a non-quantitative review of information available electronically, however, it seems that the recreational fishery on Atlantic wolffish, particularly in the western Gulf of Maine area, is very significant with party charter boats targetting of the species and significant levels of landings.[51] Further efforts are needed during the status review to better characterize this recreational catch, both qualitatively and quantitatively.

4. Assessing Fishing Impacts on U.S. Atlantic Wolffish

There are two major ways that fishing has impacted the U.S. population of Atlantic wolffish. The most direct impact is through mortality from recreational and commercial fishing since there is an incidental take of Atlantic wolffish in a variety of fisheries. Indirect impacts

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[46] Reports are available at: http://maine.gov/dmr/rm/trawl/reports.htm (last visited 9/16/08).
[47] "Maine-New Hampshire Inshore Groundfish Trawl Survey Procedures and Protocols, 2005" Found at: http://www.maine.gov/dmr/rm/trawl/procanprot.pdf (last visited 9/16/08).
[48] See Final Report on the Maine-New Hampshire Inshore Groundfish Trawl Survey, October 2004--September 2005 at 2. Found at: http://maine.gov/dmr/rm/trawl/reports.htm (last visited 9/16/08).
[49] *Status of Fishery Resources off the Northeastern US – Atlantic wolffish.* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 9-16-08). Most recent commercial landings data (through 2007) found at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.
[50] *Id.*
[51] *E.g.*, www.wildlife.state.nh.us/Fishing/Fishing_Reports/Fishing_Reports_2007/fishing_report_052407.htm; www.bluewatercharters.com/Fishing_Trips.html; www.relentlesscharters.com/FishingReports-2006.html;

include damage to habitat from trawling or other bottom-tending gear. See Section IV.F above; Watling and Norse 1998; Auster and Langton 1999; Collie *et al*. 2000), and alterations to the ecosystem that might influence Atlantic wolffish populations. *See* Sections IV.H and IV.J above. The direct impacts of commercial fishing are considered here.

The direct impact of fishing on a fish population can be examined by looking at the correlation between fisheries dependent data (i.e., commercial landings) and fisheries independent data (i.e., population estimates from research survey trawls). Although the fishery-dependent landings data is limited, as noted above, there is a clear correlation between the general trend observed in the data from landings and the data from research surveys. This is consistent with, but does not demonstrate, a cause and effect relationship between population abundance and fishing (Figure 8).

When a population of fish is over-exploited, and landings begin to decline principally because fishing is depleting the population, one might expect a particularly strong correlation between the survey results and landings. In the case of Atlantic wolffish, during the period from 1968-2004, the correlation with landings was only moderately positive (r= 0.43 for mean weight per standardized trawl; r=0.41 for mean number per standardized trawl). However, when calculated for the sub-set of data corresponding to the period of precipitous population decline (1983-2004; 1983, peak in commercial landings; Figures 8 and 9) the correlations were much more strongly positive (r = 0.91 and 0.81 respectively). These observations are again consistent with the hypothesis that fishing is driving down the population of Atlantic wolffish. One can not rule out, however, the possibility that another unidentified factor (or factors) was influencing trends in both landings and survey data.

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Figure 8: Wolffish Abundance in #/tow over time as indicated by spring and fall survey data as well as commercial landings.
Source: NEFSC/NOAA website http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/. Most recent commercial landings data (through 2007) found at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.

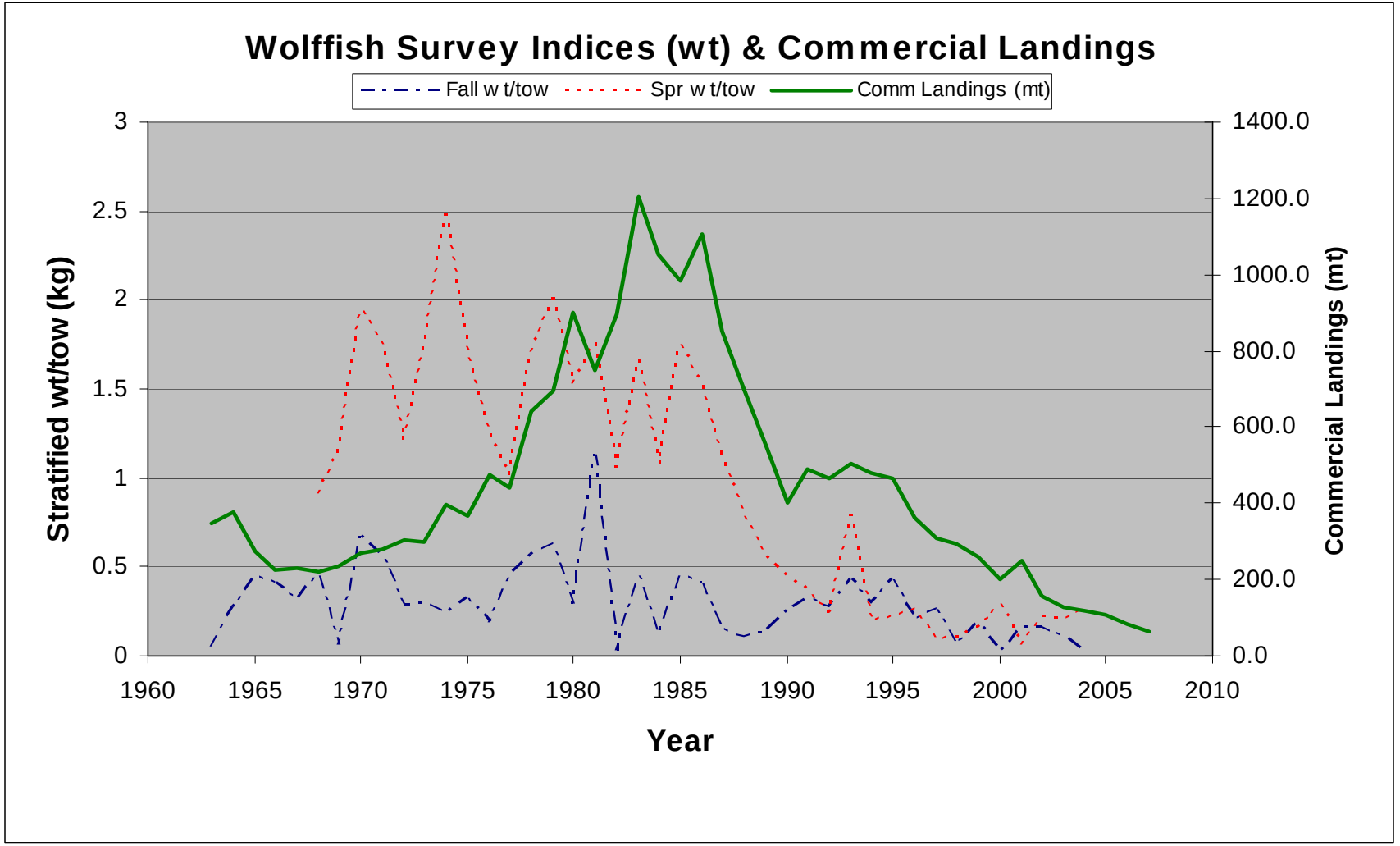
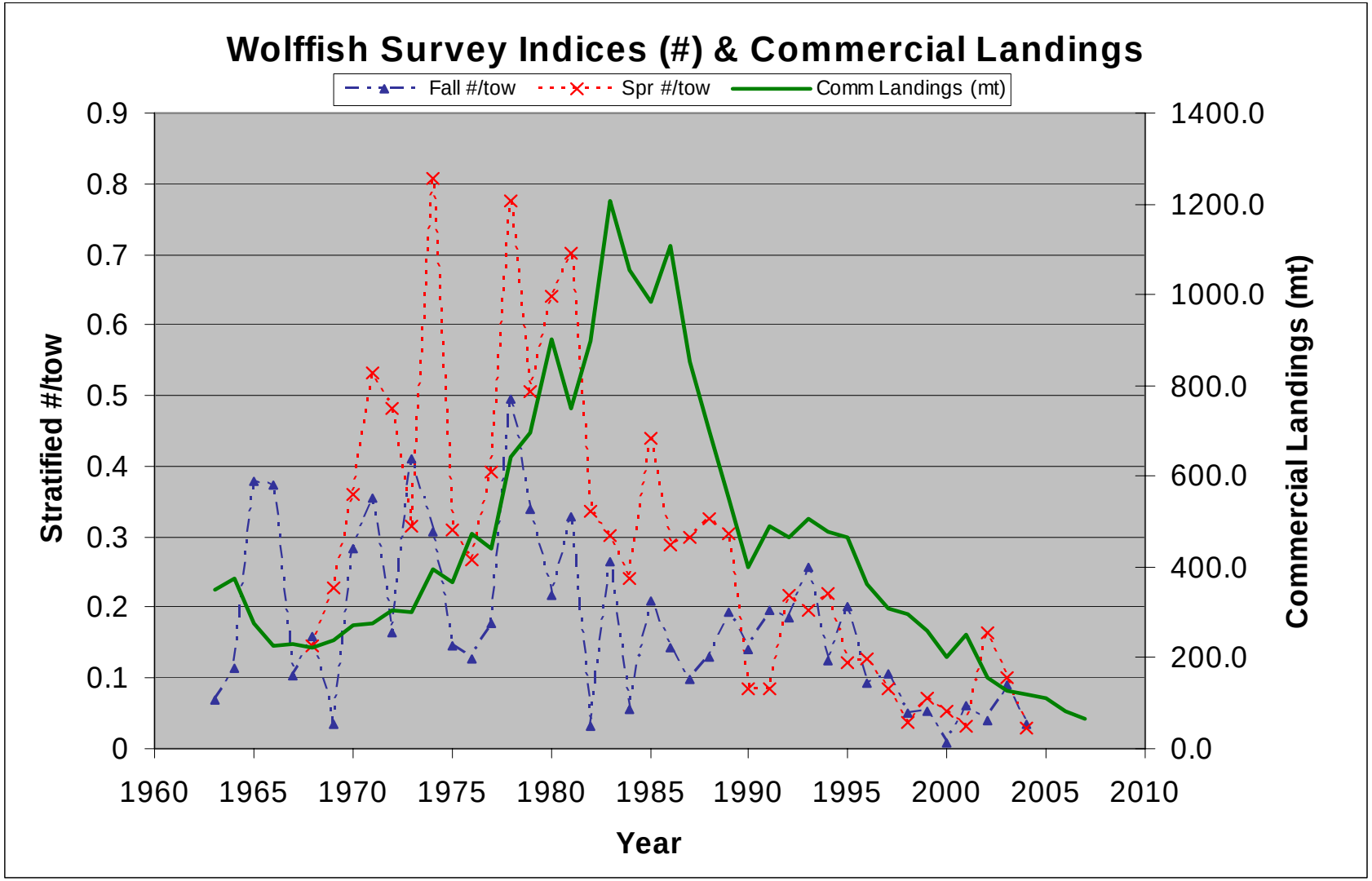


Figure 9: Wolffish abundance in weight/tow
Source: NEFSC/NOAA website: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/. Most recent commercial landings data (through 2007) found at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.



F. Relative Abundance and Geographic Range Contraction in Atlantic Wolffish

NMFS (through NEFSC) used research survey trawl data to examine the geographic range and relative abundance patterns of Atlantic wolffish during five year time blocks beginning in 1968.[52] This series of maps shows significant contraction in the geographic distribution and decline in the abundance of wolffish over nearly four decades. Over this same time period, the abundance of Atlantic wolffish declined markedly (see also Figures 8 and 9 above), and the geographic range contracted to a fragment of its historic range (see Figure 10). This conclusion is fully supported by state trawl survey data from Massachusetts to Maine, which indicate virtually no presence of Atlantic wolffish in state waters that once supported abundant populations. Although the species was formerly widely distributed throughout the Gulf of Maine and Georges Bank, the present distribution of Atlantic wolffish, as evidenced by NMFS maps for the most recent period (2001-2005), indicates that there are relatively few fish, and—based on best available science--those few appear to be concentrated in a limited number of isolated areas in federal waters. These areas include the northeast peak of Georges Bank, and the Jeffreys Ledge and Stellwagen Bank regions off Massachusetts.

Range contraction and fragmentation are both recognized as important criteria for status assessment by the IUCN. According to these international standards, the U.S. population warrants endangered classification.[53] Further quantification of range changes should be undertaken during a status review using the most current federal and state survey information.

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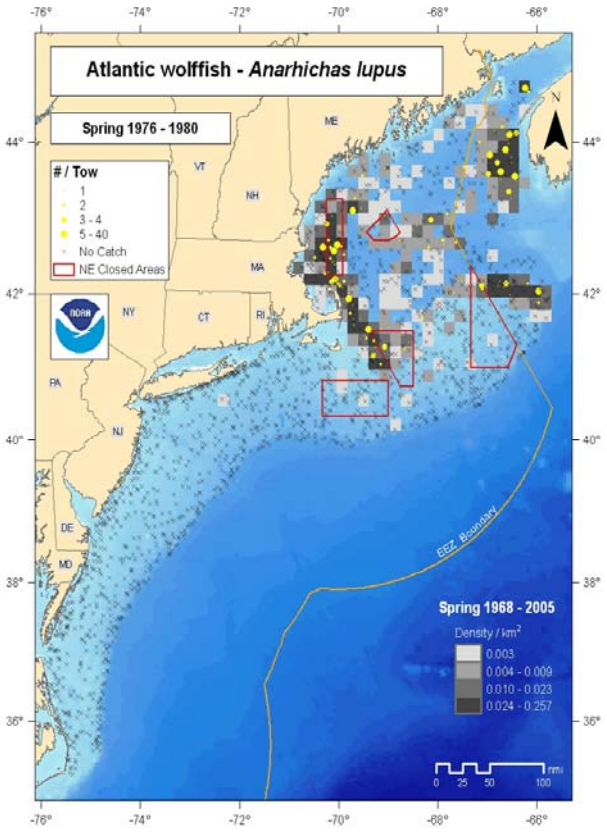
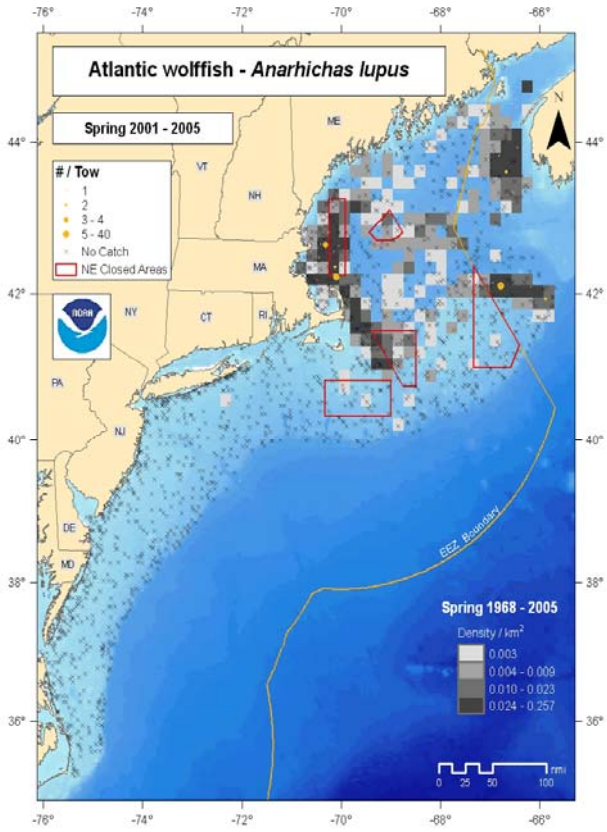
[52] *Status of Fishery Resources off the Northeastern US – Atlantic wolffish.* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/index.html (last viewed 8-27-08).
[53] IUCN Red List of Threatened Species, 2001 Categories & Criteria (version 3.1), http://www.iucnredlist.org/info/categories_criteria2001. Haedrich Declaration at ¶ 8.

Figure 10: Relative Distribution and Abundance of wolffish in the Northwestern Atlantic, 1976-1980, 2001-2005. Shaded squares code the distribution and abundance of wolffish based on the whole data series. Yellow dots show the past (left) and present range and abundance (right).
Source: Northeast Fisheries Science Center / National Oceanic and Atmospheric Administration
Dataset title: NEFSC Spring Bottom Trawl Surveys
Online Resource: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/animation/spring/



1976-1980



2001-2005

VI. Distinct Population Segment Analysis

A. Introduction

Petitioners request that NMFS determine that the United States population of Atlantic wolffish is a distinct population segment ("DPS") that warrants listing as *endangered* under the ESA. The determination of a DPS is inherently part of a "petitioned action," subject to the same standard NMFS uses to make any other element of a "90-Day Finding." *See* 16 U.S.C. § 1533(b)(3)(A). The ESA standard requires "substantial scientific or commercial information indicating that the petitioned action *may* be warranted." 16 U.S.C. § 1533(a)(3)(A) (emphasis

added). Petitioners specifically request that NMFS determine the existence and status of a U.S. distinct population segment ("U.S. DPS") in the waters of the U.S. including the U.S. Exclusive Economic Zone ("EEZ"). In the alternative, Petitioners request NMFS to determine that one or more of the identifiable sub-populations within U.S. waters independently qualify as a DPS in need of listing.

The designation of a DPS has three components under the DPS Policy. *Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act*, 61 Fed. Reg. 4722, 4725 (Feb. 7, 1996) ("DPS Policy"). As applied to the Atlantic wolffish, NMFS must determine that the U.S. population is *discrete* "in relation to the remainder of the species to which it belongs." 61 Fed. Reg. at 4725. Second, NMFS must find that the population is *significant* "to the species to which it belongs." *Id*. Finally, after NMFS determines the population is both discrete and significant, NMFS must evaluate whether the petition presents substantial scientific or commercial information in the petition with respect to the DPS population that may warrant potentially listing of the DPS as *endangered* or *threatened* based on the conservation status of the species "in relation to the Act's standards for listing." *Id*.; 50 C.F.R. § 424.14(b)(1)&(2).

In addition to the requirements of the DPS Policy, the applicable regulations provide that determination of a "species" under the ESA should rely on the biological expertise of the Service and the scientific community. 50 C.F.R. 424.11(a). This Petition provides a framework to define the U.S. population (or, in the alternative, one or more identifiable sub-populations) of Atlantic wolffish as a DPS, in order for NMFS to comply with procedural and substantive duties of the ESA.

B. Criteria for Designation of Distinct Population Segments under the Joint DPS Policy

Congress amended the ESA in 1978 to make clear that they intended ESA protection to extend to vertebrate subpopulations including fish or wildlife that interbreed when mature. This change in the definition of "species" allowed the listing of distinct population segments. *See* 16 U.S.C. § 1532(16). The rationale for the change was to enable NMFS and the U.S. Fish and Wildlife Service (collectively, the "Services") to "protect and conserve species and the ecosystems upon which they depend before large-scale decline occurs that would necessitate listing a species or subspecies throughout its entire range." 61 Fed. Reg. at 4722. Neither the ESA nor the scientific literature defines a distinct population segment. 61 Fed. Reg. at 4722. Therefore, in order for this undefined proxy for a protectable species subset to "be interpreted in a clear and consistent fashion," the Services drafted a joint policy statement in 1996. *Id*. The DPS Policy is the current framework to define subspecies populations eligible for protection prior to a determination of endangered or threatened status under the ESA.

The U.S. population of Atlantic wolffish satisfies the requirements for DPS status. However, if NMFS does not find the U.S. population taken as a whole meets the requirements of a DPS, Petitioners ask that NMFS examine the several subpopulations of Atlantic wolffish identified in this petition in U.S. waters, which collectively comprise the U.S. population, to determine whether each sub-population separately and independently satisfies the requirements for DPS status and, accordingly, should be evaluated for listing.

C. Discrete Population Segments of Atlantic Wolffish Exist in U.S. Waters.

Under the DPS Policy, a distinct population segment of a vertebrate species is *discrete* if it satisfies *either* of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation; or
2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

61 Fed. Reg. 4725

The discreteness analysis is a means of examining the extent to which the population in question is distinct from other populations in the same taxon. 61 Fed. Reg. at 4724. This element reflects the Services' joint understanding of the ESA's interrelated goals of "conserving genetic resources" and "maintaining biodiversity over a representative portion of their historic occurrence." 61 Fed. Reg. at 4722. This element does not require complete reproductive isolation or genetic proof of the population's distinctness. *Id.* Under the DPS Policy, there are two ways to recognize a population as discrete; however, only one is required. 61 Fed. Reg. at 4725.

The first test of discreteness requires marked separation of the population from other representative populations of the same taxon due to physical, physiological, ecological or behavioral factors. 61 Fed. Reg. at 4724. Specifically, this provision seeks to identify and protect a population based on its isolation from the rest of the taxon and to preserve and protect the genetic variability that such isolation might represent. 61 Fed. Reg. at 4723. Both NMFS and the US Fish and Wildlife Service have deemed geographical physical separation as inherently sufficient to prove discreteness on numerous occasions. *See* Hausrath, *The Designation of "Distinct Population Segments" Under the Endangered Species Act in Light of National Association of Homebuilders v. Norton*, 80 Chi.-Kent. L. Rev. 449, 460 (2005) (hereinafter "Hausrath")(noting that the government has identified DPSs based on geographical separation at least fourteen times, including the Atlantic salmon in the Gulf of Maine, Klamath and Columbia River bull trout, Jarbidge bull trout, gray wolf, pygmy rabbit, Canada lynx, and the California Desert bighorn sheep).

The second test of discreteness is a legal rather than a biological or physical inquiry and uses an international governmental boundary to define a DPS. 61 Fed. Reg. at 4723. The recognition of an international governmental boundary as an operative factor for a DPS determination is also consistent with the Convention on International Trade in Endangered Species of Wild Fauna and Flora,[54] which was implemented in the U.S. by the ESA. *See* 16 U.S.C. § 1531(a)(4)(F). The DPS Policy requires that a DPS delimited by an international boundary be exposed to significant differences in exploitation, management of habitat, or

[54] See Annex 5 to Criteria for amendment of Appendices I and II adopted by the Conference of the Parties, Conf. 9.24 (Rev. CoP14) . Can be found at: http://www.cites.org/eng/res/09/09-24R14.shtml.

regulatory mechanisms across the border that are relevant to protected U.S. ESA interests.

The driving force for using an international boundary as a way of delimiting a DPS arises from the Congressional concern to protect U.S. populations. In marine fish, there is precedent for this use of an international governmental boundary as the sole measure of discreteness as NMFS relied almost exclusively upon the international U.S. boundary as the discreteness factor when listing the smalltooth sawfish (*Pristis pectinata)* as endangered under the ESA. Final Rule, 70 Fed. Reg. 69464 (Nov. 16, 2005); *see also* Hausrath at 461 (noting numerous additional instances in which the government relied upon an international boundary to find a discrete population for the purposes of a DPS).

As will be set forth more fully below, the U.S./Canadian border constitutes such a delimiting international boundary with respect to the Atlantic wolffish. Canadian management practices with respect to the Atlantic wolffish allow continued commercial and recreational harvest of the species under the Canadian Species at Risk Act, even though the Atlantic wolffish management plan recommends live release protocols and reporting. *See* Kulka, D. *et al*., *Recovery Strategy for Northern Wolffish (Anarhichas denticulatus), and Spotted Wolffish (Anarhichas minor), and Management Plan for Atlantic Wolffish (Anarhichas lupus) in Canada.* Fisheries and Oceans Canada: Newfoundland and Labrador Region, St. John's, NL (February 2007)("Canadian Wolffish Recovery Strategy") at 68. This management action, as well as inherent differences between SARA and the ESA, makes SARA less protective than the ESA, thereby producing differences in the level of conservation status, exploitation, management of habitat and harvest regulation in Canadian waters that argues for independent protection of the U.S. populations and subpopulations under the ESA.

D. <u>The Discrete Populations are Significant.</u>

Once a population is established as discrete under one or both of the above criteria, NMFS must then assess the biological and ecological *significance* of that population. 61 Fed. Reg. at 4722. This consideration may include, but is not limited to, one or more of the following factors:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon;
2. Evidence that loss of the discrete population would result in a significant gap in the range of the taxon;
3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; or
4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

61 Fed. Reg. 4725

The U.S. population taken as a whole and the various sub-populations of Atlantic wolffish in U.S. waters satisfy the second and fourth significance factors. The second factor focuses on a "significant gap in the range of the taxon" and is the factor most often relied upon by the government to find significance. *See* Hausrath at 460 ("significant gap" finding used in twelve of the seventeen final ESA rules analyzed). This second factor fully supports listing the U.S. population of Atlantic wolffish as a DPS. The historic range of the wolffish has contracted sharply in U.S. waters over the past 40 years – thus the loss of the U.S. population (as the population which represents the southernmost extent of the historic range of the species) and any of its sub-populations would result in a significant gap in the range of the Atlantic wolffish. Haedrich Declaration at ¶ 10.

The U.S. population and sub-populations of Atlantic wolffish also arguably satisfy the fourth factor for significance as well. As discussed more fully below, these populations exhibit certain behavioral and physiological differences that suggest there are underlying genetic differences.

E. The U.S. Population of the Atlantic Wolffish is Discrete.

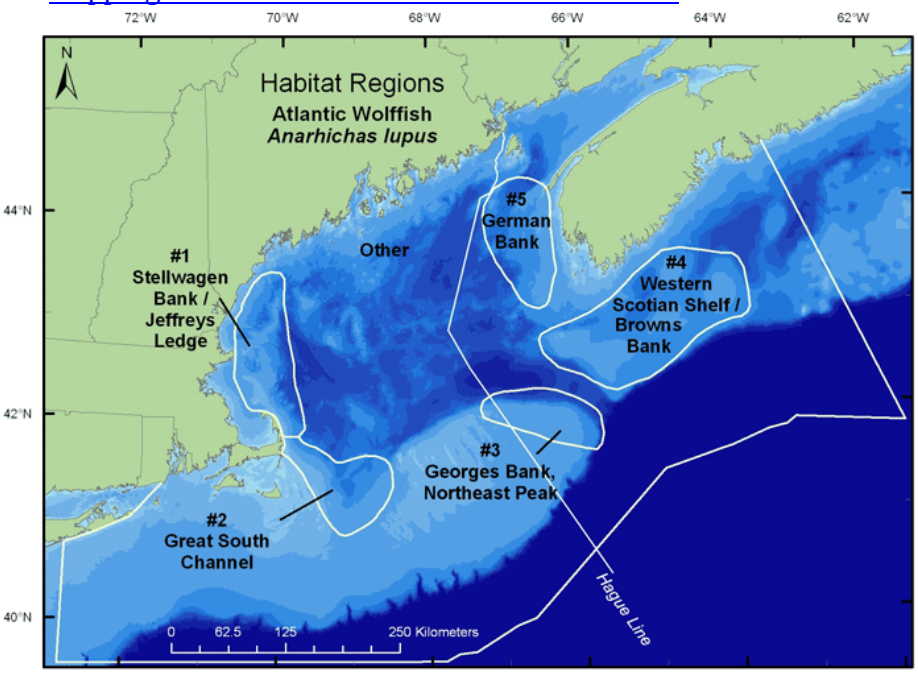
The U.S. population of the Atlantic wolffish satisfies both of the alternative criteria for being found discrete from the global species of *Anarhichas lupus*: it is physically isolated from other populations, and it is subject to significant management and conservation status differences across international governmental boundaries in its range.

1. The U.S. Population of Atlantic Wolffish is Geographically Isolated from the Canadian Population.

Scientists at the Census of Marine Life-Gulf of Maine Area Program ("CML") plotted the research survey trawl data from the available time series and identified Atlantic wolffish habitat regions based on that data. See Appendix V. The survey trawl data was obtained from both NMFS and Department of Fisheries and Oceans Canada ("DFO") because there was mutual trawling in certain overlapping areas of the Greater Gulf of Maine for some of the years. This trawl data was obtained by offshore scientific sampling based on a random stratified design, sampling 300-600 stations per survey, using area and depth zones to ensure consistency, and a 30-minute tow at a towing speed of 3.8 knots. CML then used editing polygons in ArcMap to circumscribe the general areas where Atlantic wolffish have historically been recorded by these surveys, and to indicate the populations with the highest abundance.[55] This analysis is graphically presented in Figure 11. Lastly, CML calculated declines in abundance within each of these geographically identified habitat regions as a percentage of positive tows, with a "positive tow" defined as a tow with any number of Atlantic wolffish in a spring or fall survey bottom trawl.[56]

[55] *Atlantic Wolffish (Anarhichas lupus) Abundance and Distribution in the Gulf of Maine Fall Surveys, 1963-2004*. Gulf of Maine Area Census of Marine Life. Found at: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/ (last viewed 8-27-08).
[56] *Id.*

Figure 11: Areas inhabited by Atlantic wolffish as identified by research surveys conducted since 1963.
Source: Census of Marine Life - Gulf of Maine Area Program
Dataset title: NEFSC Trawl Survey data
Online Resource: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/



CML-GMAP identified habitat regions in the Greater Gulf of Maine based on survey trawl data. Fall data was plotted from 1963-2004, and spring data from 1968-2004. Three of these habitat regions support populations in U.S. waters. Historically U.S. populations included one on Stellwagen Bank and Jeffreys Ledge, one in the Great South Channel, and the margin of a third population on the northeast peak of Georges Bank.

These Atlantic wolffish habitat regions identified by CML as well as references to discrete populations in the scientific literature, *e.g.*, O'Dea and Haedrich 2000; DFO, 2002 Sci. Stock Status Rep. A3-31, form the basis for Petitioners' identified subpopulations. While it is likely that some individuals inhabit areas not susceptible to the survey trawls or were located in surveyed areas but not captured by the survey trawls, it is important to note that less than two percent of all survey trawls in the Greater Gulf of Maine outside of one of the identified habitat regions in Figure 11 sampled an Atlantic wolffish in 2004.[57] This fact emphasizes the critical importance of the distinct sub-populations within the identified habitat areas in Figure 11. These populations are distinguishable from other representatives of the species elsewhere in the North Atlantic range due to life history characteristics such as age at maturity, possible adaptation to higher ambient water temperatures, fidelity to specific spawning grounds and lack of migration. See Sections III, IV and VI. As mentioned above, the ESA does not require absolute reproductive separation of these subpopulations from other members of the species.[58] The

[57] *Atlantic Wolffish (Anarhichas lupus) Abundance and Distribution in the Gulf of Maine Fall Surveys, 1963-2004*. Gulf of Maine Area Census of Marine Life. Found at: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/ (last viewed 8-27-08).

[58] The Services have previously expressed concern that loss of interstitial populations could result in biological isolation and have consequences for gene flow and the demographic stability of the species as a whole. *See, e.g.*, 61 Fed Reg. at 4724 ("the standard adopted allows for some limited interchange among population segments considered to be discrete, so that loss of an interstitial population could well have consequences for gene flow and demographic stability of a species as a whole").

distances between these populations alone are sufficient to ensure significant separation of these populations for this species, causing concern and meeting the first independent prong of the discreteness test.

Maps of recent research survey data (NMFS and DFO) reveal the dispersed localities where Atlantic wolffish most likely still occur in the U.S. Gulf of Maine region and in Canada. Based on the CML map for the 2000-2005 period,[59] set forth as Figure 12, Petitioners examined the nearest "neighbor" distances for U.S. Atlantic wolffish localities (a light blue circle on Figure 12 indicates a locality where a wolffish was sampled in a research survey trawl during this period). It should be noted that a number of these localities were detected based upon sampling just one or few fish. Distances among localities (samples $\geq$14 km apart) ranged from 14 km to about 85 km, with a median distance between neighboring localities of 19 km (mean = 28 km). The most substantial remaining concentration of the U.S. population apparent in this time period (Jeffreys Ledge/Stellwagen area; *see* Figures 11 and 12) documented through this approach is approximately 350 km distant from similar areas of concentration on Browns Bank in Canadian waters. The Fundian Channel forms a substantial barrier between the Gulf of Maine and Georges Bank localities (U.S. and Canada) and those on the Scotian Shelf and is the boundary between the Gulf of Maine and Scotian Shelf biogeographic regions (Crawford and Smith 2006). Oceanographic features such as the Fundian Channel isolate the populations found at disparate localities and reinforce geographic and genetic isolation. At such distances, without suitable habitat corridors between these populations, interstitial migration and recruitment is unlikely, and extirpation from U.S. waters is likely if these subpopulations disappear.

[Intentionally Blank]

[59] *Atlantic Wolffish (Anarhichas lupus) Abundance and Distribution in the Gulf of Maine Fall Surveys, 1963-2004*. Gulf of Maine Area Census of Marine Life. Available at: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/ (last viewed 8-27-08).

Figure 12: NMFS Survey trawl abundance for 2000-2005.
Source: Census of Marine Life - Gulf of Maine Area Program
Dataset Source: *See* http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/

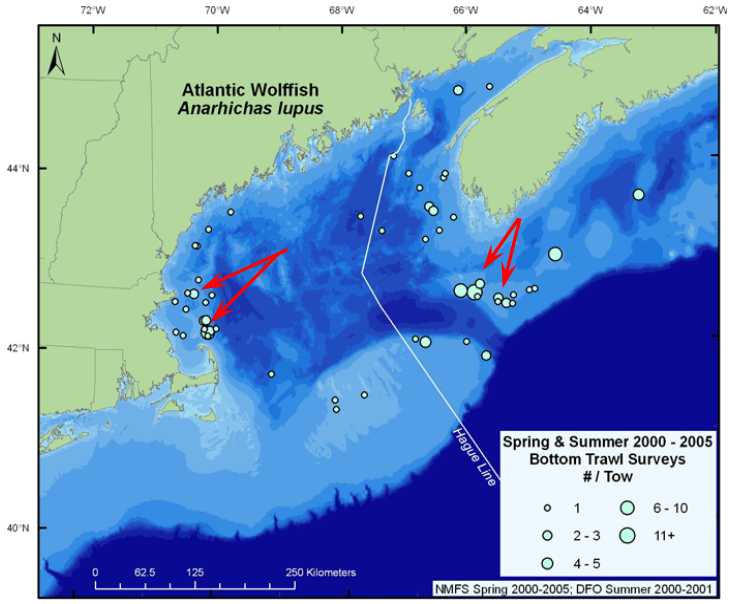


Fig. 12 shows the relative distribution and abundance of wolffish in the NW Atlantic from Spring Bottom Trawl Surveys (NMFS and DFO). Light blue circles indicate wolffish presence in 2000-2005. The number of wolffish/ tow is correlated with the size of the circle (key lower right). Red arrows point out the areas where abundance has been most substantial in this recent period. (arrows added by petitioner)

As the NEFSC and CML mapping and historical data indicate, the U.S. population of Atlantic wolffish historically spanned the waters north of New Jersey to the Canadian border, ending at the U.S. EEZ. Mapping of abundance, as well as scientific reports dating back nearly a hundred years, indicate that Atlantic wolffish once were widely dispersed throughout the Greater Gulf of Maine (Gill 1911). Recent 2006 NEFSC documents state: "In the Georges Bank-Gulf of Maine region, abundance is highest in the southwestern portion [of that region] at depths of 80 to 120 m, but wolffish are also found in waters from 40 to 240 m (Nelson and Ross 1992)."[60] NEFSC mapping of the data from the last five years in the times series indicates the species has not been caught south of Cape Cod (i.e., no positive spring survey trawls from 2001-2005).

There are three areas in U.S. waters that may harbor the major remaining subpopulations of Atlantic wolffish: (1) Jeffreys Ledge/Stellwagen Bank; (2) the Great South Channel; and (3) the U.S. EEZ portion of the northeastern peak area of Georges Bank.[61] Taken together and viewed as one population for all U.S. waters, this population is isolated and significant when viewed in relation to Canadian populations and qualifies as a DPS.

[60] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev. 2006).* Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 8-27-08).
[61] As noted above, individuals are likely resident on hard bottom sites outside of these areas such as Cashes Ledge, Fippennies Ledge, and Three Dory Ridge where they were observed in these areas in the 1980's and 1990's during ROV dives (personal communication with Dr. Les Watling 2008), but they have not been caught by recent trawl surveys. *See also* Figure 10.

It is important to note that in this habitat area over Jeffreys Ledge and Stellwagen Bank, 35% of survey trawls during the years 1974-1989 sampled one or more individual wolffish (i.e., were *positive* for Atlantic wolffish). Indeed, NMFS documents also identify this as the area of highest historic U.S. abundance.[62] However, from 1989-1999, there has been a steady decline of positive trawls from 35% to approximately 15%. There was a rise to 20% in the last time series, 2000-2004, representing a large number of positive trawls in 2003; however, in 2004 and 2005--the last two years of available data--no individuals were sampled by the NEFSC spring trawl within this habitat area.[63] This apparent decline in Atlantic wolffish abundance over the most recent two-year period of data is especially alarming in light of even greater negative trends in the other two other remaining areas in U.S. waters where Atlantic wolffish populations had previously been found.

The second area in U.S. waters that has historically hosted a recognizable subpopulation of Atlantic wolffish and may still have importance to recovery of the species in U.S. waters is the Great South Channel. Although a small number of Atlantic wolffish have been caught in that location in NEFSC fall surveys, there have been no positive tows for Atlantic wolffish in that area in the spring surveys since 1998. This is the same area where NEFSC data (mapped by CML) indicates that from 1974-1990, 25-30% of all survey trawls were positive. The lack of positive tows over a seven-year span is compelling and cannot be explained by seasonal or other migratory behavior. At such low abundance, the Atlantic wolffish has effectively been eliminated as an apex predator in that local ecosystem. Additionally, the distribution of adults may now be sufficiently sparse as to reduce encounters among the remaining adults, thereby decreasing the reproductive potential of this sub-population. This subpopulation—if it continues to exist--appears to be neither rebounding nor recruiting from elsewhere, further supporting the characterization of the non-migratory nature of Atlantic wolfish.

The third area in U.S. waters to historically support a recognizable subpopulation of Atlantic wolffish is in the northeast peak region of Georges Bank. U.S. jurisdiction is very limited over this population as only the southwestern periphery of the sampled population is within the U.S. EEZ. (See Figure 11) This population has experienced a steady decline in the number of positive tows from a high in 1974 of 33% to a low in 2004 of 8%, which represents the last five-year block of time available. Available data indicates that most observed Atlantic wolffish in the latest time series were found in Canadian waters.[64]

The distance between the remaining U.S. populations and the nearest Canadian population, with the possible exception of the northeast peak of Georges Bank, is vast, if not insurmountable in terms of the known sedentary characteristics of this species and represents significant geographic isolation, as shown in both Figures 11 and 12. While historically there was a population of Atlantic wolffish that spanned the U.S./Canadian international boundary on the northeastern tip of Georges Bank, it is uncertain whether this population still exists in any

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[62] *Id.*

[63] NMFS data mapped by CML. http://research.usm.maine.edu/gulfofmaine-census/biodiversity/species-distribution/atlantic-wolffish-decline/.

[64] Relative Distribution and Abundance of wolffish in the Northwestern Atlantic Derived from the NEFSC Spring Bottom Trawl Surveys. Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/animation/spring/ (last viewed 8-27-08).

density, as NMFS mapping indicates that no individuals were observed in spring trawls from 2001-2005 and only a limited number of individuals were observed in fall survey trawls for this time period, all of which were in Canadian waters. Presently, based on survey data, the closest distance between local populations of Atlantic wolffish on the U.S. side and those in Canada is on the order of 30 km.

Moreover, as discussed above, the more substantial U.S. subpopulation in the Jeffreys Ledge/Stellwagen Bank area is hundreds of kilometers apart from similar subpopulations in Canadian waters. *See* Figures 11 & 12. These populations, moreover, are isolated from the populations that may remain in Canadian waters on the northeast peak of Georges Bank by the clay and silt substrata that comprise much of Wilkinson and Murray Basins as well as Franklin and Rodgers Basin to the east.[65] The literature indicates that Atlantic wolffish are never caught on mud in surveys (Bigelow and Schroeder 1953) and "rarely observed" on sand bottoms (Collette and Klein-MacPhee 2002). For some migratory species of marine fish these distances and habitat gaps would be insignificant, but Atlantic wolffish are not highly mobile and have specific habitat requirements that make recruitment from a population more than one hundred miles away highly unlikely. Limited migration tends to produce discrete populations that are geographically isolated.[66] Available scientific literature concludes that the Atlantic wolffish in the western Gulf of Maine are "probably discrete" from Canadian populations on Browns Bank and the Scotian Shelf (Collette and MacPhee 2002; Idione 1998). Geographical isolation alone defines the U.S. population as a discrete population under the DPS Policy.

Additionally, the subpopulations of Atlantic wolffish identified over the three focal habitat regions Petitioners have identified above are discrete in and of themselves. The subpopulation that remains over Jeffreys Ledge and Stellwagen Bank is discrete because it is markedly separated by distances of greater than 60 miles from the nearest other potentially viable U.S. population in the Great South Channel, and by over 100 miles from the closest identified Canadian population on the Scotian Shelf. Comparable distances exist between any remaining individuals on the northeast peak of Georges Bank and subpopulations either on the Scotian Shelf, Browns Bank or the Jeffreys Ledge/Stellwagen Bank area. As already mentioned, the species is essentially non-migratory and unlikely to recruit from distant populations.

2. The U.S. Populations is Discrete Based on Physiological and Behavioral Factors

The first prong of the discreteness test is also independently satisfied by the physiological and behavioral differences that distinguish the U.S. Atlantic wolffish populations from populations elsewhere in the range. Physically, Bigelow and Schroeder indicate that Atlantic wolffish in the western Gulf of Maine have coloration differences from those from Georges Bank (Bigelow and Schroeder 1953). The same reference indicates that Atlantic wolffish in U.S. waters have adapted to the highest water temperatures recorded for the species throughout its North Atlantic range. *Id.* Such apparent adaptation to survival in warmer ocean temperatures may well prove critical to the species' survival as climate changes results in increases in ambient ocean temperatures over the species' range over time.

[65] *See* Crawford and Smith 2006 at Figure 8-7.
[66] Personal communication with Dr. Richard L. Haedrich 2008.

These U.S. populations are also distinguishable from other representatives of the species due to fidelity to specific spawning grounds, strong territoriality and lack of clear migration patterns or behavior. Juveniles settle and remain in proximity to where they hatch (Collette and Klein-MacPhee 2002; Haedrich Declaration at ¶ 10). *See* Sections III and IV above. The loss of these subpopulations would eliminate Atlantic wolffish that, by definition, have different and unique behavioral factors.

3. The U.S. Population Is Delimited by an International Governmental Boundary with Differing Regulatory Mechanisms and Therefore is Discrete.

The second prong of the discreteness analysis in the DPS Policy provides in pertinent part as follows:

> [A] distinct population segment of a vertebrate species is discrete if . . . [i]t is delimited by international governmental boundaries within which differences in control or exploitation, management of habitat, conservation status, or regulatory mechanisms exists that are significant in light of section 4(a)(1)(D) of the Act.

61 Fed. Reg. 4725

Applying this criterion, the U.S. population of Atlantic wolffish is discrete, independent of its locational separation and its biological and behavioral distinctions from populations elsewhere in the range, by virtue of the fact that they are separated from other Atlantic wolffish in the species' range by the international boundary between the U.S. and Canada. Because of differences in regulation of fish and endangered species in Canada and the U.S., Atlantic wolffish are subject to significantly different protection and management mechanisms in the U.S. than they are in Canada and elsewhere. As a result, the U.S. populations of Atlantic wolffish independently satisfy this component of the discreteness analysis. This petition sets forth some of the significant differences in exploitation, habitat management, or regulatory mechanisms between the United States and Canada that bear on the adequacy of the regulatory approach in the foreign nation to protect the species. The Canadian regulatory program with respect to endangered species protection is different in approach to endangered species protection than the U.S. and different specifically in how it has been applied relative to protecting Atlantic wolffish. The Atlantic wolffish is presently listed as a Species of Special Concern in Canada on the basis of a recent COSEWIC Assessment and Status Report; however, this listing affords it no protection.

Canada's Species at Risk Act (SARA) was reauthorized and came into force on June 1, 2004 to provide protection to a species or subpopulation that is added to the List of Wildlife Species at Risk or "Schedule 1" species (SARA Registry 2005), and which is either native to Canada or has been present for at least 50 years without human intervention. SARA Art. 2. SARA promotes species conservation through many mechanisms similar or nearly identical to the ESA; however, there are some significant differences (Walton 2004), which afford the Atlantic wolffish significantly less protection across the border in Canada.

First, although the public is allowed involvement in the listing process and can request investigations into alleged SARA violations, there is no explicit authority for citizen enforcement or citizen suit provisions like the ESA, and the first such petition to protect a species on an emergency basis was denied.[67] Second, although the procedural mechanisms by which a species is listed by COSEWIC are very similar to the ESA, the legal standard for listing involves "community knowledge" and "aboriginal traditional knowledge" as part of the analysis with "scientific knowledge," and thus the final authority rests with politicians and the Federal Cabinet, rather than a scientific agency like NMFS or FWS (Walton 2004). Additionally, the criteria for listing under SARA and used by COSEWIC are based on the IUCN (2001) Red List assessment criteria and are applied differently than they are in an ESA assessment, which is not restricted to using a comparable quantitative approach.

More importantly, under the Canadian endangered species analysis as it was specifically applied to the Atlantic wolffish, SARA does not afford significant protections to the species. In Canada, the Atlantic wolffish is presently designated as a Schedule 1 Species of Special Concern, defined to be "a species which may become a threatened or endangered species because of a combination of biological characteristics and identified threats." Canadian Wolffish Recovery Strategy at 3. Under this classification, the species does not receive the same protections that *threatened* or *endangered* species receive. While SARA recognizes subspecies as protectable units under the law, Canada has not promulgated a comparable DPS Policy as the U.S. has and in its analysis of the status of the Atlantic wolffish, Canada did not analyze subpopulations of Atlantic wolffish for protection. Canadian Wolffish Recovery Strategy at 15.

Furthermore, Canada allows direct harvest of Atlantic wolffish even though it is a listed species under SARA. As a "species of special concern," the SARA protections afforded to threatened and endangered species do not apply, and recovery mandates developed for other species of wolffish in Canada (the northern and spotted wolffish) are only recommendations for Atlantic wolffish. This classification of Atlantic wolffish is apparently contrary to the level of protection to which the species was entitled under SARA standards, indicating that politics may have entered into the decision. *See* Haedrich Declaration at ¶ 8. While the imposition of restrictive management actions were optional under the management plan for Atlantic wolfish, the regional DFO office, acting under its discretionary authority available under the listing, has not imposed mandatory release and reporting obligations on Canadian fishermen with respect to Atlantic wolffish. As a result, the Atlantic wolffish is not protected from commercial or recreational exploitation as are the other two Canadian species of wolffish, the northern and spotted wolffish. Canadian Wolffish Recovery Strategy at 70.

Even the recovery measures already in place for the listed northern and spotted wolffish species in Canada afford them only limited protection. Personal communications with Dr. Richard Haedrich, the author of the COSEWIC Assessment and Status Report on the Atlantic wolffish, indicate that even for the spotted (*A. minor)* and northern (*A. denticulatus*) wolffish, there are incidental take permits issued for these species on every commercial fishing vessel, effectively ensuring them no protection even under a higher listing standard under SARA. According to Dr. Haedrich, there were bycatch caps on wolffish in the 1980's in Canada, but

[67] A citizen's petition for emergency enforcement action under Article 80 was filed for the spotted owl in 2004 but denied by the Minister of the Environment (Walton 2004).

since that time the landings have not been significant enough to trigger the cap.

For the above reasons, the Canadian SARA program cannot be considered to provide adequate or comparable regulatory protection for Atlantic wolffish as compared with the U.S. ESA approach.

The use of a geopolitical boundary to define a marine population as a DPS has precedent. NMFS designated a "U.S. DPS," using the U.S. EEZ to define the population, when it listed the smalltooth sawfish, *Pristis pectinata*, as endangered under the ESA. *Final Rule,* 70 Fed. Reg. 69464 (Nov. 16, 2005). At the time of its listing, the smalltooth sawfish was present in warm waters of both the north and south Atlantic and Pacific Oceans. NMFS knew little about its life history and had limited abundance data, although available evidence showed dramatic declines in abundance. Nonetheless, NMFS properly listed the smalltooth sawfish on the basis that the review team could not identify mechanisms that were regulating the exploitation of the species outside the U.S. *Id.* Although Canada has the authority to exercise protective measures under SARA, it has elected not to do so with respect to the Atlantic wolffish.

For the foregoing reasons, the U.S. populations of Atlantic wolffish are discrete under each of the criteria set forth in the DPS Policy. Consideration now turns to the significance of the U.S. population of Atlantic wolffish.

F. The U.S. Population of the Atlantic Wolffish is Significant.

The U.S. Atlantic wolffish population is significant to the species to which it belongs. The U.S. population of the Atlantic wolffish clearly satisfies one of the four alternative criteria for being found significant: loss of the population would result in a significant gap in its historic range. Additionally, there is strong evidence suggesting that the population satisfies a second alternative criterion: morphological and behavioral characteristics provide evidence that it might differ markedly from other populations in its genetic characteristics.

1. The U.S. Population is Significant because Loss of this Population would create a Significant Gap in the Range of the Taxon.

The U.S. population represents the southernmost component of the species. The loss of this southernmost population, which covers a large portion of the historic range, would result in a significant gap in the range of the taxon. In fact, more than just a gap, the loss of the U.S. subpopulation would significantly reduce the global range of the species.[68] This area represents approximately 20% of the global range in the western North Atlantic. The Services have relied primarily on this factor in determining the significance of a potential DPS.[69]

In addition, there is evidence that loss of the individually identified subpopulations in U.S. waters would result in a series of significant gaps in the taxon because of the potential for the ultimate loss of the entire U.S. population as each of them individually disappears. Loss of the subpopulation observed on Jeffreys Ledge/ Stellwagen Bank, which was the only habitat area

[68] Personal communication with Dr. Richard L. Haedrich (2008).
[69] Hausrath at 460.

of the six identified by CML that had a modest rise in the number of individuals captured in the last time series (2000-2004) of surveys (see Figure 11), might represent the loss of the only recoverable population of Atlantic wolffish in the United States. Loss of the Great South Channel subpopulation would leave a significant gap in the taxon because this is the southernmost subpopulation in U.S. waters and the southernmost extent of the range for the global Genus as well as the species. Finally, loss of the margins of a subpopulation on the northeast peak of Georges Bank would leave a significant gap in the taxon. The proximity and survival of this population to an identified nearby Canadian population on the Scotian Shelf might become vitally important as a means of repopulating wolffish if the species were extirpated in U.S. waters.

2. The U.S. Population is Significant because it Displays Differing Physical and Behavioral Characteristics Indicative of Genetic Differences.

This significance factor from the DPS Policy is satisfied by the same analysis used in the discreteness analysis discussed above in Section IV.E.2, which is incorporated here by reference. As noted there, there is strong evidence that subpopulations of Atlantic wolffish in the U.S. differ in life history, behavioral characteristics, and physiological characteristics, indicative of genetic differences (Collette and MacPhee 2002).

G. Conclusion

In summary, the U.S. population of the Atlantic wolffish should be designated a U.S. DPS because this is a necessary and appropriate way to define and describe the U.S. metapopulation of this species and is necessary in order to prevent complete extirpation of this important subpopulation of Atlantic wolffish from U.S. waters. Also, the three major subpopulations described in the text and shown visually in Figure 11 above are each discrete and significant in their own respect and can be properly listed as separate DPSs within U.S. waters. Therefore, in the event NMFS determines that the entire U.S. population of Atlantic wolffish should not be deemed a DPS, Petitioners request that NMFS find each of the subpopulations located at Jeffreys Ledge/Stellwagen Bank, the Great South Channel, and the northeast peak of Georges Bank to be distinct DPSs.

Abundance data plotted over the last forty years is the best available scientific information regarding the status of these populations. Although mitochondrial DNA analysis is unavailable to confirm the isolation and genetic distinction between these subpopulations, it is not required under the ESA or the DPS Policy. *See* DPS Policy, 61 Fed. Reg. at 4722. Based on what scientists know about the life history characteristics of this solitary, sedentary, benthic species, a combination of physical, physiological, ecological and behavioral factors in the Greater Gulf of Maine define these fragmented populations as geographically and biologically isolated. The distances involved and the nature of the intervening substrate types coupled with all known behavioral characteristics of the fish provide little opportunity for or expectation of recruitment from other Atlantic wolffish populations elsewhere in the range. Any limited migrations that Atlantic wolfish may exhibit will not solve this problem. Each of the identified Atlantic wolffish populations is discrete based on adult fidelity to spawning site and ecological factors. The U.S./Canadian international boundary defines their discreteness as well, given the

differences in management actions being taken in Canada in response to the threats these animals face.

The U.S. populations and each of the subpopulations identified is also significant: the loss of any one of them would result in a significant gap in the range of the taxon. Finally, there are phenotypic differences, which are likely the result of genetic differences.[70] These differences include variations in color based on geography, variations in age at maturity and size based on temperature, and variations in local race adaptations to warmer seasonal water temperatures. The recognition and protection of one or all of these distinct population segments is a necessary step towards the conservation of the species.

VII. The U.S. DPS of the Atlantic Wolffish Meets the Definition of an Endangered Species under the Endangered Species Act.

The Atlantic wolffish population located in U.S. waters is both discrete and significant. Therefore the U.S. population of Atlantic wolffish should properly be classified as a DPS under the ESA. Accordingly, NMFS must further examine the factual basis under the ESA listing evaluation factors outlined in Section 4(a) of the ESA to determine whether the U.S. population of Atlantic wolffish, when classified as a DPS, is endangered based on the factors set forth in the ESA and its implementing regulations. Should NMFS determine that the U.S. population of Atlantic wolffish is not in danger of extinction throughout all or a significant portion of its range, Petitioners request that in the alternative NMFS list the U.S. population as threatened because, at minimum, it is likely to become an endangered species within the foreseeable future.

In the alternative, should NMFS determine not to classify the entire U.S. population of Atlantic wolffish as a DPS, NMFS should classify each of the three subpopulations of the Atlantic wolffish located at Jeffreys Ledge/Stellwagen Bank, the Great South Channel, and the northeastern peak of Georges Bank as a DPS. In that event, Petitioners request that NMFS conduct a similar review with respect to each subpopulation to determine whether each DPS should be listed as either endangered or as threatened. Petitioners further note that it may also be appropriate to assign different classifications under the ESA to the populations of Atlantic wolffish identified above, even though they are members of the same vertebrate taxon. See DPS Policy, 61 Fed. Reg. at 4725; *see also* S. Rep. No. 96-151 at 7 (1979).

A. The Endangered Species Act's Listing Evaluation Criteria

Once the agency finds that Petitioners have presented substantial scientific and commercial information that Atlantic wolffish may warrant classification as one or more DPSs based on the best available scientific and commercial data, NMFS must determine whether Petitioners have presented substantial scientific and commercial information that the listing of this subspecies may be warranted. 16 U.S.C. § 1533(b)(3)(A). This latter decision is made on a review of the petition in light of any one of five statutorily identified listing evaluation factors impacting the subspecies:

[70] Personal communication with Dr. Richard Haedrich (2008) and Dr. Les Watling (2008).

(a) the present or threatened destruction, modification, or curtailment of its habitat or range;
(b) overutilization for commercial, recreational, scientific, or educational purposes;
(c) disease or predation;
(d) the inadequacy of existing regulatory measures; or
(e) other natural or manmade factors affecting its continued existence is causing the species to be either threatened or endangered….

16 U.S.C. § 1533(a)(1)(A)-(E).

This Petition demonstrates that listing the Atlantic wolffish as endangered is warranted because the best available scientific and commercial data leads to the conclusion that impacts to the species falling under four of the five listing evaluation factors leave it in danger of extinction throughout its range in U.S. waters. Specifically, the U.S. DPS of Atlantic wolffish has been and continues to be affected by habitat destruction and modification, overutilization for commercial and recreational fishing purposes, inadequate existing regulatory mechanisms, and other natural or manmade factors that are all contributing to the Atlantic wolffish's risk of extinction. Disease and predation do not appear to be leading contributors to the decline of the species, although increased predation may be playing a role.

B. Present or Threatened Destruction, Modification or Curtailment of Habitat or Range

Atlantic wolffish are benthic fish that have a strong preference to live and nest in areas with a complex bottom relief such as rocks, large stones, boulder fields, and glacial till, making bottom trawling, dredging, and other destruction of their habitat a primary threat to their survival. Their strong preference for these habitats as their numbers decline is reinforced by the recent mapping by the Census of Marine Life.[71] Their migrations are local and limited, and they do not form large schools, preferring to live within a short distance of where they were spawned, and making them particularly vulnerable to habitat destruction. Watling Declaration at ¶ 11; Haedrich Declaration at ¶ 10. The biology of this fish dictates that the nest-like mass of eggs laid under rocks and brooded by the male for the next period of four to nine month not be disturbed. Disturbances in habitat during this time result in high rates of mortality of both eggs and adults.[72] Watling Declaration at ¶¶ 11 & 12. Critical habitat loss and alteration are major factors in their precipitous declines.

For many years, the impacts of mobile fishing gear on the hard bottom substrates that the Atlantic wolffish are wholly dependent on as habitat were not studied. However, in the last decade the adverse effect of mobile gear on these hard bottom habitat types has been well-documented (Watling and Norse 1998; Collie *et al.* 1997; Auster *et al.* 1996). Recent scientific studies have used extensive dive data, submersible support vessels and sidescan sonar to document the impacts of modern fishing practices. In terms of their effect on the biodiversity of the ecosystem, these practices have been likened to terrestrial clear cutting in forest ecosystems

[71] *Atlantic Wolffish (Anarhichas lupus) Abundance and Distribution in the Gulf of Maine Fall Surveys, 1963-2004*. Gulf of Maine Area Census of Marine Life. Found at: http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations/atlantic-wolffish-decline/ (last viewed 8-27-08).
[72] Collette and Klein-MacPhee 2002.

(Watling and Norse 1998). An analysis of thirty-nine published fishing impact studies establishes that fauna in the hard bottom substrate habitats that Atlantic wolffish require are far more adversely affected by towed bottom-fishing gear than are the less stable and more dynamic habitats where opportunistic species such as bivalves are common (Collie *et al.* 2000) *See* Watling Declaration at ¶ 8. Trawling and dredging are particularly likely to disturb the hard substrate and benthic communities that the Atlantic wolffish depend upon to nest and spawn. *See* Watling Declaration at ¶¶ 10-12; Haedrich Declaration at ¶ 10.

Modern fishing practices and activities significantly affect the Atlantic wolffish at all stages of its lifecycle. First, trawling disturbs the rocky substrate that wolffish need for their nests; rolling the movable rocks and boulders, and crushing and dispersing the temperature sensitive eggs in the nest. Watling Declaration at ¶¶ 10-12. Second, trawling alters the physical structure and habitat complexity that juvenile fish need for survival, both by removing the physical biogenic and sedimentary structures necessary for protection, and by removing the organisms that create those structures (Auster *et al.* 1996). Third, bottom trawling removes mature wolffish, which have been described as apex predators and critical for trophic function in their ecosystems (Steneck *et al.* 2004). Removal of apex predators causes "trophic cascading" and ecosystem altering effects on the entire benthic community (Steneck *et al.* 2004; Frank *et al.* 2005). Finally, bottom trawling and dredging for shellfish harvesting, navigational purposes, or utility installations could cause indirect deaths to all life stages by re-suspending bottom sediments which can smother spawning areas and egg nests, damage gills, and release settled toxic heavy metals (O'Dea and Haedrich 2002).

Complicating this loss of biodiversity resulting from modern fishing practices and other human activities is the mounting scientific evidence that collapse of fish populations in large marine ecosystems occurs at higher rates in species-poor ecosystems than in species-rich ecosystems (Worm 2006). Mobile fishing practices that alter the benthic habitat and reduce overall habitat complexity, without a sufficiently large area of offsetting undisturbed areas, may ultimately threaten the long-term viability of benthic communities (Auster *et al.* 1996). The NRC report (2002) on bottom trawling states: "Many studies indicate that stable communities of low mobility, long-lived species are more vulnerable to acute and chronic physical disturbance [trawling] than are communities of short-lived species in changeable environments. Habitat complexity is reduced by towed bottom gear that removes or damages biological and physical structures. The extent of the initial effects and the rate of recovery depend on the stability of the habitat. The more stable biogenic, gravel, and mud habitats experience the greatest changes and have the slowest recovery rates."[73] Virtually every government and scientific reference that explores the threats to Atlantic wolffish concludes that fish trawls and dredging of their critical habitat is the prime concern.

Based on calculations made with trawl and dredge gear activity data, it is estimated that all U.S. waters in the Gulf of Maine were impacted at least once every year by mobile fishing gear in the years between 1984 and 1990 and that all navigable areas on Georges Bank were impacted three to four times per year during that same period (Dorsey and Pederson 1998). As the following figure graphically illustrates, this trawling and dredging exists in the same areas

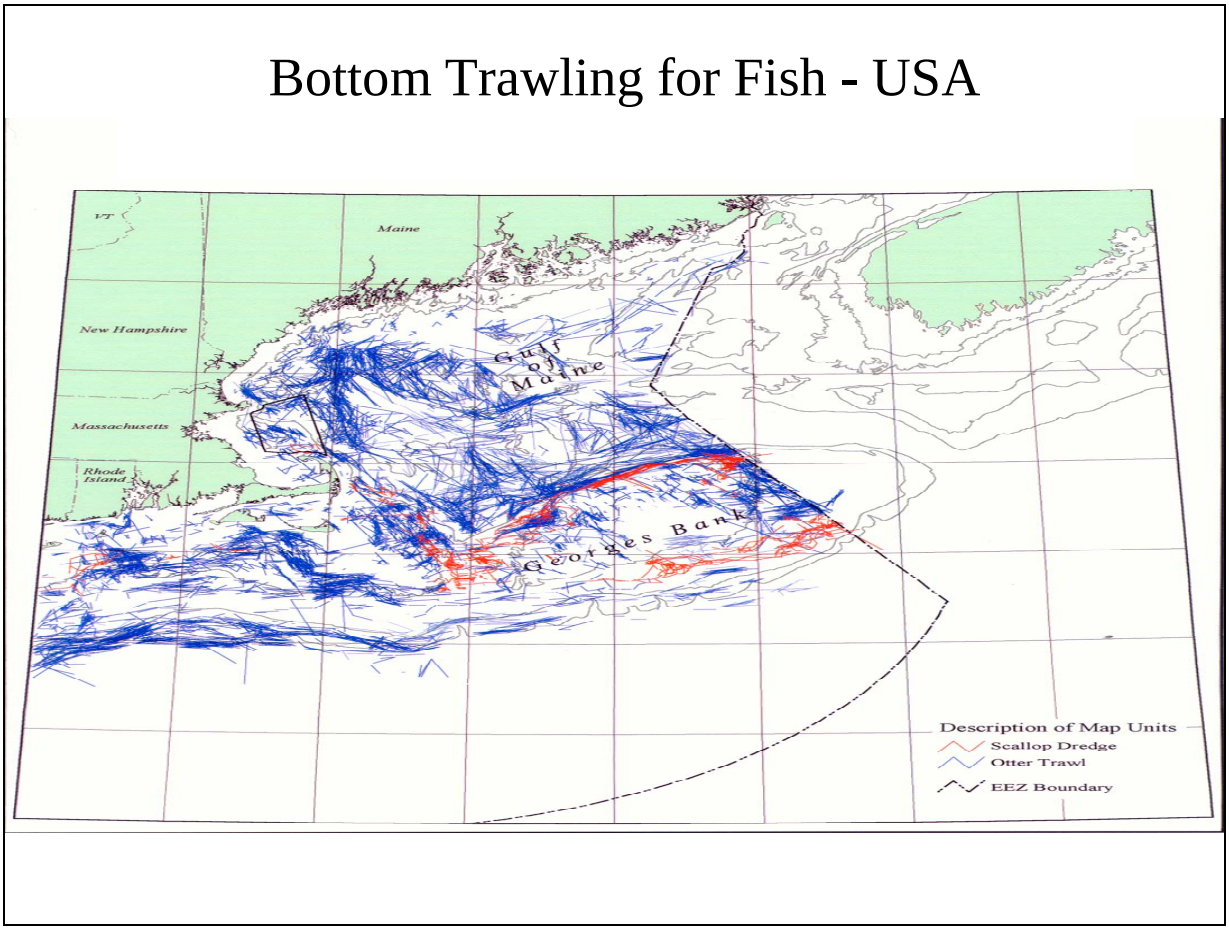
[73] *Effects of Trawling and Dredging on Seafloor Habitat*, National Research Council. Found at: http://books.nap.edu/openbook.php?isbn=0309083400

identified by Census of Marine Life—Gulf of Maine Program as hot spots for the remaining Atlantic wolffish sub-populations. *Compare* Figure 13 *with* Figures 11 and 12. While the Western Gulf of Maine Groundfish Closed Area is presently providing some protection for wolffish habitat from some of the bottom-tending fishing gears within its boundary, other gears that impact the bottom, such as herring mid-water trawl gear, are allowed in the Closed Area and often trawl near, and make contact with, the ocean bottom.[74] Moreover, the Closed Area does not encompass all of the Atlantic wolfish habitat within its boundaries. Finally, the closure could be lifted or modified in the future by the fishery managers for considerations that have nothing to do with protecting or restoring critical wolffish habitat. The habitat losses and modifications due to dredging and trawling over the Greater Gulf of Maine is threatening the survival of the Atlantic wolffish with extinction and will likely cause irreparable harm without protection under the ESA.[75]

[Intentionally Blank]

[74] *See, e.g.*, FINAL AMENDMENT 1 TO THE FISHERY MANAGEMENT PLAN FOR ATLANTIC HERRING 499 (2006); Memorandum from Lori Steele, Herring Plan Development Team Chairman, Atlantic Herring Stock/Fishery Update 15-16 (September 7, 2007)(summarizing NMFS observer program data and reporting the "bycatch" of metal debris).
[75] Watling Declaration at ¶ 13; Haedrich Declaration at ¶ 10.

Figure 13: Bottom Trawling in US Waters
Source: Auster, P. J. and Langton, R. W. (1998). The effects of fishing on fish habitat[76]
Dataset title: NMFS Sea Sampling database 1989-1994, represents 14,908 tows
Online Resource:
http://ocean.floridamarine.org/efh_coral/pdfs/Habitat_Plan/HabitatPlanAPPM.pdf
Key: Red = Scallop Dredgers; Blue = Otter Trawls



Loss and degradation of habitat has contributed to the decline of many marine species and has likely impacted the distribution and abundance of the Atlantic wolffish. Watling Declaration at ¶¶ 10 - 13; Haedrich Declaration at ¶ 10. Biological factors such as the limited adult migrations and the restricted dispersal of larvae from the hatching site make the population especially at risk when a discrete population in a given region is decimated through environmental or anthropogenic causes such as bottom trawling or dredging, as it is unlikely to be replenished from elsewhere. Haedrich Declaration at ¶ 10. Given the widespread destruction and alteration of natural seafloor habitats in the Gulf of Maine, the habitat available to sustain the Atlantic wolffish population has been greatly reduced. Moreover, the aspects of the habitat that are being altered are the precise aspects of that habitat type that make it most critical for the Atlantic wolffish for successful reproduction. Watling Declaration at ¶¶ 11 & 12. Long term

[76] In *American Fisheries Society Symposium*, Vol. 22, pp 150-187

commitment to habitat protection will be necessary for the eventual recovery of this species. Watling Declaration at ¶ 13. The CML mapping (Figures 11 & 12) identify the highest priority areas in need for protection from bottom trawling and other disturbances of those surfaces for the remaining U.S. populations of Atlantic wolffish.

C. Overutilization through Commercial and Recreational Fishing

As recently as twenty years ago in Atlantic Canada, Atlantic wolffish were the subject of a directed fishery, but today Atlantic wolffish primarily figure in U.S. and Canadian commercial landings as "bycatch."[77] Historically, the Atlantic wolffish has been caught as bycatch in gillnets, otter trawls, trammel nets, seine nets and rarely with hand lines and long lines.[78] Atlantic wolffish are especially vulnerable in the spring to the otter trawl fisheries when out feeding and on their limited movements to shallower or deeper waters. In other parts of the world, a recent market demand has occurred for this species under the name of "ocean catfish," and in New England Atlantic wolffish are often landed and sold in local markets when caught as bycatch by commercial fishermen.[79] There have been aquaculture efforts in northern Europe, but none in the western Atlantic.

There have been dramatic and sustained Atlantic wolffish population declines throughout the northwest Atlantic Ocean due to overutilization of the species. Atlantic wolffish, historically most abundant in waters off Newfoundland and Labrador, experienced a 91 percent decline in two generations from 1978-1994 (O'Dea and Haedrich 2002). Despite the limited indirect protections afforded by the Canadian Atlantic groundfish moratorium imposed in 1992 to protect Atlantic cod stocks in certain Canadian waters, the mature biomass of Atlantic wolffish has not improved according to a 2002 Stock Status Report.[80] The contracting geographic range and the loss of populations in the northwestern Atlantic has been predominantly caused by commercial overfishing, both as a consequence of earlier directed fisheries in places like western Greenland, and later from indirect incidental catches in Canadian and U.S. fisheries.[81] Abundance of the Atlantic wolffish species has dropped precipitously throughout all or a significant portion of its range in the northwestern Atlantic Ocean. Virtually every analysis of Atlantic wolffish identifies overutilization in fisheries harvests as one of, if not the major, factor in their decline.

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[77] "Bycatch" has many definitions. The MSA defines bycatch as fish harvested in a fishery, not kept or sold for personal use, including economic discards and regulatory discards. The NMFS definition of bycatch linked to wolffish documents defines bycatch as "animals other than the desired species that are caught by fishermen." http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/definitions.html. NEFSC documents refer to the wolffish as bycatch. *Status of Fisheries Resources off Northeastern United States- Atlantic wolffish,* ("Wolffish are taken primarily as bycatch in the Georges Bank Gulf of Maine otter trawl fisheries.") Available at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed on 9/16/08); NMFS also refers to the wolffish as bycatch in their 2005 CMER Research Topic. http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/index.html - *Atlantic wolffish- Bycatch Characterization and Genetic Analysis.*

[78] Watling and Norse, 1998

[79] U.S. landings through 2007 can be found at: http://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES. Based on that data base, U.S. commercial landings were 142,588 pounds in 2007 in this bycatch fishery.

[80] DFO Stock Status Report A3-31 (2002).

[81] Although overfishing is considered the main cause of the collapse of cod stocks, another articulated factor contributing to the lack of recovery is the infusion of cold, Arctic-derived low salinity waters which causes changes in abundance of phytoplankton, zooplankton, and fish populations (Frank *et al*., 2006).

A commercial "bycatch fishery" can be quite significant in terms of total landings, however, as is the case with Atlantic wolffish in U.S. waters. In 2003, the Northeast Fisheries Science Center ("NEFSC") reviewed the status of the resource and concluded that Atlantic wolffish were "overexploited and in a severely depleted state."[82] In reaching this conclusion, NEFSC relied on two key measures: the abundance and biomass of the species. Abundance, as measured by commercial landings, had "declined sharply" from 1984 to 1998.[83] In 1998, the commercial landings of 300 metric tons ("mt") were the lowest recorded amount since the early 1970's. Biomass, as measured by NEFSC spring bottom trawl survey biomass index, had shown a "consistent downward trend since the late 1980's."[84] Biomass had fluctuated for twenty years (1968-1988) between 1.0 kg/tow and 2.0 kg/tow; however the 1997-1999 indices were less than 0.2 kg/tow representing only 8 percent of the 1968-1988 average and "the lowest in the time survey series."[85]

These conclusions formed the basis for the NMFS designation of the Atlantic wolffish as a Species of Concern in 2004. 69 Fed. Reg. 19975 (April 15, 2004). NMFS concluded at that time that the "stock remains overexploited and severely depleted."[86] Despite its knowledge that abundance and biomass of the Atlantic wolffish have declined sharply and its decision to list the wolffish as a Species of Concern, NMFS has enacted no substantive protections for the species and the mere listing as a Species of Concern provides none. In 2006, NEFSC updated the status of the Atlantic wolffish, again noting precipitous declines in both abundance and biomass in the last 5-year time period.[87]

Research trawl data obtained from NEFSC since the 2003 Status of the Resource Report and commercial landings data that covers the years between 1998 and 2004 provide further evidence of this precipitous decline. Scientists noted a further sharp decline from 1998, when 300 mt was the lowest recorded value for commercial landings, to a new low of 118 metric tons in 2005.[88] Data updated to 2007 show commercial landings declining even further to 65 metric tons.[89] The population decline rate for the U.S. population of Atlantic wolffish, expressed relative to generation time, for the period 1983 through 2004 period (i.e., 22 years beginning at

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[82] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev. 2006).* Available at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed on Apr. 25, 2007)

[83] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish* (1998). Available at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm115/wolf.pdf

[84] *Id.*

[85] *Species of Concern—Atlantic wolffish* (NOAA 2007). Available at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticwolffish_highlights.pdf

[86] NMFS Species of Concern available at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlantic_wolffish.pdf

[87] NEFSC Ref. Doc. 06-05. Available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0605/ (last viewed 8-27-08)

[88] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (rev. 2006).* Available at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed on 9-16-08)

[89] Most recent commercial landings data (through 2007) found at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.
Petitioners recognize that a portion of the recent decline in commercial landings data is associated with the new groundfish closure areas that correspond with some of the remaining concentrations of Atlantic wolffish in U.S. waters. The research trawl surveys, however, continue to reflect that there are real declines of Atlantic wolffish, even within these closed areas.

the point of precipitous decline) corresponds to an approximately 95% decline over three generations (estimated at 30 years; Figure 10).[90] Even looking at older data when wolffish were more abundant, Collette and Klein-MacPhee conclude that Atlantic wolffish in the Gulf of Maine are "clearly overexploited and depleted" (Collette and Klein-MacPhee 2002).

Atlantic wolffish are also caught by recreational fishermen but the available data on the amount of fish caught or landed from recreational fishing that is available to Petitioners is not sufficient to calculate any estimates on how significant a role this fishery might be playing in the declining populations and contracting range of the U.S. Atlantic wolffish. Earlier analyses of recreational landings indicated that the proportional contribution of recreational fishing to Atlantic wolffish harvest was "insignificant;"[91] however, this conclusion appears to be based on landings data from the 1990's when the commercial landings were significantly higher.[92] Atlantic wolffish are caught in the present recreational fishery, which has full access to one of the few remaining areas of Atlantic wolffish concentration in U.S. waters on Jeffreys Ledge and Stellwagen Bank, which areas are largely otherwise closed to commercial groundfishermen.[93] Measures directed toward this recreational fishery should be included in any protection and recovery strategy for Atlantic wolffish.

There were recent efforts to include Atlantic wolffish as a species managed by the New England Fishery Management Council under the Northeast Multispecies Groundfish Fishery Management Plan, but the Council has not included the species in any of the fishery management plan amendments currently under consideration. As a result, Atlantic wolfish--perhaps the most seriously depleted demersal species in the Gulf of Maine and on Georges Bank--is wholly unmanaged. Given the severe declines in their populations and the additional stresses associated with the historic destruction and modification of their critical hard bottom habitats, any catch or landing of Atlantic wolffish in U.S. waters by commercial or recreational fishing results in overutilization of the species.

The largest subpopulation of Atlantic wolffish in U.S. waters identified by NMFS survey trawl data is over Jeffreys Ledge and Stellwagen Bank (Figure 12, arrows). Under the Northeast Multispecies Fishery Management Plan, much of this area has been closed to commercial groundfishing since 1998. However, as discussed above, other recreational fishing, shrimping and "mid-water" trawl herring fishermen are allowed to fish in the closed areas. There are also no prohibitions against other non-fishing commercial habitat-disturbing activities taking place in

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[90] *See* Appendix IV. Dr. Richard Haedrich at Memorial University in St. John's, Newfoundland, calculated declines in abundance using NEFSC spring and fall survey trawl data. The calculations assume a conservative age at maturity of 6 yrs (Canadian Department of Fisheries and Oceans (DFO) documents indicate 10-11 years) and a generation time of 10.2 years.

[91] *Status of Fisheries Resources off Northeastern US - Atlantic wolffish (revised December 2006)*. NEFSC – Resource Evaluation and Assessment Division. Found at: http://www.nefsc.noaa.gov/sos/spsyn/og/wolf/ (last viewed 8-27-08)

[92] Idoine, J. *Atlantic Wolffish – Status of Fishery Resources off the Northeastern US for 1998*. Northeast Fisheries Science Center. Found at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm115/wolf.pdf (last viewed 8-27-08). This document presents limited recreational data that is subsequently referenced in other status reports, suggesting that no new data on recreational catches of Atlantic wolffish has been developed.

[93] *See, e.g.*, "Striper fishing slow, but groundfishing is hot," Points East Magazine at 80 (August 2008) ("two wolf fish" caught by one recreational fisherman on Jeffreys Ledge). Additional references to directed recreational fishery are provided in footnote 51 above.

these areas.

The Western Gulf of Maine Closure prohibits commercial groundfishing in an area 27 x 100 km and encompasses middle Jeffreys Ledge and the eastern part of the Stellwagen Bank National Marine Sanctuary (Malik 2005). The data showing some concentration of Atlantic wolffish in this area suggests that the protections offered by the closure may have aided in allowing a population of wolffish to survive in or near this area. The data also indicates that presently Atlantic wolffish straddle the western boundary of the Western Gulf of Maine Closure and points farther west, suggesting that a management measure that moved this western boundary further to the west might increase the likelihood of the ultimate survival of the Atlantic wolffish.

In conclusion, recent trends in abundance, incidence and biomass data indicate the Atlantic wolffish is rapidly disappearing in U.S. waters due to overutilization, and strongly suggest they will be extinct in the foreseeable future unless dramatic remedial action is taken.

D. Disease or Predation

As discussed above, *see* Section VII above, the best scientific information available indicates that the decline of this species is due primarily to commercial and recreational fishing; destruction, degradation or modification of critical habitat; and the lack of effective regulatory mechanisms protecting the species; not disease or predation.[94] Parasites may play a role in tooth destruction and infected muscle tissue, but there is nothing in the literature to suggest that they play a signficant role in the survival of the species (*E.g.*, Collette and Klein-MacPhee 2002).

In addition, as discussed above, *see* Section IV.H. above, several marine species prey on Atlantic wolffish at various life stages, including gray seals and dogfish, which are increasing in numbers in the Gulf of Maine. There is no literature that Petitioners have found that suggest that natural mortality changes are a primary cause or even a significant factor in the precipitous declines in Atlantic wolffish abundance or contractions in range, but further study and analysis is needed on the role such predation may play as a recovery strategy is developed and implemented for the species.

E. Inadequate Regulatory Mechanisms

Federal and state regulatory regimes currently in place are not intended to and do not in fact protect the U.S. population of Atlantic wolffish. As noted above, Atlantic wolffish are harvested without limit as incidental bycatch in fishing gear such as trawls, gillnets, handlines, traps, longlines and dredges and by recreational fishermen. The present lack of regulatory measures addressing the Atlantic wolffish in any fashion at all creates no incentives to avoid or to minimize its catch as bycatch or to protect its habitat or even educate the public about the peril of the species and actions that could be taken by the public to reduce that jeopardy. The absence of such regulation combined with the ongoing strong market demand for Atlantic wolffish as a table fish and the increasing scarcity of the fish are incentives for fishermen to keep the Atlantic wolffish they catch.

[94] *See also, e.g.,* Canadian Wolffish Recovery Strategy at 4.

In federal waters, fish are managed under the Magnuson-Stevens Act ("MSA")[95] and its implementing regulations, which include several fishery management plans ("FMPs"). In addition, FMPs have been implemented under the jurisdiction of the Atlantic States Marine Fisheries Commission ("ASFMC") which focuses on fisheries in inshore state waters.[96] Congress enacted the MSA to create a national program for the conservation and management of fishery resources of the U.S., 16 U.S.C. § 1801(2)(a)(6), with multiple stated purposes including optimizing the commercial and recreational yield of the nation's fish resource, preventing overfishing, rebuilding overfished stocks, and ensuring conservation including the facilitation of protecting essential fish habitat. *Id*.

In the northeast, the New England Fishery Management Council ("Council") is responsible for developing FMPs for the fish resources off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. To date, the Council has developed nine fishery management plans ("FMP's") to manage a number of different fish species. NMFS has implemented all of these FMP's, including the Northeast Multispecies FMP, which governs the groundfish complex. Recent amendments including Amendment 13 and Framework 42 (2004), revised target biomass levels and fishing mortality limits, and adopted rebuilding strategies for "overfished" stocks. As noted above, neither NMFS nor the Council have not formally identified Atlantic wolffish as "overfished" and do not regulate the species. Petitioner CLF recommended that the Council take action through Amendment 16 to add Atlantic wolffish to the Multispecies FMP and to implement the appropriate measures necessary to reduce harvest and to protect habitat. *See* Appendix VI. The Council and NMFS declined to include Atlantic wolffish. This decision means that catching or landing of Atlantic wolffish is completely unregulated in federal waters and that any specific habitat protections that might have been available to or critical for the Atlantic wolffish under the "essential fish habitat" provisions of the MSA are unavailable.

The failure to indentify the Atlantic wolffish as an overfished stock and to include it in a FMP leaves the U.S. population of Atlantic wolffish entirely outside any direct regulatory protections that might be available under the MSA or under state law developed through the ASMFC. Moreover, courts in reviewing ESA decisions have consistently held that "an agency may not rely upon future actions to justify a decision not to list a species as threatened or endangered."[97] Listing the Atlantic wolffish under the ESA is warranted at this time because even if the Council were to ultimately include the wolffish in a FMP, there are no current, enforceable measures in place that afford any protection. Moreover, the MSA, which requires fishery management plans to balance a variety of biological, social, and economic factors, does

[95] 16 U.S.C. § 1801 *et seq.*, "MSA"; including the Sustainable Fisheries Act, P.L. 104-297; and 2007 Reauthorization of MSA, HR 5946.

[96] http://asmfc.org. This management regime is a cooperative agreement between fifteen coastal states and NMFS whose goal is to conserve and manage the resources for sustainable use within the three-mile jurisdiction of state waters. Information and abundance of Atlantic wolffish in state waters is available from 1963-2002 (NEFSC Ref. Doc 06-05). The ASMFC has not identified the wolffish as one of its twenty-two managed species and under this regime they are inadequately protected as well.

[97] *Biodiversity Legal Found. v. Babbitt*, 943 F. Supp. 23, 26 (D.D.C. 1996); *Southwest Center for Biological Diversity v. Babbitt*, 939 F. Supp. 49, 52 (D.D.C. 1996); *CBD v. Badgley*, 2001 WL 844399 (D. Or. 2001) (citing *Oregon Natural Resources Council v. Daley*, 6 F. Supp.2d 1139, 1153-54 (D. Or. 1998); *Friends of Wild Swan, Inc. v. USFWS*, 945 F. Supp. 1388, 1399 (D. Or. 1996))

not offer protections to the Atlantic wolffish that are in any sense the functional equivalent of those required by the ESA.[98]

F. Other Natural or Manmade Factors Affecting the Atlantic Wolffish

Other possible outside influences identified as contributing to the decline of this population are pollution and sedimentation which occur after fishing activities such as bottom trawling and commercial dredging, disturbances that have been implicated as potentially smothering spawning areas and damaging gills, which causes decreased fertilization rates and aberrant male nesting behavior (O'Dea and Haedrich 2002). Scientific opinion also suggests that the use of bottom-tending mobile gear such as dredges and trawls disturb rocky material and sediment, which may not only move boulders that shelter nests but also flatten the sea floor, thus leveling out the topography and fiulling burrows, which can smother egg nests, disperse eggs and expose them to predators. Watling Declaration at ¶ 11. Channel dredging and aggregate extraction are also implicated as destabilizing the seabed, increasing erosion, and polluting previously healthy areas.[99]

Emerging environmental stresses from climate change or ecosystem shifts due to natural or manmade stresses may make the wolffish more vulnerable to disease or predation; however, at this time the potential for any of these environmental factors to play a significant or imminent threat is simply unknown.[100]

G. Conclusion

Based on a review of the best scientific and commercial data, impacts to the U.S. population of the Atlantic wolffish falling under at least three, if not four, of the five listing evaluation factors are contributing to its precipitous decline toward extinction and justify its listing as an endangered species. For these reasons, NMFS must make a finding pursuant to 50 C.F.R. § 424.14(b)(1) and 16 U.S.C. § 1533(b)(3)(A) that the Petitioners' requested listing action may be warranted and move forward immediately with the necessary status review of this DPS of Atlantic wolffish.

VIII. NMFS Must Designate Critical Habitat under the ESA

While a presentation on critical habitat is not strictly necessary at this stage in the petition process under NMFS regulations, *see* 50 C.F.R. § 424.14(b)(2), Petitioners urge NMFS to designate critical habitat for the Atlantic wolffish concurrently with its listing under the ESA because of the serious nature of the threats to the species.

[98] While Petitioners are hopeful that with adequate protection, Atlantic wolffish may once again be rebuilt to a level where a sustainable commercial and recreational harvest is possible, that day is far over the horizon given the current status of this species in the U.S.
[99] Messiah *et al*., 1991
[100] *See* Canadian Wolffish Recovery Strategy at 26.

Critical habitat as defined by Section 3 of the ESA is:

> (i) 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
>
> (ii) the 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.

16 U.S.C. § 1532(5).

The designation of critical habitat is essential to the recovery of a species, and takes into account the ecosystem upon which the species depends, one of the fundamental purposes of the ESA. Section 7 mandates that no action be authorized, funded, or carried out by a federal agency that will "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical habitat]." 16 U.S.C. § 1536(a)(2). "Destruction or adverse modification" is "a direct or indirect alteration of critical habitat which appreciably diminishes the value of that habitat for *either* the survival *or* the recovery of a listed species." [101]

The Secretary in his determination of what areas constitute critical habitat "shall 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). For the Atlantic wolffish, these features would include space for individual and population growth, space for normal behavior, and an area sufficient for normal nutritional and physiological requirements. Important factors identified in the regulations as applied to the wolffish include cover or shelter including rocky substrates for which the species could spawn and nest, sites for breeding, reproduction, rearing of offspring, and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. *Id*. Constituent elements that would contribute to the future sustainable population shall be listed concurrent with the critical habitat description. *Id.*

In order to identify important habitat areas to be used in the designation of critical habitat, scientists consider high relative abundance of a species as a valuable indicator (Auster *et al*. 2001; Cook and Auster 2005). Because different species of fish utilize habitat differently at various life stages, identifying areas of high abundance for both juveniles and adults would be ideal (Auster *et al*. 2001; Cook and Auster 2005; Crawford and Smith 2006), but may not available for the wolfish. For the Atlantic wolffish, the gravel and rocky substrates and biogenic structures of reefs, plants, and sponges naturally associated with those substrates provide protection for the juveniles from predators and the currents, and also protection for the adult males guarding the nest of eggs that once dispersed are not believed to survive (Collette and MacPhee). Watling Declaration at ¶¶ 10-13.

[101] Ctr. for Biological Diversity v. BLM, 2003 U.S. App. LEXIS 4865 (9th Cir. 2003)(emphasis added).

In order to identify potential critical habitat for the Atlantic wolffish through identification of "specific areas within the geographical area occupied by the species," 16 U.S.C. § 1532(5)(A), Petitioners have reviewed abundance data from NOAA and DFO and survey trawl data for the years 1963 to 2005 that was mapped over the Gulf of Maine substrates by the Census of Marine Life. *See* Figure 11. This abundance data was also mapped by NOAA over time and over historical populations. *See* Figure 10. These data and maps are the best available scientific information on the priority sites for habitat protection and should be used in the designation of critical habitat. In order to identify potential critical habitat for the Atlantic wolffish in "specific areas outside the geographical area occupied by the species at the time it is listed . . . [that] are essential for the conservation of the species," Petitioners urge a precautionary approach and suggest that areas recently inhabited by wolffish (5-10 years ago) or where it is believed remnant populations may still exist, such as Cashes Ledge or similar areas should also be considered for designation as critical habitat.

Petitioners request that the NMFS propose critical habitat for the Atlantic wolffish concurrently with its proposed listing. A precautionary approach should be taken in order to buffer against unanticipated events, such as changes in environmental conditions or disaster.[102] At minimum, the Atlantic wolffish critical habitat must include the areas including Jeffreys Ledge and Stellwagen Bank, the U.S. portion of the northeast peak of Georges Bank, and the Great South Channel where the remaining sustainable population in U.S. waters presently exists. Petitioners will submit additional comments regarding critical habitat once the NMFS has issued a positive 90-day finding on this Petition and initiated a status review.

X. Conservation Measures Recommended

When a species such as the Atlantic wolffish is listed under the ESA, there are several additional substantive protections that are afforded to the listed species. Among these are the preparations of a recovery plan for the species under Section 4(f) of the ESA. 16 U.S.C. § 1533(f). To the maximum extent practicable, incorporated into each plan is a "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). While it is premature to thoroughly analyze the specific management and regulatory measures that might be considered necessary if the U.S. population of Atlantic wolffish is listed, Petitioners have included here a brief discussion of the types of potential measures that may be necessary.

Importantly, when listing a species NMFS may issue regulations necessary to protect the species from threats to its continued existence in addition to designating critical habitat. There are a number of regulatory measures that should be required in order to reduce many of the negative impacts of fishing and other anthropogenic activities negatively affecting the Atlantic wolffish, including impacts resulting from bycatch and habitat destruction. Petitioners believe that additional lessons can be learned from an analysis of the Canadian efforts to recover wolffish over the last several years, including the importance of working closely with fishermen in program design and implementation.

[102] *See, e.g.*, Mee, Laurence. "Reviving Dead Zones." *Scientific America*, October 2006: 79-85.

Critically, the conservation measures should, at minimum, be designed to achieve the following objectives:

- Reduce mortality of wolffish resulting from commercial and recreational fishing to a minimum;
- Protect critical habitat from adverse impacts resulting from fishing and other human activities.;
- Coordinate regulations and other recovery efforts with Canadian regulators in order to institute consistent strategies throughout the historic range of the Atlantic wolffish in the northwest Atlantic;
- Increase research on Atlantic wolffish and the factors that may be affecting its survival and recovery, which might include increased understanding of its forage needs and the impacts of other environmental factors; and
- Increase public education and awareness of the status of the species, the recovery strategy, and steps that the public, including particularly commercial and recreational fishermen, can take to assist in the recovery effort.

In order to achieve these objectives, the specific conservation measures should include the following:[103]

(1) Establish targeted area closures that prohibit physical alteration of the benthic habitats, including commercial navigational dredging, oil and gas development, marine construction, and mobile fishing gears known to fish on or near the ocean floor in areas where Atlantic wolffish are known to be present. The fishing gears prohibited in such closures should include scallop and clam dredges, bottom trawls, and mid-water trawls (*e.g.*, single and pair mid-water trawls used targeting herring and mackerel, which are known to be fished at the bottom and to make contact with the bottom).[104]

(2) Prohibit possession of Atlantic wolffish by all commercial and recreational fishermen. Rules should establish standards for handling and release of wolfish that are caught inadvertently and educational programs should be developed to work with fishermen on protocols for the live release of Atlantic wolffish. Rules should ensure that all wolfish caught and released alive or discarded be recorded and reported.

(3) Establish procedures that trigger additional area closures to gear capable of catching wolfish if they are caught with any frequency outside the designated closed areas.

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[103] Several of these initial recommendations are consistent with measures identified by NMFS in its publication on Species of Concern in the Northeast Region (Maine through Virginia) (NOAA Fisheries 2004) at 10. Available at: http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/SOC%20Final%20Report-web.pdf (last viewed 8-27-08)

[104] The data contained in this Petition suggest that these closures likely can be built around existing groundfish closure boundaries, thus helping to minimize the impacts to many commercial fishermen. For example, the Western Gulf of Maine closure already includes some of the most important habitat for the Atlantic wolfish, and its current protections may be improved by adjusting the western boundary west and adding fisheries to its prohibitions.

(4) Establish monitoring and reporting protocols that ensure high levels of observer coverage in commercial fisheries operating in areas where wolffish may be present, all catch on vessels carrying an observer is sampled, and extrapolation of all reported wolffish bycatch data.

(5) Regularly review for additional area closures based on monitoring data and fishery-independent data.

(6) Establish a gear research program designed to reduce the bycatch of wolffish and habitat impacts from mobile fishing gear.

(7) Establish and fund a program for additional Atlantic wolffish research programs that could aid in its recovery.

(8) Designate critical habitat concurrent with the listing.

(9) Complete a timely recovery plan.

XI. Conclusion

Based on the best available scientific and commercial data, information and opinion, Atlantic wolffish are rapidly headed toward extinction in U.S. waters. This Petition demonstrates that listing the U.S. population of Atlantic wolffish as an endangered distinct population segment under the ESA is not only consistent with the relevant legal criteria, but also is necessary to prevent its extinction in U.S. waters. It is also significant to the health of the species throughout its range. NMFS has already identified Atlantic wolffish as a species at risk with vulnerable life-history characteristics. The best available scientific and commercial data indicate now that listing the Atlantic wolffish as endangered should occur, due to the multiple and cummulative threats of overutilization from fishing, habitat destruction, and inadequate regulatory measures. There is little the U.S. can directly do to address the larger threats faced by the genus *Anarhichas* throughout its range, but the steps that it can take to protect and recover the U.S. populations are clear. Petitioners strongly urge NMFS and the Secretary to take action to protect the Atlantic wolffish in U.S. waters before it is too late.

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APPENDIX I—LITERATURE CITED

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***Electronic copy of documents available on CD included with Petition.**

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APPENDIX II—DECLARATION OF DR. RICHARD HAEDRICH

MEMORIAL UNIVERSITY

DECLARATION OF RICHARD HAEDRICH, MSc, PhD

I, Richard L. Haedrich, pursuant to the provisions of 28 U.S.C. § 1746 do hereby declare as follows:

1. I am an ichthyologist and biological oceanographer with broad research experience in the taxonomy, distribution and ecology of deep-sea fishes. I received my training at Harvard (A.B., M.Sc., PhD 1965), spent a year in Denmark as a Fulbright Fellow, and worked as a Research Scientist at the Woods Hole Oceanographic Institution before moving to accept a full professorship at Memorial University in 1979. I am now retired but continue at the university as a Professor *emeritus*.

2. My research focus has been primarily in the Northwest Atlantic, with emphasis on the relationships of fishes to their environment. My recent research has addressed fisheries, especially changes in the fishery ecosystem of Newfoundland before, during and after the great cod collapse in 1992. I have published over 150 papers in the primary peer-reviewed scientific literature and co-authored the book *Deep-sea Demersal Fish and Fisheries* (Chapman & Hall, London 1997). I have been the chief scientist on numerous scientific research cruises, beginning at Woods Hole and continuing on Canadian ships out of the Bedford Institute. I served as Director of Memorial's Newfoundland Institute of Cold Ocean Science, the Marine Sciences Research Laboratory, and the expanded Ocean Sciences Center. From 1999 to 2004 I was co-chair of the newly-formed Marine Fish Subcommittee of the national Canadian Endangered Species Committee ("COSEWIC").

3. I make this affidavit based on my own personal knowledge to address matters relating to a petition to list the Atlantic wolffish (*Anarhichas lupus*) as an *endangered* species under the Endangered Species Act ("ESA").

4. In 1999, we began a general examination of population trends in non-target species of the Northwest Atlantic fishery ecosystem drawing on a database of over 24,000 US and Canadian scientific survey trawl samples that covered the region from Cape Hatteras to the northern tip of Labrador. Included among the species considered were the Atlantic, northern, and spotted wolffish. All three species displayed marked population declines over the 24 years of the data. Based on calculations of decline rates and incidence of occurrence we showed that all three species of wolffish met the criteria for "Endangered" status according to the International Union for Conservation of Nature ("IUCN") standard. These results were

combined with an up-to-date review of all available biological/ecological information on the species, which became part of an Honours thesis and ultimately three separate reports submitted to COSEWIC.

5. In the Northwest Atlantic, the Atlantic wolffish ranges from the northern part of Georges Bank in the Gulf of Maine to Labrador. The species' most southerly range is in U.S. waters and our analysis showed that it has undergone a steady decline there, with a significant decline in numbers during the 1970's - somewhat before the much larger decline seen in Canadian waters. The original data series we had for the U.S. population of Atlantic wolffish ended in 1994, but additional scientific survey data up to 2006 are included in the petition to list the Atlantic wolffish as *endangered* under the ESA in U.S. waters. Those data show that the decline we noted has continued. From 1995 to 2006 there has been an 86.4% drop in the numbers of Atlantic wolffish, which even in the beginning of that series were recognised as in a clear decline. Thus the merits of the present petition must be considered very serious indeed.

6. The criteria for listing species in Canada under the Species At Risk Act ("SARA") are based on the international IUCN Species Survival Commission standards. Briefly, these are: A) declining total population, B) small distribution and decline or fluctuation, C) small total population size and decline, and D) very small population or restricted distribution. Due to the nature of marine fishes, with their large numbers and broad ranges, usually only criterion A (declining total population) applies.

7. Excellent quantitative data to address criterion A are gathered annually in the Northwest Atlantic by the scientific trawl surveys conducted by the National Marine Fisheries Service ("NMFS") in U.S. waters and the Department of Fisheries And Oceans Canada ("DFO") in Canadian waters. The great advantage of criterion A is that it is based on quantitative, objective and verifiable information with accepted and internationally agreed-upon thresholds, i.e. a decline >70% over 10 years or 3 generations = Endangered (COSEWIC), a decline >50% over 10 years or 3 generations = Threatened (COSEWIC), and so on.

8. Under the above rules, the Atlantic wolfish in U.S. waters would qualify as Endangered under COSEWIC (and in fact "Critically Endangered" under IUCN). This is what the Marine Fish Subcommittee of COSEWIC recommended for the species in Canadian waters when its report was submitted in November 2000; but, in the face of strong vocal opposition from representatives of DFO the much lesser status of Special Concern was eventually settled upon.

9. I have assisted in producing the petition to list, primarily in advising the proponents on how to approach the scientific survey data they obtained from NMFS. I provided the appropriate formulas and verified their calculations of decline rates. It was advisable to treat the spring and fall surveys separately. The spring survey contains numbers of small fish presumably sampled as they are dispersing to stake out territories. The fall survey is mostly the larger adults that have settled into their territories

10. The observation of a declining total population (criterion A) in marine fishes is often the result of over-exploitation, but indirect effects can also come into play depending upon

particular life history traits. Because wolffish are territorial within specific benthic habitats and do not move very far from the spot where they were born, the habitat fragmentation and destruction that result from bottom trawling are serious threats. The full range of wolffish in U.S. waters is regularly trawled with heavy bottom gear. Besides direct mortality to any fish captured, trawling results in the dislocation or removal of the boulders that provide nest sites. That wolffish occur in fewer and fewer survey samples over time is the expected result of habitat destruction and contributes to the shrinking range that is also observed. Range contraction and the fragmentation of a formerly widespread population into small, discrete groups associated with specific local habitats are criteria that IUCN recognises as characteristic of an Endangered species.

I declare under the laws of the United States of America that the foregoing is true and correct.

Executed on this 12th day of September, 2008.

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Richard L. Haedrich, PhD

APPENDIX III— DECLARATION OF DR. LES WATLING

BEFORE THE SECRETARY OF COMMERCE:
PETITION FOR A RULE TO LIST ATLANTIC WOLFFISH
UNDER THE ENDANGERED SPECIES ACT

DECLARATION OF LES WATLING

I, Les Watling, pursuant to the provisions of 28 U.S.C. § 1746, do hereby declare as follows:

1. I am a biological oceanographer by training and experience. I received a B.Sc. in Zoology from the University of Calgary in 1965, an M.S. in Marine Science from the University of the Pacific in 1968, and a Ph.D. in Marine Science from the University of Delaware in 1974. I have been employed as a Professor of Oceanography in the School of Marine Sciences at the University of Maine since 1976. I am now employed as a Professor of Zoology at the University of Hawaii at Manoa in Honolulu. My specialty includes the study of sea floor life and the various factors that affect such life, whether natural or human-caused.

2. Since 2000, I have primarily studied the taxonomy, biogeography, ecology and reproduction of deep-sea octocorals. For the most part my samples have been obtained from seamounts in the North Atlantic Ocean but my research is expanding to cover seamounts and island slopes in the Hawaiian and nearby areas. My colleagues and I are particularly interested in the modes of dispersal of these animals, their long-term evolutionary history and their relationships to deep ocean water masses.

3. I have spent most of my career studying marine crustaceans, especially those in the Superorder Peracarida. I am especially interested in the phylogeny of this group, its relationship to other malacostracans and in finding molecular and morphological evidence that can be used to determine whether this old superorder is a taxonomic artifact or is monophyletic. Additional studies are ongoing on functional morphology of a variety of crustaceans including

one deep-sea shrimp that uses a novel mode of pleopod locomotion. And lastly, I have described many new crustacean species and am actively working on the small order Cumacea with a view to producing a modern revision of all the known genera.

4. I have been involved for about a decade in activities that are specifically related to reduction of adverse impacts on the marine environment from human activity. Most of this work has focused on the impacts of bottom trawling on sea-floor habitat on the continental shelves in the deep sea. I believe that scientists can play an important role in marine conservation by providing the best and latest scientific information to assist decision makers to analyze and take action to reduce or prevent adverse human impacts on the marine environment.

5. The purposes of this declaration are two-fold: (1) to explain the detrimental impact of bottom-tending mobile gears, especially scallop dredges, on seafloor habitat; and, (2) to describe the importance of specific seafloor habitat to the Atlantic wolffish (*Anarhichas lupus*).

Adverse effects of bottom-tending fishing gear on seafloor habitat

6. Bottom trawling and scallop dredging are devastating to life on the sea floor. When I make a dive to the bottom of the Gulf of Maine in a research submersible, I can tell immediately whether an area has been recently trawled for fish or dredged for scallops. After trawling, the sponges and mussels, the tube-dwelling worms and the amphipod crustaceans that live in undisturbed areas are almost all gone. Boulders formerly covered with marine animals are almost lifeless from being rolled around by nets or dredges and the mud has deep scars. Nothing humans do to the sea has more physical impact.

7. Most places in New England ocean waters that we study - chosen because we thought that their bottom roughness would ensure that they had little chance of being altered by

trawling or dragging - in fact, almost always show signs of having been dragged over. Evidence of a trawl or drag has been especially obvious since the mid-1980s when the invention of rockhopper trawl gear allowed these rough areas to be fished. In the Gulf of Maine, ninety (90) percent of the bottom habitat has been altered by mobile fishing gear, including the Stellwagen Bank National Marine Sanctuary - where gravel and sand can't be mined and oil drilling is forbidden, but any and all bottom habitat can be completely altered by fishing gear.

8. A consistent pattern has emerged from studies of benthic ecosystems – the impact of dredging and mobile fishing gear is most severe in the relatively stable environments that are dominated by long-lived species (such as the Atlantic wolffish) and least severe in those communities that are already dominated by short-lived species. In particular, the first pass of a scallop dredge is detrimental to this ecosystem due to the resuspenion of sediments that have accumulated on the ocean floor and the smoothing of micro-features on the seabed.

9. Further, these sea floor habitats do not recover from disturbances quickly. Even when a seafloor habitat is closed to human habitat disruption, as in the Western Gulf of Maine Closure Area, our studies suggest that the seafloor habitat will take somewhere between twenty-five (25) and fifty (50) years to recover both in terms of topography and diversity.

Seafloor Habitat of the Atlantic Wolffish

10. At present, fishing in waters that are home to the Atlantic wolffish includes bottom trawling and use of other bottom-tending mobile fishing gear that destroys seafloor habitat. In the Gulf of Maine, for example, bottom tending mobile gear destroys habitat in the Stellwagen Bank National Marine Sanctuary and habitat on other boulder and cobble hard-bottom areas that are home to the last remaining wolffish populations in United States waters.

11. Destruction of seafloor habitat in these areas adversely affects the Atlantic wolffish. Atlantic wolffish have specialized habitat requirements, requiring large, stable boulders under which they can nest, and to which they can return after catching prey. Usually these boulders are well settled into the surrounding bottom sediments, and don't move as the fish excavate their burrows under them. Bottom tending mobile gear not only moves the boulders but also flattens the sea floor, leveling out the topography and filling burrows. These impacts have been recorded on video and in still images. I have produced a short video entitled "Habitats and Fishing in the Gulf Of Maine: A Tale of Two Sites," documenting the differences between undisturbed and trawled bottoms, to be shown at the 2008 American Association for the Advancement of Science's Boston meeting, and available at http://www.mcbi.org/what/AAASsymposia.htm. After Atlantic wolfish lay their eggs in these under-boulder burrows (often called "nests"), the male guards the egg mass for up to nine months. Wolffish live only in areas where this type of habitat exists, and are not capable of populating in other areas - disturbance of this boulder habitat by mobile fishing gear means that wolffish nests will be turned upside down, dispersing the eggs and exposing them to predators.

12. Given the widespread destruction of seafloor habitat in the Gulf of Maine, the habitat available to sustain Atlantic wolffish populations has been greatly reduced. Further, the part of the habitat that is being altered is the part that the Atlantic wolfish depend upon the most for successful reproduction.

13. Absent some action to reduce or eliminate the destruction of seafloor habitat in the few remaining areas of United States waters that harbor remnant populations of the Atlantic wolffish, it is probable that it will be faced with extinction in those waters in the near future.

I declare under penalty of perjury under the laws of the United States that the foregoing declaration is true and correct.

Executed on this fifteenth day of September 2008.

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Les Watling, PhD

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Watling, L. 2007. Impacts of Mobile Fishing Gear on Continental Shelf Sedimentary Habitats. In Todd, B.J., and Greene, H.G., eds., Mapping the Seafloor for Habitat Characterization: Geological Association.

Waller, R., L. Watling, P. Auster, T. Shank. 2007. Anthropogenic impacts on the Corner Rise Seamounts, NW Atlantic Ocean. Journal of the Marine Biological Association of the United Kingdom 87:1075-1076..

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APPENDIX IV— RATE OF DECLINE CALCULATIONS (Dr. Richard L. Haedrich)

2005 Wolffish Update					
		Fall	Fall	Spring	Spring
	commercial	stratified	stratified	stratified	stratified
Year	landings 1000(mt)	mean wt/tow	mean #/tow	mean wt/tow	mean #/tow
1963	0.176	0.054	0.068		
1964	0.375	0.273	0.115		
1965	0.274	0.452	0.378		
1966	0.226	0.404	0.372		
1967	0.228	0.318	0.103		
1968	0.222	0.458	0.16	0.916	0.146
1969	0.237	0.059	0.035	1.152	0.227
1970	0.270	0.667	0.284	1.954	0.361
1971	0.275	0.566	0.356	1.744	0.531
1972	0.305	0.283	0.165	1.217	0.483
1973	0.299	0.294	0.411	1.741	0.316
1974	0.396	0.246	0.306	2.491	0.808
1975	0.359	0.322	0.146	1.698	0.311
1976	0.469	0.189	0.127	1.231	0.268
1977	0.437	0.452	0.178	1.018	0.391
1978	0.635	0.562	0.494	1.715	0.776
1979	0.685	0.63	0.339	2.017	0.506
1980	0.889	0.295	0.217	1.529	0.64
1981	0.747	1.134	0.328	1.764	0.701
1982	0.900	0.031	0.031	1.057	0.337
1983	1.196	0.45	0.264	1.664	0.301
1984	1.050	0.127	0.056	1.085	0.241
1985	0.979	0.451	0.208	1.747	0.44
1986	1.103	0.414	0.142	1.507	0.288
1987	0.840	0.146	0.098	1.115	0.298
1988	0.696	0.102	0.13	0.799	0.326
1989	0.549	0.141	0.192	0.553	0.305
1990	0.401	0.252	0.14	0.442	0.084
1991	0.489	0.325	0.196	0.366	0.085
1992	0.465	0.268	0.184	0.243	0.217
1993	0.506	0.427	0.257	0.795	0.196
1994	0.479	0.293	0.124	0.197	0.22
1995	0.467	0.431	0.202	0.216	0.121
1996	0.363	0.199	0.092	0.263	0.127
1997	0.309	0.259	0.106	0.095	0.084
1998	0.296	0.066	0.051	0.105	0.037
1999	0.257	0.186	0.052	0.159	0.072
2000	0.200	0.025	0.007	0.294	0.054
2001	0.250	0.161	0.062	0.063	0.032
2002	0.155	0.158	0.04	0.223	0.165
2003	0.129	0.105	0.091	0.212	0.101
2004	0.014	0.021	0.034	0.261	0.029
2005					
		Pearson correl w/landings		full data series	
		0.24	0.16	0.43	0.40
		Fall	Fall	Spring	Spring
		mean wt/tow	mean #/tow	mean wt/tow	mean #/tow
		same since 1983			
		0.55	0.53	0.91	0.81

APPENDIX V—CENSUS OF MAINE LIFE ANALYSIS

Gulf of Maine Area Program

Atlantic Wolffish (*Anarhichas lupus*)

Abundance and Distribution in the Gulf of Maine

Fall Surveys, 1963-2004

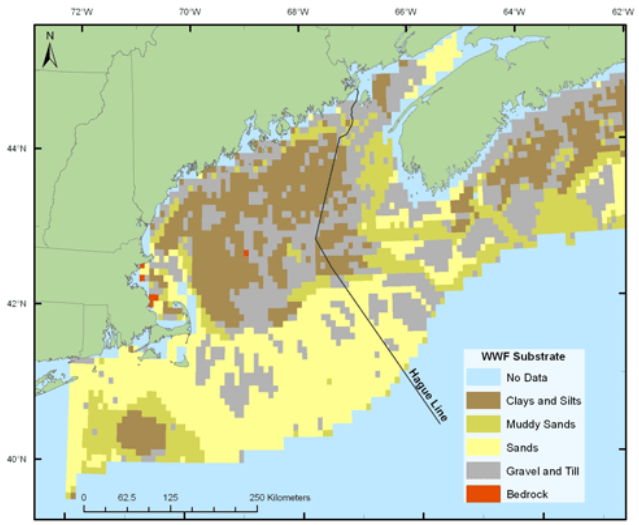
How have wolffish populations changed through time? Are there any patterns in wolffish populations that may be correlated with habitat?

We compared the sampling effort and frequency of occurrence of Atlantic wolffish in the Gulf of Maine with the corresponding substrate and charted changes in their population over time within specific habitat areas.

Significance

> This study demonstrates how the National Marine Fisheries Service (NMFS) database can be used to investigate the changing population of a single species through time. These data show wolffish abundance decreasing through time, and they indicate linkages between wolffish abundance and substrate as approximated by the World Wildlife Fund Gulf of Maine substrate layer.

Substrate

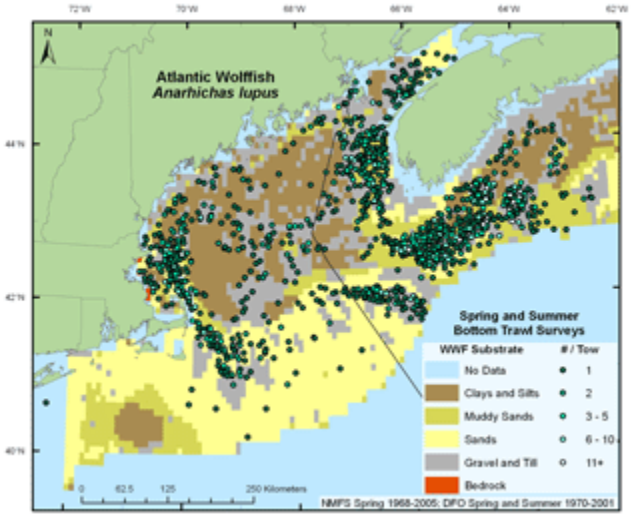


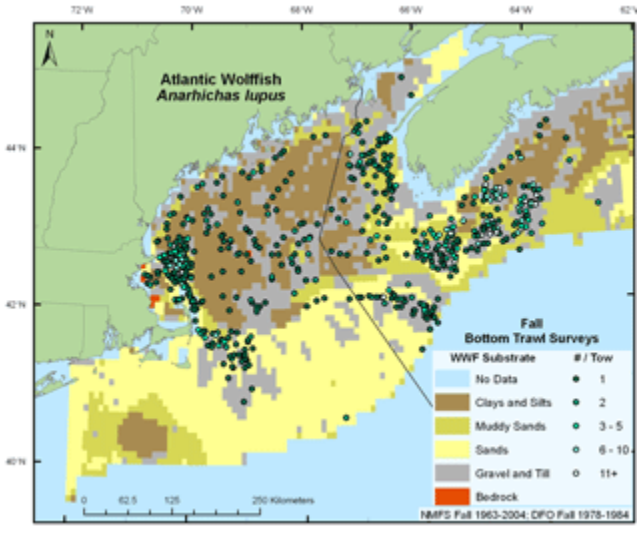
The coarse resolution of the World Wildlife Fund substrate layer, shown above, provides an indication of basic substrate types in the Gulf of Maine.

Spring & Summer

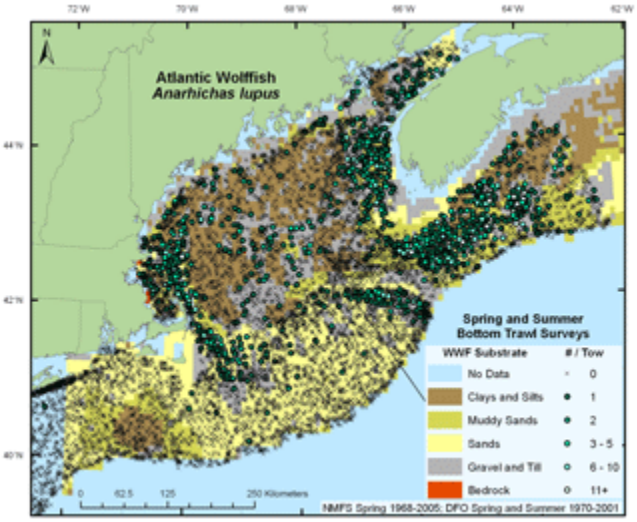
Fall

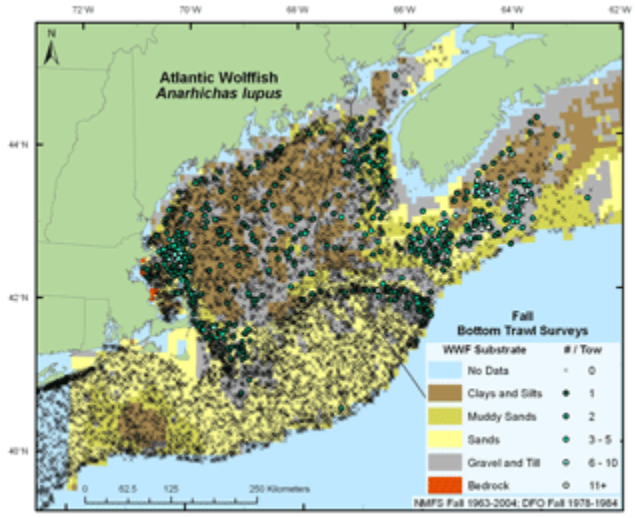
Maps of Wolffish Abundance



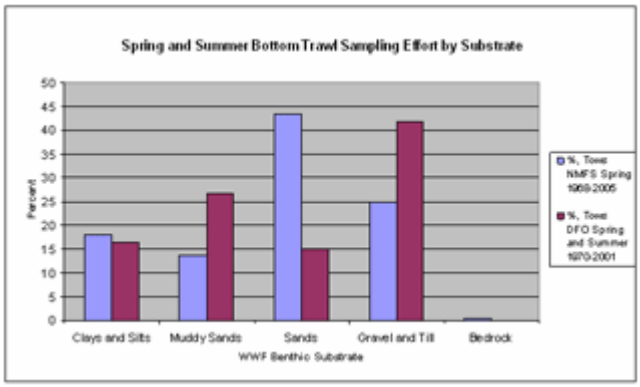


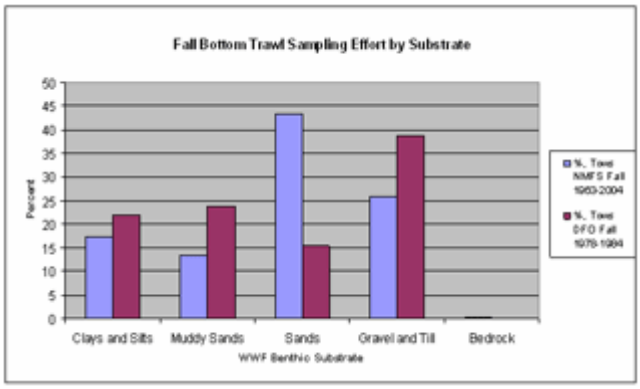
Maps of Wolffish Abundance Including the Zero Tows





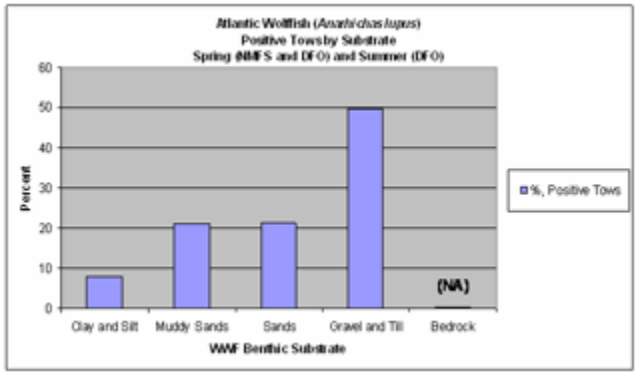
Graphs of Sampling Effort by Substrate

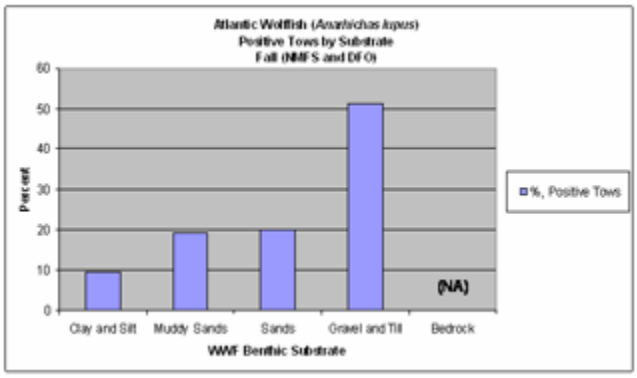




This shows no sampling on bedrock and ample sampling on the other substrate types.

Graphs of the Distribution of Positive Tows by Substrate

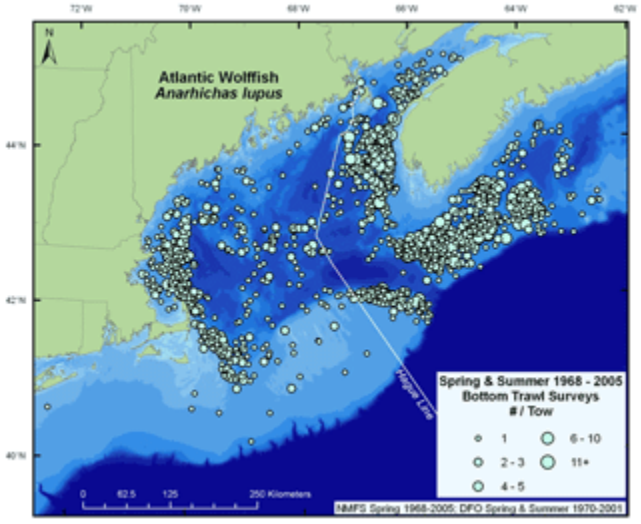




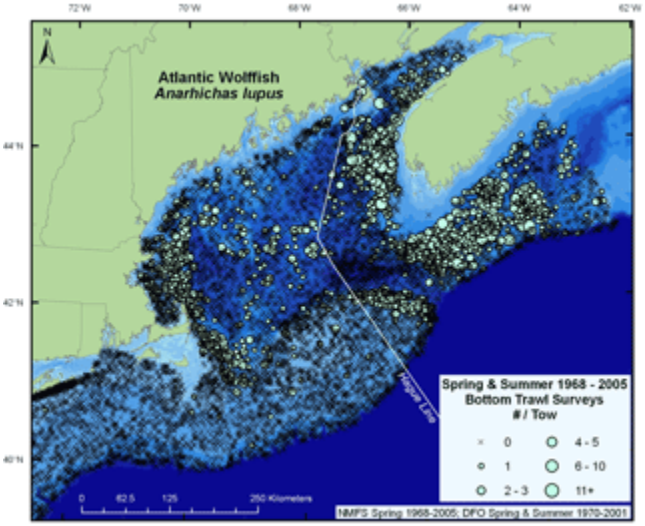
The positive tows for wolffish in the Gulf of Maine occurred in these substrates as shown by the above proportions. (*E.g. approximately 50% of all tows positive for wolffish were taken on gravel and till.*) There is no significant change between seasons.

Abundance

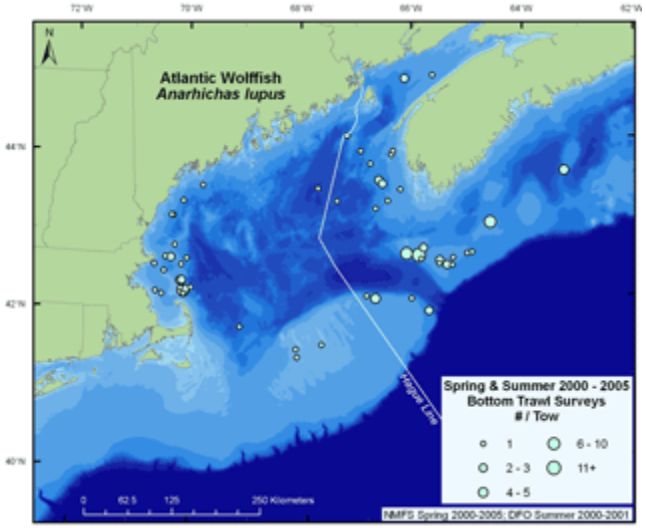
Map of Wolffish Abundance, Spring and Summer 1968-2005



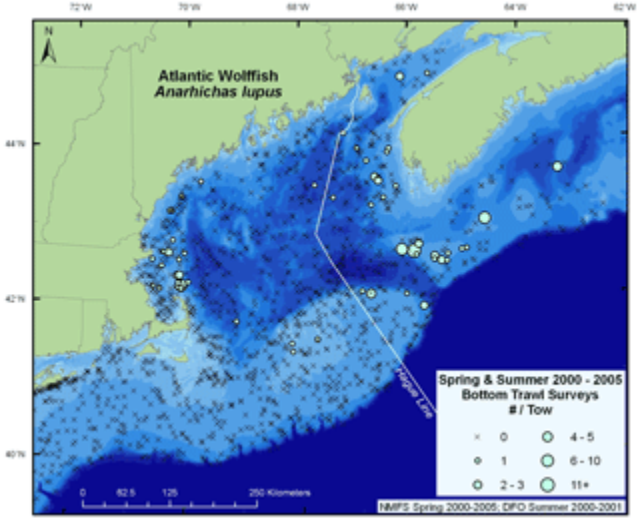
Map of Wolffish Abundance, Spring and Summer 1968-2005 including zero tows



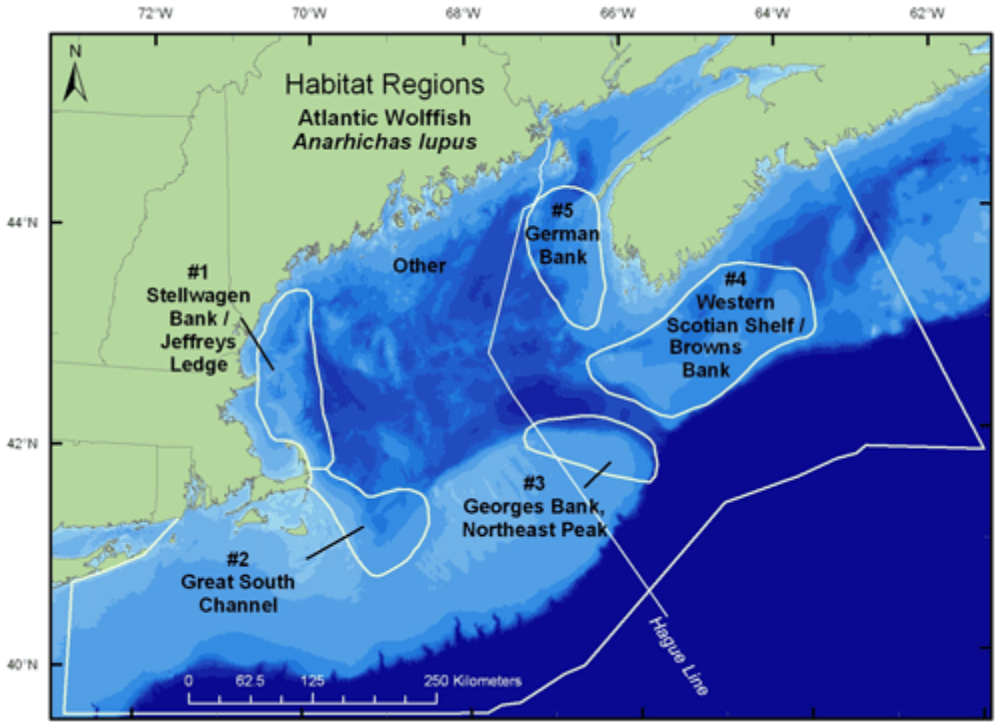
Map of Wolffish Abundance, Spring and Summer 2000-2005



Map of Wolffish Abundance, Spring and Summer 2000-2005 including zero tows

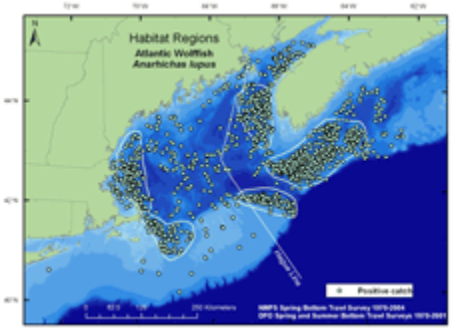


Habitat Regions

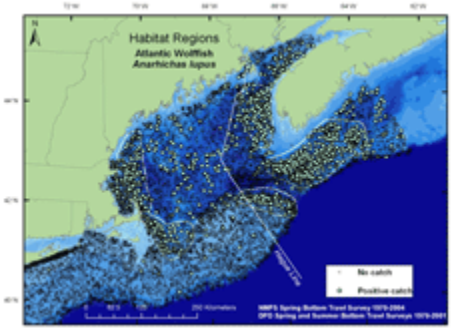


The habitat regions represent areas where wolffish have been recorded by NMFS (National Marine Fisheries Service, United States) and DFO (Department of Fisheries and Oceans, Canada) surveys through time. We created the habitat region boundaries as a way of exploring wolffish abundance over time in specific areas in the Gulf.

Map of Positive Wolffish Tows



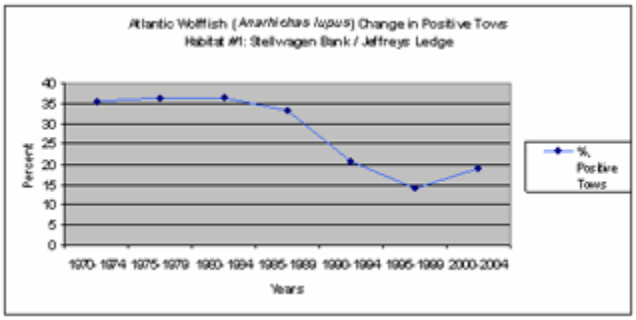
Map of Sampling Effort



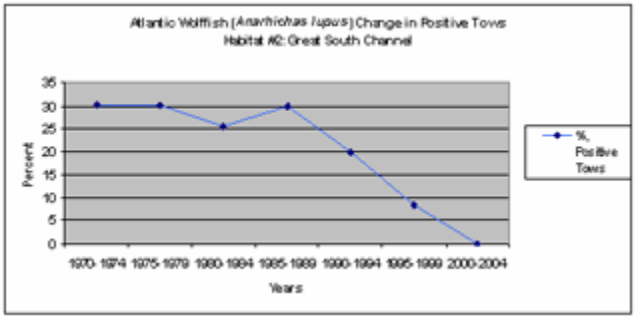
Change in Positive Tows within the Habitat Regions

Data Sources: NMFS Spring Bottom Trawl Survey 1970-2004; DFO Spring and Summer Bottom Trawl Surveys 1970-2001

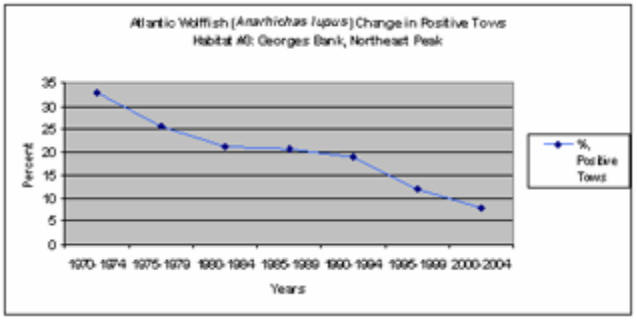
#1 Stellwagen Bank / Jeffreys Ledge



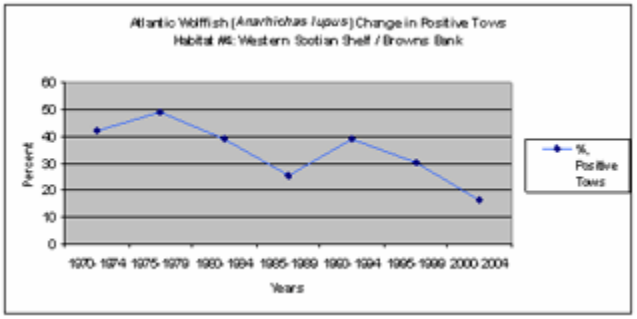
#2 Great South Channel



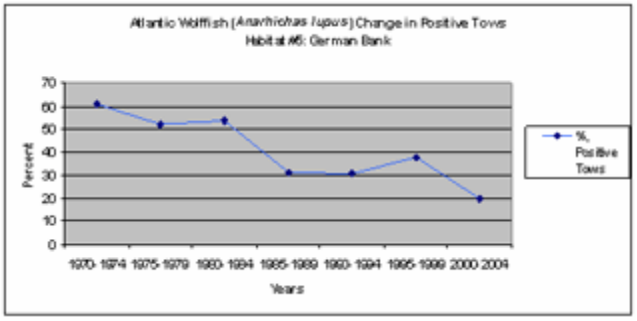
#3 Georges Bank, Northeast Peak



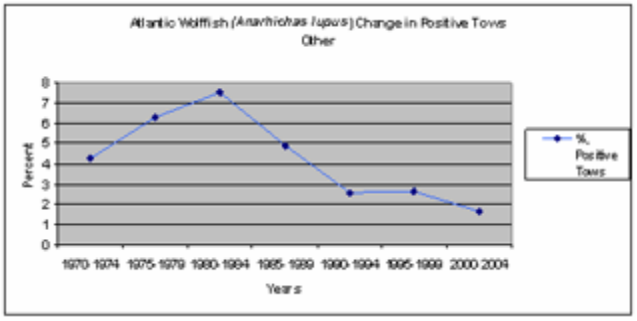
#4 Western Scotian Shelf / Browns Bank



#5 German Bank



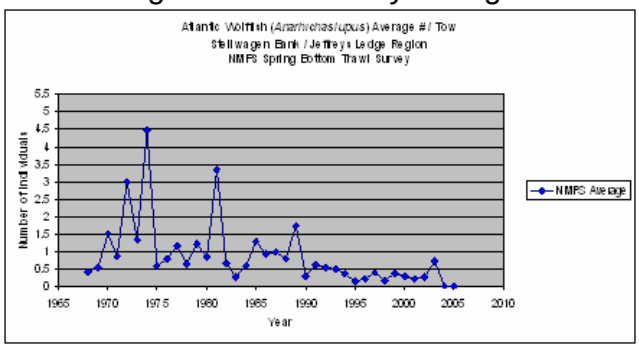
Other (Gulf of Maine outside of defined Habitat Regions)



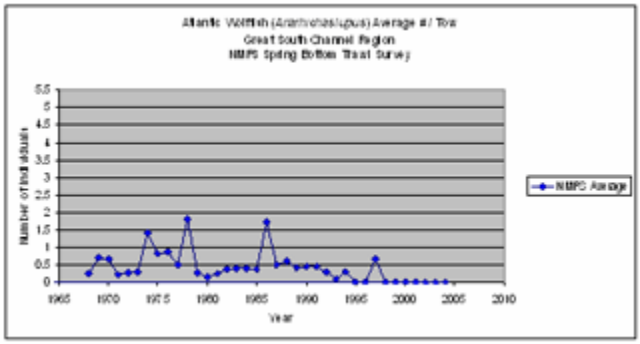
Average Number of Wolffish per tow within the Habitat Regions

(Average Number Based on All Tows)

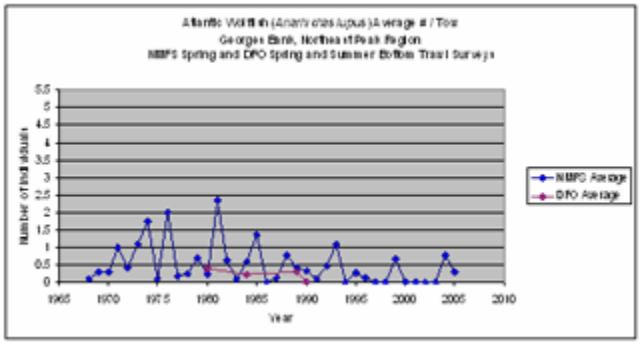
#1 Stellwagen Bank / Jeffreys Ledge



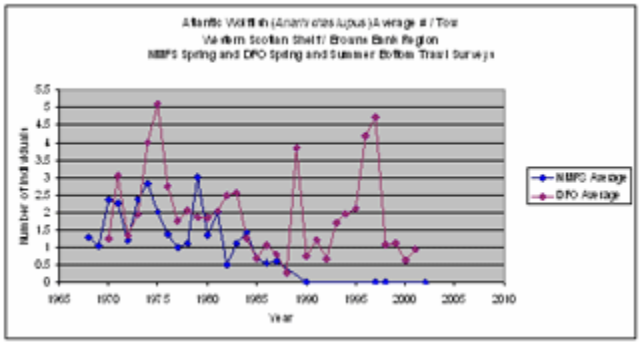
#2 Great South Channel



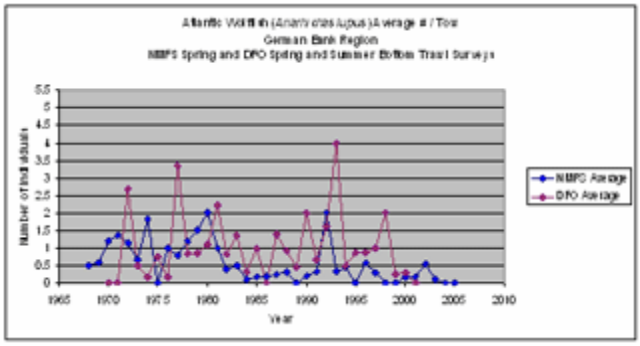
#3 Georges Bank, Northeast Peak



#4 Western Scotian Shelf / Browns Bank



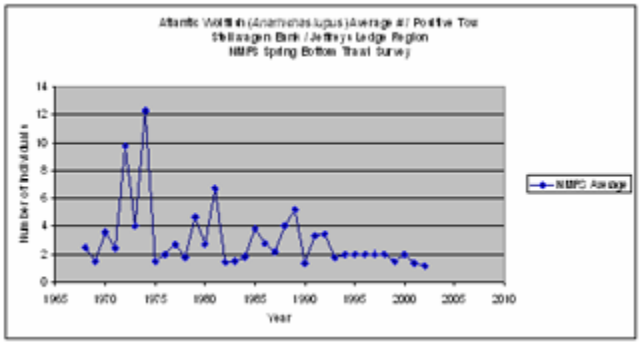
#5 German Bank



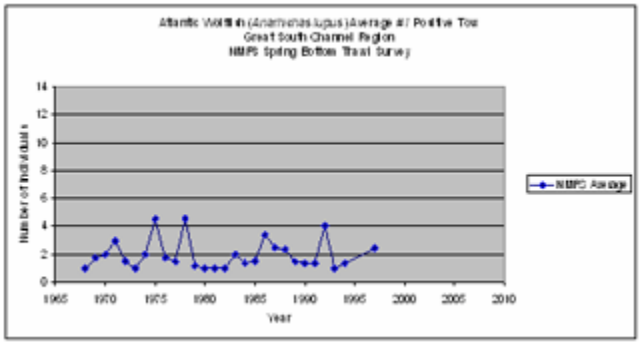
Average Number of Wolffish per positive tow within the Habitat Regions

(Average Number Based on Positive Tows)

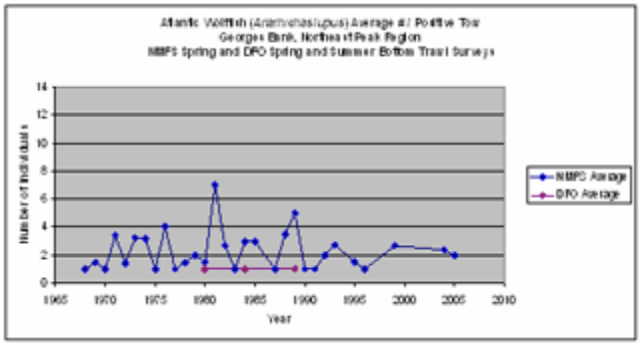
#1 Stellwagen Bank / Jeffreys Ledge



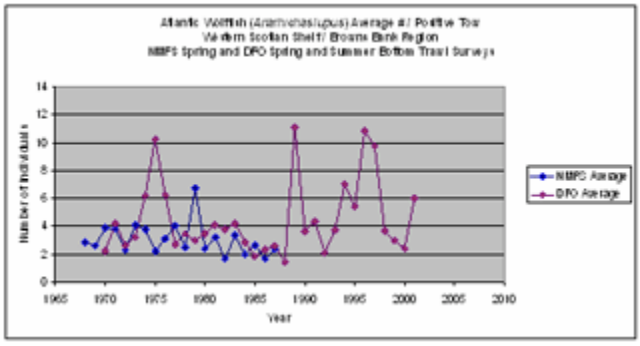
#2 Great South Channel



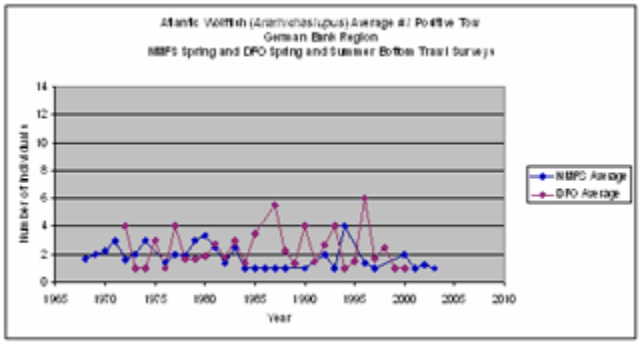
#3 Georges Bank, Northeast Peak



#4 Western Scotian Shelf / Browns Bank

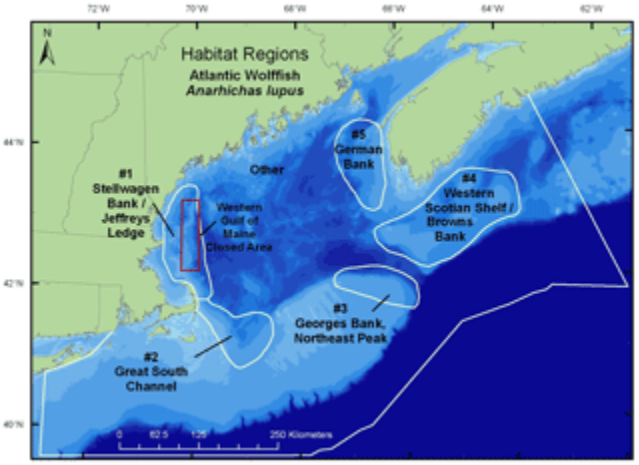


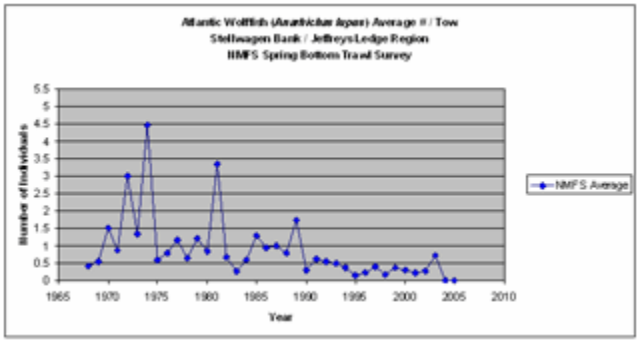
#5 German Bank

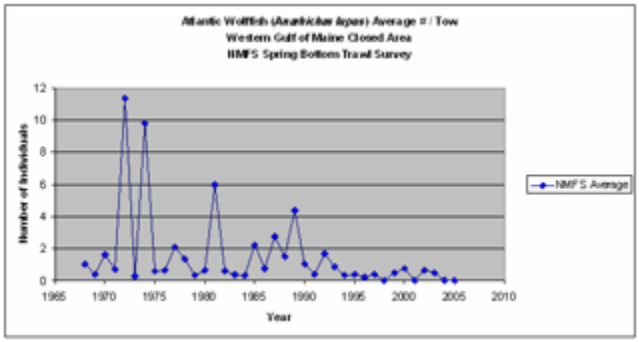


Western Gulf of Maine Closed Area

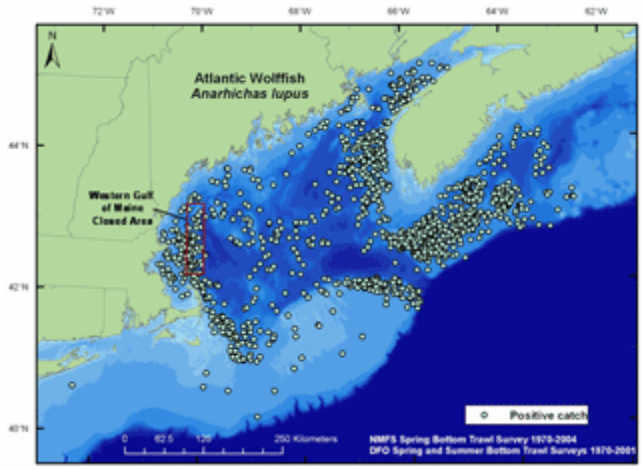
Map of Gulf of Maine Closed Area and Habitat Regions and Figures of the Number of Wolffish per Tow

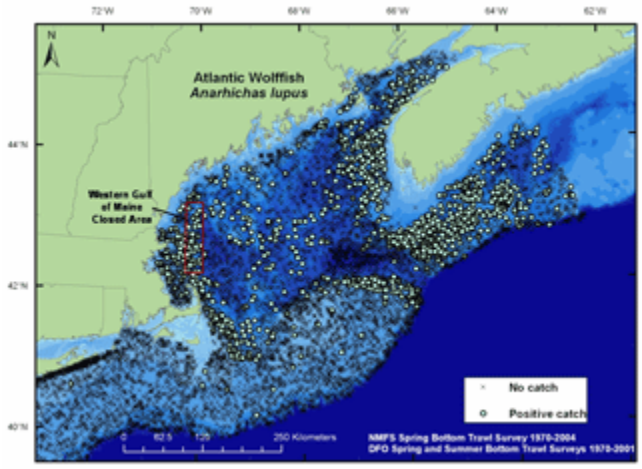






Maps of the Gulf of Maine Closed Area and Wolffish Distributions and Sampling Efforts





Data Sources

Data

NMFS (National Marine Fisheries Service): The NMFS data were obtained by Erica Fuller through Chad Keith. The NMFS data were already separated into spring and fall surveys.

DFO (Department of Fisheries and Oceans, Canada): The DFO data were a lab copy.

Base maps

WWF Benthic Substrate:

The substrate layer is a product of a WWF-Canada and CLF project Classifying and Mapping Physical Habitat Types (Seascapes) in The Gulf Of Maine and The Scotian Shelf: Seascapes Version to May 2003 by Hussein Alidina and John Roff. The data were displayed by the substrate field and the colors reflect the substrate as illustrated in Figure 5.12 of the report: http://gmbis.iris.usm.maine.edu/Documents/FInal%20Seascapes%20Methods%20Report%20May%202003.pdf Metadata: http://gmbis.iris.usm.maine.edu/WWF%20Pelagic%20Seascapes%20Metadata.xml.

Canada:

Paskevich, Valerie, 20020401, CANADA: Eastern Canadian Provinces:, U.S. Geological Survey, Coastal and Marine Geology Program, Woods Hole Field Center, Woods Hole, MA. http://pubs.usgs.gov/of/2003/of03-001/data/basemaps/canada/canada.htm.

USA:

Paskevich, Valerie, and Environmental Research Institute, Inc. (ESRI), 20010331, USA: United States basemap data layer for the Gulf of Maine surficial sediment GIS project.: U.S. Geological Survey, Coastal and Marine Geology Program, Woods Hole Field Center, Woods Hole, MA. http://pubs.usgs.gov/of/2003/of03-001/data/basemaps/usa/usa.htm.

Bathymetry:

USGS Digital bathymetry of the Gulf of Maine, constructed by Ed Roworth and Rich Signell, gom15dd. http://pubs.usgs.gov/of/1998/of98-801/bathy/index.htm.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Geophysical Data Center, 2001. **2-minute Gridded Global Relief Data (ETOPO2)** http://www.ngdc.noaa.gov/mgg/fliers/01mgg04.html

Western Gulf of Maine Closed Area:

Center for Marine Conservation (Carol Baumann), 20010419, nmfs closures: part of the Marine and Coastal Protected Areas Mapping Project, Center for Marine Conservation, Washington DC.

NMFS NEFSC Bottom Trawl Survey 1963-2003

This bottom trawl survey data are provided by the Northeast Fisheries Science Center of the U.S. National Marine Fisheries Service in Woods Hole, MA, USA. This is the U.S. analog to the DFO Bottom Trawl Survey. Data is provided for 1963 through 2003.

APPENDIX IV — CLF MULTISPECIES AMENDMENT 16 SCOPING COMMENTS (12/29/06)

Conservation Law Foundation

December 29, 2006

John Pappalardo
Chairman
New England Fishery Management Council
210 Orleans Road
North Chatham, MA 02650

Paul Howard, Executive Director
New England Fishery Management Council
50 Water Street, Mill #2
Newburyport, MA 01950

Via email to comments@nefmc.org

Re: Multispecies Amendment 16 – Scoping Comments

Dear Mr. Pappalardo, Mr. Howard, and Members of the New England Fisheries Management Council:

The Conservation Law Foundation (CLF) commends the Council for its decision to examine new approaches to groundfish management in New England, and we thank you for providing the opportunity to make recommendations for issues to be analyzed in Amendment 16 and its environmental impact statement.

I. Amendment 16 Must Ensure That Rebuilding Mortality Objectives Are Achieved with a High Probability of Success

Foremost, Amendment 16 must make the adjustments to mortality rates and management measures necessary to achieve the mortality objectives for the rebuilding plan established through Amendment 13. These adjustments will be informed by the 2008 groundfish stock assessment. Through Amendment 16, the NEFMC and NMFS need to change the historic pattern of implementing management measures – primarily input controls like cuts in Days-at-Sea – that fail to achieve the fisheries mortality objectives. One way to help break this pattern is to enact the management measures that have an increased probability of success. While there is apparently some debate as to whether the NEFMC has applied probabilities of success to its alternative management measures in the past, at best the NEFMC like many other councils, has operated under the assumption that a 50 percent probability of success is sufficient. Given New England's historic failure to achieve its mortality targets, CLF strongly encourages the Council to adopt a probability of success that is significantly greater than that of a coin-flip; at a minimum a 75 percent probability of success would be appropriate.

Further, the Amendment 13 plan relies primarily on mortality objectives set at the fishing rate that would produce maximum sustainable yield (MSY). Amendment 13, however, defines optimum yield (OY) at 75 percent of MSY. The NEFMC should base annual catch limits in New England on the rates necessary to achieve OY, which would help to ensure that overfishing does not occur.

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MASSACHUSETTS: 62 Summer Street, Boston, Massachusetts 02110-1016 • Phone: 617-350-0990 • Fax: 617-350-4030
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1. The 2008 Stock Assessment and Amendment 16 Can Not Be Used to Re-examine Biomass Targets

While Amendment 13 contemplated a re-examination of biomass targets as part of the 2008 stock assessment and 2009 mid-term adjustment, the failure to achieve the target fishing rates during the initial years of the plan will prevent this re-examination from taking place. Specifically, Amendment 13 and its implementing regulations state that such an examination could occur if the mortality objectives (primarily set at Fmsy) were met in the initial years of the plan. As was made clear in the 2005 stock assessment update (GARM II) and the analysis for Framework 42, the groundfish plan's mortality objectives have not been achieved. It is important given the amount of work that will need to be completed for Amendment 16 and its tight timeframe that the council utilize the NEFMC staff and NEFSC resources effectively. Undertaking a reexamination of the biomass targets, which would be in violation of regulations, would not be an effective use of limited resources. Limited resources should be dedicated to improving the stock assessments themselves in order to address things like the historic retrospective patterns in many stocks that have repeatedly resulted in over-estimates of biomass and underestimates of fishing mortality. More rigorous analysis of proposed measures in order to determine their probably of success with increased accuracy should also be made a priority. The biomass targets establish through the 2001 stock assessment (GARM I) underwent a rigorous peer review which concluded the new targets were justified by the best available science. Absent any new evidence, indicating review of these targets is warranted, they should not be reexamined.

II. Amendment 16 Should Move Toward a New System for Groundfish Management

Although it was a difficult decision, the NEFMC also deserves credit for taking steps through Framework 42 to reduce fishing mortality beginning in 2006, bringing mortality back in line with the rebuilding plan. The Framework 42 exercise helped convince many that the NEFMC needs to examine new approaches to groundfish management as part of its scheduled 2009 mid-term adjustment to the rebuilding plan. Specifically, it appears that the NEFMC recognizes that the New England-wide "one-size-fits-all" management that is characteristic of its current regulatory approach, which relies primarily upon regulating the number of days fishermen can fish, has not been an effective tool for ending overfishing and rebuilding fish stocks. The Framework 42 exercise should also make clear that the days-at-sea approach is not working for fishermen trying to manage a business, especially smaller boat fishermen who are leaving the fishery because they do not have enough days left to fish and lack the capital to buy or lease additional fishing effort. New approaches to groundfish management should seek to improve the likelihood of rebuilding success through systems that increase accountability while increasing the flexibility fishermen seek to target healthier stocks.

1. The Council Should Accept for Consideration as One Alternative for a New System of Groundfish Management "Local Area Management"

The Conservation Law Foundation submitted a letter in support of the Area Management Coalition (AMC) proposal for development of a "Local Area Management" system of groundfish management as part of Amendment 16 to New England's multispecies fishery management plan (Groundfish FMP). We request that you consider Area Management as one groundfish management system alternative for analysis in the Amendment 16 Environmental Impact Statement.

The Northwest Atlantic ecosystem, the fish populations it supports, and fishing communities throughout New England continue to suffer due to depleted fish populations resulting from the failure of the existing groundfish management system to achieve its conservation and rebuilding goals. It is CLF's view that a shift to Area Management would help the Groundfish FMP to meet its conservation and

rebuilding goals through reduced reliance on input controls, improved accountability, and increased stewardship from fishermen provided with a more active role in managing the areas they fish. The opportunity for finer scale management presented through the AMC proposal provides the best opportunity to begin addressing the distinct needs of specific ecological areas that lie within the larger, New England management area. It will provide the NEFMC with new tools for the protection of local stocks, for the creation of appropriate management measures that can increase flexibility for fishermen while ensuring accountability, and for the development of new economic opportunities for fishermen.

Please see the Local Area Management proposal submitted by the Area Management Coaltion for further details and discussion supporting this approach to groundfish management.

2. The Council Should Also Consider a "Point System" and Additional Sectors, Which Could Be Implemented in Conjunction with Local Area Management

CLF has not had an opportunity to closely examine the more fully developed point system proposal being prepared by the Northeast Seafood Coalition (NESFC), however, based on our knowledge including discussion with the NESFC, we believe that the point system merits consideration as an alternative management system in Amendment 16. We note that if a point system is approved by the Council, it could be used in conjunction with a Local Area Management system to help ensure accountability and provide some of the flexibility fishermen seek. The details for how these two systems could work independently and together should be developed through the Amendment 16 EIS.

III. Regardless of the Management Scheme, Amendment 16 Must Adopt New Measures to Ensure Accountability

Such measures need to prevent overfishing ensure that depleted stocks rebuild by achieving the mortality targets contained in the rebuilding plan control rules, minimize bycatch, and protect habitats, especially those habitats critical to the growth and survival of juvenile fish. Central to this effort will be establishment of enforceable catch limits for both target species and bycatch, including bycatch of species not commercially managed. The recently reauthorized Magnuson-Stevens Act requires the NEFMC to set annual catch limits based on the recommendations of its Science and Statistical Committee and to ensure accountability for meeting those limits. As the Council moves forward with Amendment 16 and considers alternatives to the DAS management regime, the Council must take this opportunity to adopt effective management measures that will ensure accountability regardless of the management system adopted.

1. Amendment 16 Should Establish Hard TAC Backstops for All Managed Groundfish Species Applicable to Any Management System or Program

Regardless of the management system ultimately adopted through Amendment 16, and for any individual program established under the groundfish FMP (e.g., sectors, co-operatives, point system), an annual catch limit made enforceable through a hard-TAC backstop must be established to provide a failsafe for ensuring accountability.

It is known that poorly designed hard-TAC systems can have unintended consequences, such as derby fishing. With modern information systems and years of experience with designing various management measures that can pace a fishery, such results are entirely avoidable.[1]

[1] Some participants in N.E. groundfish management commonly refer to New Engalnd's failed experience with the hard-TAC program of the 1970's. It is also appears to be common knowledge that the program failed because of

Examples of accountability measures that can improve administration of such an enforceable system include the following:

Enforceable Annual Catch Limits: Establish area where an annual catch limit will be assigned for each managed stock with accountability assured through a hard-TAC backstop.

Option 1: Once a stock's TAC is reached, the area (area where the stock is) will close to all gear capable of catching the stock. This would occur for the specific TAC period (e.g., quarter, month, etc.).

Option 2: Overage Provision up to 10% above the TAC – A deduction would be required from the TAC for the stock for the period (e.g. week, quarter or year (annual catch limit)). The Area will close to all gear capable of catching the stock if 110% of the TAC is reached in any TAC period

Measures to Pace the TAC: Input controls should be developed for each Area designed to ensure the TAC is not exceeded and to pace the distribution of the TAC across the fishing year (e.g. quarters, months, etc.).

Underages: "Underages" for any stock within a fishing year may be carried over to the following defined TAC period (e.g., week, month, quarter) within the area. While underages cannot be carried over from year-to-year, if fishermen form into sectors or an entity to manage an area and that sector or participants in an area stay under the area TAC they should not be penalized for overfishing that takes place in other areas.

Full retention: All managed fish stocks caught should be retained and counted toward the sector, area, or other applicable TAC.

3. New Measures to Avoid and Minimize Bycatch Including Expanded Use of Byactach Caps

Amendment 16 must continue efforts by the NEFMC to effectively avoid and minimize bycatch in the grounfish fishery, and fisheries where groundfish are caught. Among these measures, Amendment 16 should implement expanded use of bycatch caps for all managed fish species, both within and outside the groundfish FMP, and non-managed species that are identified as risk (see discussion of Atlantic wolfish and cusk below). Bycatch should also be developed for protected species including sea turtles and marine mammals. When a bycatch cap is reached for any given management time period (e.g., if the annual catch limit is divided by time period) in an area where the stock is likely to be caught, the fishery should close down to all gear capable of catching that species within the area. The use of such caps builds incentives into the fishery to avoid the species of concern and protects it from over-exploitation.

4. Funding for Additional Observer Coverage

Amendment 16 should consider alternatives for industry funding of at lease some observers as part of any new management system or program. Increased levels of observer coverage benefit all parties interested in groundfish management, will contribute to rebuilding through use of bycatch data to design better fishery management measures, and as stocks rebuild industry should be expected to contribute to increasing observer coverage to appropriate levels (*see* Draft Omnibus SBRM Amendment) or to

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widespread cheating, poor information management, and lack of enforcement, all matters that can now be addressed in modern fisheries management.

development of new more cost-effective monitoring technologies (e.g., video) sufficient to monitor the fishery and ensure accurate and precise estimates of catch, including discards.

IV. As Part of an Effective Management System Ensuring Accountability, Amendment 16 Must Adopt New Measures to Ensure Adequate Monitoring of Mortality

In order to achieve the FMP goals and to meet the accountaibility requirements of the newly reauthorized MSA, Amendment 16 must finally establish effective measures to monitor mortality or target and non-target species.

1. Observer Coverage and Observation Technology

At-sea observers are recognized as the most effective method to monitor catch and bycatch in a fishery. The Omnibus SBRM Amendment discusses the benefits of observer coverage and proposes a method for determining adequate levels of observers in the fishery by gear type and species. Amendment 16 must be used as the vehicle to specify levels of observer coverage to assess bycatch at precise enough levels to manage the fishery using mortality caps, as required by the 2005 federal court decision related to bycatch requirements in this fishery.[2] In addition, the Council should consider alternatives for improving bycatch information through the use electronic video monitoring, recently studied on an experimental basis by some New England fishermen.

2. Vessel Monitoring Systems

Vessel monitoring systems (VMS) provide crucial time and area information about the multispecies fishery and can contribute to real time reporting of catch and bycatch. To date, VMS has only been required for some, but not all programs within the groundfish fishery. Amendment 16 should require VMS for all fishery participants.

3. Real Time Landings Reporting and Catch Estimates

Amendment 16 should establish the use of real-time landings and bycatch reporting throughout the fishery in order to enable more dynamic and adaptive management such as specific area closures when mortality limits are approached.

4. Addressing Recreational Data Quality

An ongoing problem with New England fisheries management is the poor quality of recerational fishing data. Amendment 16 should be used to consider appropriate alternatives in improve recreational fishing data including increased use of electronic reporting, where appropriate, and review of other existing reporting protocols.

V. ADDITIONAL ISSUES

1. The NEFMC Should Take Action to Manage the Wolffish

The Atlantic woflfish have been recognized by the NOAA Fisheries Proactive Conservation Program as a *Species of Concern* with vulnerable life-history characteristics. Existing regulations are inadequate to protect this severely depleted species, and trawl survey and landings data over time indicate

[2] *See Conservation Law Foundation v. Evans*, D.D.C. No. 04-811 ESH at 79-82 (March 9, 2005)(*consolidated as Oceana v. Evans).*

declining wolffish abundance. Further, a dramatic decrease in it spatial range indicates that it is at risk of never recovering to healthy levels, and ultimately may be at risk of extinction if immediate action is not taken. Because the wolffish is not the subject of a directed fishery in the Northwest Atlantic it remains unmanaged and unregulated, thus no regulatory protections exist. The listing as a *Species of Concern* affords the wolffish no protection.

Atlantic wolffish are benthic, predatory fish that prefer to live and nest in areas with a complex bottom relief such as rocks and large stones, making bottom trawling, dredging, and other destruction of their habitat a significant threat. Nesting behavior, in particular, also appears to make the wolffish vulnerable to bycatch. Wolffish eggs are laid in a "nest" at the bottom, which if disturbed jeopardizes the nest and the larvae and makes the wolfish vulnerable to habitat impacts. Wolffish were historically found primarily in the deeper waters of the continental shelf on rocky or hard clay bottoms, preferring boulder fields and only occasionally sand or mud, and the evidence indicates this has not changed despite recent significant declines in abundance. The best available scientific data appears to indicate that there is only a single remaining significant population of wolffish in U.S. waters, located in the Jeffrey's Ledge/ Stellwagen area. This population appears geographically and in all likelihood genetically isolated from other remnant populations in the Gulf of Maine and Georges Bank areas, and the existing population is not widely dispersed. Limited migrations of these fish put it at further risk of decline and decrease the likelihood that the gaps between the remaining population and remnant populations can be bridged to help recovery, absent regulatory protection.

More than twenty years ago in Newfoundland and Greenland, the Atlantic wolffish was the subject of a directed fishery, but today primarily figures in US commercial landings as bycatch. Wolffish caught as bycatch are landed and sold commercially. Historically, the wolffish has been caught as bycatch in gillnets, otter trawls, trammel nets, seine nets and rarely with hand lines and long lines. The wolffish are especially vulnerable in the spring to the otter trawl fisheries when out feeding and on their limited migrations to shallower or deeper waters. Although the wolffish is occasionally caught by recreational fishermen, it does not appear to be significant enough to play a role in population dynamics. Its plentiful plates of teeth as well as its aggressive disposition make it difficult to handle for commercial fishermen and a poor candidate for scientific research.

Population dynamics and stock assessments for this species are not currently maintained by NMFS although there is survey trawl data as well as commercial landings from 1963 to today, showing steady declines from the high recorded abundance levels in 1983. Communications with NEFSC indicate there are no spawning stock biomass projections for this species as the life history data is not analyzed and/or currently unavailable. Commercial landings along the Northwest Atlantic peaked in 1983 at 1.196 mt, but have fallen steadily to under 0.014 mt in 2004 (last year available for NEFSC data). NMFS has recently been working on a new Status of the Stocks web page and completed data queries resulting in the maps supporting this analysis.[3]

The best available science indicates that the wolffish is unmanaged, over-exploited, severely depleted, and vulnerable to further, perhaps irreversible, decline. CLF urges the Council to take action through Amendment 16 to conserve this species including action to protect the wolffish from bycatch and further damage to its critical habitat.

2. The NEFMC Should Take Action to Manage the Cusk

Similar to the wolfish, available data show a significant decline in abundance and a dramatic decrease in the spatial range of the cusk over time resulting in severely depleted population levels. The cusk has also been recognized by the NOAA Fisheries Proactive Conservation Program as a Species of

[3] The maps are of spring and fall bottom trawl survey in roughly five year blocks with a density image in the background consisting of data from the entire time series.

Concern. As noted above, this designation affords no regulatory protections. Protection of the cusk takes on added significance as it is the only member of its genus in the world.

The cusk is a member of the cod family Gadidae. It was Listed as "threatened" on SARA (COSEWIC 2003), placed under bycatch limitations for the first time in 1999 (DFO Stock Status Report 2000) and a bycatch cap of 1000 tons was placed on the combined landings of all fleets. The cusk has a very restricted spatial distribution (core distribution is 41-44 degrees N in Gulf of Maine/Southern Scotian Shelf). Occurrences of the cusk outside of its core distribution are largely confined to the edge ands slope of the continental shelf in relatively deep water. The cusk prefers hard rocky substrate.

Unlike the wolfish, the eggs of the cusk are buoyant and dispersed in the water column making them less vulnerable to some of the habitat impacts that affect the wolfish. The cusk lay more eggs, and are among the most fecund of fishes (>1 million eggs in mature fish>60 cm.). The cusk is managed under Canadian jurisdiction as a "threatened" species with no directed fishery and a bycatch cap. Spawning grounds for the cusk appear to be largely unidentified and this information should be developed through Amendment 16. The core distribution of cusk straddles international boundaries and it is surveyed by both NMFS and DFO. Demersal juveniles and adults are slow moving, solitary, sedentary and do not school.

Cusk appear in small numbers on both sides of the US/CA border. Canadian data shows a decline in CPUE starting from late 1970 to early 80's. Over the full period, 1970-2001, 32 years or 3.5 cusk generations, CPUE declined by 93.4%. Population estimates for fish greater than 50cm (size of 50% maturity) closely follow declines in CPUE. A decline of 95.5% from 1970-2001 was observed. In the early 70's the CPUE was .21 individuals per tow. This number declined steadily reaching .02 in 1994. Over the whole range and full period 1970-1994, 25 years or about 3 generations, the number per tow declined by 90.4%.There were some directed fisheries until 1999, but most appear to be taken as bycatch on longlines that target Atlantic halibut, cod, haddock, and Pollock.

The available information indicates that the NEFMC should develop management measures for the cusk, including establishment of bycatch caps and other measures including potential gear modifications and closures designed to minimize bycatch and bycatch mortality. The Amendment 16 EIS should be used to identify whether additional areas for cusk habitat protection should be established.

3. Habitat Measures

Any effective rebuilding program must include measures to protect the habitat that is critical to fish survival, particularly habitat important to the survival and growth to maturity of juvenile fish. New England's Omnibus Habitat Amendment is due to be completed at about the same time as Amendment 16, and it is anticipated that it will include new measures to protect fish habitat important to juvenile groundfish. Amendment 16 should consider any additional habitat actions deemed necessary to help ensure that the rebuilding program continues on schedule, to implement a move to new groundfish management systems such as Local Area Management, or to protect habitat for species such as the wolfish or cusk that have not been considered as part of the Omnibus Habitat Amendment. A move to area management, for example, could require the NEFMC and NFMS to consider new mechanisms that would allow for faster, more adaptive changes to habitat closures based on new information provided by local fishermen or other interested parties. Moreover, the NEFMC should consider taking action, based on the ongoing analysis contained in the Omnibus Habitat EIS, to zone areas for fishing based on gear type and habitat. The most destructive fishing gears should be zoned away from the most vulnerable habitat.

Thank you for considering these comments. The Conservation Law Foundation looks forward to working with the NEFMC and other interested parties to address the difficult issues that continue to face

the groundfish fishery in New England. Should you have questions regarding these comments or wish to discuss any of the issues raised by these comments further, please contact me at rfleming@clf.org or by telephone at 207.729.7733.

Sincerely yours,

/S/_____
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