Marine Species on the Move in the Northwest Atlantic: A Sea of Transboundary Governance Challenges

Professor David L. VanderZwaag
Canada Research Chair in
Ocean Law and Governance
Marine & Environmental Law Institute
Schulich School of Law
Dalhousie University

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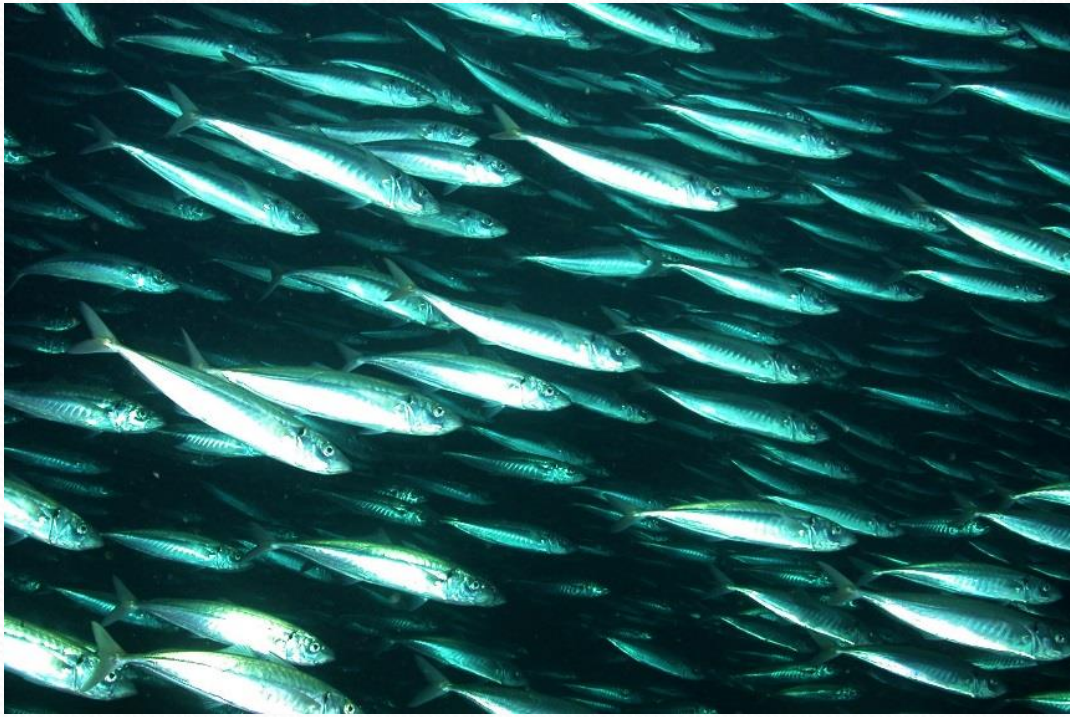
Introduction

- Managing transboundary fish stocks has been exceedingly difficult, even without changing ocean conditions, with many "wavemaking" issues

+ Ensuring scientific cooperation
+ Determining appropriate management measures
+ Deciding on allocation criteria
+ Establishing effective compliance and enforcement arrangements

- Predicting climate-induced responses of transboundary marine fish populations remains problematic due to a complex mix of variable conditions

+ Temperature
+ pH
+ Salinity
+ Oxygen levels
+ Abundance and distribution of prey and predators
+ Currents
+ Data availability



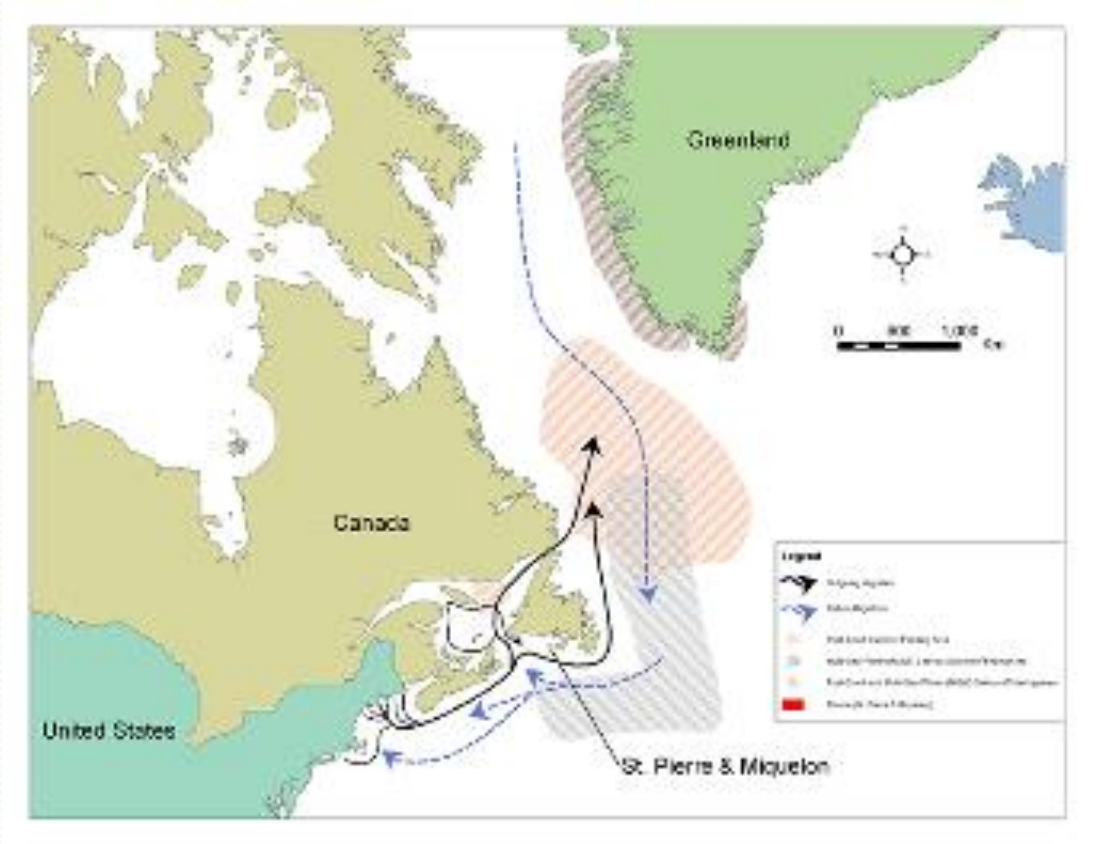
- This presentation highlights the challenges being faced in managing four categories of transboundary fish stocks in the Northwest Atlantic in an era of changing oceans

1. Atlantic Salmon (Anadromous)
2. Atlantic Bluefin Tuna (Highly Migratory)
3. American Eel (Catadromous)
4. Shared Groundfish in the Georges Bank Region (Straddling Stocks)

- A four-part “speed cruise” follows

1. Atlantic Salmon

- Salmon from Canadian and U.S. waters are known to undertake long migrations to feeding grounds off Western Greenland

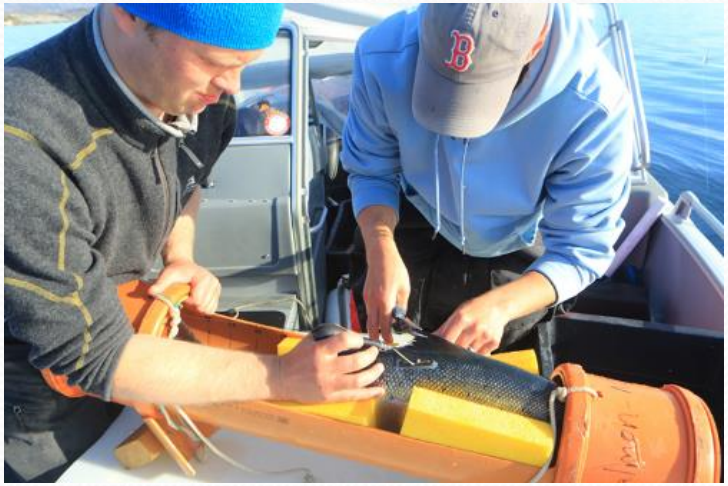


- The status of many of the contributing salmon populations might be described as “dire”
- Atlantic salmon in U.S. rivers are listed as endangered under the *Endangered Species Act*
- Atlantic salmon in inner Bay of Fundy rivers have been listed as endangered under Canada’s *Species at Risk Act*
- All commercial fisheries for North American Atlantic salmon are closed

- An array of contributing factors are likely at play in severe population declines including
  - Habitat degradations and dams
  - Elevated river acidities linked to acid rain
  - Parasites
  - Warming waters
    - May be causing early smolt migrations to sea when ocean conditions are poor for growth and survival
    - Southern edge of Atlantic salmon range is known to have shrunk by 2 degrees latitude (about 140 miles) (Windsor et al. 2012)

- Scientists and managers believe substantial mortalities occur at sea but a major scientific program, Salmon at Sea (SALSEA), has not been able to provide definitive answers on the causes

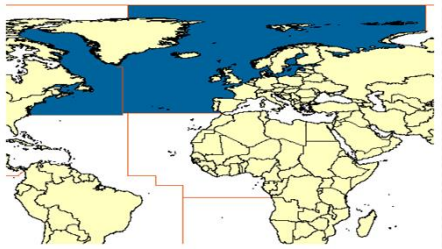
+ Most tagging and tracking of salmon has been coastal in nature



+ Uncertainty over how changing ocean currents, temperatures and food webs are influencing salmon populations (Windsor et al. 2012)

- Transboundary fisheries management has been exceedingly challenging even without the threats of climate change

+ The North Atlantic Salmon Conservation Organization (NASCO) was established in 1984 to manage salmon stocks moving beyond natural jurisdictions



  - West Greenland Commission established to regulate fisheries off of West Greenland
  - In early years, Commission not successful in curbing Greenlandic unilateral setting of quotas, including commercial catches

- In 1998, a breakthrough was accomplished where Greenland agreed to an internal consumption fishery only, estimated in the past to be 20 tonnes with this quota applying for most years through 2011
- In 2012, Greenland began to authorize factory landing quotas (25t for 2012, 35t for 2013, 30t for 2014) in addition to the personal consumption and other components of the fishery
- Reported catches escalated
  - 33t in 2012
  - 47t in 2013
  - 58t in 2014

Photo courtesy of Iain McLaren, FRS

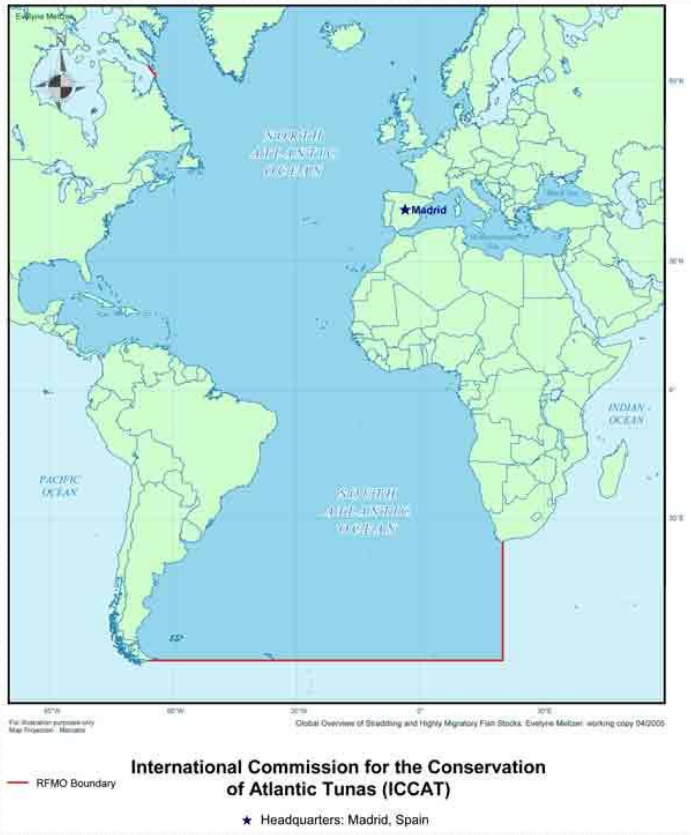
Photos courtesy of Mark Ives, CEFAS

- The International Council for the Exploration of the Sea (ICES) scientists have continually recommended against a mixed stock fishery off West Greenland
- At the 2015 NASCO meeting, the WGC could not reach consensus on a regulatory amendment and Greenland unilaterally committed to limit the total annual catch for all fishery components to no more than 45t in 2015, 2016 and 2017

- Suffice it to say, climate change impacts have <u>not</u> entered seriously into management measure discussions

2. Atlantic Bluefin Tuna

- Bluefin tuna are known to have a broad geographical distribution across the spatial coverage of the International Commission for the Conservation of Atlantic Tunas (ICCAT)



- The management of bluefin tuna has been problematic even without changing ocean conditions

+ From the late 1990s to 2008, ICCAT refused to follow scientific advice and set TACs above scientific recommendations

+ ICCAT was even called the International Conspiracy to Catch All Tunas

+ ICCAT has yet to agree on Convention amendments to formally incorporate precautionary and ecosystems approaches

- ICCAT continues to quite arbitrarily manage bluefin tuna stocks as two populations (western and eastern/Mediterranean) with a 45^{O} W meridian boundary even though stock structures remain largely unidentified and substantial mixing is known to occur (Fromentin et al. 2014)

- Atlantic bluefin tuna are known to have quite a tolerance for low and high ocean temperatures (Mahling et al. 2015)

+ Physiologically stressed by temperatures greater than 28-29^{O}C
+ Growing concerns over suitability of spawning areas in the Mediterranean and Gulf of Mexico with projected rising ocean temperatures

- Ocean warming has in fact raised new fisheries governance challenges with Atlantic bluefin migrating further north off Eastern Greenland

+ Migration believed to be linked to rising ocean temperatures off Eastern Greenland and the migrations of key prey, especially mackerel, into the region (Mackenzie et al. 2014)

+ Bycatch of Bluefin tunas in mackerel fisheries estimated to be
  - Three fish in 2012
  - None in 2013
  - Approximately 13 tonnes in 2014
  - About 2 tonnes in 2015

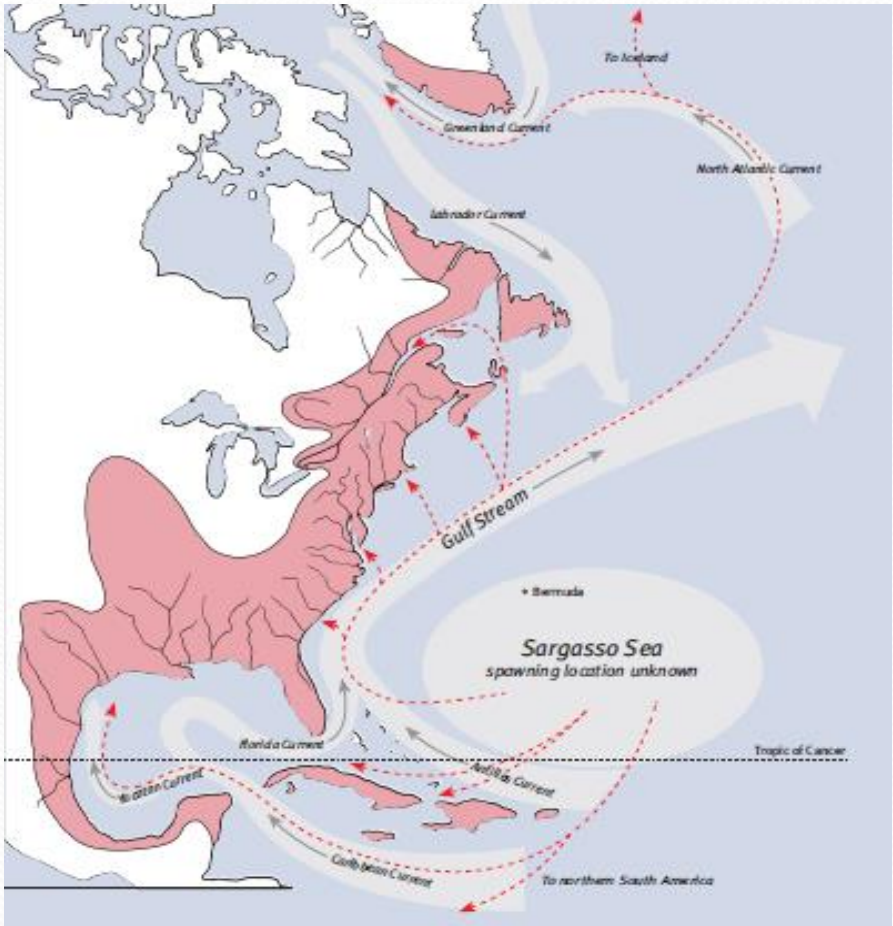
+ Uncertain whether migrating tunas are from the western or eastern Atlantic populations

- Greenland bycatches raise substantial governance challenges

+ Greenland is not a Party to ICCAT
+ The UN Fish Stocks Agreement (1995) restricts access to highly migratory fishery resources to members of regional fisheries management organizations having competence over such stocks (UNFA, Art. 8)
+ Greenland is considering becoming a Party to ICCAT, possibly under the wing of Denmark
+ ICCAT has not "woken up" to the issue
+ Greenland did contact ICCAT regarding the 2014 catches but apparently there was not much of a response as ICCAT had no category for Greenland catches in its reporting file
+ Meanwhile, Greenland is restricted in trading harvested bluefin tuna
  - Tuna caught in 2014 were reportedly transported to Iceland, an ICCAT member, and therefore not permitted to receive fish caught outside ICCAT allocations
  - Tuna taken back to Nuuk for frozen storage and alternative marketing

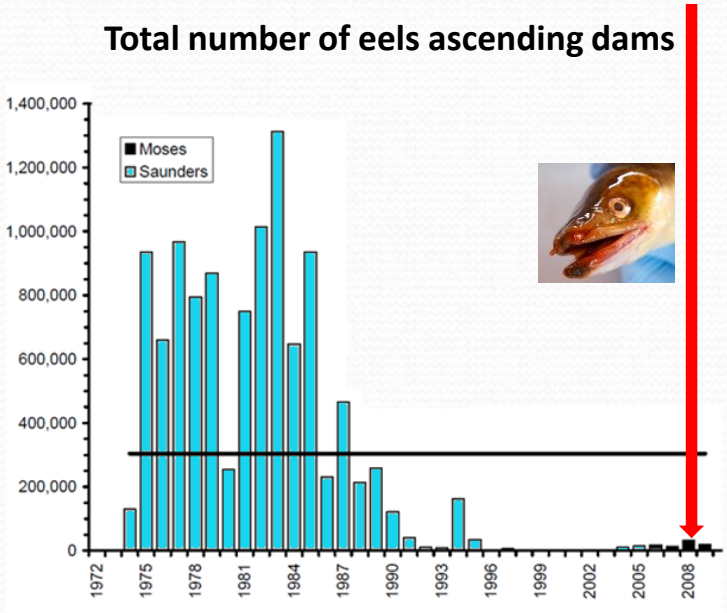
3. American Eel

- American eels are considered to be “one big happy family” and have a broad geographical range from Southern Greenland to the northeast coast of South America



Source: Gulf of Maine Council on the Marine Environment. 2007. *American Eels: Restoring a Vanishing Resource in the Gulf of Maine*, at 2.

- Scientists consider American eels to be threatened in light of their abundance declines and numerous anthropogenic threats
+ Abundance declines
  - The Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2012 assessed American eel as threatened
  - Canada is considering the listing of American eel under its *Species at Risk Act* (SARA)
  - In the **upper St. Lawrence River**, eel recruitment levels are 2% of those observed in the 1980s



DFO 2010. Status of American eel and progress on achieving management goals. DFO Can. Sci. Advis. Rep. 2010/nnn.

- Swirling number of threats
  - Hydroelectric dams and turbines
    - Over 8,000 dams of at least 2.5 m in height on the St. Lawrence River watershed in Canada alone

http://www.thecanadianencyclopedia.com/media/beauharnois-dam-2015.jpg

    - Silver eels exiting Lake Ontario are estimated to have an accumulated turbine mortality of 40% after passing through two generating stations

  - Bioaccumulation of contaminants

  - Swim bladder nematode parasite (*Anguillicoloides crassus*)

– Vulnerability to fisheries

Price of eels skyrockets to $2,000 per pound in Maine as result of worldwide shortage

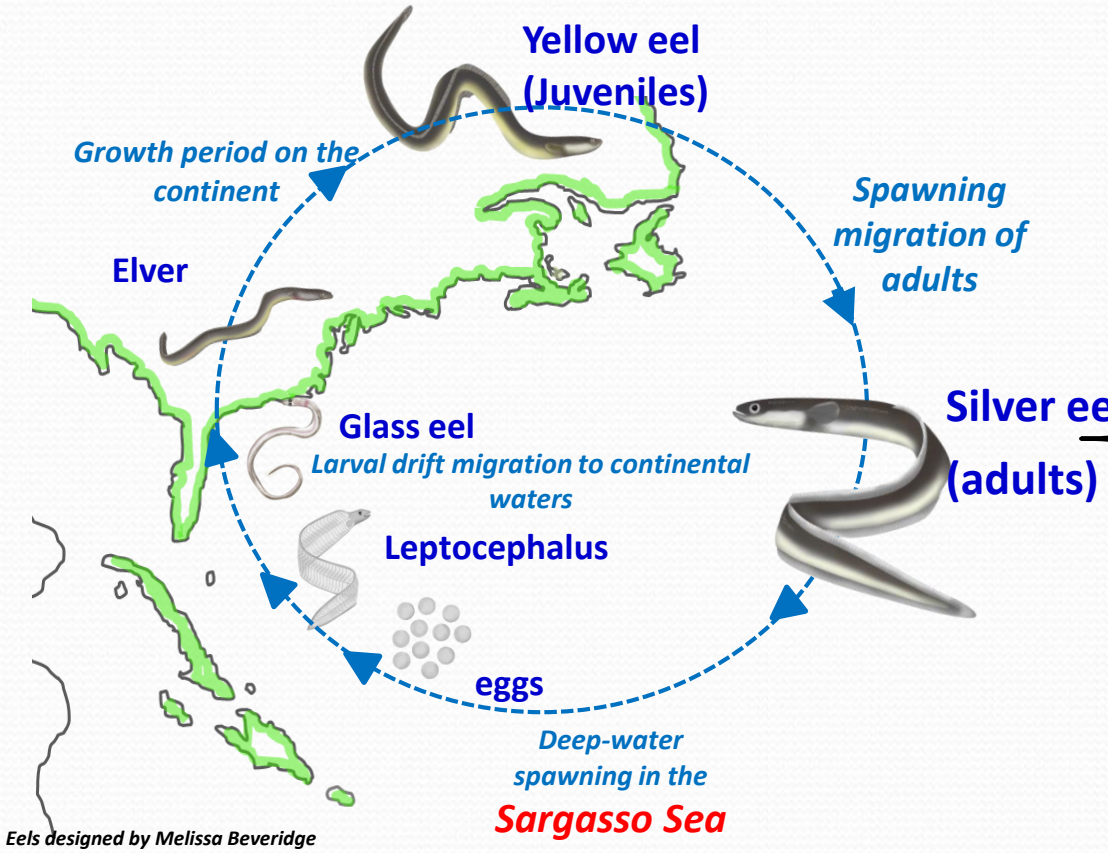
Sources: WCSH6 News, 2012; Huffington Post, 2012

- Climate change impacts on the North Atlantic also suspected to be a factor in declines, e.g.

+ Reduced larval survival due to warming of the spawning area in the Sargasso Sea

+ Changing positions and strengths of ocean currents, particularly the Gulf Stream (Vélez-Espino and Koops 2010)

- Scientists have yet to unravel all the mysteries of American eel migration routes and exact location of spawning in the Sargasso Sea



Escapement from continental waters

- Orientation mechanisms?
- Individual travel speed?
- Effect of body size or body condition?

Oceanic migration:

No adults ever caught in open ocean or in the Sargasso Sea!!!

- Migration routes ?
- Environmental conditions?
- Vertical migrations?
- Swimming speed?
- Orientation mechanisms?
- Exact location of the spawning site?

(Kleckner and McCleave 1985; Fricke & Kaese 1995; Jellyman & Tsukamoto, 2002, 2005; Tesch 1974-1991)

European eels also spawn in the Sargasso sea!

- A major scientific breakthrough did recently occur

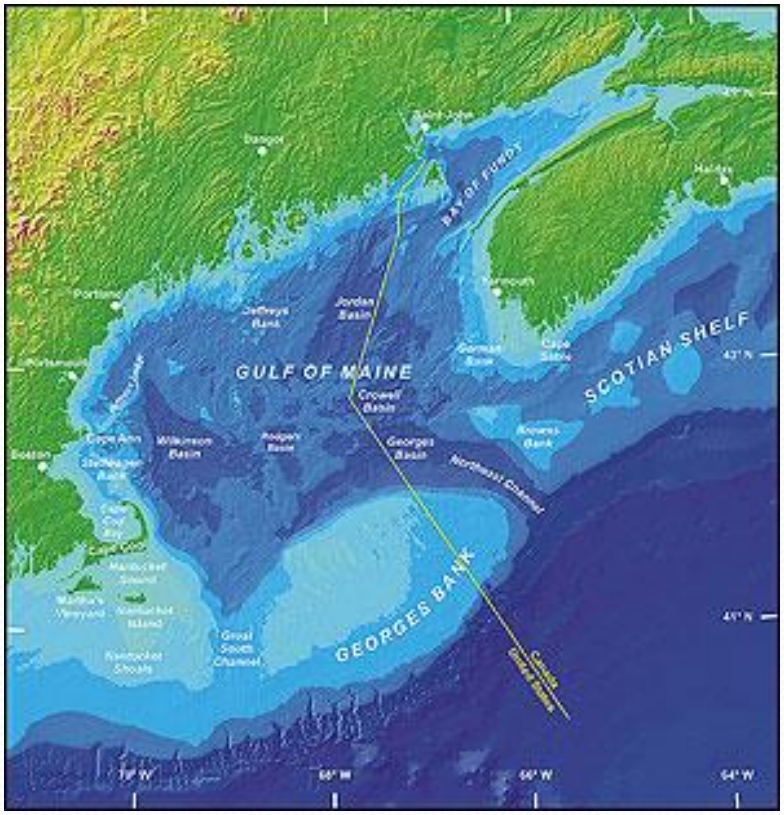
+ In the fall of 2014, OTN scientists trucked eels from the St. Lawrence region to Nova Scotia and released the tagged eels from near Blandford (about 45 miles south of Halifax)
  - Several eels made it off the continental shelf
  - Two reached the Gulf stream
  - One made it to the Sargasso Sea, close to Bermuda

- No bilateral or regional agreements/arrangements have been forged to address the scientific and management challenges facing American eels!

http://www.mnr.gov.on.ca

4. Straddling Groundfish on Georges Bank

- Transboundary management of three important commercial groundfish stocks (cod, haddock, yellowtail flounder) became critical after the World Court drew an ocean boundary across Georges Bank in 1984



- An informal management arrangement was established in 1995 to facilitate federal coordination of scientific research and fisheries management

+ Canada-U.S. Transboundary Resources Steering Committee

  - Transboundary Resource Assessment Committee
  - Transboundary Management Guidance Committee (government-industry committee, 2000)

- An agreed quota sharing formula was agreed to in 2003

+ Initially weighing geographical distribution of stocks (60%) and historical catch (40%) (1967-1994 landings)

+ Phasing by 2010 to
  - Distribution (90%) (determined by US and Canadian trawling surveys)
  - Historical utilization (10%)

- The status of Georges Bank cod and yellowtail flounder is very poor

+ Catch of yellowtail flounder in 2014 was 159 mt, the lowest amount since 1935

+ Catch of cod in 2014 was 534 mt
  - Catches averaged 17,198 mt between 1978 and 1993
  - Catches peeked at 26,463 mt in 1982

- Scientists have "sounded the siren" on the possible role of rapid warming to the collapse of the Gulf of Maine (GOM) cod fishery
  + Between 2004 and 2013 the GOM has warmed faster than 99.9% of the global ocean
  + Pershing et al., "Slow adaptation in the face of rapid warming leads to collapse of Gulf of Marine cod fishery" *Science* 350 (November 13, 2015): 809-812

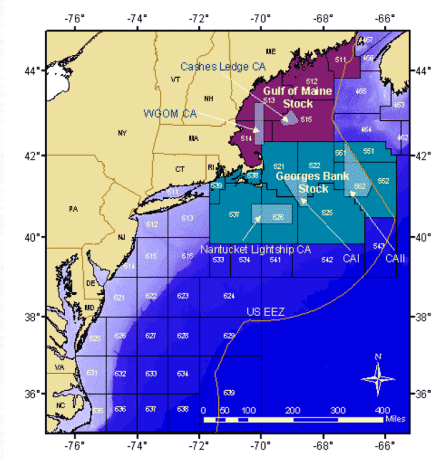


Figure 1.1. Statistical areas used to define the Gulf of Maine and Georges Bank cod stocks.

- Surprisingly, climate change has received no explicit attention for Georges Bank transboundary management
  + In the giving of scientific advice
  + In the recommendations of annual quotas

- Climate change may be indirectly reflected on the <u>distribution</u> component of the sharing formula

+ Canadian shares of cod have increased slightly since 2010
  - 76% in 2010
  - 81% in 2011
  - 76% in 2012
  - 84% in 2013
  - 78% in 2014
  - 81% in 2015

+ U.S. shares of yellowtail have fluctuated but recently increased
  - 64% in 2010
  - 55% in 2011
  - 49% in 2012
  - 43% in 2013
  - 82% in 2014
  - 70% in 2015

- Scientific uncertainty prevails over whether cod have moved off the Bank into deeper water around the Bank and into adjacent management areas

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MEOPAR

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