Anadromous Fish and Groundfish: Making the Connection

• Sea-run migratory fish were historically important prey for groundfish (cod, haddock).

• Dams, harvest, water quality degradation, development, etc. contributed to major declines in anadromous fish populations.

• Declines in anadromous fish may have influenced declines in groundfish stocks.

• Large-scale restoration efforts in Maine have enhanced the abundance of anadromous fish in nearshore waters.

• Assessment surveys evaluated the effect of changing prey availability and its contribution to groundfish diets.
Cod: Need I Say More?
Anadromous Fish: Why Do We Care?

• ASMFC 1985: “The species are valuable to the states and the nation.”
• Culturally important food source
• Commercially important bait source - lobster
• Nutrient exchange (Walters et al 2009, Guyette et al 2013)
• Potential prey buffer for salmon (Saunders et al 2006)
• Prey source for big fish (Ames 2004; Ames & Lichter 2013)
Number of fisheries on the Potomac, about........................................... 150
Number of shad taken in good season [six week]............................... 22,500,000
Number of herrings under similar circumstances.............................. 750,000,000

-Baird 1886

Large haul of American shad in the Susquehanna River.
Source: U.S. Fish & Wildlife Service
“Vast numbers once swam in all suitable waters through the State…”

Foster and Atkins 1867

“…600,000,000,000 pounds of fish along our coast of this one species. It may safely be assumed that at present not more than one-tenth of 1 per cent. of these fish now inhabit the waters specified, or only 600,000,000.”

Baird 1886, comparing contemporary river herring stock to observations of 1835.
Present: Continued Decline of Alosines

NMFS commercial landings (pounds): American shad and river herring along the Atlantic coast

American shad

River herring
Figure B7. Spawning stock biomass (SSB-line) and recruitment (age 1-bar plot) for Georges Bank Atlantic cod, 1978-2011. The colored plus sign is the retrospective adjusted 2011 SSB and the white diamond with blue dot is the retrospective adjusted 2010 recruitment.
What Happened to Sea-run Fish?

“For a few years after the construction of these dams, fish were abundant; then a rapid decline set in, and in a few years more they were comparatively scarce.”

Foster and Atkins 1869

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<table>
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<th>Coastal region</th>
<th>Watershed</th>
<th>Total dams constructed 1600-present</th>
<th>Year of earliest documented dam construction</th>
<th>Number of dams still on watershed as of 2006</th>
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Hall et al. 2011
Not just dams...

Fishing Pressure

“Owing to the comparatively unrestricted destruction of fish, the waters of Maine have been so depleted, that...the yield has not been sufficient for the wants of the people...” Stillwell and Smith, 1879

Pollution

Climate change (more recently?)
What are we doing about it?

- Laws that encourage restoration: Federal Power Act, ESA, CWA
- 1985 ASMFC Fishery Management Plan
  - In response to depletion of stocks from overfishing, loss of habitat, inconsistent management actions and lack of data
  - Promote the coordinated protection and enhancement of shad and river herring stocks.
- Sustainable harvest requirements
- Proactive habitat enhancement: dam removal, culvert replacements
- Proactive management: stocking
- Outreach: Public education and involvement
What are we getting from our efforts?

Estimate of river herring run size in coastal Maine rivers

River Herring (Millions)

Year

The Broader Influence of Restoration

• Odds of alosines as prey increases substantially where restoration has been successful

• Alosines accounted for c. 5–10% of the diet by mass for several marine piscivores

• Odds ratios of anadromous predation were as much as 460 times higher in the targeted sampling compared with the broad-scale sampling.

McDermott et al. 2015
Future: Tens of Millions of Adults, Billions of Juveniles

- Goal is historical numbers of fish & a functioning ecosystem
- Will require continued public investment for this public resource
- Restoration (increased fish abundance) will:
  - Support coastal communities
  - Benefit nearshore ecosystems and fisheries
Suggested Reading

Ames 2004
Ames and Lichter 2013
Foster and Atkins 1867, 1869, 1870
Goode 1887
Hall 2009

Hall et al. 2011, 2012
McDermott et al. 2015
NMFS 2013
Willis et al. 2013
Wilson et al. 2009