Nearshore Ecology of Atlantic Salmon in the Gulf of Maine Region

Workshop 2: Bays and the Gulf of Maine
**Atlantic Salmon Life Cycle**

**Ocean**
- **1SW or 2SW**: Jun 04, Jun 05
- **postsmolts**: Jun 03
- **smolt**: May 03
- **HATCHERY Inputs**

**River**
- **Parr**: Apr 03
- **Fry**: Jun 01
- **alevin**: Jan 01
- **eggs**: Nov 00

**Inputs**

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The diagram illustrates the life cycle of Atlantic Salmon, showing the transitions between different stages: eggs to alevin, alevin to smolt, smolt to postsmolt, postsmolt to 1SW or 2SW, 1SW or 2SW to adults, and adults back to eggs in the ocean. The river stages include parr and fry. The transitions are marked with arrows indicating the timeline.
Common Marine Environment

US Stocks Highly Migratory

Inner Bay of Fundy Stocks—Limited Migration
The Problem: Declining Abundance
North Atlantic Wide

Data Source: ICES 2006
Core Reviews/Resources

- DFO (2001)
  - 12 top Ho
  - 10 estuary marine
    - 1 is fw-marine interaction
  - 2 freshwater

  - Dams
  - Early Marine Survival
  - Hatcheries
Legault (2004/2005) PVA - illustrates freshwater, marine, and stocking

Base
Juvenile S + 0.08
Marine S + 0.04
Juv S + 0.04 & Mar S + 0.02

Stocking
Poor Marine Survival: an Atlantic-wide Issue

USA/Scotia Fundy - hatchery

Gulf Region/Quebec - wild

Northern Europe - wild

Southern Europe - wild

Data Source: ICES 2006
Observation 1: Scale Issue
Lower Abundance – Remnant of 4H’s?

North American Returns (2SW only)

Data Source: ICES 2006
Observation 2: Phase/Regime Shift
Change in Ocean Productivity

Data Source: ICES 2006
A Salmon’s Ocean Life:
A big black box

<table>
<thead>
<tr>
<th>spawn</th>
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<th>postsmolt</th>
<th>adult</th>
<th>spawning</th>
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NOAA NEC Programs-
Progress has been made

Pre-1995

Large parr estimate \rightarrow Assumed overwinter survival \rightarrow Adult returns

Post -2000

Large parr estimate \rightarrow Overwinter survival \rightarrow Smolt estimate \rightarrow Estuarine mortality \rightarrow Nearshore mortality \rightarrow Harvest \rightarrow Adult returns

Large unknowns still remain

spawn    hatch    parr    smolt    postsmolt    adult    spawning
Progress has been made: Number Crunching

![Graph showing abundance over post smolt weeks](image)

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More Progress Needed: Salmon Ecosystems Research and Management

2009 and beyond

- Large parr estimate
- Overwinter survival
- Smolt estimate
- Estuarine mortality
- Nearshore mortality
- Harvest
- Adult returns

spawn | hatch | parr | smolt | postsmolt | adult | spawning
Workshop Purpose:
Ecology of Gulf of Maine Atlantic Salmon in Nearshore Marine Ecosystems

- Workshops- bring together marine scientists of multiple disciplines to discuss and develop:
  - testable hypotheses to advance our understanding of current low marine survival of Atlantic salmon and
  - management prescriptions to increase marine survival
- Multi-disciplinary - awareness, communication, collaboration, and action
- Outcomes -
  - Refine NOAA program around agency strengths (focus current resources)
  - Develop new programs – interdisciplinary programs (initiatives for expanded research and management actions)
- Products:
  - Sea Grant NOAA Lab Reference Document
  - Synthesis in Fisheries
Additional Concepts

• **Time and Space** –
  • *Smolt- Post smolt*: nearshore May-July, heavy losses first months
  • *Returning Adults*: nearshore May-October

• **Small fish in big ocean**
  • *Relatively Small Size*: upon sea-entry
  • *Numbers Overall* – needle in haystack
    • However not many other surface oriented fish
    • But likely not a driver or keystone species
Small Fish Big Water
- Surface Ecosystem

- Atl. Mackerel
- Blueback herring
- Lumpfish
- Alewife
- Atl. herring
- Other
Additional Concepts

• **Surface Orientation** –
  • Smolt- post smolt: top 5 m of water column, some sounding occurs, not well understood

• Early losses high
  • *r*-selected species survival curve
  • telemetry analyses
Telemetry Investigations: Migration/Survival dynamics

Penobscot smolt with depth tag

Narraguagus Survival Curve

Ecological Zones
Salmon’s Ocean Life:
Many smaller black and grey boxes

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Our Task: Ho and Rx for Sustainable Populations

Historical US freshwater survival (0.13-6.09%)