

Fisheries Management Law & Economics

Fisheries Management & Cod

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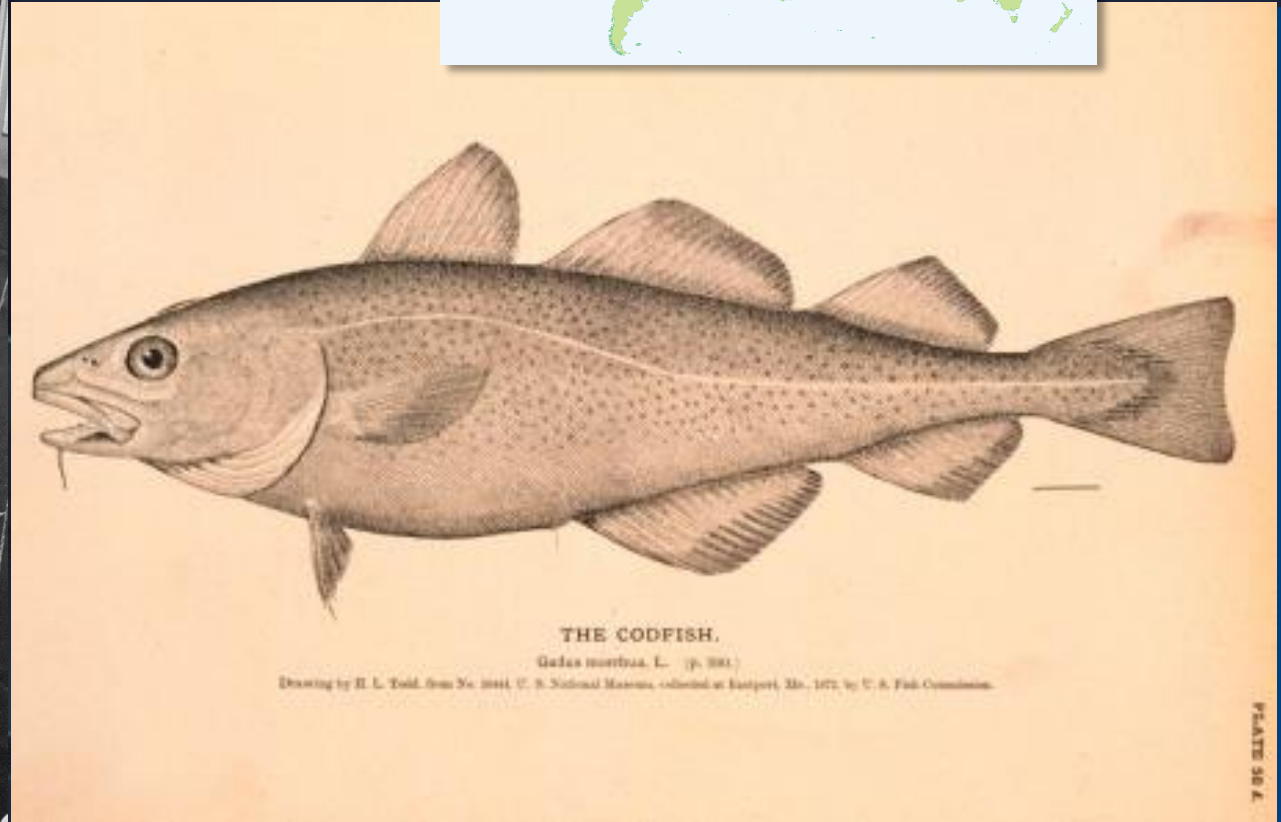
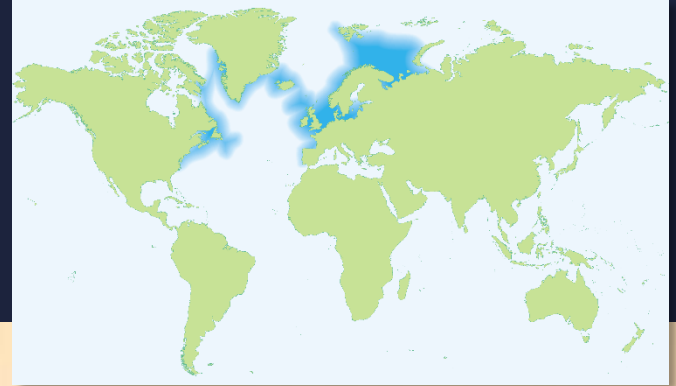
Fisheries Technology

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Management & the Story of Cod



Outline

Introduction to Fisheries Management

History of Cod

Collapse of Cod

Impacts of Cod Collapse

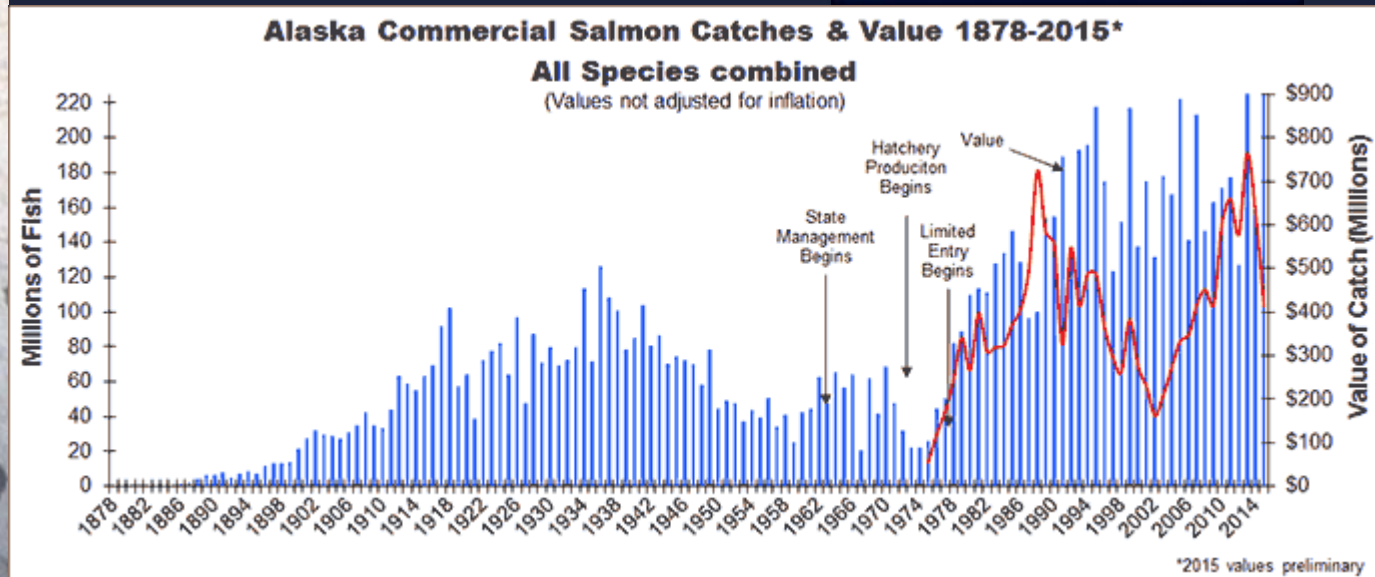
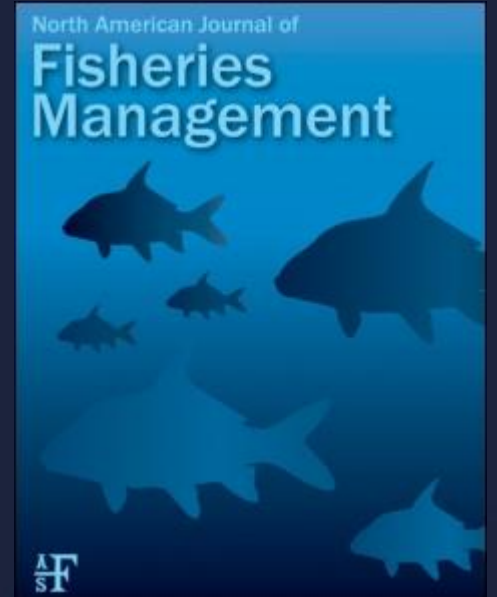
Cod Management strategies

General Fisheries Management Framework

Student Learning Outcomes

- Define fisheries management and the reasons that it is necessary in modern times
- Summarize the history of the Atlantic cod fishery
- Summarize the collapse of the Atlantic cod fishery
- Outline and identify the impacts of the Cod collapse
- Describe the cod management strategies that were employed to try and rebuild stocks
- Outline the framework and tools used in traditional fisheries management

What is Fishery Management



Review of Legislation

We have covered International, Federal, and State fisheries laws including

- UNCLOS, EEZ, CCRF
- Magnuson-Stevens, MMPA, ESA, CWA, Salmon Treaty
- AK constitution, ADF&G, BOF process

Form framework for fisheries management

- Effective fishery management
 - Consistent with these laws & policies
 - Must be enforceable

What is Fishery Management

- Where do we get this from - Wiki
- Fisheries management draws on fisheries science in order to find ways to protect fishery resources so sustainable exploitation is possible.
- What if no Exploitation?
 - Just monitoring

The need for management

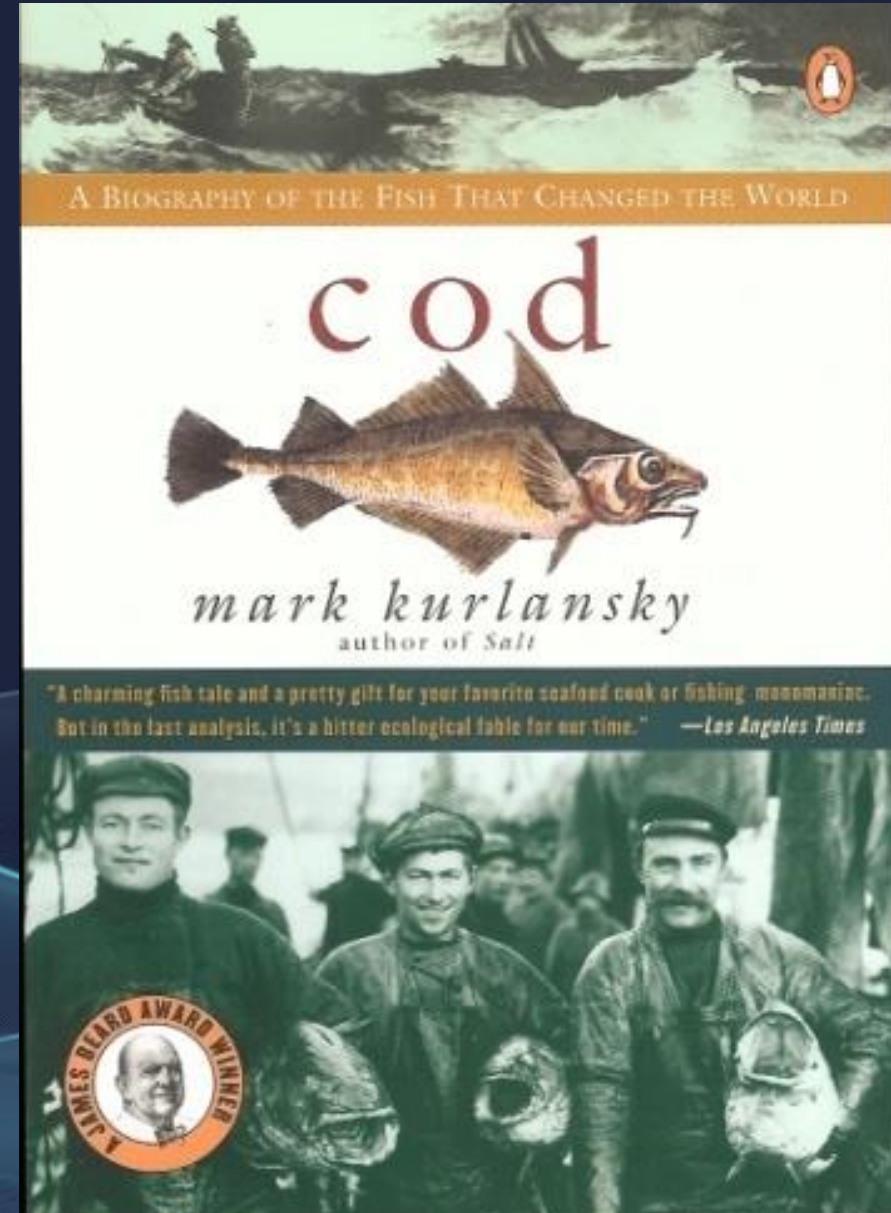
- Before Laws?
 - Open Access, First come first serve
 - Distant-managed, corporate-controlled fish traps and high seas Japanese harvests were depleting salmon runs in Alaska
 - Industrial development was causing irreversible damage to salmon and other species habitat in both Atlantic and Pacific areas
 - North Atlantic cod fisheries in sharp decline
 - The United Nations declared 30% overfished

Self Check

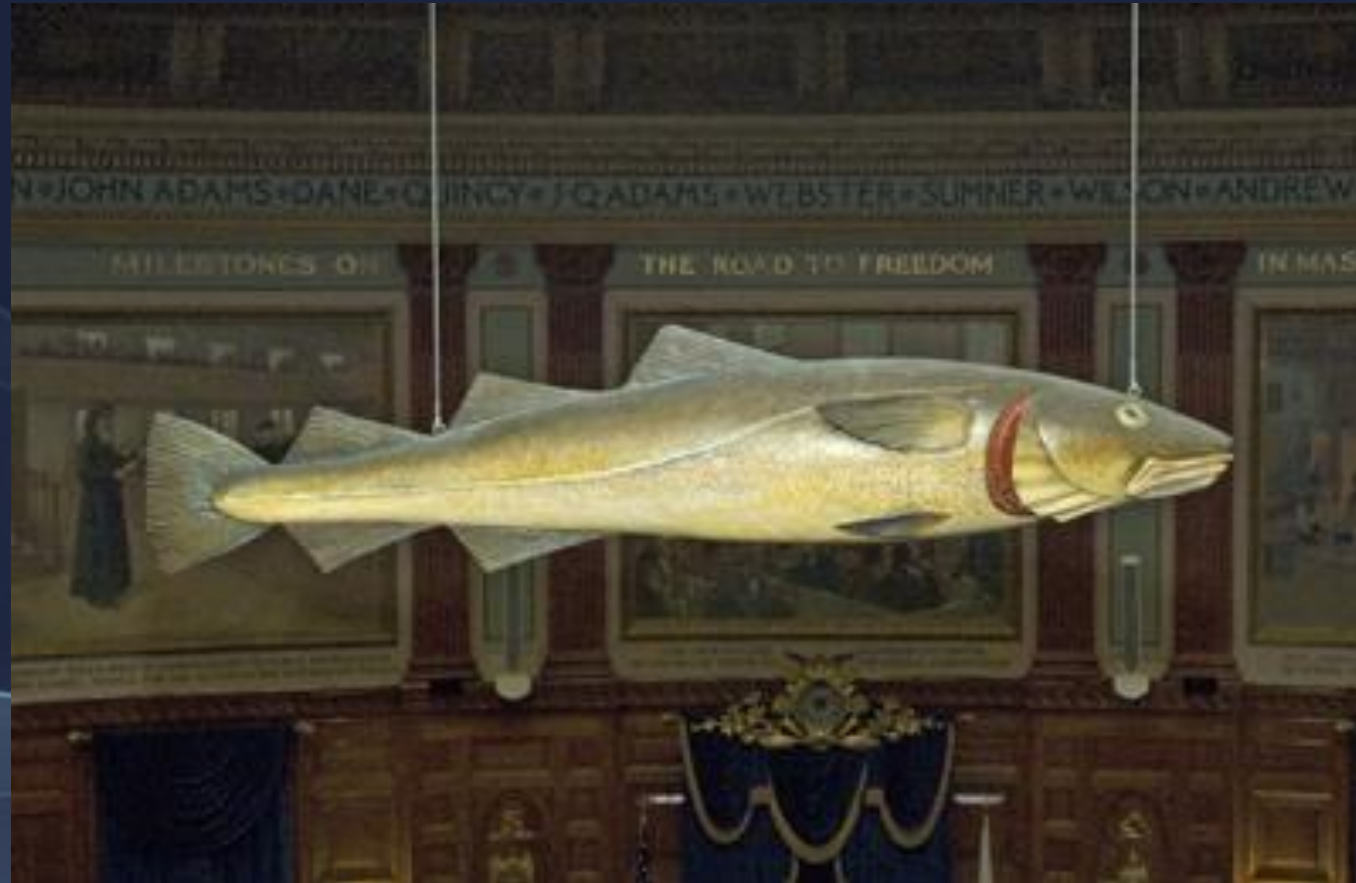
- Effective laws are critical to building the foundation for fisheries management
 - True
 - False
- Fishery Management uses science to protect fisheries and allow sustainable exploitation
 - True
 - False

Lets Talk About Cod

....World's most influential fishery ever



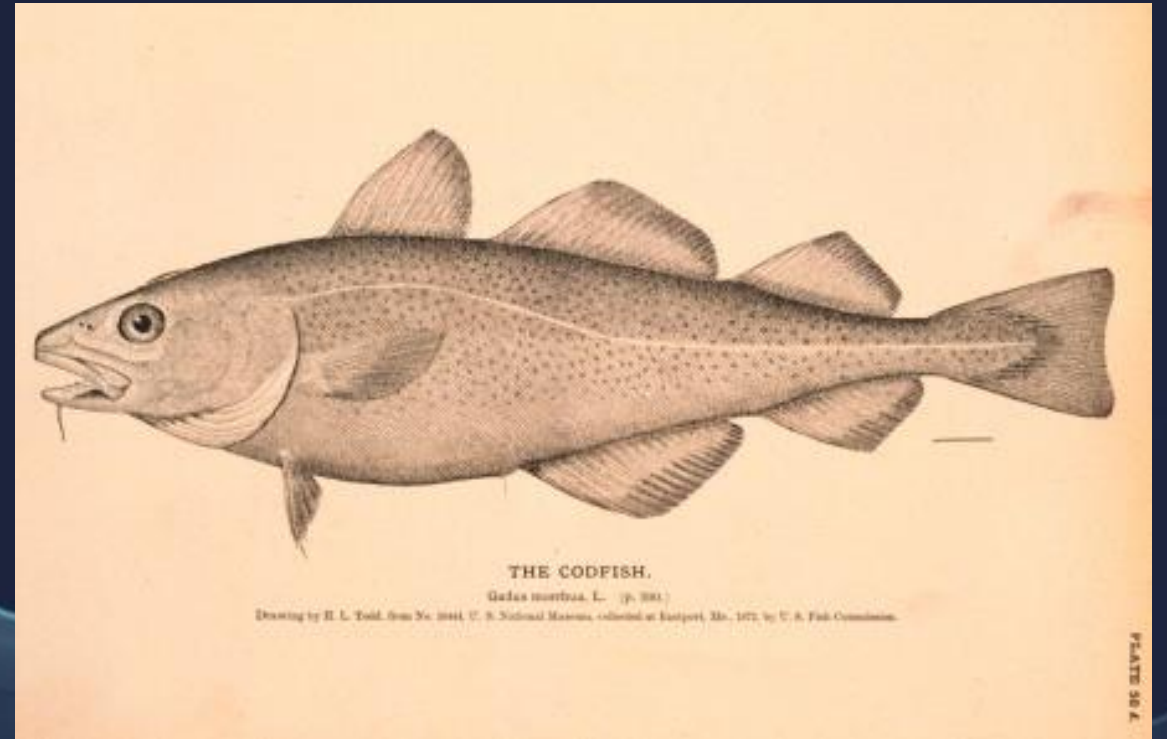
“The Sacred Cod”



House of Representatives - Massachusetts State House

Cod – Basic Biology

- Demersal
- Maximum age 20+ years
- Length – 130cm (51 in)
- Weight – 25 – 35kg (77 lbs)
- Sexual maturity 2-4 years
- Broadcast spawners
- Omnivorous



“Cod - A species too well known to require any description. It is amazingly prolific. Leeuwenhoek counted 9,384,000 eggs in a cod-fish of a midling size - a number that will baffle all the efforts of man to exterminate.”

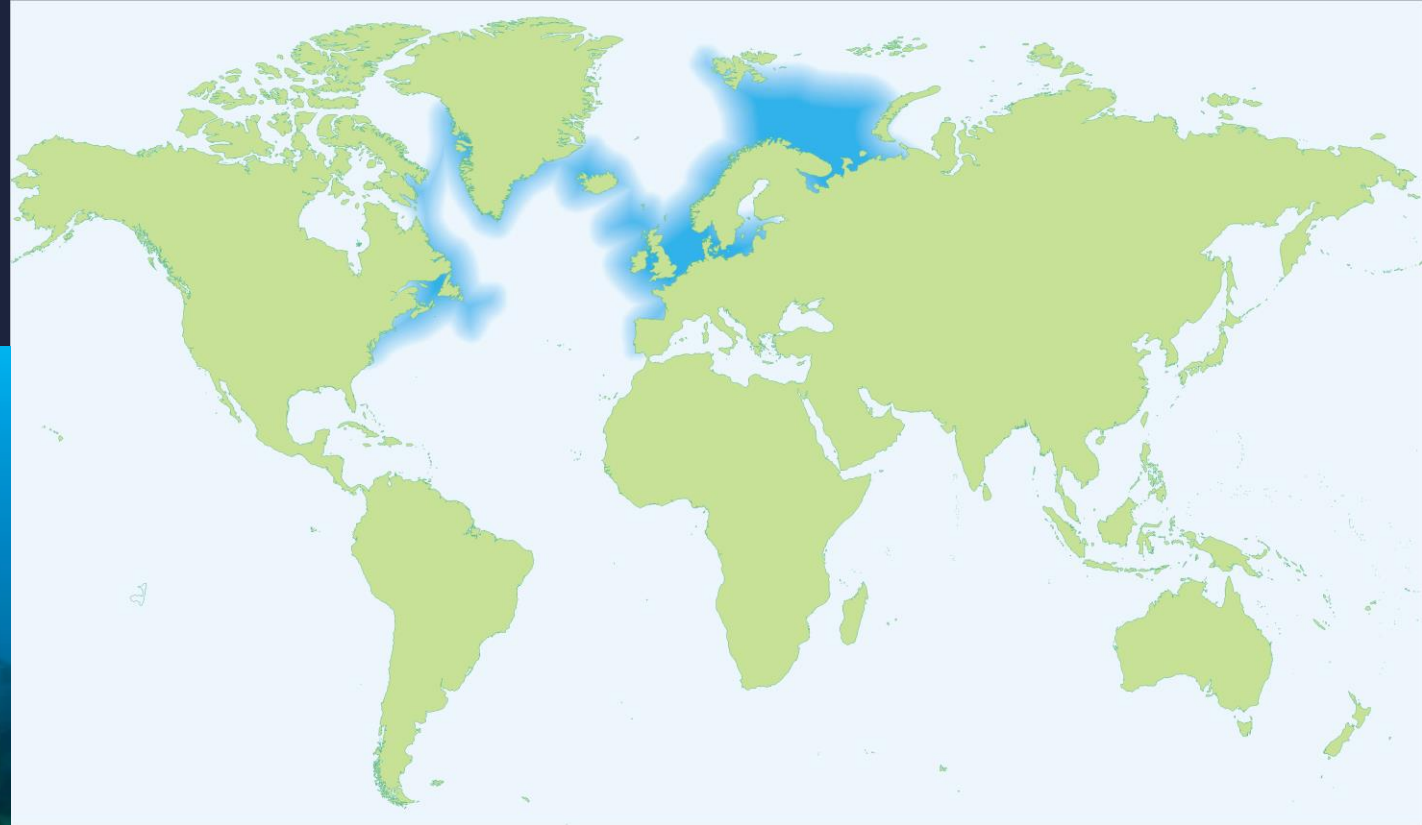
Cod Use to get big!

- Over 100 lbs not uncommon
- 180 lb caught in 1938
- 211 lb caught in 1895
- Not this big for > 100 yrs



Distribution of Atlantic Cod

- North Atlantic
- Coastal & Offshore
- Breeding congregations



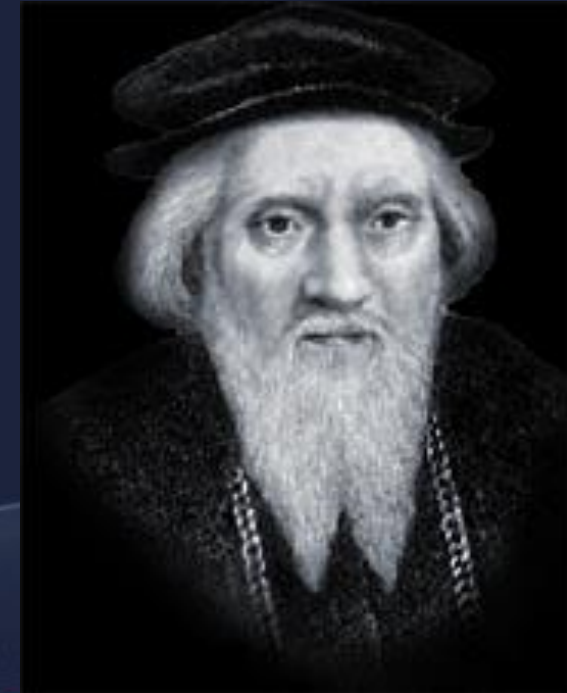
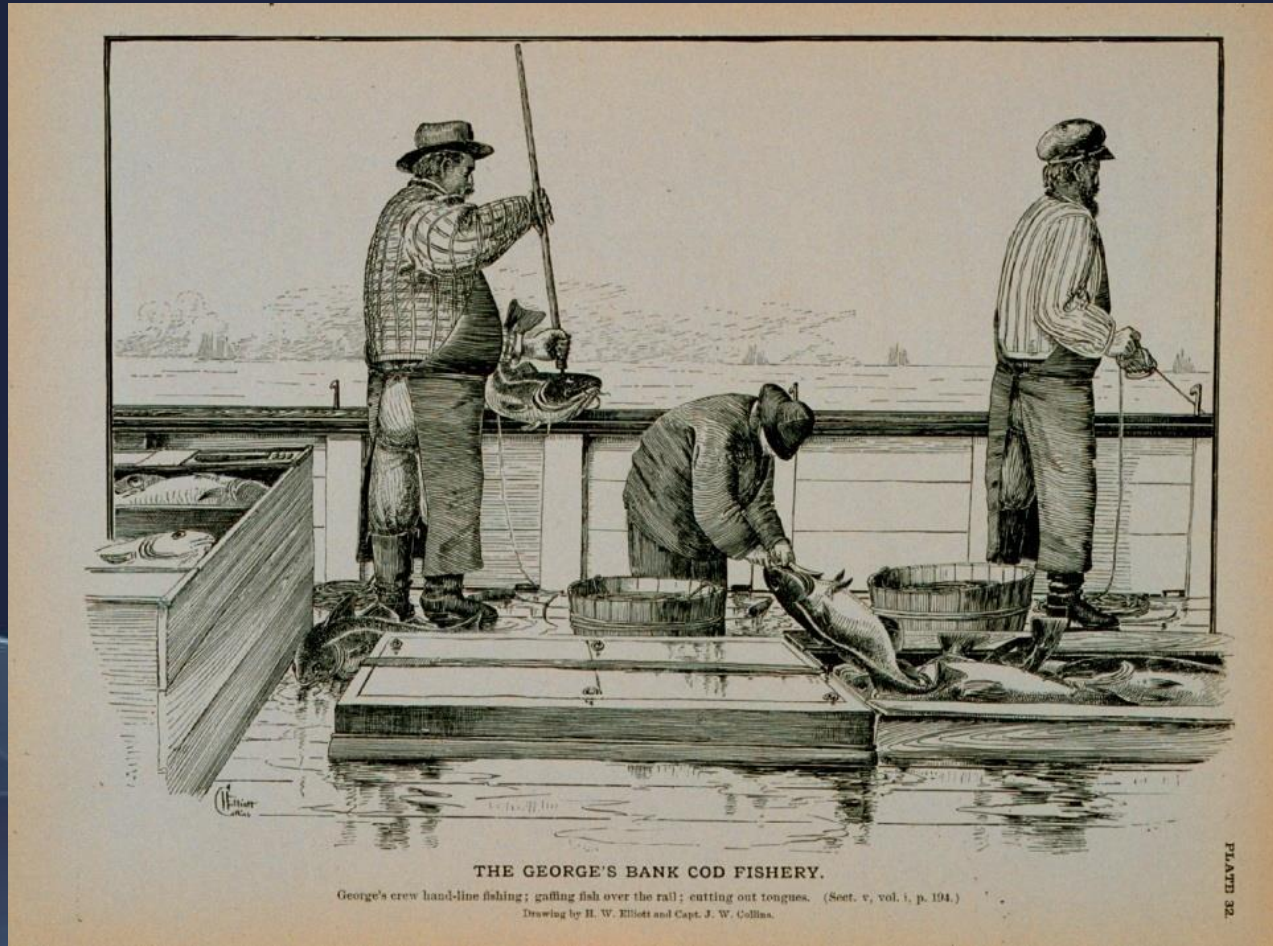
Where do they live?



Georges Bank
East Scotian Shelf
Grand Banks



Cod Early History



1497 English explorer John Cabot - “The coast was churning with cod of school size and body size never before seen.”

Cod in the 1500s

- Newly discovered cod stocks off the coast of Newfoundland were being fished by European fishermen who used single baited hooks
- “With incredible quantities, and no less varieties of kinds of fish in the sea and fresh waters, as Trouts, Salmons and ... also Cod, which alone draweth many nations thither, and is becoming the most famous fishing of the world.”
- Profits from Grand Banks cod become a major contributor to European wealth



1550 - Cod were so abundant that one English captain reported "that we hardly have been able to row a boat through them."



THE BANK HAND-LINE COD FISHERY.

Hand-line dory cod fishing on the Grand Bank. (Sect. v, vol. i, p. 136.)

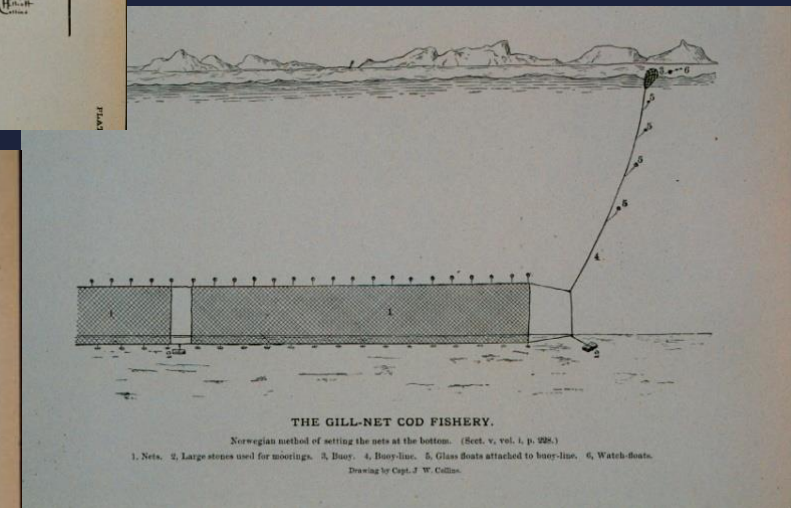
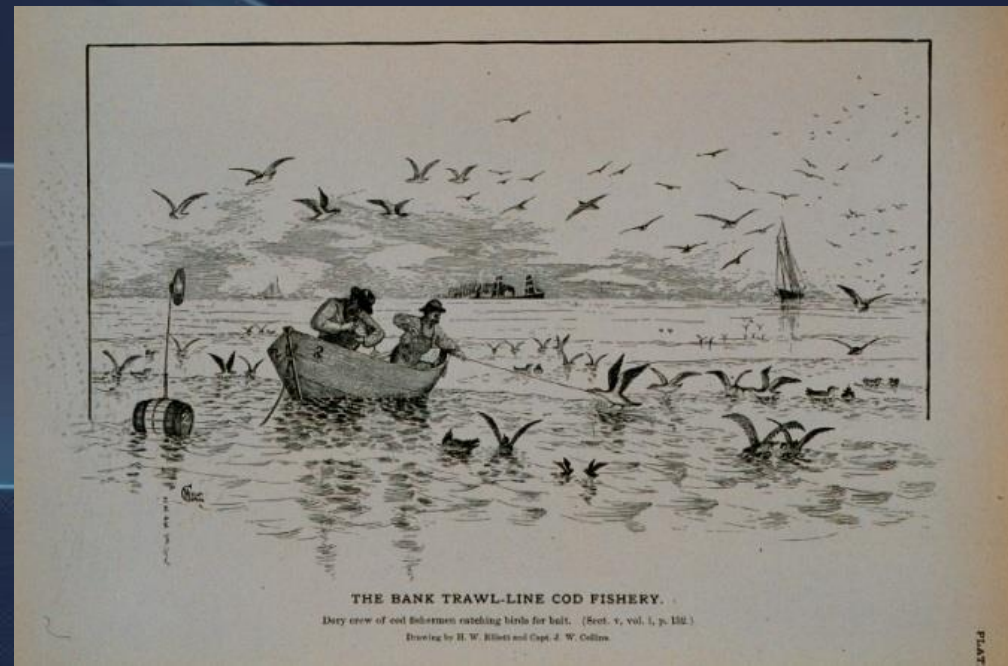
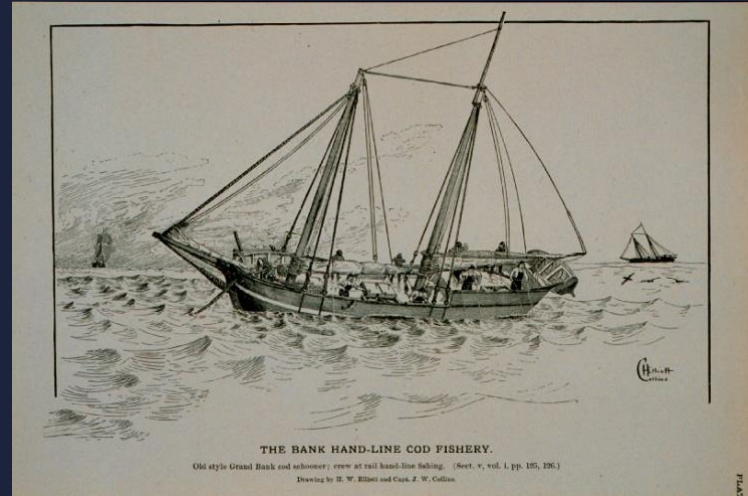
Drawing by H. W. Elliott and Capt. J. W. Collins.

Early harvest methods included handline, longline and gillnets

- Wind Powered Schooner
- Gillnet
- Dory fisherman - handline

Major U.S. ports (1800s)

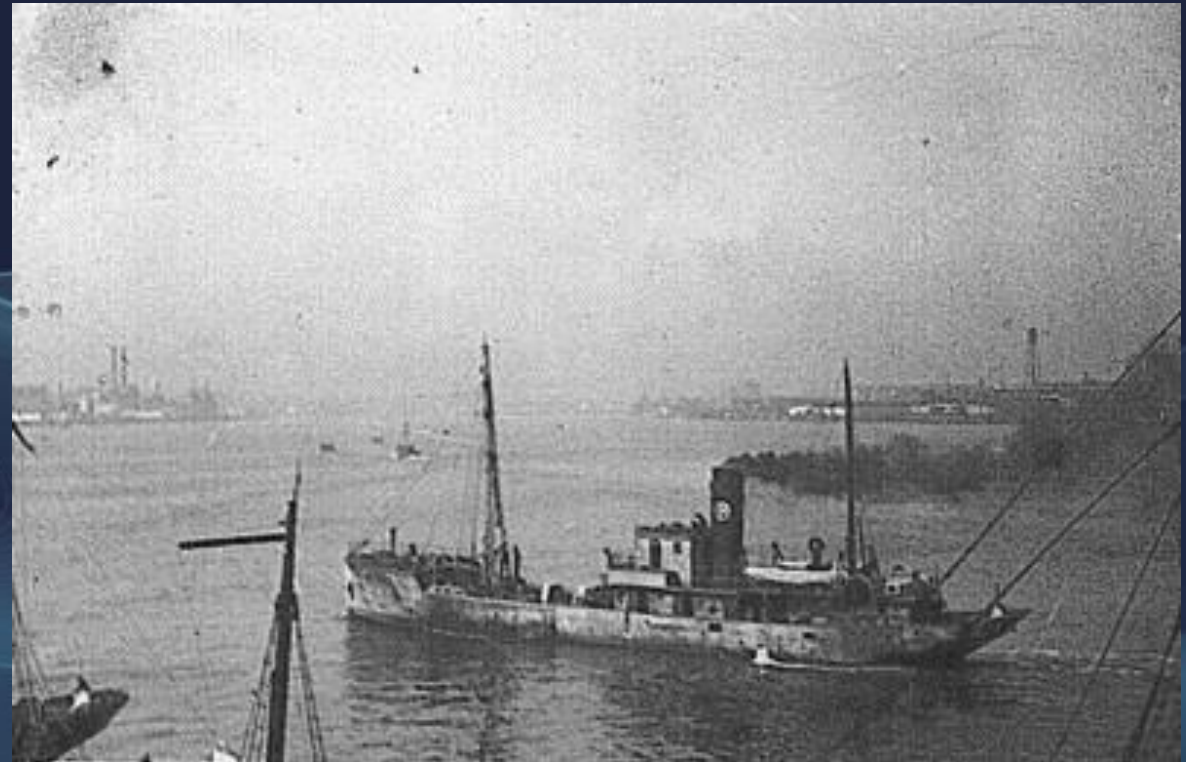
- Gloucester
- Boston
- New Bedford



1880-1910 - First signs of trouble

- Fishing pressure on the Grand Banks cod stocks increases dramatically due to the decline of inshore stocks
- Standard of living plummets in Newfoundland
- 1906 - French steam trawlers appear on the scene
- Science warns of fishing pressure

French Steam Trawler



Bottom trawling becomes the harvest method of choice

- Bycatch
- Habitat destruction



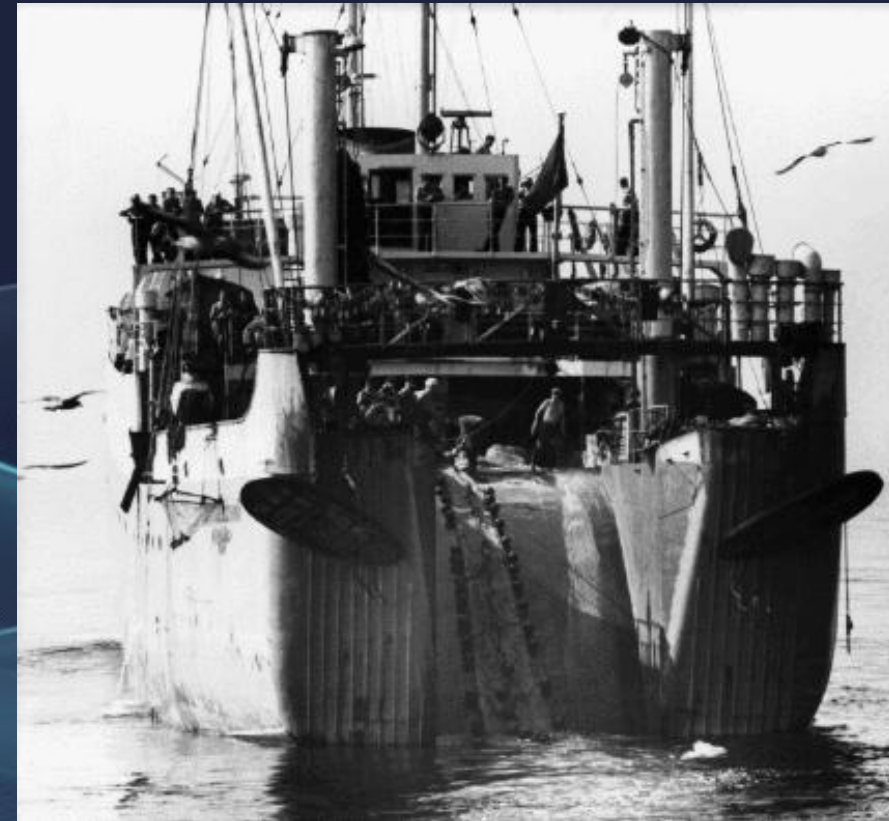
An Early Warning

“While the facts before us show no proof or presumption of any depletion of the fisheries on the banks frequented by American otter trawlers, it is possible that the seeds of damage already have been sown and their fruits may appear in the future or that the development of a wholly unregulated fishery eventually may result in injury where none exists.”

1914 Report of the U.S. Commissioner of Fisheries

Increasing fishing pressure from foreign vessels

- 1954 - The first factory-freezer trawler, the British fishing vessel *Fairtry*, fishes the Grand Banks for cod
 - 400 ft steam trawlers
 - 600 tons / day
- 1968 - over 800,000 tons of cod were harvested accounting for 40% of global fish landings
- Overinvestment in fishing power



Soviet Factory Trawler

- 900 trawlers
 - 400 Soviet
- 60% of adults removed
- 3X recommended catch



Atlantic cod landings from Georges Bank 1893 - 2004

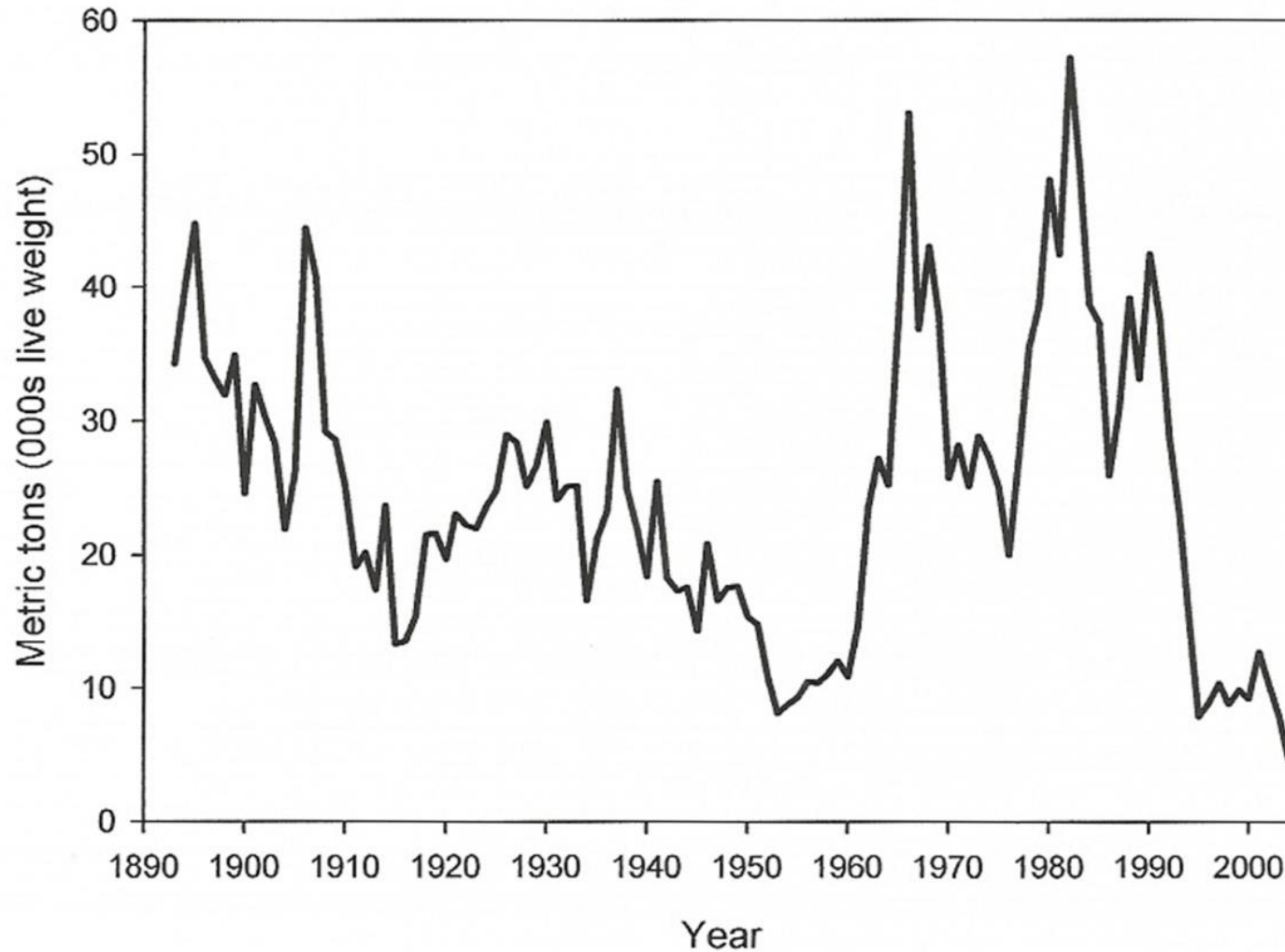
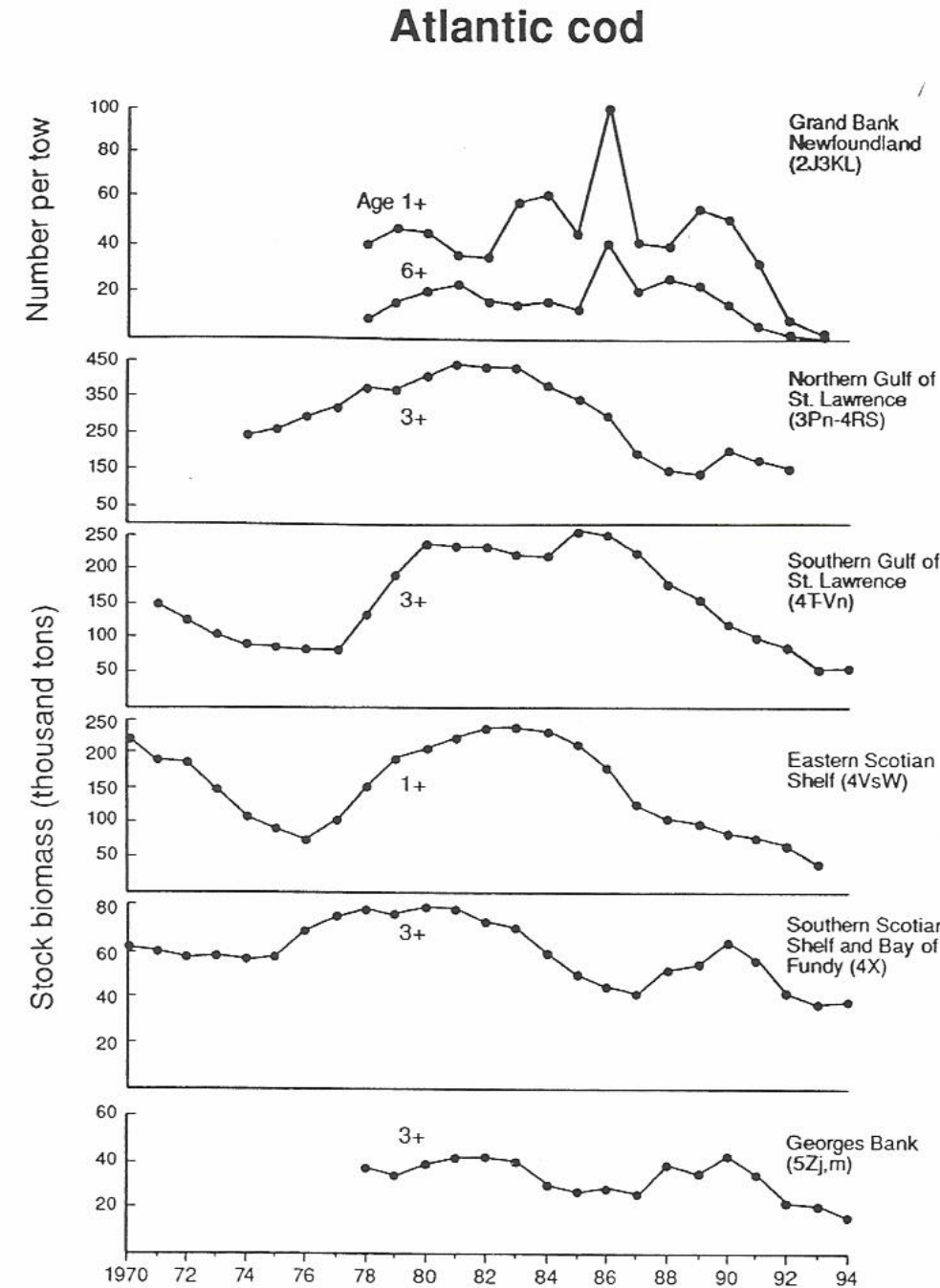


Figure A1a. Total commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6), 1893-2004.

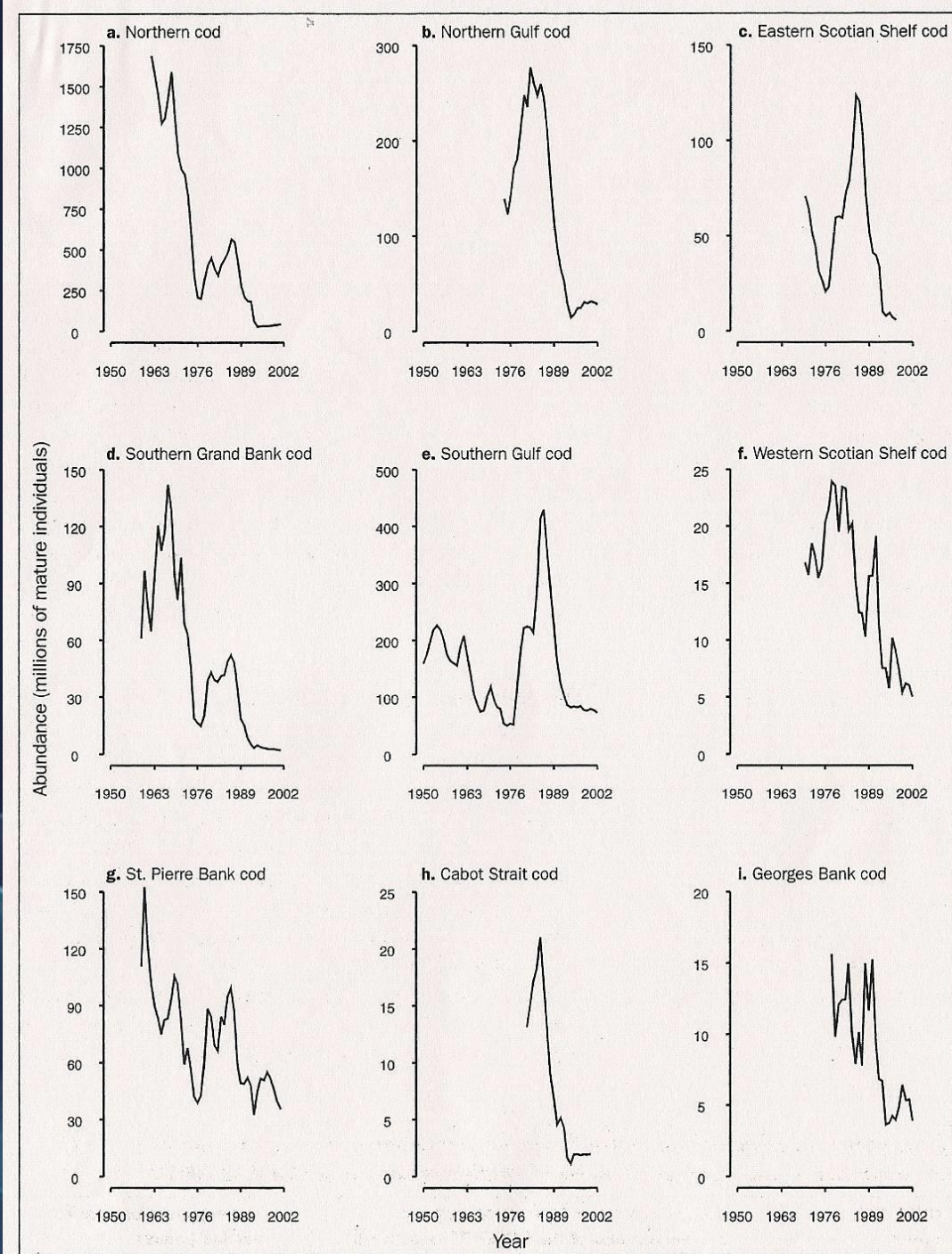
Cod Trends

- Trends in stock sizes of Atlantic cod in the northwest Atlantic 1970-1994
 - Sharp decline 1990 - 1994



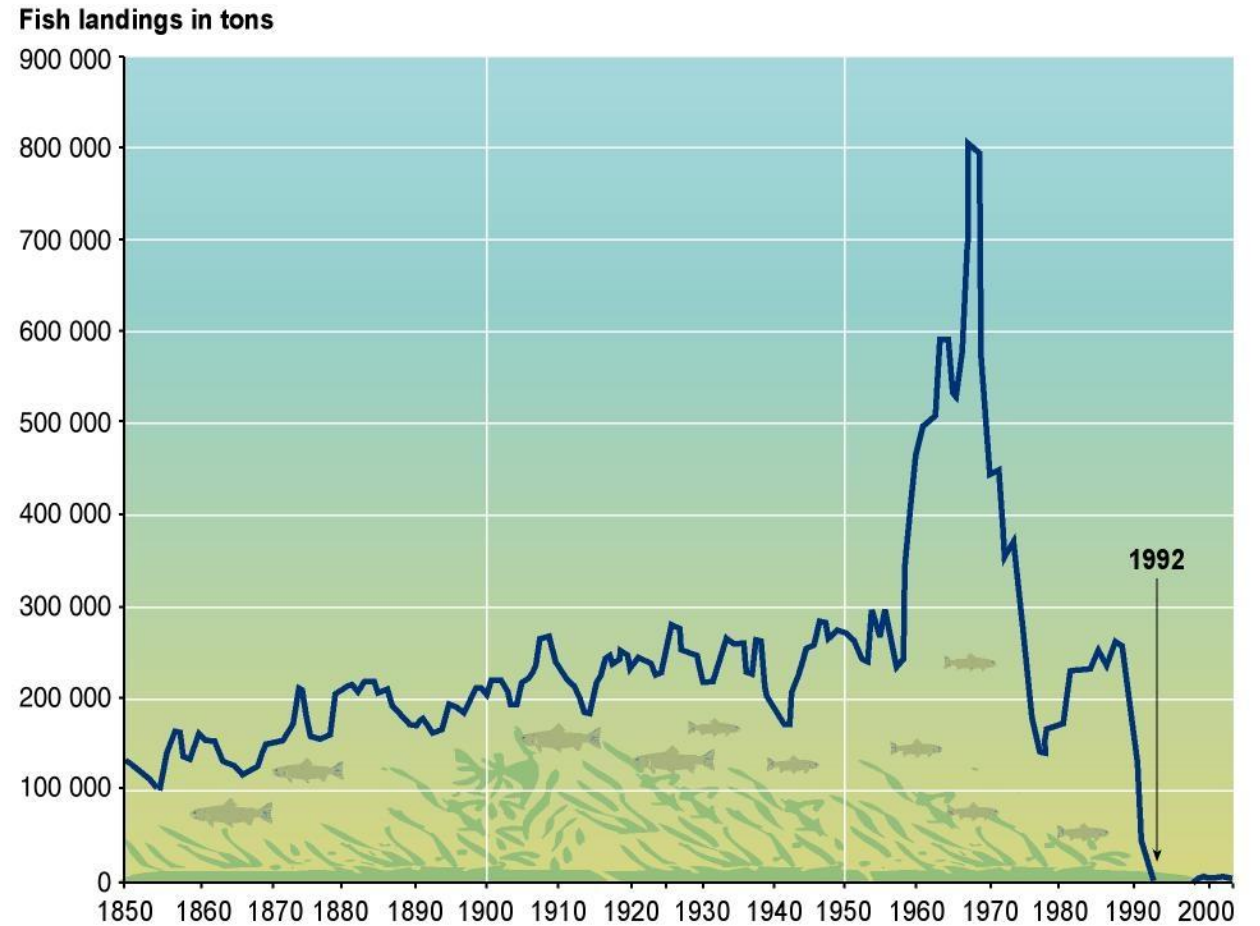
Cod in Canada

- Trends in abundance of spawning Atlantic Cod in Canadian waters
- 9 stocks 1950 – 2002
 - Sharp Declines late 1980's



Atlantic cod stocks off Newfoundland

- In 2003, the Newfoundland cod population was declared “endangered” by the Canadian government
 - Sharp Decline 1980’s

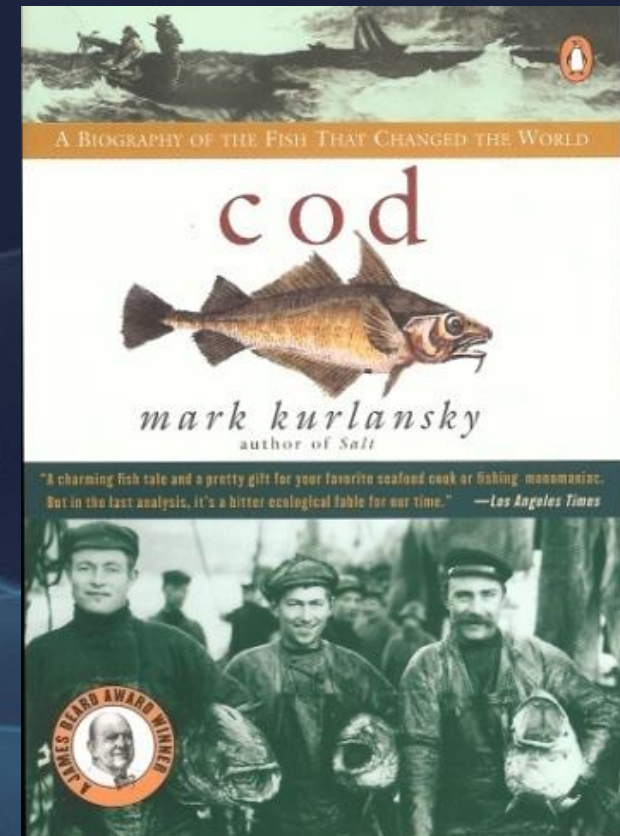


Source: Millennium Ecosystem Assessment

The Cod are Gone

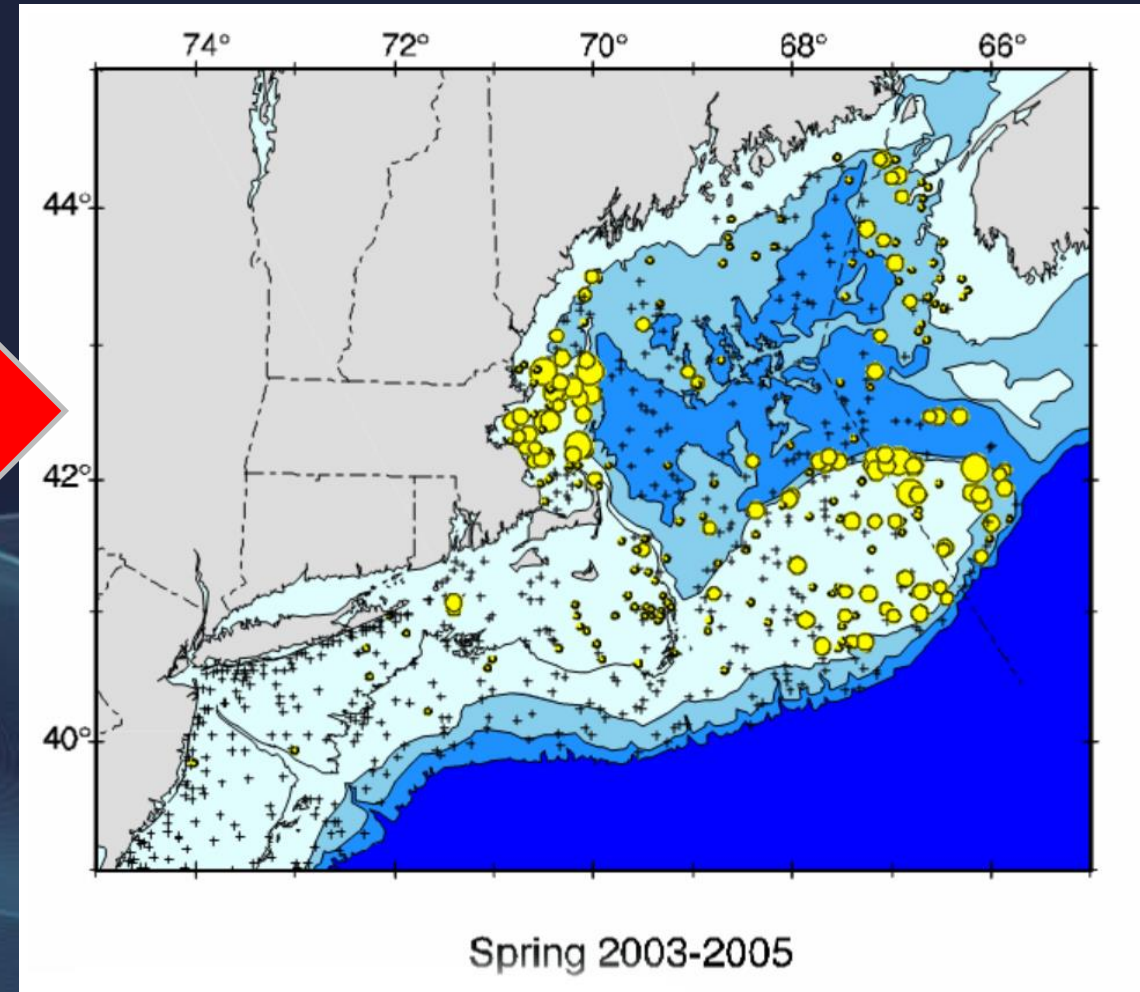
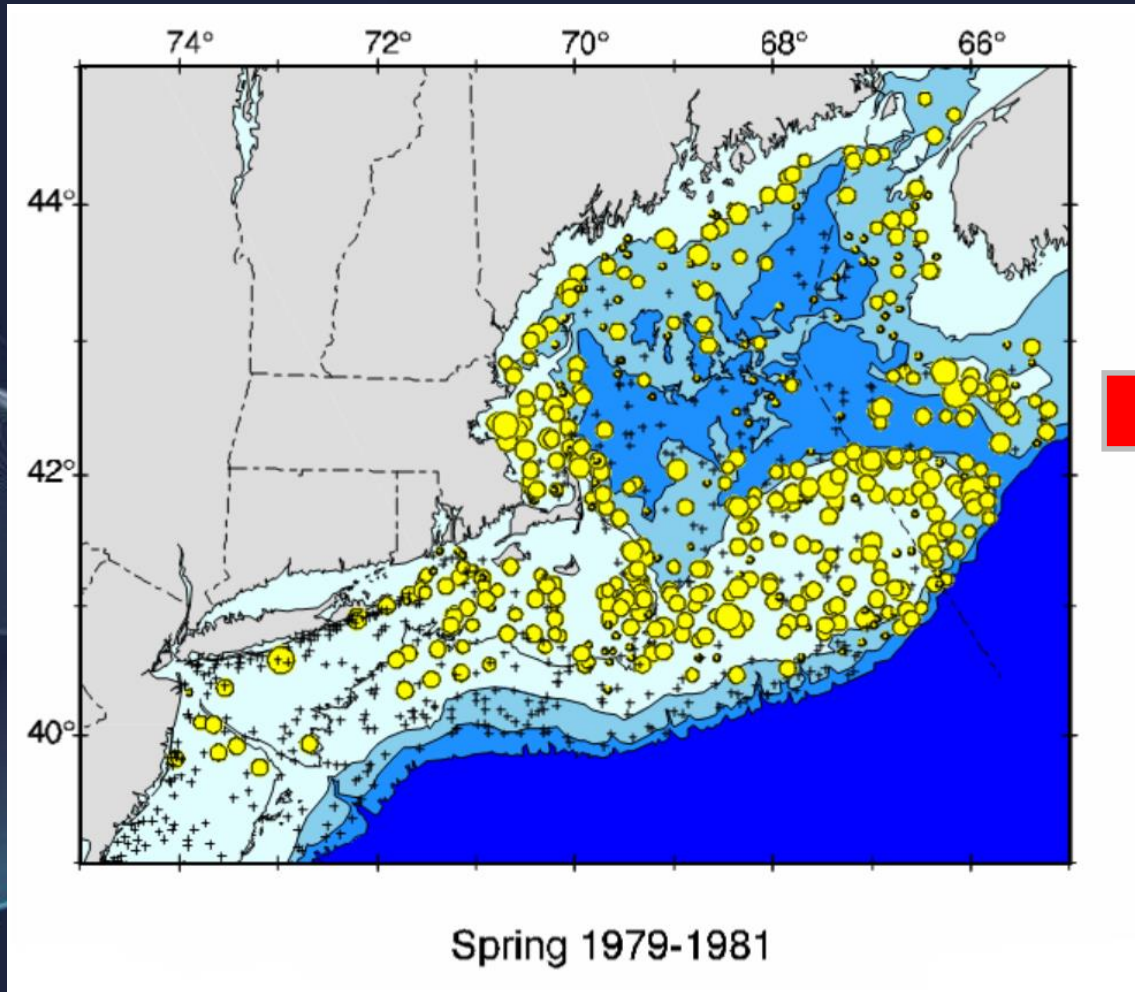
"Just 3 years short of the 500-year anniversary of the reports of Cabot's men scooping up cod in baskets, it was over. Fishermen had caught them all....."

Mark Kurlansky 1997



Distribution and abundance of cod in the Northwest Atlantic 1979-2005

www.nefsc.noaa.gov/read/popdy/cod_animation/



Collapse

“If John Cabot were alive today, he would not recognize Georges Bank. Instead of a sea swarming with majestic cod, he would find dogfish. Instead of flounder, he would find skates. Instead of a fisherman’s dream, he would find a nightmare.”

U.S. Congressman Gerry Studds 1991

Kurlansky: “The problem with the people in Petty Harbor, out here on the headlands of North America, is that they are at the wrong end of a 1,000-year fishing spree.”

Self Check

- Cod could be said to be the worlds most influential fishery ever
 - True
 - False
- About when did the cod stocks collapse
 - 1850
 - 1910
 - 1950
 - 1990

Break

Population, Community and Ecosystem-level Effects

- Fishing-induced changes in life history characteristics
- Fishing-induced evolutionary changes
- Trophic cascades
- Habitat alteration



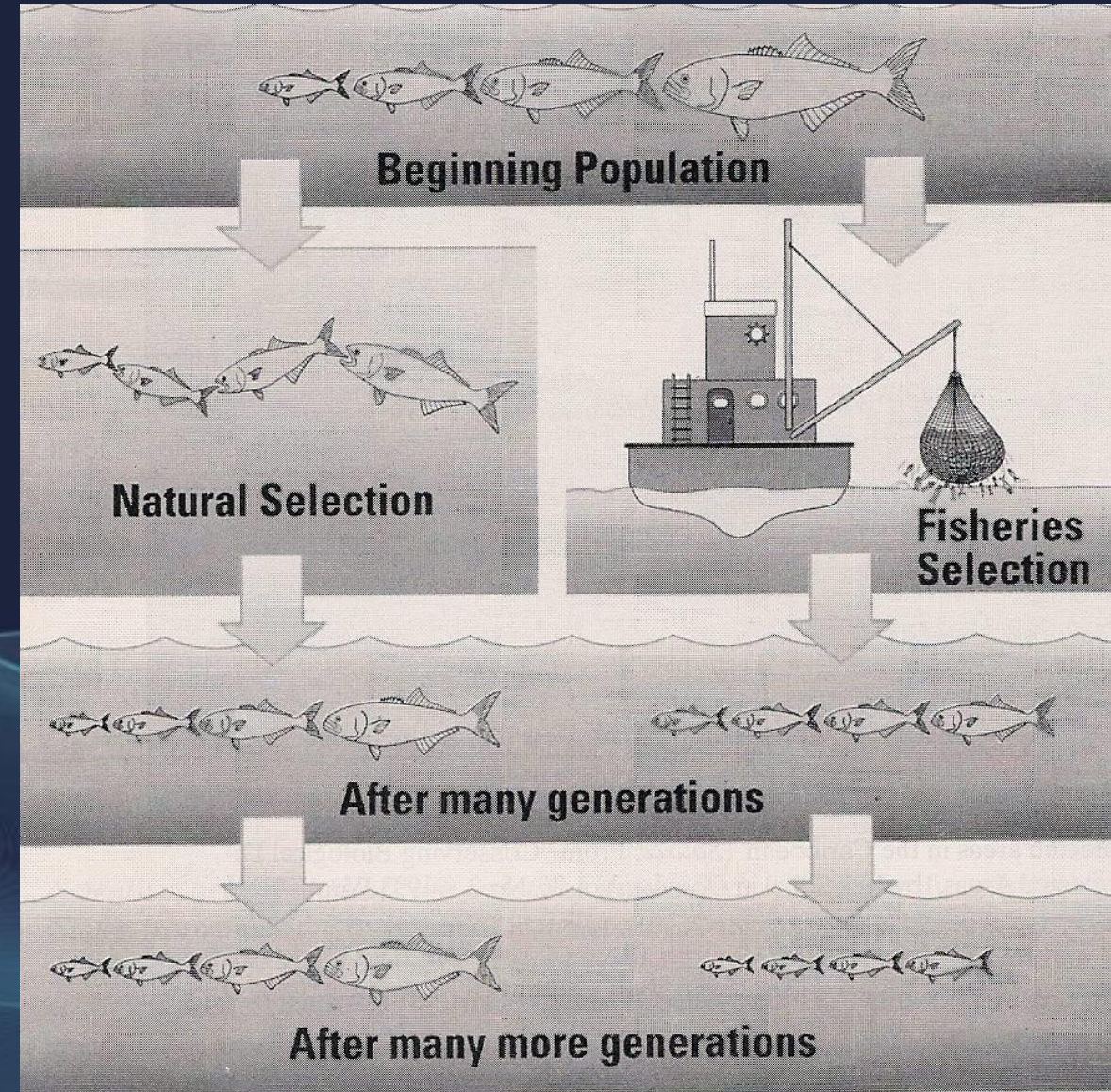
Fishing-induced changes in life history characteristics

- Female cod responded to fishing pressure by spawning at an earlier age
- However,
- ... younger females produce smaller and fewer eggs and smaller fry that are more susceptible to predation.



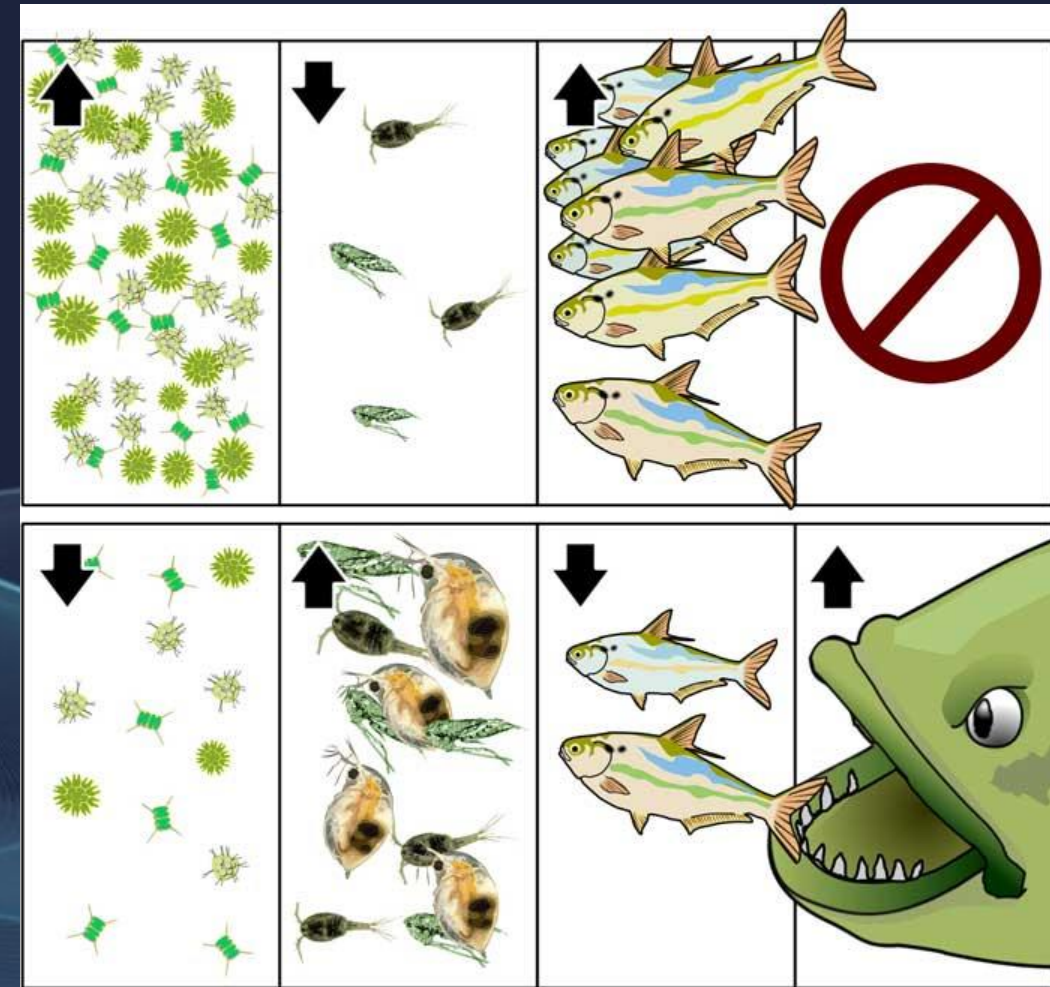
Fishing-induced evolutionary response in Atlantic Cod

- Fishing pressure exerts strong selection against large individuals in the population
- and, for small, slower growing fish.



Evidence of a Trophic Cascade

- The domino-like effect of removal of a top predator
- “The population has yet to recover... with large predatory fish removed, their prey have had population explosions and have become the top predators, affecting the survival rates of cod eggs and fry.”



Habitat Degradation: the impact of fishing gear



Before trawling



After trawling

Deep-sea *Oculina* coral reefs off Florida's Atlantic Coast

Damage to benthic habitats may slow the recovery of some fish stocks



Before trawling



After trawling

Self Check

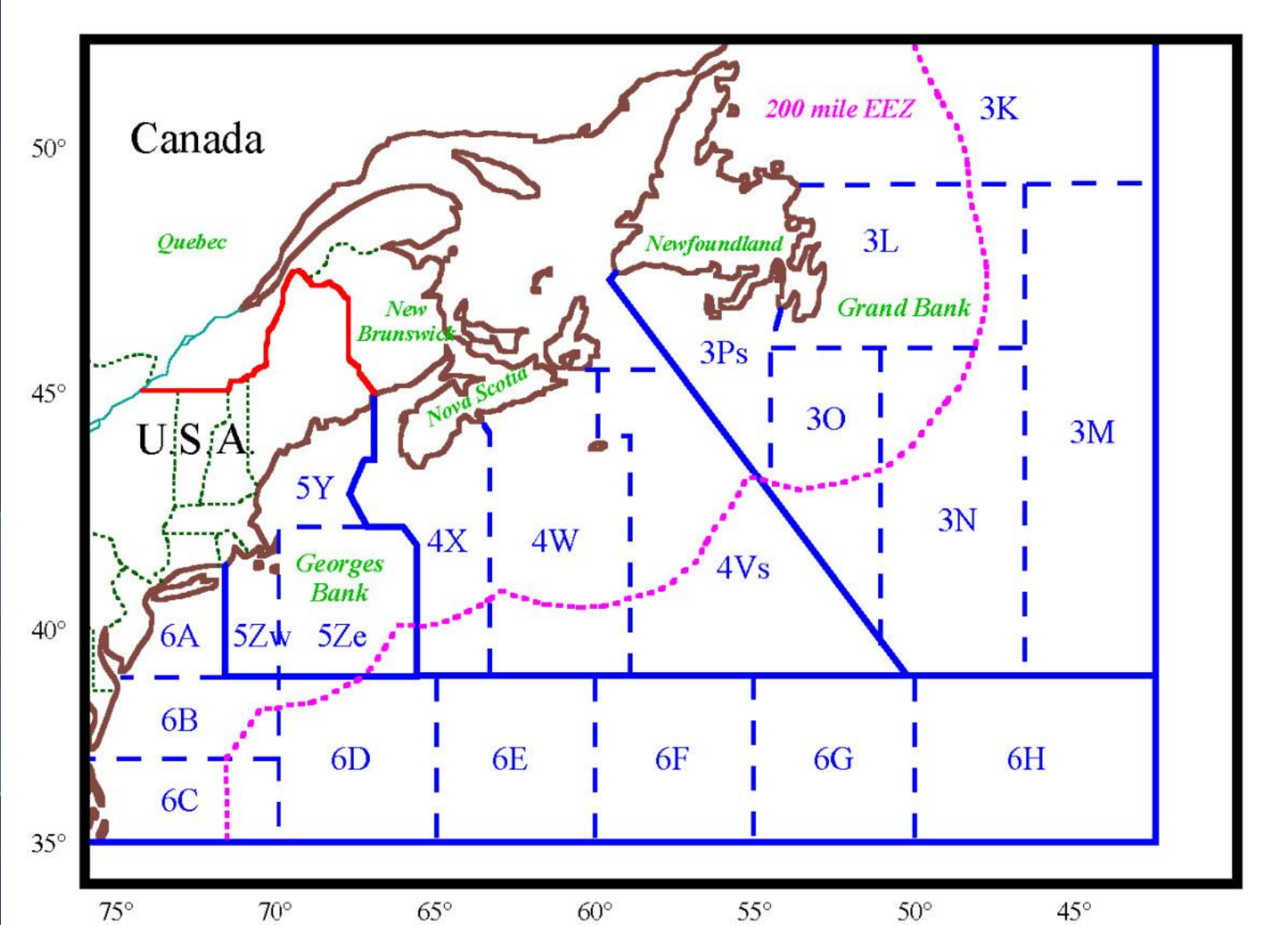
- A trophic cascade can be described as a domino-like effect of removal of a top predator
 - True
 - False
- The collapse of cod was primarily due to the trophic cascade imposed by fishing pressure despite suitable fish habitat
 - True
 - False

Cod Management

- 1953 - Minimum mesh sizes for trawl nets
- 1975 - International Commission for the Northwest Atlantic Fishery (ICNAF) reduced total allowable catch by half
- 1976 - U.S. and Canada establish a 200-mile “exclusive economic zone” (EEZ)

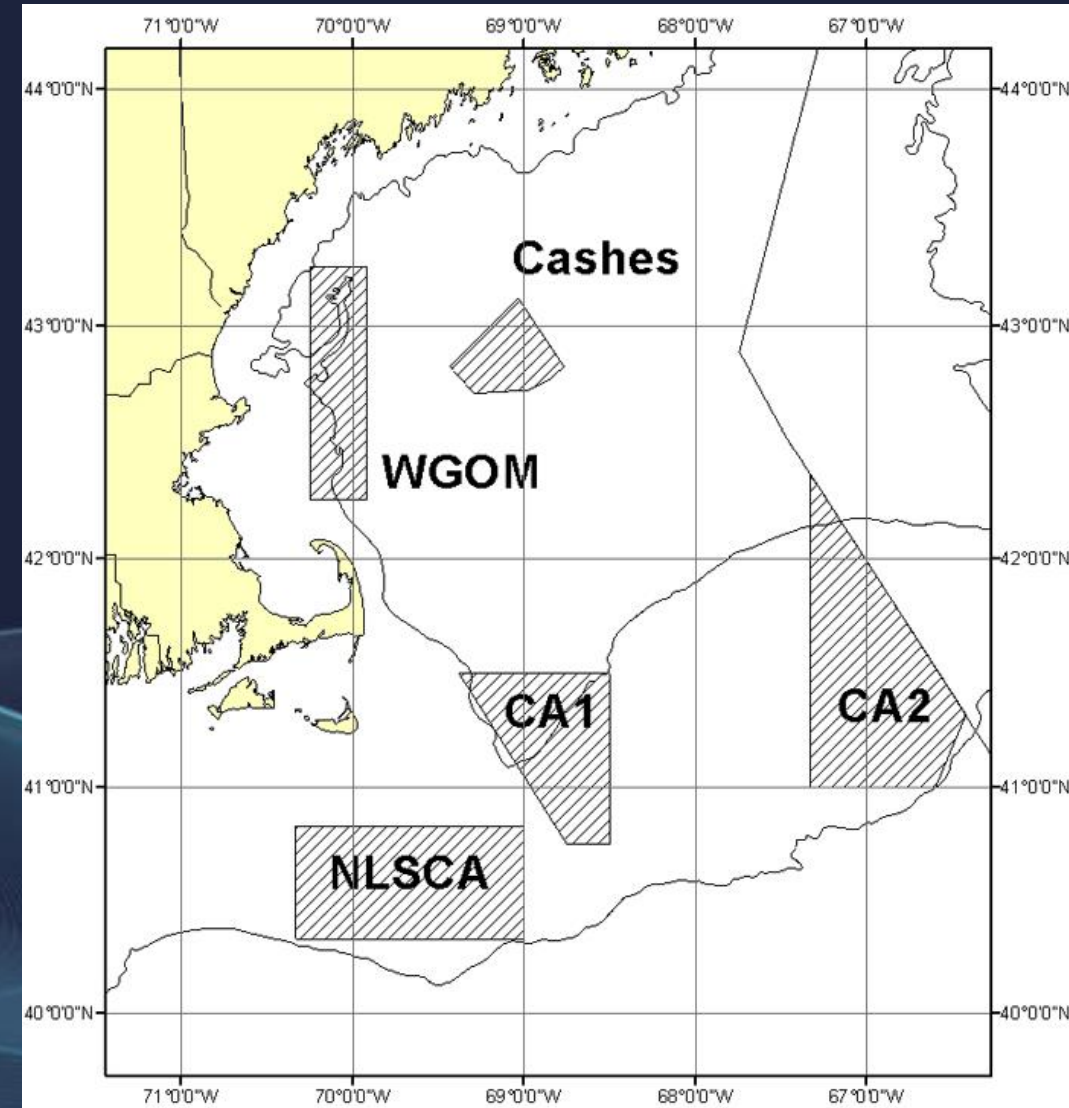


200 Mile EEZ US & Canada



Seasonal and year-round closures were implemented on cod fishing grounds

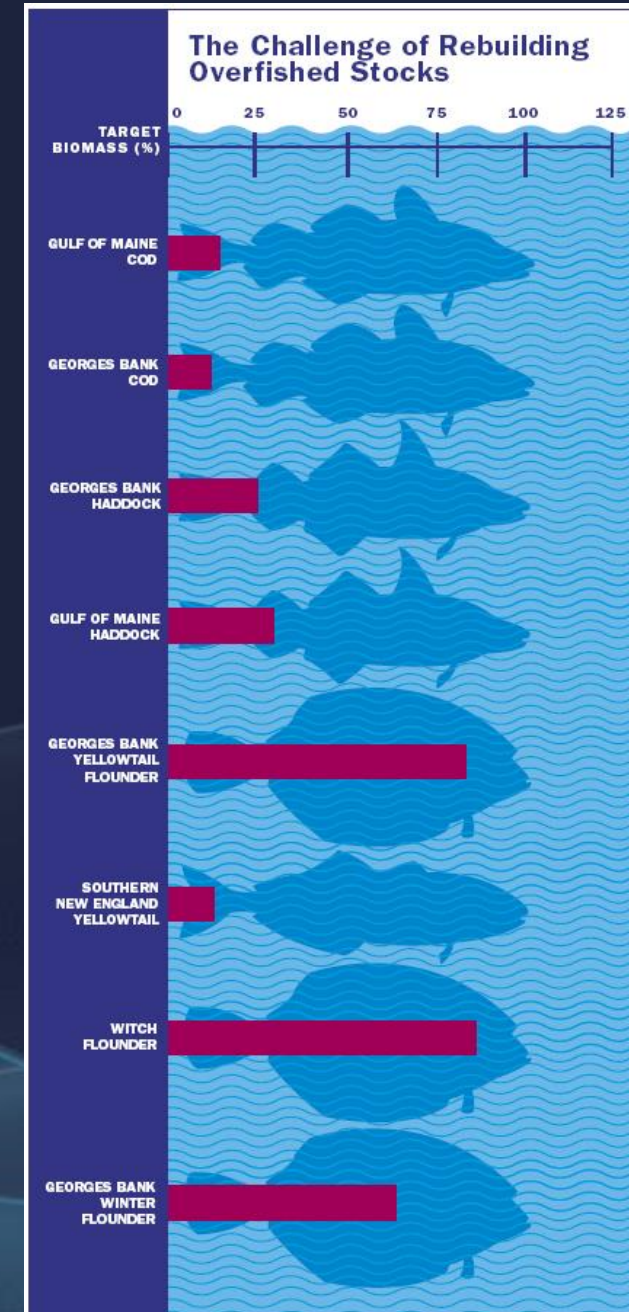
- WGOM – Western Gulf of Maine
- Cashes – refers to “Cashes Ledge,” a traditional cod fishing site
- CA1/CA2 – Conservation Areas 1 and 2
- NLSCA – Nantucket Lightship Conservation Area



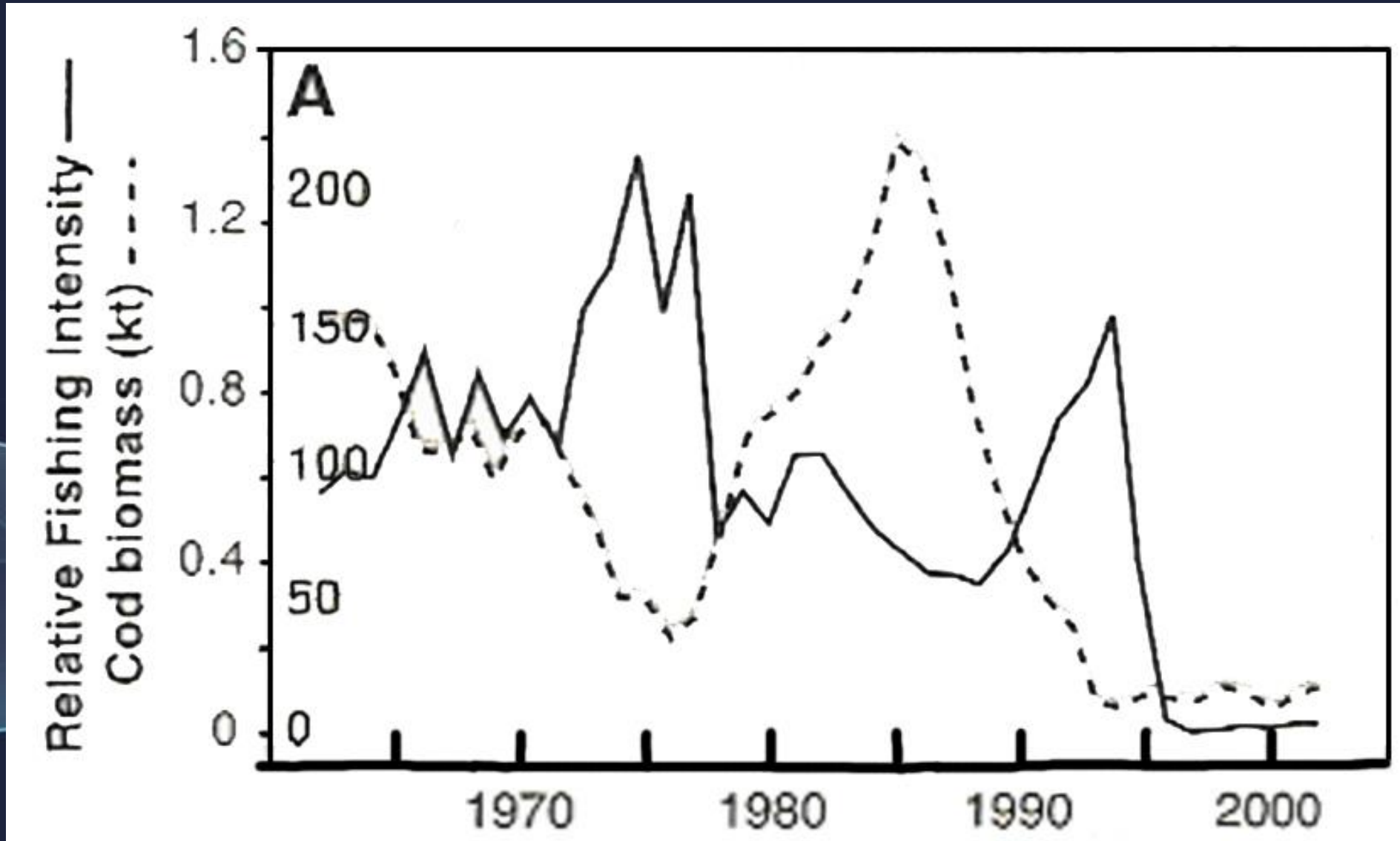
The Challenge of Rebuilding Overfished

Stocks:

- Stocks below biomass targets
- Stocks continue to be “overfished”
- Slow recovery
- Low recruitment (the addition of young fish into the population)



Expected recovery after 1993 reduction in fishing effort has not yet occurred



Summary of Atlantic Cod History

1500s – Europeans discover Canadian cod stocks

1600s – Cod fishery develops longlines and single baited hooks

1700s – Newfoundland prosperity is based on cod fishery

1800s – Nearshore stocks decline

Early 1900s – Steam trawlers begin fishing for cod

1950s – First appearance of factory-freezer trawlers

1960s – Discovery of additional offshore stocks and increased fishing effort dramatically increase cod harvest

1970s – Canadian TACs reduced and 200-mile limit established

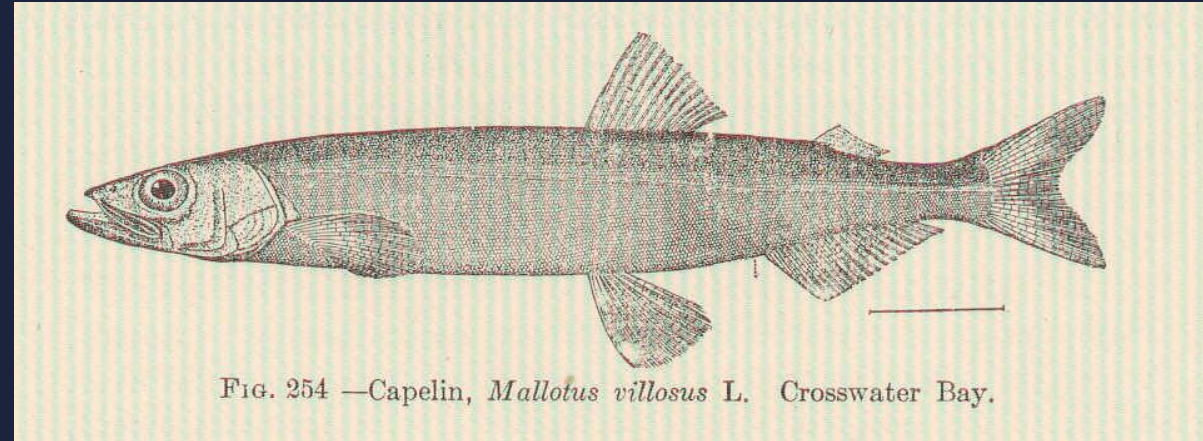
1980s – Canadian and U.S. governments attempt to prop up cod industry with subsidies

1992 – Several cod stocks collapse; fishing moratorium declared

2000s – Cod recovery is limited despite no targeted fishery

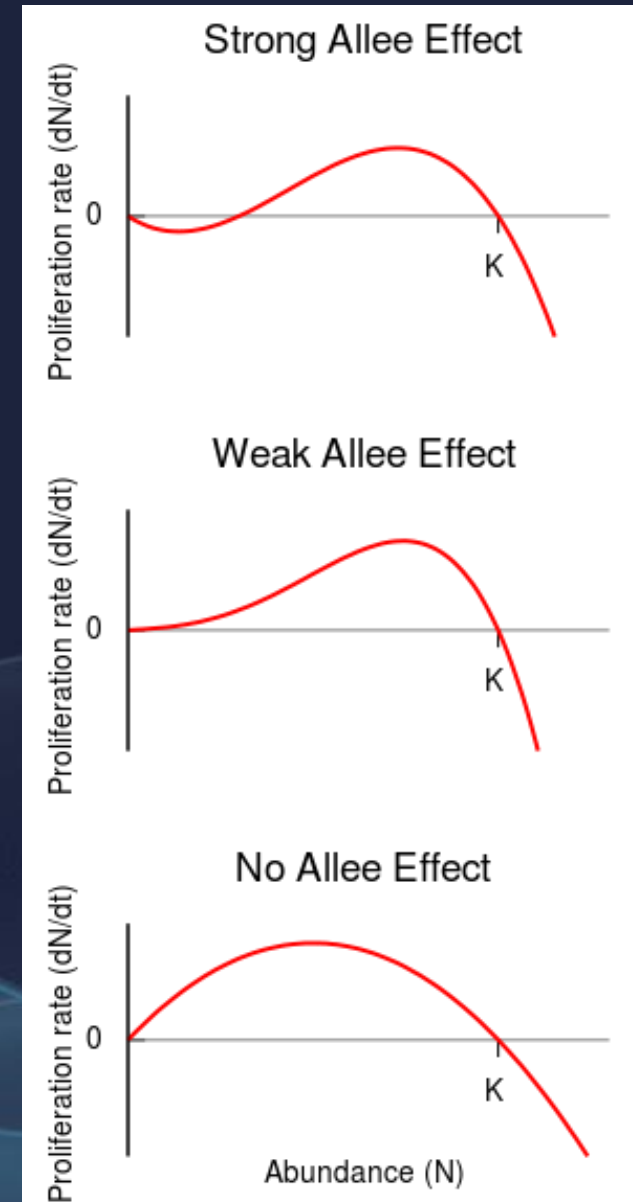
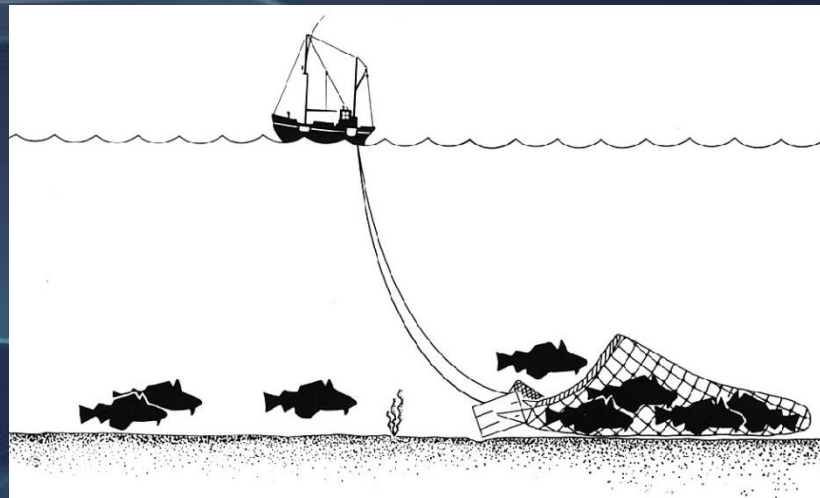
What might be preventing the recovery of Atlantic Cod stocks?

- Directed and non-directed fishing
- Bycatch from other fisheries
- Altered biological systems
 - increased predation (e.g., grey seals, herring)
 - decreased food availability (e.g., capelin, American lobster)



What might be preventing the recovery of Atlantic Cod stocks?

- Fishery-induced Changes To Life History
- Loss of Genetic Variability
- Habitat Modification By Bottom Trawling
- Re-opening of Closed Fisheries
- The Allee Effect (Depensation)



What societal factors contributed to the decline of the Atlantic cod?

- Improved technologies
- Tragedy of the commons
- Shifting baselines
- Government subsidies



The Future of Atlantic Cod

- New England Fishery Management Council's Northeast Multispecies Fishery Management Plan
- **2007** - reauthorization of the Magnuson Stevens Act
- Proposed Southern Grand Bank marine protected area
- Can we really implement ecosystem-based fishery management?

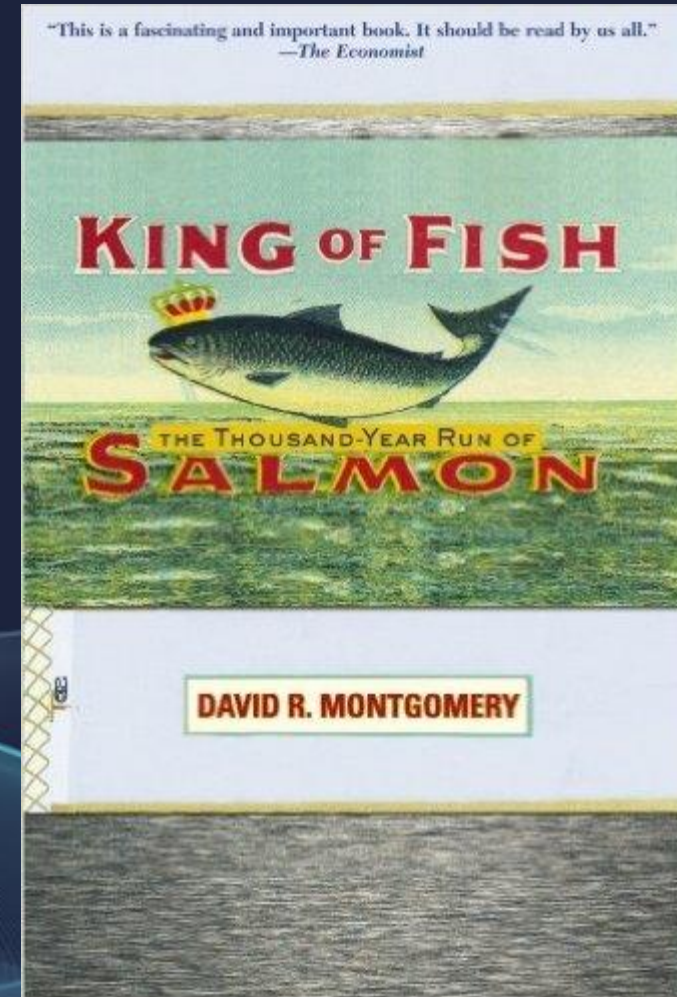
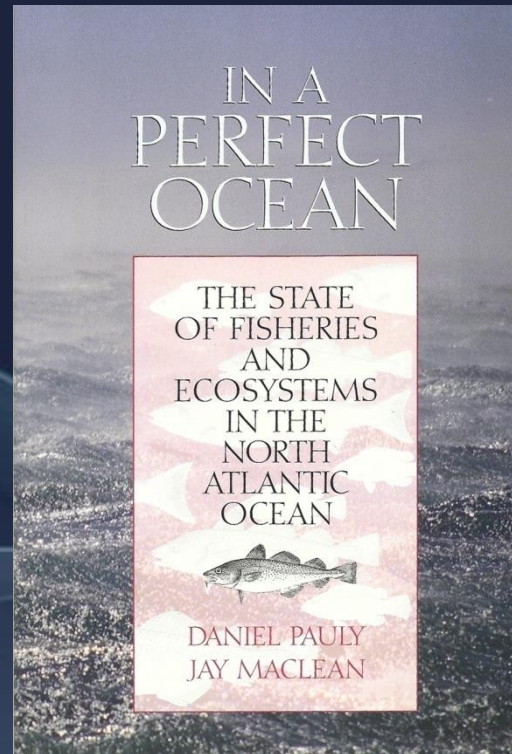
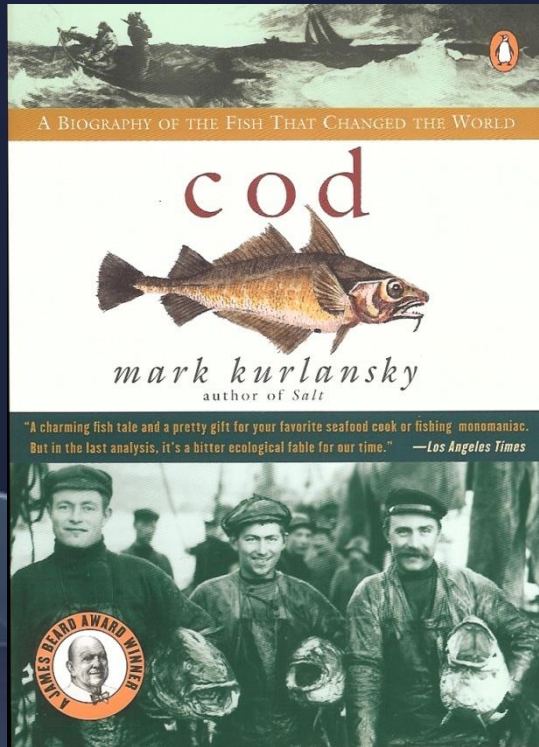


Summary



- Atlantic cod has been a cultural and economic resource for centuries
- Decades of overfishing led to a catastrophic collapse in 1992
- Several factors contributed
- Recovery has been slow despite reduced fishing effort
- An ecosystem-based approach is required

Further reading



Self Check

- Identify the management measures put in place to try and limit the decline in cod stocks
 - Minimum trawl mesh sizes
 - Reduction in catch limits
 - Closed areas
 - Establishment of a EEZ
 - All of the above
- Identify reasons that cod stocks may not be rebuilding
 - Directed and non-directed fishing
 - Bycatch from other fisheries
 - Altered biological systems
 - Habitat Modification By Bottom Trawling
 - Re-opening of Closed Fisheries
 - All are responsible

What is Fish Management

- FAO Food and Agriculture Organization UN
- There are "no clear and generally accepted definitions of fisheries management"
- Working FAO definition
 - ‘The integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives.’

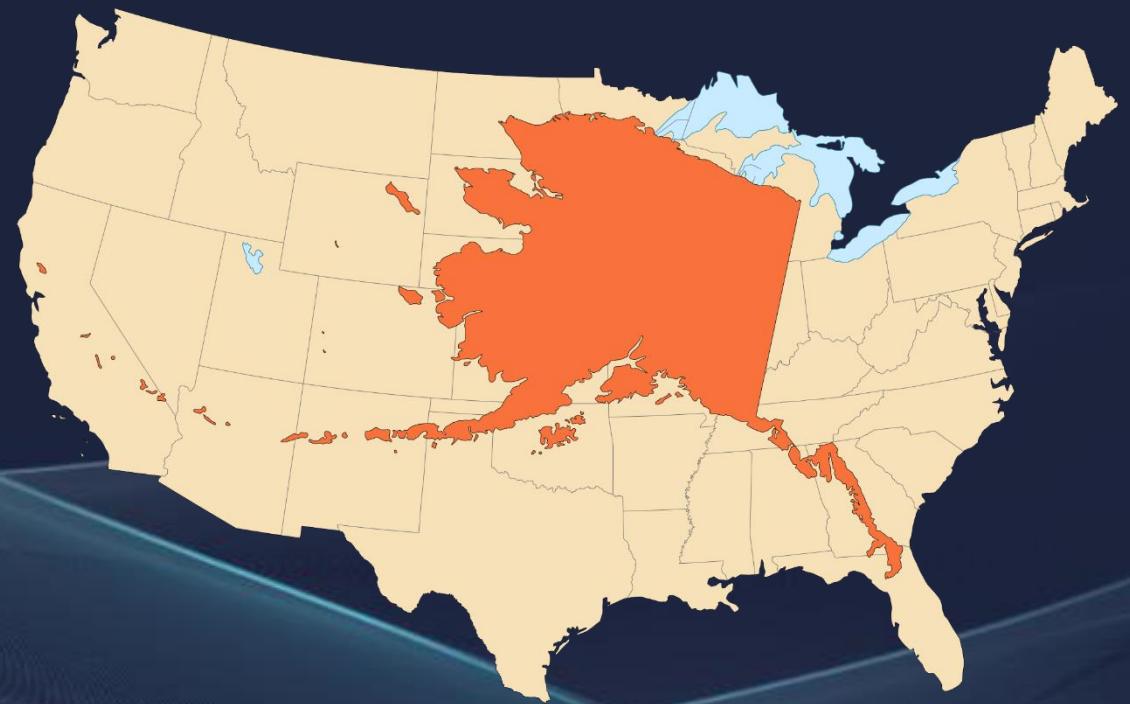
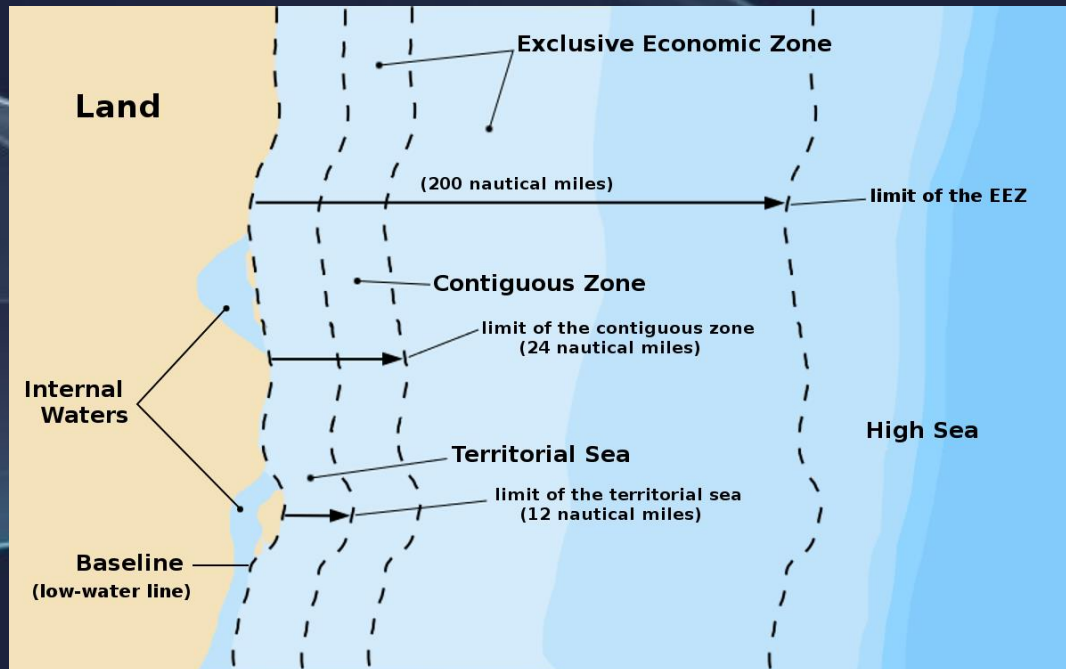
Management

- Management methods are diverse and make sense in the context of how they are applied to a particular fishery
- The concept that overfishing is even possible has been a difficult lesson for the industrialized world to grasp

Management is New

State, federal, and international laws concerning fisheries and realization that fisheries must be managed are all relatively recent developments:

- Alaska Statehood (1959)
- FCMA (1976)
- UNCLOS (1982)



What is Fish Management

Modern fisheries management is often referred to as a governmental system

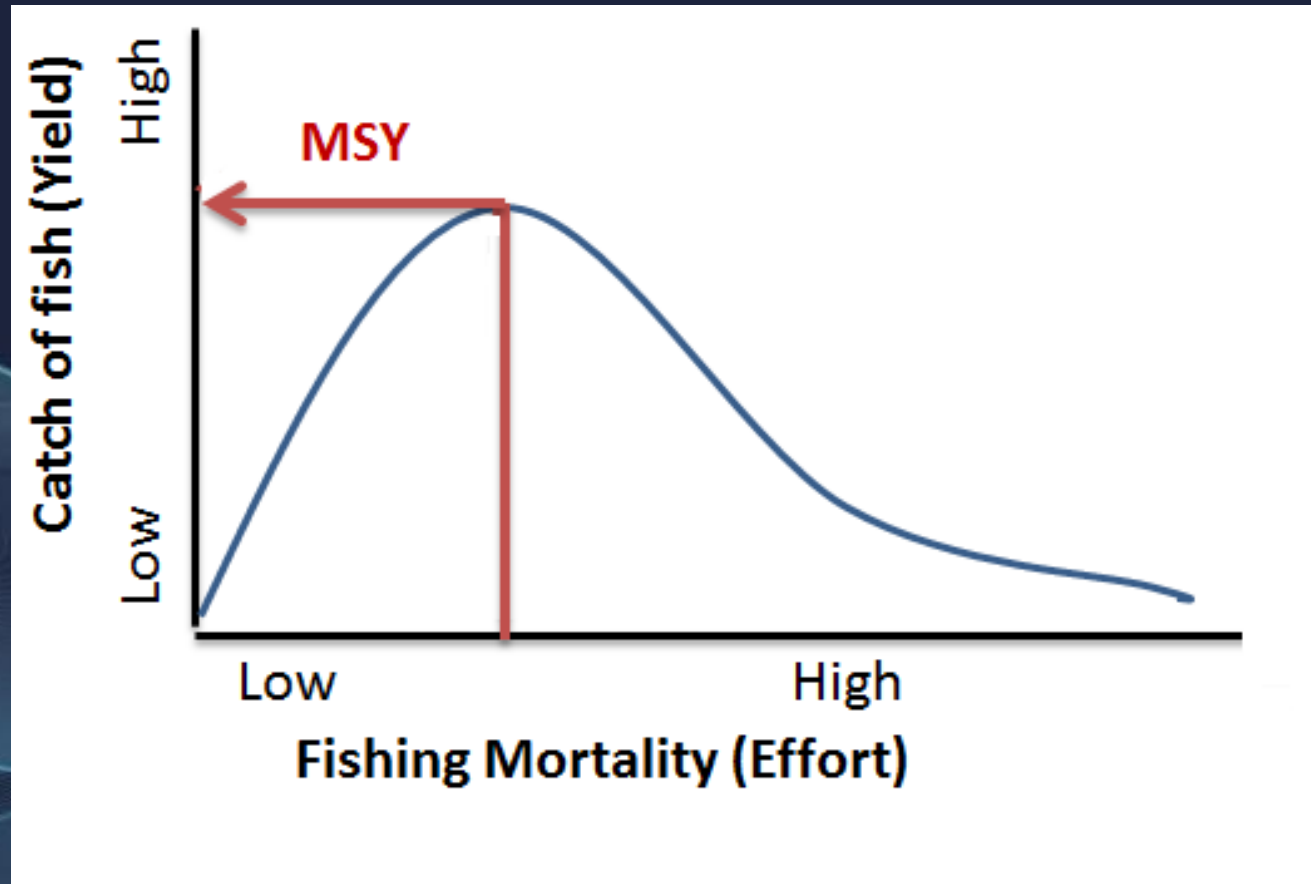
- Appropriate management rules based on defined objectives
 - Sustainable, escapement, subsistence, etc.
- Mix of management strategies (tools) to implement the rules
 - Regulations, Open/closed areas, MPA
- Put in place by a system of monitoring control and surveillance.
 - Feds, State, ADF&G, IPHC, NPFMC

Fishery Management

- Management varies greatly between fisheries
 - Fish Biology
 - Ecological considerations
 - Fishery economics
 - Historical fishing practices
 - Government structure
 - Fisheries data
 - Research programs and many other factors
- Knowledge and technology are rapidly changing
- Fisheries management is not static
 - Constantly evolving
 - Rapidly changing

Traditional Fisheries Management

- MSY Maximum Sustainable Yield
- Quotas (Total allowable catches)
- Legislation
- Closures
- Gear Restrictions



Self Check

- Fisheries management can be said to be fairly consistent between fisheries
 - True
 - False
- Select all of the traditional tools available to fisheries managers
 - MSY Maximum Sustainable Yield
 - Quotas (Total allowable catches)
 - Legislation
 - Closures
 - Gear Restrictions
 - All of the above

Summary



- Fisheries Management
- Need for Management
- Atlantic Cod
 - Cultural and economic resource for centuries
 - Decades of overfishing led to a catastrophic collapse in 1992
 - Many factors contributed
 - Recovery has been slow despite reduced fishing effort
 - An ecosystem-based approach is required
- Management strategies