

NMFS Vulnerability Analysis

- Years of work to conduct the necessary quantitative assessments

Atlantic cod
Atlantic croaker
Cusk
River herring

- NMFS is working on a relative, qualitative assessment method

> 50 managed fishery species
~ 21 stocks rebuilding - climate effects likely negative for 66%
> 25 protected species
> 5 species under review

Science, Service, Stewardship



Protocol for Assessing Vulnerability of Fish Stocks to Climate Change

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**NOAA
FISHERIES
SERVICE**

NMFS Vulnerability Analysis

- Based on methods applied in two papers
- Similar to Overfishing Vulnerability Analysis (Patrick et al (2010) <http://fishbull.noaa.gov/1083/patrick.pdf>)

Global Change Biology

Global Change Biology (2010) 16, 1936–1953, doi: 10.1111/j.1365-2486.2009.02128.x

An integrated risk assessment for climate change: analysing the vulnerability of sharks and rays on Australia's Great Barrier Reef

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Reviews in Fisheries Science, 18(1):106-124, 2010
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ISSN: 1064-1262 print
DOI: 10.1080/10641260903434557



Marine Fisheries Management in a Changing Climate: A Review of Vulnerability and Future Options

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NMFS Vulnerability Analysis

Components of Vulnerability

Exposure

- Direct and indirect effects
 - SST
 - Acidification
 - Ocean circulation
 - Freshwater input

Sensitivity

- Attributes
 - Physiological
 - Change in larval survival
 - Prey specificity

Adaptive Capacity

- Attributes
 - Stock range
 - Stock mobility
 - Reproductive potential
 - Stock status

Relative ranking of vulnerability for species included in the assessment

NMFS Vulnerability Analysis

- Northeast Pilot week of 27 August
- Hosted at Narragansett Laboratory
- ~20 species to evaluate the method
- Assessment of all fishery species planned for 2013
- Could develop assessment for protected species in the region



NMFS Vulnerability Analysis

- Species chosen from across life histories

Atlantic cod	Groundfish
Winter flounder	Coastal
Spiny Dogfish	Groundfish
Atlantic sea scallop	Shellfish
Atlantic herring	Pelagic
Deep-sea red crab	Shellfish
Thorny skate	Skate
Little skate	Skate
Bluefish	Pelagic
Surfclam	Shellfish
Summer Flounder	Coastal
Black Sea Bass	Coastal
American Lobster	Shellfish
Atlantic Croaker	Coastal
Atlantic Sturgeon	Anadromous / Catadromous
Shortnose sturgeon	Anadromous / Catadromous
River Herring	Anadromous / Catadromous
Cusk	Groundfish
Rainbow smelt	Anadromous / Catadromous

- Representing fishery and protected species concern

NMFS Vulnerability Analysis

- Results are relative: species X is assessed to be more vulnerable than species Y

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NMFS Vulnerability Analysis

- Southeast Pilot planned for September 2013
- Will use pilot to modify approach
- Planning for NE assessment of all managed fishery species in 2013

NEFMC

MAFMC

ASMFC

Protected Resource
Fishery Species