PETITION TO LIST

The Northwest Atlantic Distinct Population Segment (DPS) of the Thorny Skate (*Amblyraja radiata*) as an Endangered or Threatened Species or, Alternatively, to List the United States DPS of the Thorny Skate as an Endangered Species UNDER THE U.S. ENDANGERED SPECIES ACT

Photo by Bernd Ueberschaer

Submitted to the United States Secretary of Commerce, Acting through the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service

Petitioner:
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August 11, 2011

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Executive Summary

The Animal Welfare Institute (AWI) hereby petitions the Secretary of Commerce, acting through the National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA), to list, as a Distinct Population Segment (DPS), the Northwest Atlantic Population of thorny skates (*Amblyraja radiata*) as endangered [or threatened] throughout all or a significant portion of its range pursuant to the federal Endangered Species Act (ESA). In the alternative, AWI seeks an endangered listing for the United States DPS of the thorny skate. In addition, for the United States population, AWI seeks the designation of critical habitat as authorized by statute.

The thorny skate is a "K-selected" species and as such is relatively long-lived, reaches sexual maturity at a late age, and has a low fecundity. Given these life history characteristics and the species' limited ability to recover in response to abrupt population declines, the thorny skate is particularly vulnerable to overexploitation.

Thorny skate populations throughout the northwest Atlantic have declined precipitously over the past four decades. In Canada, where the species is still fished in a directed fishery, thorny skates have suffered a dramatic population decline since the 1980s that is conspicuously parallel to the species' decline in United States waters. Though the species is ostensibly maintaining historically low, relatively stable population numbers in Canadian waters currently, there is evidence of hyper-aggregation at the species' center of biomass for the northwest Atlantic, with 80% of the biomass now concentrated in 20% of the area along the southwest slope of the Grand Banks.[1] IUCN assessed the thorny skate population in Canada as "Vulnerable," however the New England Fishery Management Council (NEFMC) Fishery Management Plan (FMP) asserts that Canada's current Total Allowable Catch (TAC) limits for thorny skate exceed the recommended level of exploitation to rebuild the stock.

Though apparently persisting at historically low levels in Canada, the thorny skate is most imperiled in the United States where biomass indices have steadily declined since the mid-1970s and are currently at all-time lows. Despite the species' designation as "prohibited" since 2003 under NEFMC's Skate FMP, unsustainable bycatch mortality and illegal landings continue to drive down population numbers and threaten the species' survival in United States waters. Accordingly, the species is currently listed as a "Species of Concern" by NMFS and was assessed as "Critically Endangered" in United States waters by the International Union for Conservation of Nature (IUCN).

Regulatory mechanisms in Canada and the United States have been insufficient to promote significant stock rebuilding and improve the species' precarious status throughout the northwest Atlantic. Specifically, NMFS' regulatory scheme has failed to rebuild the thorny skate's seriously depleted population in United States waters. Therefore, NMFS should list the Northwest Atlantic population as endangered [or threatened] (or, alternatively, the United States population as endangered) pursuant to the ESA. For the United States population, NMFS should also designate critical habitat.

[1] Kulka *et al.* (2006) note that for other marine fish species (e.g., the northern cod), hyper-aggregation has been demonstrated to be a precursor to collapse (citing Rose and Kulka 1999).

Notice of Petition

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I. Specific Requested Actions

AWI hereby formally petitions the Secretary of Commerce, pursuant to 16 U.S.C. § 1533(b)(3), 5 U.S.C. § 553(e), and 50 C.F.R. § 424.14(a), to list, as a Distinct Population Segment (DPS), the Northwest Atlantic population of thorny skates (*Amblyraja radiata*) as an endangered [or threatened] species and thereby adopt and enforce a strict prohibition on all take of thorny skates and United States waters.

Alternatively, if NMFS determines that the Northwest Atlantic population of the thorny skates does not qualify for listing, AWI requests that NMFS list, as a DPS, the United States population of the thorny skate as endangered pursuant to the statutes and regulations referenced above. In addition, AWI seeks the designation of critical habitat for the thorny skate in United States waters as authorized by statute (16 U.S.C. § 1533(a)(3)(A)).

II. Petitioner

AWI is a national, non-profit charitable organization, dedicated to alleviating the suffering inflicted on animals by humans. AWI engages policymakers, scientists, industry professionals, non-governmental organizations, farmers, veterinarians, teachers, and the public in its broad animal protection mission.

AWI works to minimize the impacts of all human actions detrimental to endangered species, engages Congress to strengthen the ESA, and representatives of AWI regularly attend meetings of the Convention on International Trade in Endangered Species of Wild Fauna and Flora to advocate for the international protection of threatened and endangered species.

AWI can be contacted in Washington, D.C. at 900 Pennsylvania Ave. SE, Washington, D.C. 20003, telephone number (202)337-2332. If any correspondence related to this petition is to be sent by electronic mail, please direct it to AWI's Executive Director, Susan Millward, at susan@awionline.org.

III. NMFS Must Issue an Initial Finding within 90 Days that the Petitioned Action May Be Warranted

Upon receipt of this petition, the ESA requires NMFS to initiate a specific response process. First, within 90 days NMFS must "make a finding as to whether the petition presents substantial scientific or commercial information indicating that the petition action *may* be warranted" (16. U.S.C. § 1533(b)(3)(A) [emphasis added]). AWI need not demonstrate that the proposed revision action is warranted, rather, AWI must only present information demonstrating that such action may be warranted (16. U.S.C. § 1533(b)(3)(A)). Within 12 months of receiving this petition, NMFS is required to determine how it will proceed with the requested listing, moving forward with a proposed rule if it determines such action is warranted (16 U.S.C. § 1533(b)(3)(B)). A decision to list must be based on the "best scientific and commercial data available" (16 U.S.C. § 1533(b)(1)(A)).

While AWI believes that the best available science demonstrates that listing thorny skates (Northwest Atlantic population or, alternatively, the United States population) as endangered or threatened *is* warranted, there can be no reasonable dispute that the available information indicates that listing the species as endangered or threatened *may* be warranted, a conclusion which would necessitate NMFS issue a positive 90-day finding. Indeed, IUCN has assessed the global population of thorny skates as "Vulnerable" and assessed this species in United States waters as "Critically Endangered" (IUCN 2011).

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I. Species Account

A. Biology and Status

1. Taxonomy

Amblyraja radiata is most commonly referenced as the "thorny skate" or "starry skate" (IUCN 2011), though, for the purposes of this petition, "thorny skate" will be used exclusively. The thorny skate was formally in the genus *Raja* but was moved to the genus *Amblyraja* in 1998. The genus name is derived from the Greek "*amblys*" meaning blunt or dull and the Latin "*raja*" meaning stingray (IUCN 2011). (The full taxonomic description of the species is provided in Table 1 below.)

Kingdom	*Animalia* – Animal
Phylum	*Chordata* – Chordate
Subphylum	*Vertebrata* – Vertebrate
Class	*Chondrichthye* – Cartilaginous Fish
Subclass	*Elasmorbranchii* – Cartilaginous Fish, Ray, Shark, Skate, and Torpedo
Order	*Rajiformes* – Ray, Sawfish, Skate
Family	*Rajidae* – Ray, Skate
Genus	*Amblyraja* – Stout Skate
Species	*Amblyraja radiata* – Thorny (or Starry) Skate

Table 1: Taxonomic Hierarchy[2]

2. Physical Description

Thorny skates are distinguishable from other skate species by a combination of the following characteristics: the rostrum is stout and extends distinctly anterior to the anterior-most pectoral rays; thorns with radiate bases are present in a single row along the midline of the disc and tail; and the mid-row thorns from the nuchal region to the origin of the first dorsal fin (i.e., the middle of the back and tail) range from 11-19 (NEFSC 2003 citing McEachran 2002). The species is generally brown dorsally with a white ventral surface (NOAA 2007).

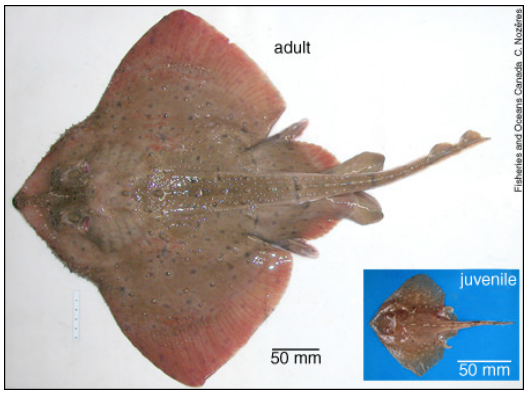

Figure 1: Photos of the Thorny Skate (Adult and Juvenile)
Source: Marine Species Guide for the St. Lawrence[3]

[2] See Integrated Taxonomic Information System (ITIS) Report, http://www.itis.gov/servlet/SingleRpt/SingleRpt. [Accessed June 2011]. ITIS is a coalition of federal agencies formed to create scientifically credible taxonomic information for use by the scientific community and the general public.

Thorny skates may reach lengths of over 39 in (1 m) total length (TL), but maximum size varies over its range and evidence suggests that size varies by locale (NOAA 2007). European thorny skates (e.g., from the North Sea) are smaller than those from Iceland and North America. Maximum sizes reported include 102 cm TL from Nova Scotia, 89.5 cm TL from Georges Bank, 80.0 cm TL from Massachusetts Bay, and 93.5 cm TL off the coast of New Jersey (NEFSC 2003). Thorny skate specimens captured off the Labrador coast have not been measured at lengths greater than 72 cm (Templeman 1987).

3. Geographic Range

The thorny skate is one of seven skate species endemic to the waters of the northwest Atlantic Ocean.[4] It is a boreal and arctic species found on both sides of the Atlantic Ocean from Greenland and Iceland to the English Channel in the eastern Atlantic (Compagno *et al.* 1989) and from the Hudson Bay, Canada, to South Carolina in the western Atlantic (Robins and Ray 1986; Collette and Klein 2002). The center of the thorny skate's abundance in the northwest Atlantic extends northward from the Gulf of Maine as far north as the Gulf of St. Lawrence, and the thorny skate is the predominant skate species on the Grand Banks and northeast Newfoundland Shelf (McEachran and Musick 1975; Kulka and Mowbray 1998). Northeast Fisheries Science Center (NEFSC) bottom trawl surveys indicate that in United States waters thorny skates are most abundant in the Gulf of Maine and on Georges Bank, with very few thorny skates caught inshore (<27 meters depth), around Southern New England, or in the Mid-Atlantic regions (NEFMC 2009).

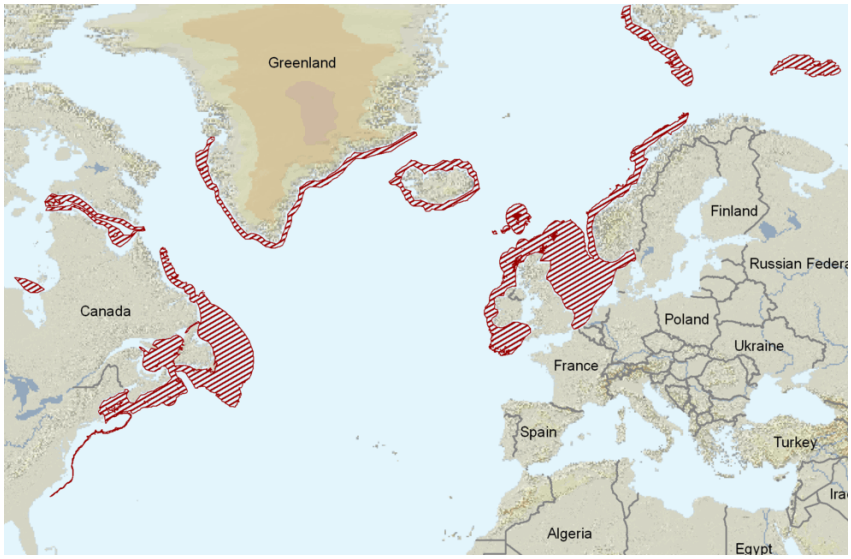

Figure2: Range of Thorny Skate

Source: IUCN Red List of Threatened Species, Thorny Skate (*Amblyraja radiata*) [5]

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[3] See http://slgo.ca/app-guidesp/en/poiss/sp/a-radiata.html [Accessed July 2011].

[4] In United States waters, the thorny skate is managed in a complex of seven native skate species with which it shares this portion of its range: the winter skate *(Leucoraja ocellata)*, little skate *(Leucoraja erinacea)*, barndoor skate *(Dipturus laevis)*, smooth skate *(Malacoraja senta)*, clearnose skate *(Raja eglanteria)*, and rosette skate *(Leucoraja garmani)* (NOAA 2007).

[5] See http://www.iucnredlist.org/apps/redlist/details/161542/0 [Accessed July 2011].

The greatest density of thorny skates in Canadian waters is in the Grand Banks region off Newfoundland, where it is managed as a single stock. The continuous distribution, lack of physical barriers on the Grand Banks, and a synchronous migration indicate that the stock found predominately in the Grand Banks region represents a single reproductive population (Kulka *et al.* 2006). Since the mid-1980s, however, the thorny skate's range on the Grand Banks has been contracting (Kulka and Miri 2003).

Several reports indicate that thorny skates can make short-distance seasonal migrations but generally remain sedentary. Limited seasonal migrations have been noted on the Scotian Shelf, which lies between the Grand Banks in Canada and United States waters (Simon and Frank 1996), and recent distribution studies show that thorny skate on the Grand Banks undergo a seasonal migration, shifting to deeper waters during the winter/spring and to shallower waters in the summer/fall (Kulka and Miri 2003). Notwithstanding these limited migrations, the species is generally considered non-migratory. A 20-year study in the Newfoundland area notes that most of the tagged skates were recaptured less than 97 km from their tagging location, indicating a relatively sedentary population (Templeman 1984). No studies suggest that the species endeavors a trans-Atlantic migration.

4. Life History and Reproduction

The thorny skate, like other elasmobranchs, is a "K-selected species," and as such is relatively long-lived, reaches sexual maturity at a late age, and has a low fecundity (Sulikowski *et al.* 2005a). Researchers aged thorny skates in the Gulf of Maine and found the oldest estimated age to be 16 years for both females and males (corresponding lengths – 105 cm for female, 103 cm for male) (Sulikowski *et al.* 2005a). The maximum lifespan of the thorny skate in the wild is unknown. In a separate study, Sulikowski *et al.* (2006) estimates that female thorny skates reach sexual maturity at approximately 11 years (corresponding length – 875 mm TL) and males at approximately 10.90 years (corresponding length – 865 mm TL).

Thorny skates are oviparous (i.e., egg layers) and reproduce throughout the year in the Gulf of Maine and in autumn months on the Grand Banks (Sulikowski *et al.* 2005b; del Rio 2001, 2002). While few studies have examined the fecundity and reproductive success for this species, the New England Fishery Management Council (NEFMC) extrapolated data from a 2008 study by Parent *et al.* using captive skates and estimated the thorny skate's mean annual fecundity at 40.5 eggs per year, with a hatching success of 37.5% (i.e., roughly 15 surviving hatchlings per year). Separate studies by Templeman (1987) and Walker (1998) estimate litter sizes of 10 to 45 eggs. Berestovskii (1994) estimates the thorny skate's embryonic development period to take 2.5 to 3 years, while separate laboratory studies estimate the development period of the embryos, in temperatures of 32°F to 49°F (-0.3°C to 9.5°C), at 2 to 2.5 years (FMNH 2011). Size at birth ranges from 8 to 12 cm TL (Berestovskii 1994; Kulka and Miri 2003; Walker 1998).

5. Habitat

Thorny skates are found over a wide variety of ocean floor substrates from sand, gravel, and pebbles to broken shell and soft mud (NEFSC 2003). In the northern Atlantic, they inhabit cooler waters with a

temperature range from -1.3°C to 14°C, while on the Grand Banks they are concentrated in bottom temperatures between 2.5°C and 5°C (McEachran 2002). Thorny skates can be found at a depth range of 18 to 1200 meters, but surveys from Nova Scotia to Cape Hatteras found that they generally occur at depths between 27 and 439 meters and are most abundant between 111 and 336 meters (NEFSC 2003). The species has been found in Gulf of Maine waters at depths greater than 26 meters and as deep as 669 meters along the upper part of the continental slope off southern New England (NEFSC 2003).

6. Prey and Predation

Thorny skates are both benthivorous and piscivorous, feeding opportunistically on the most abundant and available benthic invertebrates and forage fish throughout their range (NEFSC 2003). However, the thorny skate's diet is size-dependant. Larger thorny skates over 60 cm TL feed primarily on squid and fish such as herring, redfish, sculpins, wolfish, mackerel, sand lance, and flatfish, while smaller skates 20 to 60 cm TL feed mostly on polychaetes, euphausids, and decapods (Collette and Klein-MacPhee 2002).

Small sized skates (≤ 30 cm TL) consume approximately 500 g per year of prey items, while medium (31-60 cm TL) and large skates (>60 cm TL) consume around 1.5 kg and 12 kg per year, respectively (NEFMC 2009). Possible competition for prey resources exist between thorny and smooth skates. Although they are sympatric species (i.e., overlapping in distribution), the possible competition likely poses a limited threat to the thorny skate because it has a more diverse diet than the smooth skate (NEFSC 2003).

Predators of juvenile and adult thorny skates include seals, sharks, and halibut; predators of thorny skate eggs include halibut, goosefish, and Greenland sharks, and predatory gastropods can eat thorny skate embryos within egg capsules (NEFSC 2003).

7. Population Trends

The 2008 Skate Stock Assessment and Fishery Evaluation (SAFE) Report prepared by the NEFMC documents a precipitous decline in the thorny skate's abundance and biomass in United States waters since the late 1970s. In 1987, the biomass index for thorny skates initially fell below the established biomass threshold value (2.2 kg/tow) and biomass indices for the species have demonstrated a persistent decline since that year. When the skate Fishery Management Plan (FMP) was implemented in 2003, the thorny skate was listed as "overfished" because the biomass index that year (0.74 kg/tow) was below the established biomass threshold (2.2 kg/tow) and well below the biomass target (4.41 kg/tow) (NEFSC 2007).[6]

In addition to the thorny skate's "overfished" status, NMFS also ascribes a status designation that "overfishing is occurring" when three-year moving average of the species' biomass index falls more than

[6] The biomass *target* is estimated as the 75th percentile of the appropriate survey series for that species (i.e., 4.41kg/tow for thorny skates), and the stocks are declared to be "overfished" (i.e., below biomass threshold) when the three-year moving average of the NMFS trawl survey index (mean weight per tow) is less than one half of the 75th percentile of mean weight per tow of the reference survey series for that species (i.e., less than 2.20 kg/tow for thorny skates) (NEFMC 2006).

20% between reference points (NEFMC 2009). In 2009, NMFS determined that "overfishing is occurring" on thorny skates because the 2005-2007 three-year moving average was 24% lower than the 2004-2006 three-year average (NEFMC 2009). The most recent three-year average mean biomass survey from 2008-2010 (0.245 kg/tow) is the lowest in the entire time series, indicating that the population of thorny skates in United States waters is currently at its nadir (SPDT 2011).

Parallel to these downward trends in United States waters, Canadian indices of thorny skates also demonstrate a precipitous decline over the past four decades. The thorny skate dominates Canadian catches of skate species, comprising approximately 90% of rajids caught in survey trawls (NEFMC 2009 citing Kulka and Miri 2003) with the center of concentration of thorny skates in Canadian waters, as well as the northwest Atlantic generally, on the Grand Banks. Since the mid-1980s, the range of the thorny skate on the Grand Banks has been contracting (Kulka and Miri 2003). Canadian assessments indicate that the thorny skate population in this area has been near historically low levels for the last 14 years, and there is evidence of hyper-aggregation with 80% of the biomass now concentrated in 20% of the area along the southwest slope of the Grand Banks (Kulka *et al.* 2007). Kulka *et al.* (2006) notes that for other marine fish species (e.g., the northern cod), hyper-aggregation has been demonstrated to be a precursor to collapse (citing Rose and Kulka 1999).

8. Factors for Decline

The most pressing threat to the thorny skate in New England waters is commercial fishing where skates are taken primarily as bycatch during groundfish fishing operations. Since 2000, approximately 65-86% of total skate discards have been derived from otter trawl fisheries; scallop dredge gear is the second largest discard component, followed by sink gillnet gear (NEFMC 2009 citing NEFSC 2007). While research is currently underway to empirically assess discard mortality rates of skates caught as bycatch, acute discard mortality of thorny skates is assumed to be 50% (SPDT 2011). Delayed mortality resulting from injury, disease, or increased predation risk as a consequence of capture and release (or discard) has not yet been investigated in any skate species (NEFMC 2009).

Although reported skate discard rates have been declining since the 1990s, the decline likely corresponds to the increasing demand for skate wings (NEFMC 2009 citing NEFSC 2007) coupled with increasing restrictions on other, more profitable groundfish species (NEFMC 2009). The current market for skate wings is primarily an export market, with France, Korea, and Greece as leading importers. Seafood dealers prefer large-sized wings, and thorny, barndoor, and winter skates are all considered sufficiently large enough species to warrant processing. Despite a prohibition since 2003 on the possession and landing of thorny and barndoor skates in United States waters, NEFMC confirms that illegal thorny and barndoor skate wings still occur in landings (NEFMC 2009). Specifically, figures provided in the 2008 SAFE Report from NMFS Fisheries Statistics Office indicate that from 2006-2007 thorny skate wings comprised 3%, 6.7%, and 0.2% of sampled landings for Maine, Massachusetts, and Rhode Island respectively (NEFMC 2009).

Further, thorny skate distribution overlaps with the geographic area of the most significant portion of directed fisheries for other skate species like the winter skate, which is targeted for its wings as well as for lobster bait (NOAA 2007). Although the 2003 Skate FMP implemented reporting requirements that included species-specific codes (e.g., code 3700 for thorny skates), currently landings in the United States are generally not reported by species. According to the NEFMC SAFE Report (2008), "[a]lthough reporting of skate landings by species has been encouraged, species identification by vessels and dealers remains problematic, and most landings continue to be unclassified or misrepresented" (NEFMC 2009). In 2007, for example, the vast majority of all landed skates were reported as "unclassified" (NMFS landing species code 3651) (NEFMC 2009). Thus, incidental thorny skate catches and landings are likely under-reported.

In general, skates have little to no recreational value and are not intentionally pursued in any recreational fisheries in the United States (NEMFC 2009). Between 2000-2007, recreational skate landings, where skates are retained and/or killed by the angler, comprised only 0.4-3.0% of the total estimated catch during this time period; the vast majority of skates caught by recreational anglers were released alive (NEFSC 2009). In 2003, threats to thorny skates from foreign and recreational landings were insignificant and, together, accounted for less than 1% of the total United States fishery landings (NEFSC 2003).

The main human induced threat in Canada is the directed fishery on the Grand Banks where an average of about 11,800t of skate biomass have been removed in the past five years using trawl gears (Kulka *et al.* 2004). In light of the historically low population levels of thorny skates in Canadian waters and the evidence of hyper-aggregation on the Grand Banks, the 2008 SAFE Report asserts that the current Total Allowable Catch (TAC) limits for the directed thorny skate fishery in Canada (e.g., 12,000t in Division 3LNO) exceed the average catch during a period when minimal or no rebuilding of this stock occurred (Simpson and Miri 2010).

In Canada, thorny skates are also taken as bycatch in areas from the Scotian Shelf and north to the Davis Strait, but in much smaller amounts than associated with the directed fishery on the Grand Banks (IUCN 2011). While the thorny skate population on the Scotian Shelf has historically been smaller than that on the Grand Banks, the population on the Scotian Shelf has declined consistent with the population decline on the Grand Banks (IUCN 2011). The Scotian Shelf population showed an 80% decline in biomass from the mid-1970s through the mid-2000s with no obvious environmental cause (IUCN 2011). In Division 3 LNO/Subdivision 3Ps (around the Grand Banks) thorny skate abundance indices from spring surveys peaked at 213, 697 in 1985 and appear to have stabilized in recent years (Simpson and Miri 2010).[7] Like the biomass index on the Grand Banks, biomass surveys conducted on the Scotian Shelf reveal that thorny skate population levels have remained relatively stable but at low levels over the past

[7] The 2008 and 2009 spring survey results for Division 3LNOPs were 79,027 and 58,629, respectively (Simpson and Miri 2010).

12 years (IUCN 2011). McPhie (2007) reports that these results are correlated with greatly reduced groundfish fishing efforts.

B. The Northwest Atlantic or, Alternatively, the United States Thorny Skate Populations are Distinct Population Segments

1. ESA Definition of Distinct Population Segment

The ESA grants NMFS authority to list any "species" as endangered or threatened. A "species" is defined to include "any distinct population segment (DPS) of any species" (16 U.S.C. §§ 1533; 1532(16)). The Fish and Wildlife Service and NMFS's Joint Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (61 FR 4722; February 7, 1996) identifies "two criteria for making DPS determinations: (1) The population must be *discrete* in relation to the remainder of the taxon (species or subspecies) to which it belongs; and (2) the population must be *significant* to the remainder of the taxon to which it belongs" (75 FR 132; July 12, 2010).

"A population segment of a vertebrate species may be considered discrete if it satisfies either one 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 ESA" (75 FR 132; July 12, 2010). Courts have interpreted "markedly" to mean "appreciably" separate from other populations (*National Assoc. of Home Builders v. Norton*, 340 F.3d 835, 851 (9th Cir. 2003)).

If a population segment is found to be discrete under one or both of the enumerated conditions, its biological and ecological significance to the taxon to which it belongs is to be evaluated. This consideration may include, but is not limited to: (1) persistence of the discrete population segment in an ecological setting unusual or unique to the taxon; (2) evidence that the loss of the discrete population segment would result in a significant gap in the range of a 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 historic range; and (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics (75 FR 132; July 12, 2010). These significance factors are "nonexclusive" – if any one factor is satisfied, a discrete population is considered significant (*see Maine v. Norton*, 257 F.Supp. 2d 357, 388 (D. Me. 2003)). If a population segment is both discrete and significant, then it is a DPS and may be evaluated for endangered or threatened status.

2. The Northwest Atlantic Population of Thorny Skates is a DPS

The Northwest Atlantic thorny skate population, encompassing Canadian and United States waters, undoubtedly satisfies both the "discrete" and "significant" requirements for DPS designation under the

ESA. The Northwest Atlantic population is "discrete" because it is "markedly separated from other populations" due to "physical [and] behavioral factors," and is "significant" because the loss of the [DPS] would result in a significant gap in the range of the taxon" (75 FR 132; July 12, 2010).

Scientific literature on thorny skates consistently demarcates the Northwest and Northeast Atlantic populations (e.g., NEFSC 2003 citing McEachran 2002). While research indicates that small groups of this species may make limited seasonal migrations, the thorny skate is generally considered a sedentary species. A twenty-year study of the Northwest Atlantic stock in the Newfoundland area by Templeman (1984) found that most thorny skates were recaptured within 97 km of their tagging location; and in Passmaquoddy Bay off the northeastern shore of Maine, the species is a year-round resident (NEFSC 2003 citing Tyler 1971). Studies of the Northeast Atlantic stock also indicate a relatively sedentary population. In the North Sea, for example, 85% of tagged thorny skates were recaptured within 93 km of their release point (Walker *et al.* 1997). Indeed there are no scientific studies that indicate trans-Atlantic migration or significant genetic interface between the Northwest and Northeast Atlantic stocks.
The IUCN evaluated the conservation status of several populations of thorny skates throughout the Atlantic and assessed the Northeastern Atlantic stock as a "Species of Least Concern." In striking contrast, the IUCN assessed the species as "Vulnerable" in Canadian waters and "Critically Endangered" in United States waters. Considering the distribution of the species both in the Northeast and Northwest Atlantic, there can be little question that if the United States and Canadian populations were extirpated, this would result in a significant reduction in the species range with no evidence that populations outside of this range could recolonize United States and Canadian waters. Accordingly, the best available scientific evidence clearly establishes that the Northwest Atlantic population of thorny skates is a markedly discrete and significant population and, thus, constitutes a DPS of the species pursuant to the ESA (75 FR 132; July 12, 2010).

3. The Population of Thorny Skates in United States Waters is also a DPS

As an alternative to DPS designation of the Northwest Atlantic population, the thorny skate population in United States waters also satisfies the "discrete" and "significant" requirements for DPS designation under the ESA. The United States population is "discrete" because "it is delimited by international governmental boundaries [delineating the United States and Canada] within which differences in control of exploitation, [. . .] conservation status, [and] regulatory mechanisms exist that are significant in light of § 4(a)(1)(D) of the ESA" (75 FR 132; July 12, 2010).[8] Evidence also suggests that the United States DPS may also be "discrete" because it is "markedly separated" from the Canadian population "as a consequence of physical [and/or] ecological factors" (75 FR 132; July 12, 2010). Further, the United States population meets the "significant" criterion of DPS designation because the loss of the [DPS] would result in a significant reduction in the range of the taxon.

[8] NMFS published in the Federal Register a negative 90-day finding to list Northwest Atlantic porbeagle sharks as a DPS under the ESA (75 FR 132; July 12, 2010). In this finding, NFMS expounded upon the USFWS and NFMS's joint policy on the criteria for making DPS determinations (61 FR 4722; February 7, 1996). The findings made in that notice are being used herein to justify the merits of a DPS designation for the thorny skate.

Marked disparities between Canada and the United States regarding control of exploitation, conservation status, and regulatory mechanisms substantiate the "discreteness" of the United States DPS of the thorny skate. In Canada, the thorny skate is managed as a single stock under Canadian fishery regulations, and thorny skates dominate Canadian commercial catches representing approximately 95% of total skates caught. Thus, the skate fishery on the Grand Banks is considered a directed fishery for thorny skates (Kulka *et al.* 2010).

As a direct result of overfishing and bycatch mortality, the Canadian thorny skate population suffered a precipitous decline from the mid-1970s through the mid-2000s, but recent biomass indices show that the population has stabilized at very low levels. Despite the conspicuously low population numbers, the current TACs for skates in Canadian waters "greatly exceeds the average catch during a period when minimal or no rebuilding of this stock occurred" (Kulka *et al.* 2010); NEFMC, in consultation with NMFS, concurs that these TACs exceed the recommended level of exploitation to rebuild the stock (NEFMC 2009). Despite these conclusions, the thorny skate lacks substantive protective regulatory measures and has not yet been afforded any level of protective status in Canada.[9]

Over the past four decades in the United States, the thorny skate has undergone a dramatic population decline parallel to its decline in Canadian waters. Unlike Canada, however, the United States has never had a directed fishery for thorny skate. The population decline in the United States is primarily attributed to retained incidental catches, bycatch, and discard mortality. Further, in contrast with the relatively stabilized Canadian population, the United States population of thorny skate is currently being "overfished" and continues to decline despite its listing as a "prohibited species" under the 2003 FMP prohibiting commercial and recreational fisheries for the species (NEFMC 2009).

In addition to these differences in conservation actions and fishery regulations between Canada and the United States, evidence supports the contention that population segregation and sub-division into subpopulations is occurring in the Northwest Atlantic stock (IUCN 2011). The center of concentration of thorny skates in the entire northwest Atlantic region is on the Grand Banks off the coast of Newfoundland, where the species' range has been contracting since the 1980s (Kulka and Miri 2003). The population on the Grand Banks underwent a 68% decline between the 1970s and early 1990s (Kulka *et al.* 2007). Recent studies indicate that the decline coincided with a period of cold ambient temperatures. Consequently, 80% of the biomass is now "hyper-aggregated" in 20% of the area along southwest slope of the Grand Banks (Kulka *et al.* 2007).

In United States waters, thorny skates are most abundant in the Gulf of Maine and Georges Bank offshore strata (NEFMC 2009). Juxtaposing these relatively concentrated populations in United States

[9] As of June, 2007, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was scheduled to undertake an assessment of the thorny skate for risk of extinction (Kulka *et al.* 2007). No assessment report had been issued as of August 10, 2011.

waters to the "hyper-aggregated" Canadian population, the United States DPS may be "discrete" under the DPS requirements of the ESA because it is "markedly separated from [the Canadian] populations […] as a consequence of physical [and] ecological factors" (75 FR 132; July 12, 2010).

The loss of thorny skates in United States waters would result in an appreciable loss of the species' population in the northwest Atlantic. Further, the best available scientific evidence indicates that the Northwest Atlantic population of thorny skates is "discrete," at least because of international regulatory differences and potentially because of separation resulting from physical and ecological factors. Thus, the thorny skate population within United States waters constitutes a DPS pursuant to the ESA.

II. The Thorny Skate Satisfies the Statutory Criteria for Listing as an Endangered Species

The ESA defines an endangered species as "any species which is in danger of extinction throughout all or a portion of its range" (16 U.S.C. § 1532(6)). A species is threatened if "it is likely to become an endangered species within the foreseeable future" (16 U.S.C. § 1532(20)). In determining whether or not a species is endangered, NMFS must base its decision on five factors prescribed by the statute:

(A) Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

(B) Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

(C) Disease and Predation

(D) Inadequacy of Existing Regulatory Mechanisms

(E) Other Natural or Manmade Factors

The presence of "any one or a combination" of the listing factors requires listing (50 C.F.R. § 424.11(c)). "Each factor is equally important and a finding by the Secretary that a species is negatively affected by just one of the factors warrants a nondiscretionary listing as either endangered or threatened" (*see National Wildlife Federation v. Norton*, 386 F. Supp. 2d. 553, 558 (D. Vt. 2005)). Further, the listing decision must be made "*solely* on the basis of the best scientific and commercial data available" (16 U.S.C. § 1533(b)(1)(A)). "Economic considerations have no relevance to determinations regarding the status of species" (H.R. No. 97-835 (1982)).

Though evidence is provided in this petition in respect to all five listing factors, the continued survival of the Northwest Atlantic DPS of the thorny skates (which includes the United States DPS) is endangered by three of the five factors enumerated in the ESA: (B) overutilization for commercial, recreational, scientific, or educational purposes; (D) inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors.

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

Bottom trawl fisheries are responsible for up to 86% of thorny skates caught as bycatch in United States waters and are the primary component of Canada's directed thorny skate fishery (NEFMC 2009). Otter

trawling is shown to have enduring negative impacts on benthic ecosystems (Collie 2000; NEFSC 2004), however there is currently a dearth of scientific study specifically quantifying the impacts of trawling on thorny skate habitat in the northwest Atlantic.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

1. Historical Overutilization

AWI acknowledges that NMFS has generally rejected "overutilization for commercial purposes in the form of historical overfishing" as a significant factor for ESA listing. In its negative 90-day finding of an ESA listing petition for the Northwest Atlantic DPS of the porbeagle shark, NMFS acknowledged the petitioner's claim that "historical and continued overfishing requires that the species be listed under the ESA," but dismissed this contention because, at the time of the petition, porbeagle population numbers were stable at low levels and possibly increasing (75 FR 132, July 12, 2010). In another case, NMFS issued a negative 12-month finding for listing the barndoor skate and stated that although "available data suggest that overfishing (directed catch and bycatch) was the major threat," biomass indices at the time of petitioning had steadily increased, due in part to the elimination of foreign fishing (67 FR 188, Sept. 27, 2002).

Distinguishable from both of these findings, in which historical overutilization was not deemed a significant factor for listing because biomass indices indicated stable/increasing populations, population estimates for the thorny skate in Canadian waters indicate stable, but not increasing numbers. And in United States waters biomass indices have been declining for decades without reprieve, despite the federal ban on the landing and possession of thorny skates since 2003. Thorny skate populations were historically exploited at such unsustainable rates in United States waters that any continued mortality today, through either illegal landings or discard mortality from incidental bycatch, could have devastating and irrevocable impacts on the survival of the species.

Participation in the skate wing fishery in the northwest Atlantic has grown dramatically over the past 30 years in response to the burgeoning international demand for skate wings and fishermen's interest in developing new markets. In Canada, skates were historically caught only as incidental bycatch in other Canadian fisheries (e.g., groundfish fisheries), but a directed skate fishery was initiated in 1994 as a response to closures in the traditional Canadian groundfish fishery and an increasing international market for skate wings (NEFMC 2009). In the United States, skate wing fisheries (primarily directed at winter skates) have also increased in number over the past few decades to satiate the growing international appetite for skate wings. The total landings of skates caught in United States waters have increased steadily since the early 1980s, from less than 1,000mt of skates (wings and/or carcasses) landed in 1982 to over 18,000mt landed in 2007 (NEFMC 2009).

While thorny skate populations throughout the northwest Atlantic suffered dramatic declines over the past few decades, biomass indices in Canadian waters indicate that the species is maintaining relatively stable population numbers at very low levels. In the United States waters, however, the thorny skate

population continues to decline at an alarming rate, despite the FMP's regulatory protections that prohibit thorny skate landings and possession. In the time lapse between the genesis of the escalating demand for skate wings in the 1980s and the FMP's implementation in 2003, the thorny skate lacked federal regulatory protections in the United States and, consequently, suffered the quintessential ravages of the "tragedy of the commons" from which the species has yet to recover. Historical overfishing of thorny skates continues to have deleterious effects on the species' population in United States waters and is a significant factor in the species' continued decline. Indeed, the most recently published biomass average (0.245 kg/tow) is around a mere 10% of the biomass threshold (2.20 kg/tow), and roughly 5% of the biomass target (4.41 kg/tow) (SPDT 2011).

2. Continued Overutilization: Illegal Landings and Discard Mortality

Although the historical decline of thorny skates in United States waters is ascribed to over-exploitation by commercial fisheries, some claim that overutilization is generally not considered a significant cause of the species' continued decline. Proponents of this argument contend that overutilization of thorny skates in United States waters (for commercial purposes) technically ceased following the prohibition on thorny skate landings and possession in 2003 (NEFMC 2009) and, additionally, that the thorny skate is not considered a preferred species in the skate wing fishery (NOAA 2007). These assertions are likely misguided, however. Thorny skate wings may not be as desired for the skate wing market as winter skate wings but, nevertheless, dockside samples of skate landings indicate that thorny skates are illegally landed, most likely for the skate wing market.

a. Illegal Landings

Thorny, barndoor, and winter skates are all considered sufficient in size for the wing market (NEFMC 2009), and despite the ban on landing thorny skates, reports of illegal thorny skate landings suggest that this species is, in fact, currently exploited in the commercial wing market (NEFMC 2009). In the United States skate landings are not reported by species, with nearly 100% of the landings reported as "unclassified" or misrepresented skates (NEFMC 2009). Port samplers and enforcement officers are not present to inspect every commercial landing, but instead conduct random portside searches. Non-routine enforcement leaves ample leeway for fishers to misreport their landings, particularly regarding the number of illegal thorny skate landings. Confirming this point, NMFS Fisheries Statistics Office issued skate wing species composition data from 2006-2007 and exposed that in Massachusetts and Maine, thorny skate wings comprised 6.7% and 3%, respectively, of the sampled dockside landings (NEFMC 2009). Given the thorny skate's historically low population numbers and life history parameters as a "K-selected" species, every illegal take exacerbates its precipitous population decline and critically threatens stock rebuilding efforts. [10]

[10] An additional source of thorny skate mortality may be "transfers at sea," by which skates are transferred at sea to other vessels, presumably for lobster bait (PDT 2011). These illegal "landings" may pose a significant threat to thorny skates as this type of activity is likely under-reported.

b. Bycatch and Discard Mortality[11]

In contrast to Canada's directed thorny skate fishery, in the United States thorny skates are primarily taken as bycatch in groundfish trawl fisheries. As a prohibited species, fishers are banned from possessing or landing thorny skates or their parts, and federal regulations mandate the fishers must discard any thorny skates that are incidentally caught in the trawl gear while fishing for other species (50 C.F.R. § 648.322(e)(1)). Although data on acute (i.e., immediate) and delayed (i.e., post-release) mortality rates of discarded skates is extremely limited, NEFSC assumes a 50% discard mortality rate for thorny skates caught in trawl gear (SPDT 2011).

According to the Standardized Bycatch Reporting Methodology 3-year Review Report, in 2009 and 2010 roughly 70% of all skates caught in various fisheries (including otter trawls, longline, sink gillnets, and scallop trawls) were discarded (NEFSC 2011). These figures may have a large margin of error, however, as pinpoint data regarding skate discard rates is contingent on the fishers' self-reporting.

Of the four otter trawling vessels selected for observation, less than 10% of the selected vessels' total trips/sea days/landings were observed under the auspices of the Northeast Fisheries Observer Program (NEFSC 2011). This study highlights the possibility of egregious mis- and under-reporting of skate discard ratios. Bearing in mind the assumed under-reporting of skate discards, from 2003-2010 3,594 thorny skates were estimated to have been discarded from otter trawl fisheries in United States waters (SPDT 2011).

Applying the assumed 50% discard mortality rate, nearly 1,800 thorny skates are estimated to have died as incidental bycatch in otter trawling fisheries. Reiterative of the potentially grievous damage illegal landings inflict on thorny skate populations, every single discard mortality – acute or delayed – exacerbates the thorny skate's population decline and critically threatens stock rebuilding efforts. Moreover, of those thorny skates caught and released alive, their short and long-term survival rate is has not yet been accurately quantified.

C. Disease and Predation

Predators of juvenile and adult thorny skates include seals, sharks, and halibut; predators of thorny skate eggs include halibut, goosefish, and Greenland sharks, and predatory gastropods can eat thorny skate embryos within egg capsules (NEFSC 2003). The thorny skate is also plagued by a variety of parasites that are found on the skin, in the intestinal tract, and in body cavities (FMNH 2011).[12] However, disease and predation are not currently assessed as significant threats to the species' survival.

[11] In the final rule listing the largetooth sawfish as an endangered species, NMFS stated that "entanglement and other bycatch are commonly considered in the overutilization factor for ESA listing" (76 FR 133, July 12, 2011).
[12] Thorny skates are parasitized by generalized species of Monogenea as well as many other parasites including protozoan parasites like *Haemogregarina delagei*, *Trichodina oviducti*, and *Trypanosoma rajae* (FMNH 2011).

D. Inadequacy of Existing Regulatory Mechanisms

1. Federal Management

Congress enacted the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in 1976 (amended in 1996) to govern marine fisheries management. Generally, the MSA regulates fishing in federal waters, and each state has jurisdiction over fisheries within three miles of its shoreline (16 U.S.C. §§ 1801; 1856(a)(1)). The MSA created eight regional fishery management councils that are charged with preparing FMPs for each fishery under the respective council's authority (16 U.S.C. § 1852(h)). The FMPs, which are codified and implemented by NMFS, must generally prevent overfishing while providing for optimal yield (16 U.S.C. § 1851(a)(1)).

In United States waters, the thorny skate is within the jurisdiction of the NEFMC, and management regulations regarding this species are stipulated by the FMP for the Northeast Skate Complex that manages the seven endemic skate species collectively as a single complex.[13] The Skate Management Unit (SMU) for the Northeast skate fishery encompasses the area of the Atlantic Ocean from 35°15.3' North latitude, the approximate latitude of Cape Hatteras, North Carolina, northward to the United States-Canada border, and extending eastward from the shore to the outer boundary of the Exclusive Economic Zone (EEZ) and northward to the United States-Canada border (NOAA 2011a). (See Figure 3.)

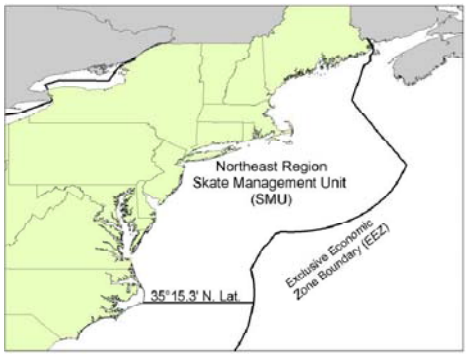

Figure 3. Skate Management Unit (SMU) [14]

The current FMP for the Northeast skate complex requires federal permits and sets Total Allowable Landings (TAL) for commercial skate fishing (NEFMC 2009; 50 C.F.R. §§ 648.320-648.323). Since 2003, the FMP has prohibited the possession or landing of thorny skates (NOAA 2011a). Specifically 50 C.F.R. § 648.320(e)(1) stipulates that a vessel fishing in the EEZ portion of the SMU may not retain, possess, or land thorny skates taken in or from the EEZ portion of the SMU. But despite NMFS's management efforts and the prohibition on thorny skate possession/landing, the species has continued to suffer an unabated decline.

[13] The seven species which comprise the Northeast skate complex include: winter, barndoor, thorny, smooth, little, clearnose, and rosette skates. For information on these species, see http://www.nero.noaa.gov/sfd/sfdskate.html.
[14] Source: http://www.nero.noaa.gov/nero/regs/infodocs/NESkateInfoSheet.pdf. [Accessed July, 2011.]

A general lack of species-specific identification, both on-boat and at landing, poses a significant threat to the thorny skate's survival in United States waters. Federal regulations require that the owner/operator of any vessel holding a federal skate permit must maintain on board the vessel, and submit to NMFS, a federal fishing Vessel Trip Report (VTR) for all fishing trips (regardless of species retained) (NOAA 2011a). On these VTRs, fishers must identify all possessed/landed skates by specific species or, generally, as "unclassified," and must report all discarded skates according to two (non-species-specific) class sizes: "large skates" (greater or equal to 23 inches total length) and "small skates" (less than 23 inches total length). Ideally, fishers would positively identify any prohibited species (i.e., thorny or barndoor skates) that were incidentally caught as bycatch and immediately discard them. However, NMFS acknowledges that the species identification by vessels, both at sea and at landing, is "problematic" despite agency-sponsored programs for fisher education, on-boat observers, and port samplers ("dockside monitors") (NEFMC 2009).

Positive species identification at landing is hindered because current regulations permit vessels to "possess and/or land skates as wings *only* (wings removed from the body of the skate and the remaining carcasses discarded)" (50 C.F.R. § 648.322(b)(4), emphasis added). The thorny skate's most distinctive and identifiable physical characteristics are large thorns on the ridgeline of its back. A vessel could foreseeably "wing" a thorny skate at sea (intentionally or mistakenly), discard the carcass, and, because the brown-/grayish wings are much less notable than the thorny body, designate the thorny skate wings as "unclassified" without alerting the port samplers or enforcement officers to the specimen's true identity as a prohibited species. Indeed, the vast majority of landed skates are landed as "unclassified" (undifferentiated by species) (NEFMC 2009).

"Problematic" misidentification pervades the dealer market as well. Permitted dealers report that the vast majority of skate wings they purchase are listed under two general (non-species-specific) market categories: "unclassified wings" (code 3651) and "big skate" (code 3671) (NEFMC 2009). Further, skates are often mislabeled at market, as evidenced by the photo below of a placard reading "Skate: *Raja Radiata*" accompanying a whole skate for sale by *Eastern Fisheries, Inc.* at the 2010 Brussels Seafood Show (Brussels, Belgium).[15] The pictured skate is likely a winter skate (*Leucoraja ocellata*), but was mislabeled as *Raja radiata*, the taxonomic identification assigned to thorny skate until 1998. (See Figure 4.) While it is unknown whether the skate was intentionally or mistakenly mislabeled, the image nevertheless highlights a lack of oversight and enforcement of the thorny skate prohibition.

Mislabeling, regardless of whether it is intentionally designed to deceive consumers or merely the result of misinformation, can increase consumer demand for the perceived product. Given the inextricable dynamic between demand and supply, fishers may be encouraged to land thorny skates in greater abundance in an effort to satiate the growing appetite, perceived or real, for thorny skate wings. This

[15] *Eastern Fisheries, Inc.* is based in Boston, Massachusetts. According to the company's website (www.easternfisheries.com), it maintains 23 fleets that fish for skates in the EEZ off the coast of New England and processes skates at only one of their three United States processing plants for domestic and international markets.

contention is not unfounded in light of the current regulatory scheme that, as admitted by NMFS, is failing to curtail illegal thorny skate landings (NEFMC 2009) and may inadvertently be fostering a market for the species' parts.

Figure 4: Skate "*Raja Radiata*" at 2010 Brussels Seafood Show (Photo source unidentified.)

Further, as previously indicated, the thorny skate has been classified as both an "overfished" and "prohibited" species since 2003. These two designations carry disparate penalties, however. Appendix 3 of NOAA's Policy for Assessment of Penalties and Permit Sanctions stipulates that fishing for, taking or retaining *overfished* species is a Level IV violation, whereas possession of *prohibited* species is a Level I violation (NOAA 2011b). (See Table 2 below.) According to the "Penalty Matrix for the MSA," Level IV violations warrant penalties ranging from $10,000 for "unintentional" violations up to $60,000 with permit sanctions for "intentional" violations. Level I violations, however, incur significantly lower penalties ranging from written warnings for "unintentional" violations up to $8,000 for "intentional" violations (NOAA 2011b). (See Table 3 below.)

Violation	Gravity Offense Level
VIOLATIONS REGARDING PERMITS, REPORTING, DOCUMENTATION, AND PERMIT REQUIREMENTS	
• Fishing for, taking, or retaining particularly vulnerable, depleted, or ***overfished*** species without a required permit	Level IV
VIOLATIONS REGARDING SIZE/CONDITION/QUANTITIY OF FISH OR LANDING/POSSESSION REQUIREMENTS	
• Possession of prohibited species	Level I

Table 2: Offense Level Guidance, Magnuson-Stevens Act Schedule (NOAA 2011b)

	Level of Culpability			
Gravity Offense Level	**A Unintentional**[16]	**B Negligent**	**C Reckless**	**D Intentional**
Level I	Written warning-$2,000	Written warning-$4,000	$2,000-$6,000	$6,000-$8,000
Level IV	$10,000-$15,000	$15,000-$25,000	$20,000-$40,000; permit sanction of 10-20 days	$40,000-$60,000; permit sanction of 20-60 days

Table 3: Penalty Matrix for Magnuson-Stevens Act (NOAA 2011b)

NMFS's designation of thorny skates as both "prohibited" *and* "overfished" inherently allows room for inconsistent enforcement of the law. A written warning for illegally taking a "prohibited" thorny skate is certainly not as deterring as a $10,000 penalty for illegally taking an "overfished" thorny skate. Since thorny skates are an "overfished" species and there is evidence that they are still being illegally landed (NEFMC 2009), records should exist of fishers cited for Level IV violations. Such records are conspicuously absent, however, lending credence to the supposition that violators are more likely being penalized under Level I, if at all.

Finally, in the Final Amendment 3 to the FMP for the NE Skate Complex, NMFS rejected skate time/area closures in the SMU. These closures were proposed as a conservation measure to promote biomass rebuilding, particularly for the thorny skate. The proposed alternatives (Alternatives 1A and 1B) that included time/area closures would have only applied to vessels on declared skate trips. Nonetheless, the time/area closure management scheme was rejected in exchange for alternatives that defined annual catch limits, total allowable landings, and accountability measures for the skate complex as a whole.

In reference to the alternatives to Amendment 3 that were ultimately adopted, NMFS asserted that "the landings and catch limits proposed by [Alternatives 3B and 4] have an acceptable probability of promoting biomass growth and achieving the rebuilding (biomass) targets for smooth and thorny skates" (NEFMC 2009). Despite this optimistic prediction, the most recent biomass index for thorny skate (2008-2010 three-year average of 0.245 kg/tow) revealed that the thorny skate population is still "overfished" and still declining (SPDT 2011). In short, the existing regulatory mechanisms set forth in the FMP under the purview of the MSA are inadequate to promote the recovery of the thorny skate in United States waters and may actually be sponsoring the species' continued decline.

Precedent is already established for providing a species with ESA protections when "prohibited" status under a FMP fails to rebuild the stock. In the case of the Atlantic salmon (*Salmo salar*), despite NEFMC's implementation of a FMP for the species in 1988 and a subsequent prohibition on possession/landing, the species continued to decline (NOAA 2011c). In 2000, NMFS and USFWS published a final rule listing the Gulf of Maine DPS of Atlantic salmon as an endangered species under the ESA (NOAA 2011c). Since

[16] The "unintentional" culpability level "reflects the strict liability nature of regulatory violations, and the fact that the statutes NOAA enforces are designed to protect marine resources even where a violation is unintentional" (NOAA 2011b).

then, NMFS and USFWS have completed a recovery plan (2005), expanded the Gulf of Maine DPS (2009), and determined critical habitat (2009) for the endangered Atlantic salmon (NOAA 2011c). In the aggregate, these ESA-sponsored federal actions effectively stymied the species' extirpation and have successfully encouraged modest stock recovery (USASAC 2011). Analogous to the Atlantic salmon, the thorny skate's unremitting population decline notwithstanding its current "prohibited" status also warrants ESA listing to prevent the species' extirpation and promote its recovery.

2. Canadian Management

Canada's regulatory mechanisms regarding its directed fishery for thorny skates have allegedly staved off extirpation of the species within the nation's waters, but these regulations have not successfully promoted stock rebuilding. Thorny skate biomass indices have reportedly stabilized in recent years, but nonetheless remain at historically low levels (NAFO 2011). The current TAC for skates established by the North Atlantic Fisheries Organization (NAFO) is 12,000t in Division 3LNO (fishery management areas on/adjacent to the Grand Banks),[17] but this limit still exceeds the average catch during a period when minimal or no rebuilding of this stock occurred (Simpson and Miri 2010). Even though the average reported annual catch from Div. 3LNO from 2005-2010 (4,947t) was less than half the current TAC, the most recent biomass surveys do not indicate a change in the status of the stock (NAFO 2011). Consequently, both the current TAC and the reported average catches are TACs for skates appear too high to promote significant stock recovery.

Moreover, the thorny skate still lacks substantive protective regulatory measures in Canada and has not been afforded a conservation status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). As of July, 2011, COSEWIC was scheduled to undertake an assessment of the thorny skate in Canadian waters for risk of extinction (Kulka *et al.* 2007), but a date for this assessment has not been determined.[18]

E. Other Natural or Manmade Factors

1. Global Climate Change and Hypoxia

Global warming poses a long-term threat to Northwest Atlantic thorny skates and their recovery from depletion. Global climate change is correlative with rising concentrations of atmospheric carbon, and the global warming trend is likely to accelerate as greenhouse gas emissions increase worldwide. The 2007 Report of the Intergovernmental Panel on Climate Change states that the atmospheric concentration of carbon dioxide has increased by 36% since 1750, the highest level for the past 650,000 years and perhaps higher than any level in the past 20 million years (Denman *et al.* 2007). Correspondingly, over the past century, the global temperature average has risen roughly 0.74°C

[17] See NAFO Conservation and Enforcement Measures: Annual Quota Table (revised July 29, 2011) at http://www.nafo.int/fisheries/frames/regulations.html. [Accessed August, 2011.]
[18] See COSEWIC Status Reports in Preparation at http://www.cosewic.gc.ca/eng/sct2/sct2_4_e.cfm. [Accessed July, 2011.]

(Trenbeth *et al.* 2007) and is forecasted to increase by 1.8 to 4°C by the end of the 21st Century (CSIC 2011 citing Meehl *et al.* 2007).

Ocean temperatures are rising in tandem with global temperatures, a trend that is likely causing adverse effects on thorny skates. After concluding a four-decade study on ocean temperatures from 1948 to 1998, Levitus *et al.* (2000) asserts that global ocean temperatures increased 0.31°C on average in the upper 300 m.[19] A study by Rose (2005) asserts that if climate change results in a warming of northern ocean waters, it is expected that more species will invade northern waters. This trend could, in turn, adversely affect the thorny skate's predator-prey dynamics. Global warming trends may also be concurrent contraction of the range of cold-water species (e.g., the thorny skate) (Rose 2005), an occurrence that would imperil the species even further.

Paralleled with global warming trends, hypoxia (oxygen deficiency) has increased in frequency, duration, and severity in the world's coastal areas during the last few decades (CSIS 2011 citing Diaz and Rosenberg 2008). These oxygen deficiencies decrease the abundance and diversity of benthic macrofauna, most notably echinoderms, fishes, and crustaceans (CSIC 2011). Continued ocean warming is predicted to increase the extent and severity of marine macrofauna mortality under hypoxia by the combined effect of reducing dissolved oxygen concentration in the ocean and increasing the oxygen requirements of organisms and their sensitivity to reduced oxygen concentrations (CSIC 2011 citing Najjar *et al.* 2010). Additionally, this combined effect is predicted to further reduce the quality and size of suitable habitat for aerobic organisms whose suitable habitat is restricted by water temperature (CSIC 2011) (i.e., the thorny skates).[20]

Concurrent with rising ocean temperatures, increased nutrient flux in coastal zones (e.g., industrial and agricultural runoff) is also contributing to the expansion of hypoxia across coastal waters worldwide (CSIC 2011 citing Diaz and Rosenberg 2008). These compounding factors suggest that the threats to marine biodiversity from hypoxia will be greater than anticipated (CSIC 2011). Although the direct impacts of these expanding hypoxic zones on thorny skates is speculative, any adverse impact on the species or on the abundance/distribution of its predators or prey will severely hinder the species' potential to recover.

2. Natural Stochastic Events

The viability of a relatively small population, like that of thorny skates in the northwest Atlantic, is a function of chance events. "These chance events are products of demographic and environmental stochasticity, that is, of unpredictable environmental factors that affect the survival or fecundity of some (in demographic stochasticity) and sometimes all (in environmental stochasticity) individuals in a population" (Hutchins and Reynolds 2004 citing Lande 1993). Small populations may be far more likely

[19] Thorny skates in the northwest Atlantic are most abundant from 111 to 336 m, and on the Scotian Shelf the species demonstrates a preferred temperature range of 2 to 5 °C (NEFSC 2003).
[20] On the Scotian Shelf the species demonstrates a preferred temperature range of 2 to 5 °C (NEFSC 2003).

to become extirpated or extinct as a result of demographic or environmental stochasticity than as a result of reduced genetic variability associated with small populations (Hutchins and Reynolds 2004 citing Lande 1993 and Caughley 1994).

As a "K-selected" species the thorny skate has a low intrinsic rate of increase and relatively late age of maturity. Similar to the barndoor skate, these life history characteristics make the species prone to excessive mortalities and rapid stock collapse (67 FR 188, Sept. 27, 2002). Accordingly, the thorny skate's alarmingly low population estimates coupled with its life history parameters (i.e., low intrinsic rate of increase, relatively late age of maturity) place the species at risk of adverse effects resulting from natural stochastic events.

III. Conclusion

A. Requested Designation

AWI requests that the Secretary of Commerce, through NMFS, list the thorny skate (*Amblyraja radiata*) as an endangered or threatened species in the northwest Atlantic under the ESA and thereby adopt and enforce a strict prohibition on all take of thorny skates in United States waters. Alternatively, if NMFS determines that the Northwest Atlantic population of the thorny skates does not qualify for listing, AWI requests that NMFS list the United States DPS of the thorny skate as endangered. In addition, AWI seeks the designation of critical habitat for the thorny skate in United States waters.

This listing action is warranted given the numerous threats that this species faces as well as its historically low population levels. As described above, the number of thorny skates in both the Northwest Atlantic DPS and the United States DPS declined precipitously over the past 40 years. The Northwest Atlantic population in Canada continues to persist at exceedingly and historically low population levels. Coupled with the population's hyper-aggregation on the southwest slope of the Grand Banks, these factors make the population highly susceptible to a stochastic event or exploitation by Canada's directed skate fishery, further imperiling the species. In United States waters, the decline in thorny skate numbers is ongoing despite a prohibition on possession and landing of the species and the species' designation as "overfished." Consequently, and based on the best available scientific evidence, it is abundantly clear that the thorny skate's continued existence is threatened by overutilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors.

B. Critical Habitat

Given that the population of thorny skates in United States waters continues to decline despite a regulatory scheme ostensibly designed to promote the rebuilding of its stock, AWI requests that critical habitat be designated for the thorny skate within the territory of the United States, concurrent with final ESA listing. Congress defines critical habitat for any threatened or endangered species in 16 U.S.C. § 1532(5)(A) as:

> (i) the specific areas within which the geographical area occupied by the species, at the time it is listed in accordance with the provisions of § 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) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of §1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. (*See also* 50 C.F.R. § 424.12.)

In determining whether critical habitat is both "prudent" and "determinable," NMFS must analyze the physical and biological requirements of the thorny skate listed in 50 C.F.R. § 424.12(b), including:

> (1) Space for individual and population growth, and for normal behavior;
>
> (2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
>
> (3) Cover and shelter;
>
> (4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally,
>
> (5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Critical habitat designation would be "prudent" because it would benefit the species generally, and is "determinable" because sufficient scientific information exists about the thorny skate's range and habitat in United States waters to determine the required habitat of the species and to permit identification of the area.

Based on the statutory definition and agency criteria for critical habitat, AWI requests that the Secretary of Commerce, acting through NMFS, designate critical habitat sufficient to protect those areas where the species is known to exist, as well as additional potential recovery habitat that may support the species.

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