

Atlantic Salmon Ecosystem Recovery: It takes a village, state, country and world



Mary Colligan
U.S. Fish and Wildlife Service
Anchorage, Alaska

Photo courtesy of Gilbert van Ryckevorsel

OVERVIEW

 **BACKGROUND**

 **BIOLOGY & STATUS OF ATLANTIC SALMON**

 **PARTNERSHIPS**

 **LOCAL**

 **STATE/REGIONAL/FEDERAL**

 **INTERNATIONAL**

 **LESSONS LEARNED**

MY HISTORY WITH ATLANTIC SALMON

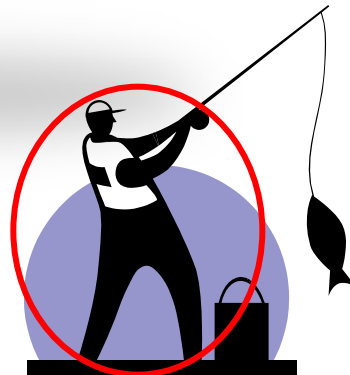
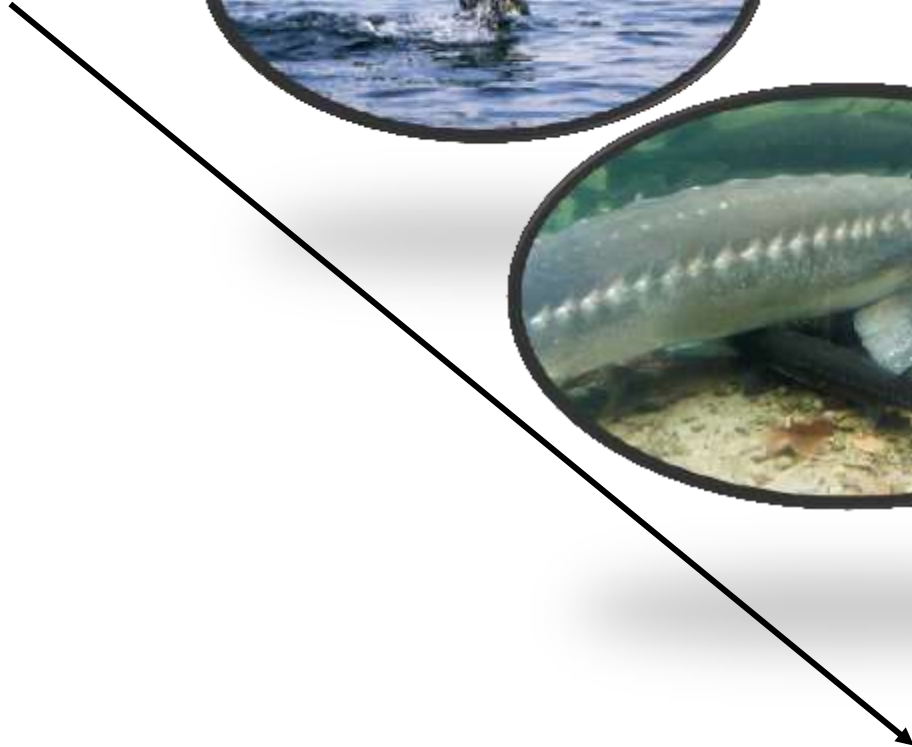
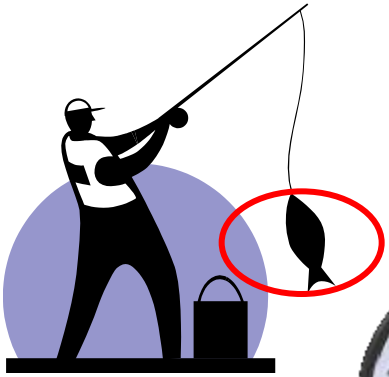


- FOGO ISLAND, NEWFOUNDLAND WITH THE QUEBEC LABRADOR FOUNDATION:

QLF EXISTS TO SUPPORT THE RURAL COMMUNITIES AND ENVIRONMENT OF EASTERN CANADA AND NEW ENGLAND TO CREATE MODELS FOR STEWARDSHIP OF NATURAL RESOURCES AND CULTURAL HERITAGE THAT CAN BE APPLIED WORLDWIDE

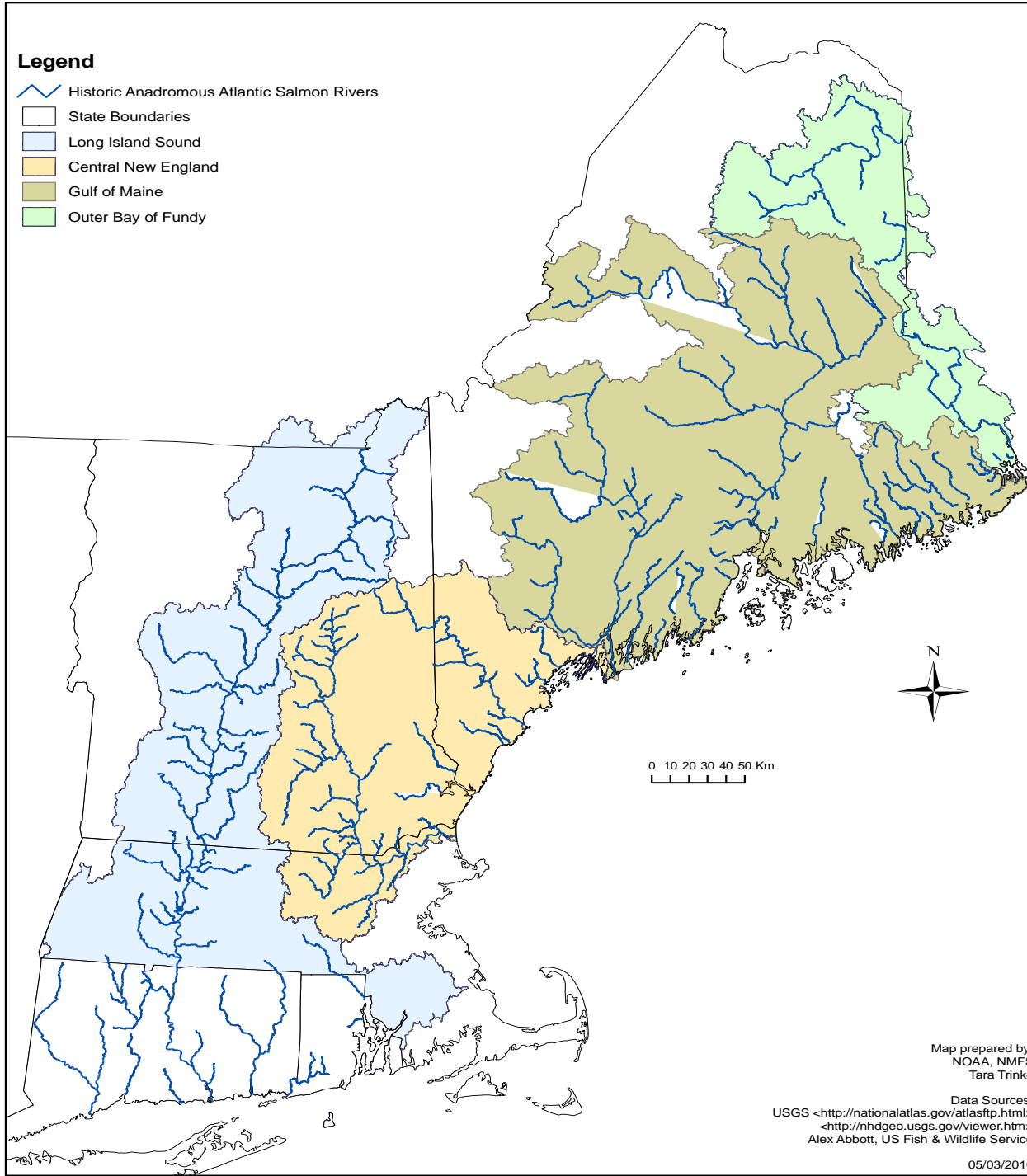
- ENDANGERED SPECIES LISTING

MY BACKGROUND



Legend

-  Historic Anadromous Atlantic Salmon Rivers
-  State Boundaries
-  Long Island Sound
-  Central New England
-  Gulf of Maine
-  Outer Bay of Fundy



Map prepared by:
NOAA, NMFS
Tara Trinko

Data Sources:
<http://nationalatlas.gov/atlasftp.html>
<http://nhdgeo.usgs.gov/viewer.htm>
Alex Abbott, US Fish & Wildlife Service

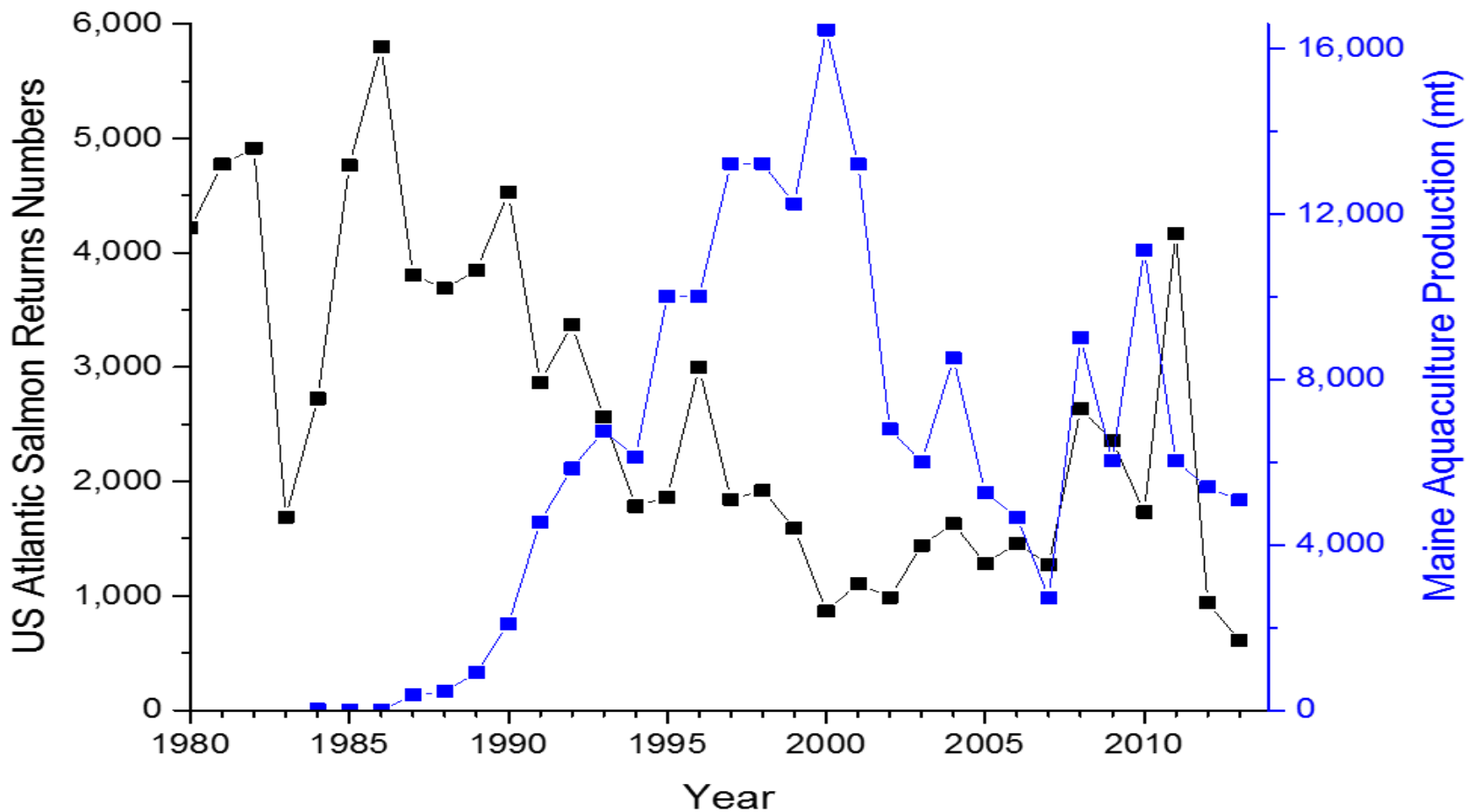
05/03/2010

Historical Perspective

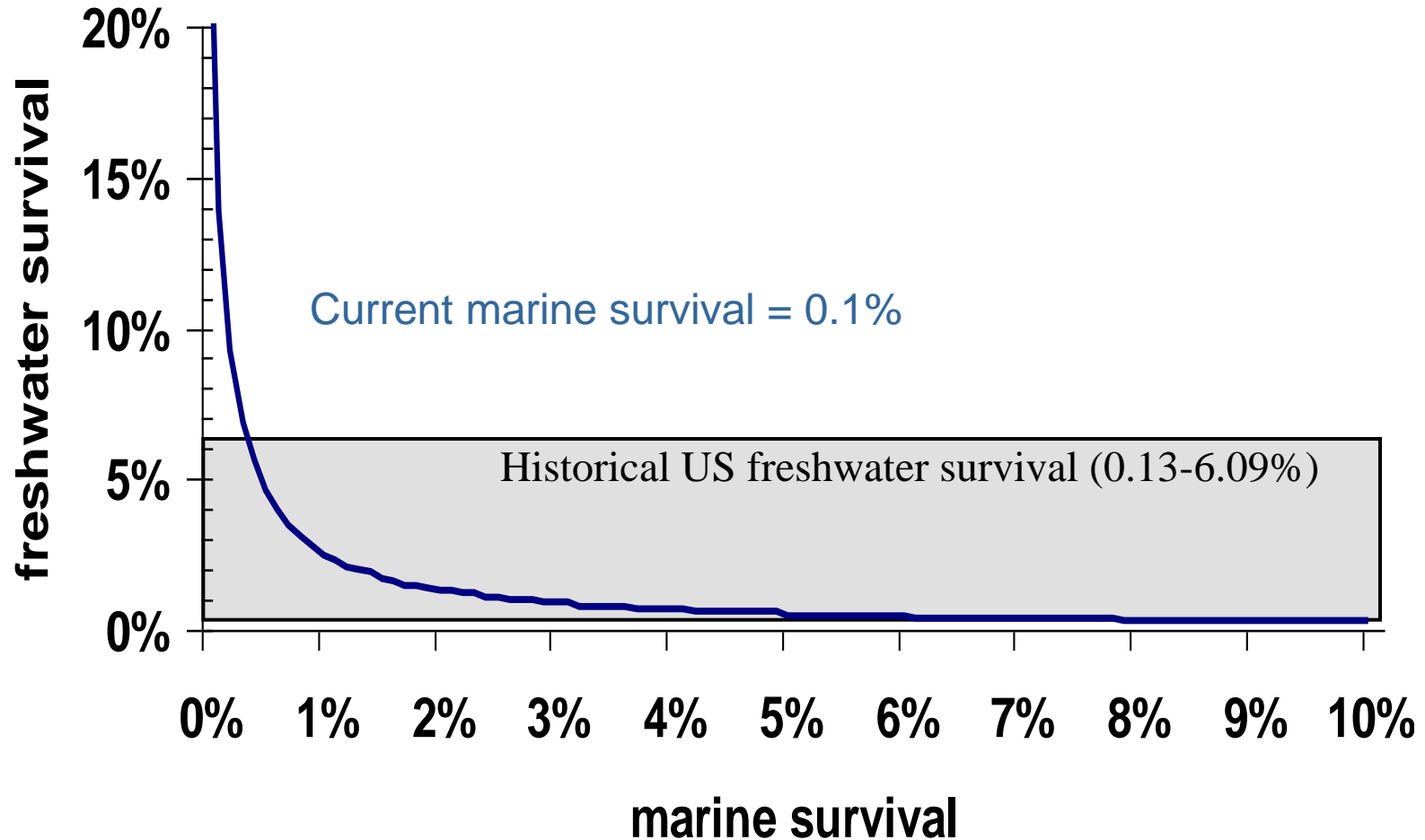
- Estimates of adult returns exceeded 300,000 annually *in Maine alone*
- Commercial fisheries
- Recreational fisheries



RETURNS AND COMMERCIAL AQUACULTURE PRODUCTION



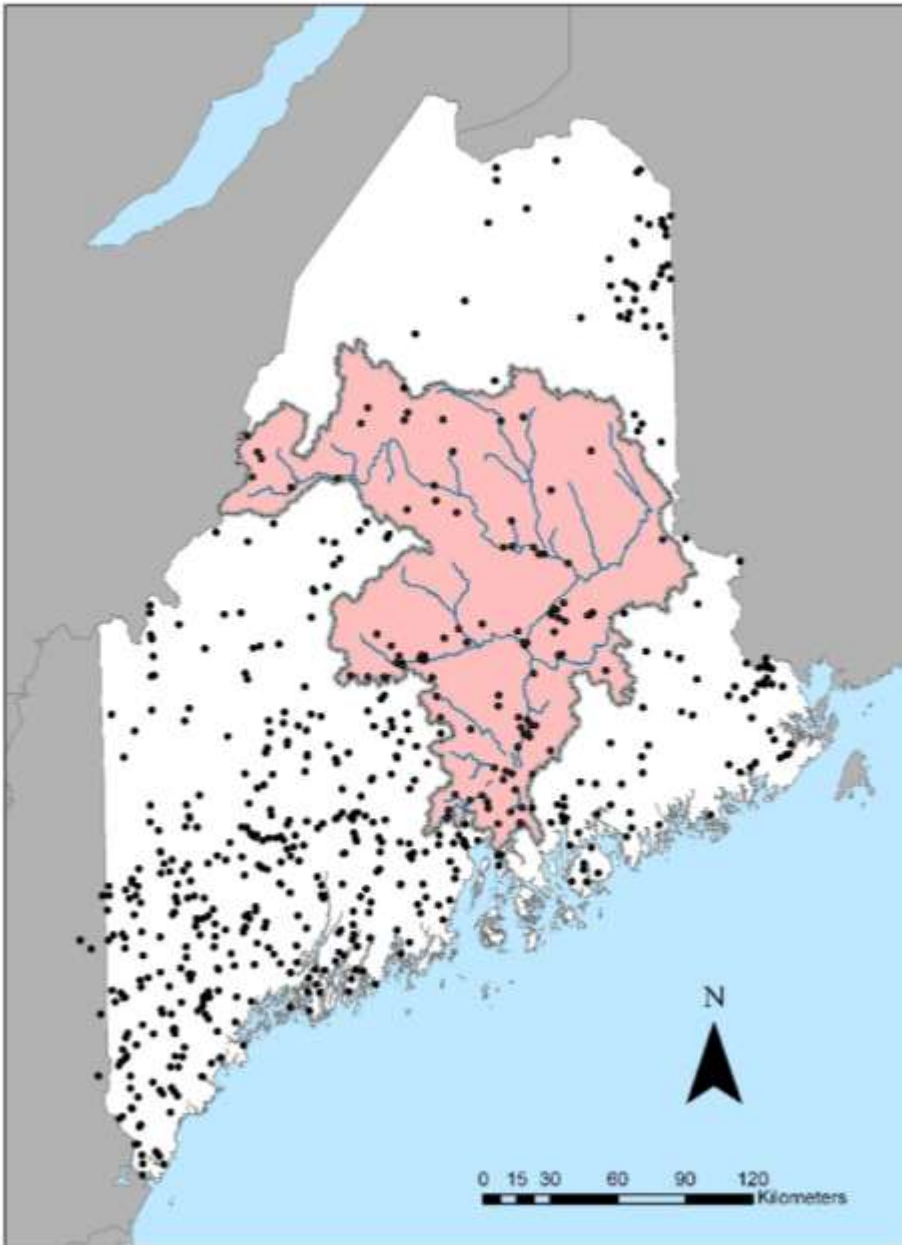
Survival Rates for Sustainable Populations



Dams in Maine

Plus, 1000s of road crossings

Historic fish community has been severely altered



Map Courtesy of Tara Trinko Lake, NOAA

Co-restoration for co-evolved species



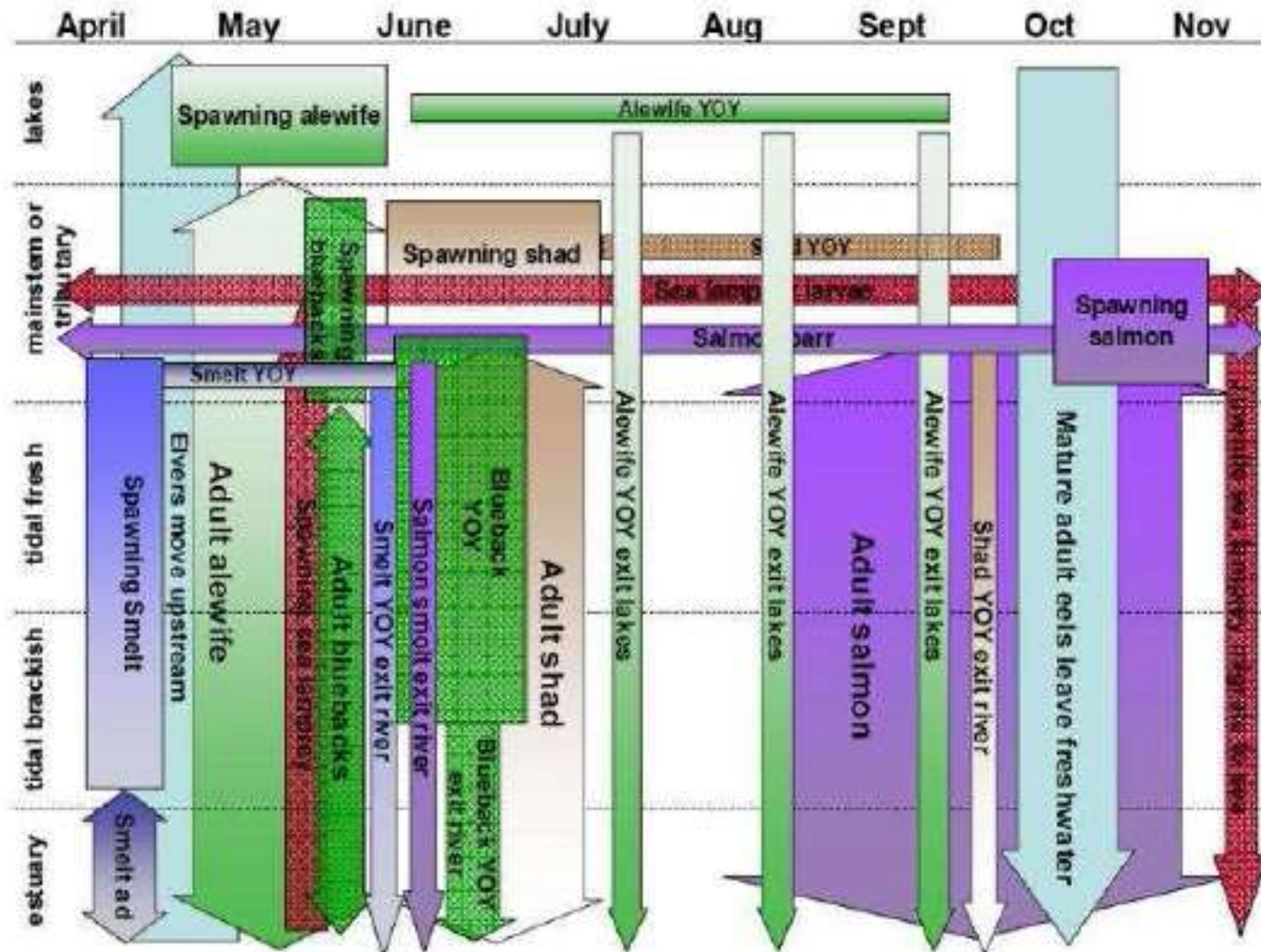
Mark McCollough

- ✓ Habitat conditioning
- ✓ Marine-derived nutrients
- ✓ Prey buffer
- ✓ Diversified prey base

35 time series analyzed

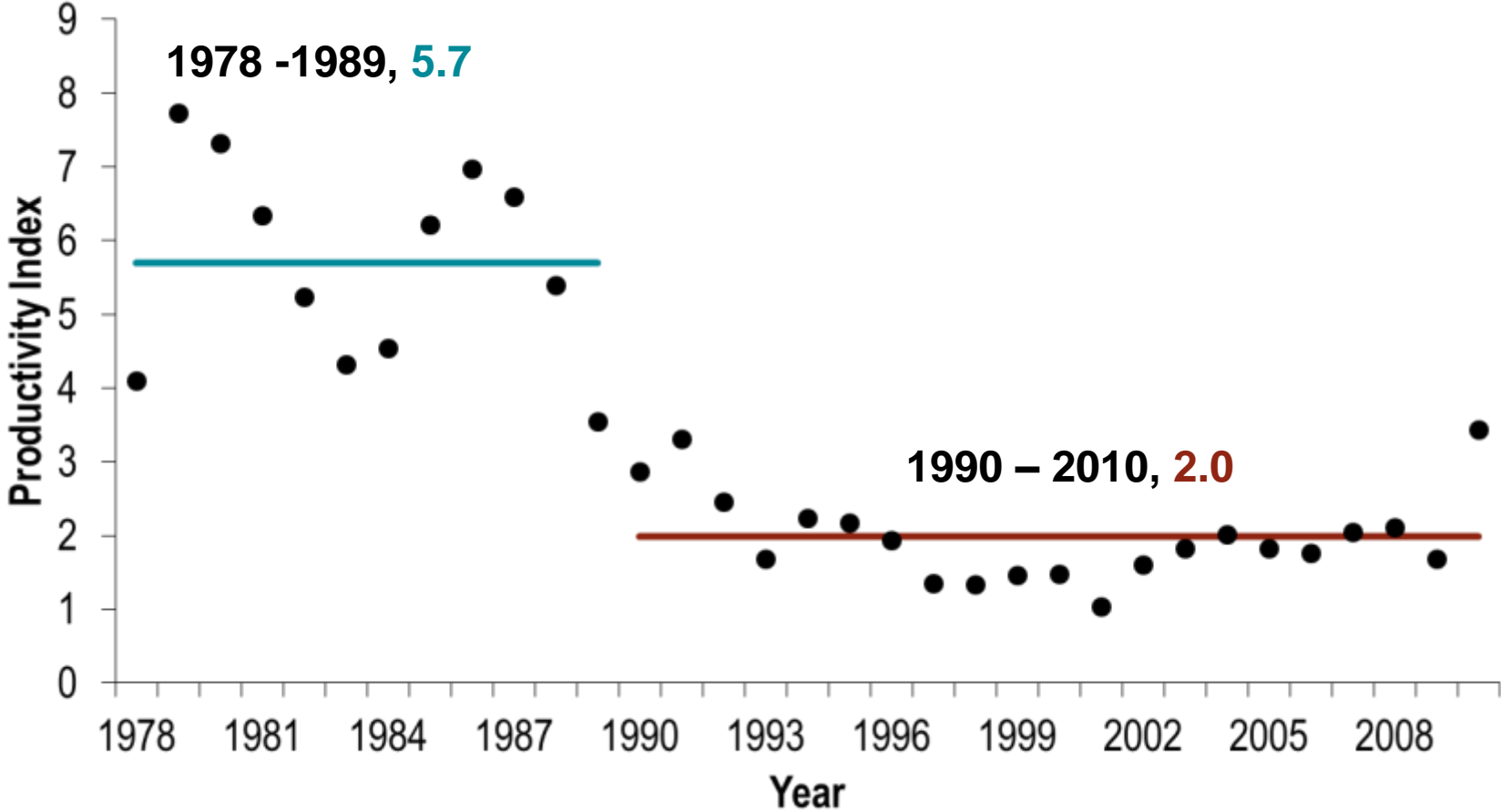
**Relative abundances had dropped to:
less than 98% of historic levels in 13
less than 90% in an additional 11.**

Highly evolved system

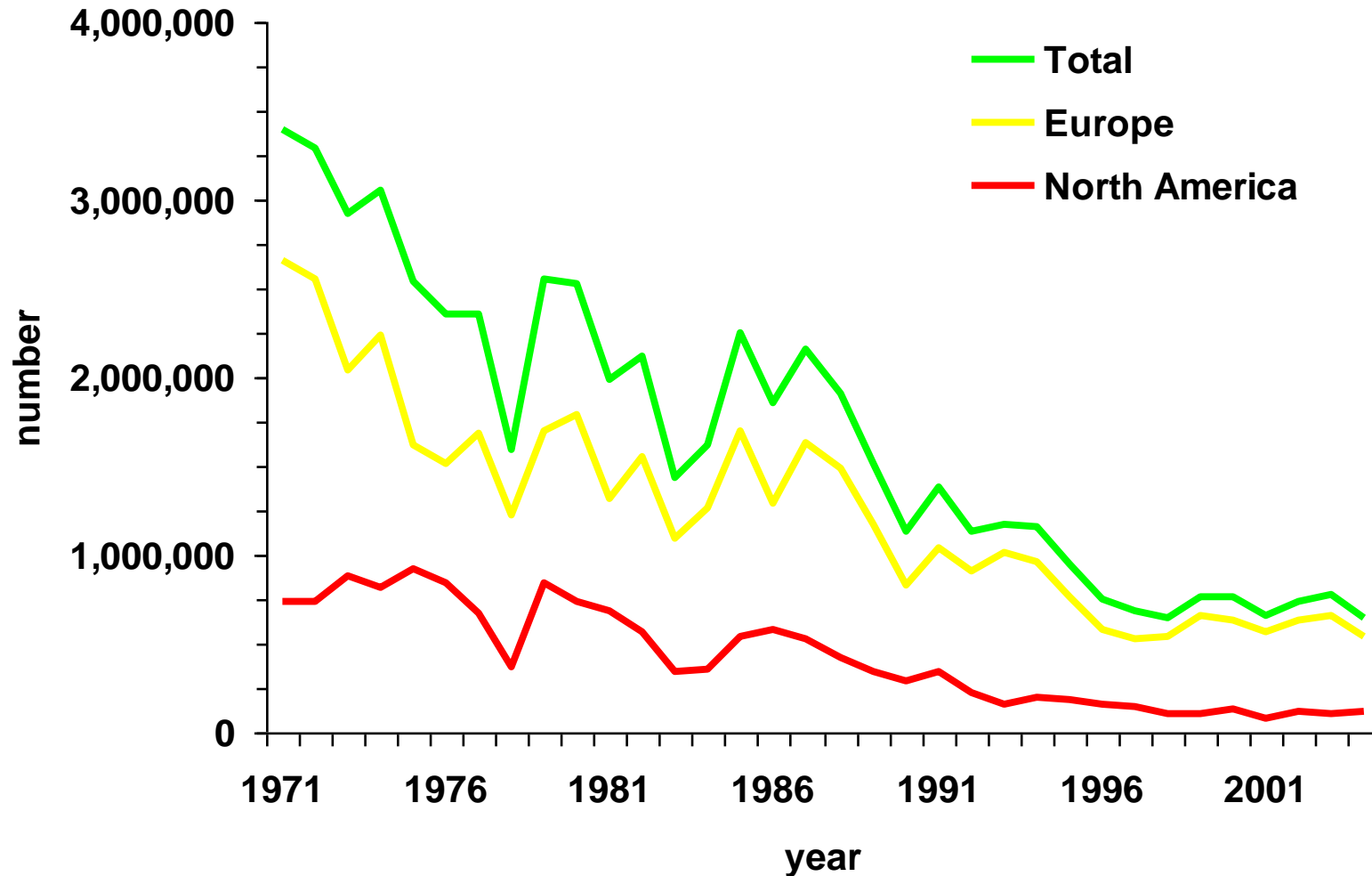


from Operational Plan for the Restoration of Diadromous Fishes to the Penobscot River, 2009 (adapted from Saunders et al. 2006)

Phase shift US marine salmon productivity



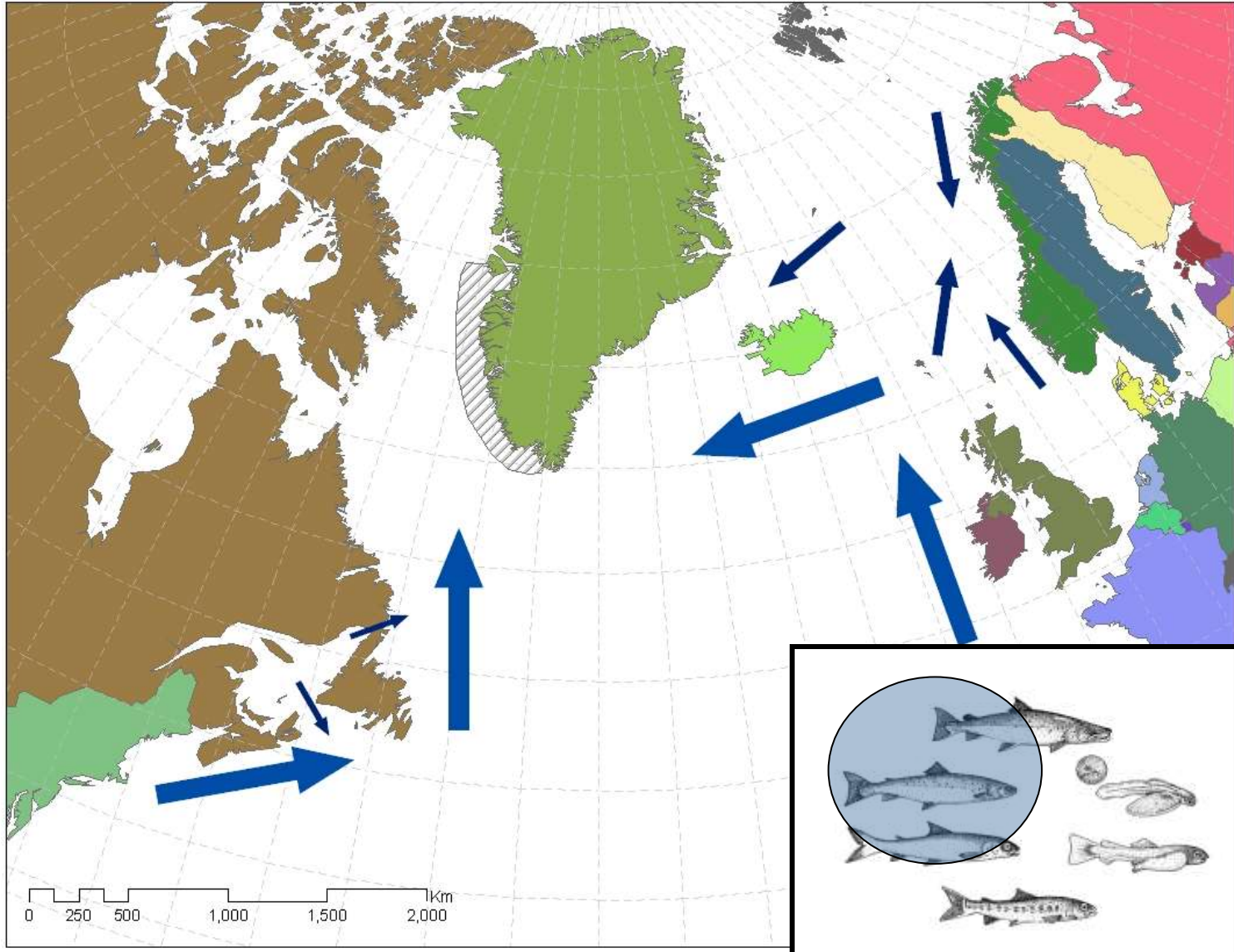
North Atlantic Pre-fishery Abundance



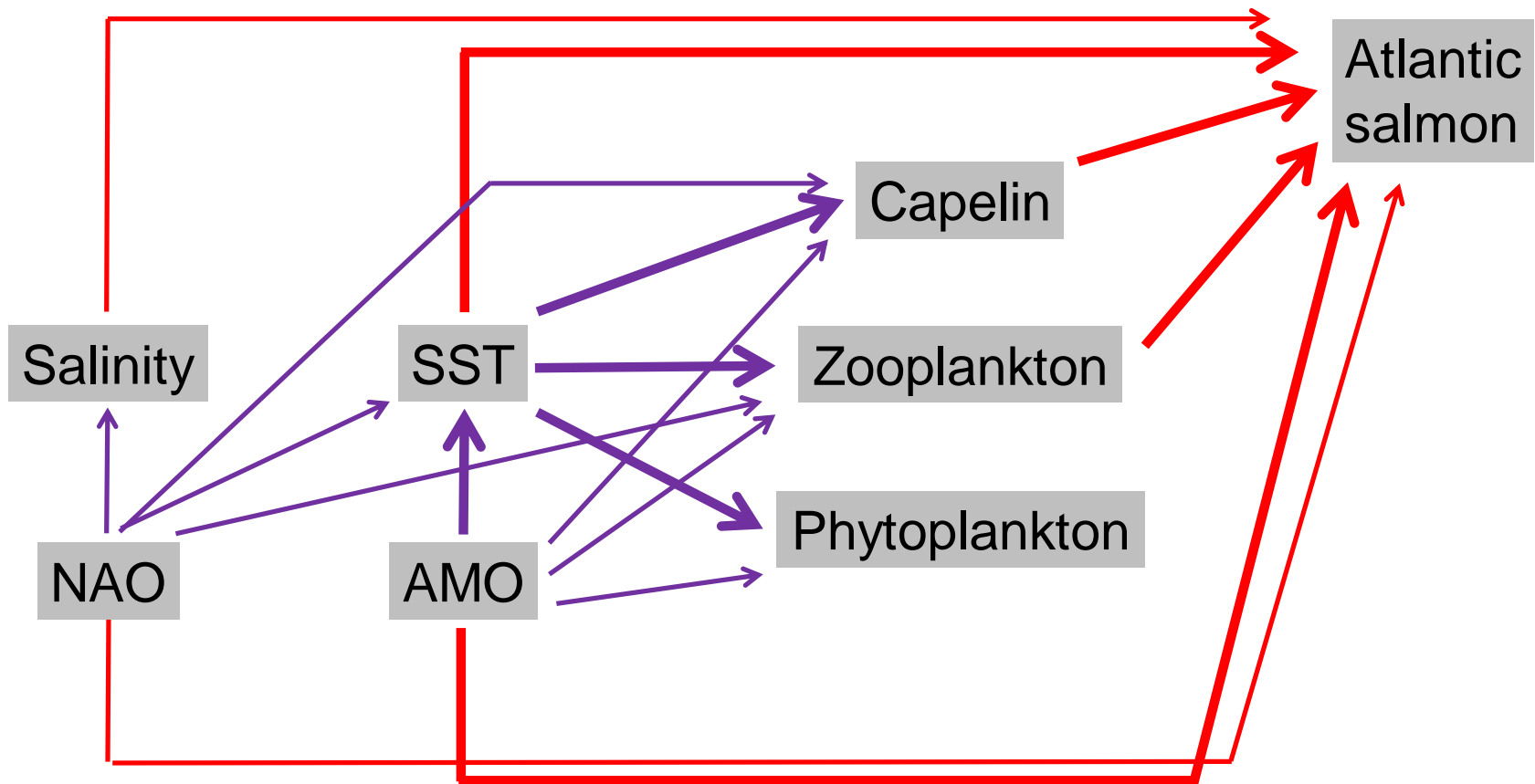
Data Source: ICES 2006

Common Marine Environment

non-maturing 1SW salmon



Salmon-marine ecosystem linkages



ATLANTIC SALMON DECLINES

HISTORIC

- DAMS
- OVER-FISHING
- POLLUTION

CONTEMPORARY

- DAMS
- MARINE SURVIVAL
- DEATH BY 1 000 CUTS
 - WATER QUALITY
 - WATER QUANTITY
 - EXOTIC SPECIES
 - AQUACULTURE
 - MANY OTHERS

ATLANTIC SALMON LISTING

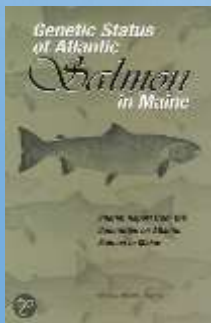
- 1991: 5 RIVERS LISTED AS CANDIDATES
- 1993: FIRST PETITION RECEIVED
- 1995: STATUS REVIEW COMPLETED; DPS CONSISTING OF SALMON IN 7 RIVERS IN MAINE IS IN DANGER OF EXTINCTION; PROPOSED RULE TO LIST AS THREATENED PUBLISHED; STATE INVITED TO DEVELOP A CONSERVATION PLAN
- 1997: PROPOSED RULE WITHDRAWN; COMMITMENT TO KEEP MONITORING
- 2000, USFWS & NOAA JOINTLY LISTED GULF OF MAINE DISTINCT POPULATION SEGMENT (DPS) AS ENDANGERED
- 2009, USFWS & NOAA EXPANDED THE LISTING & DESIGNATED CRITICAL HABITAT

POLITICAL REACTION TO THE LISTING

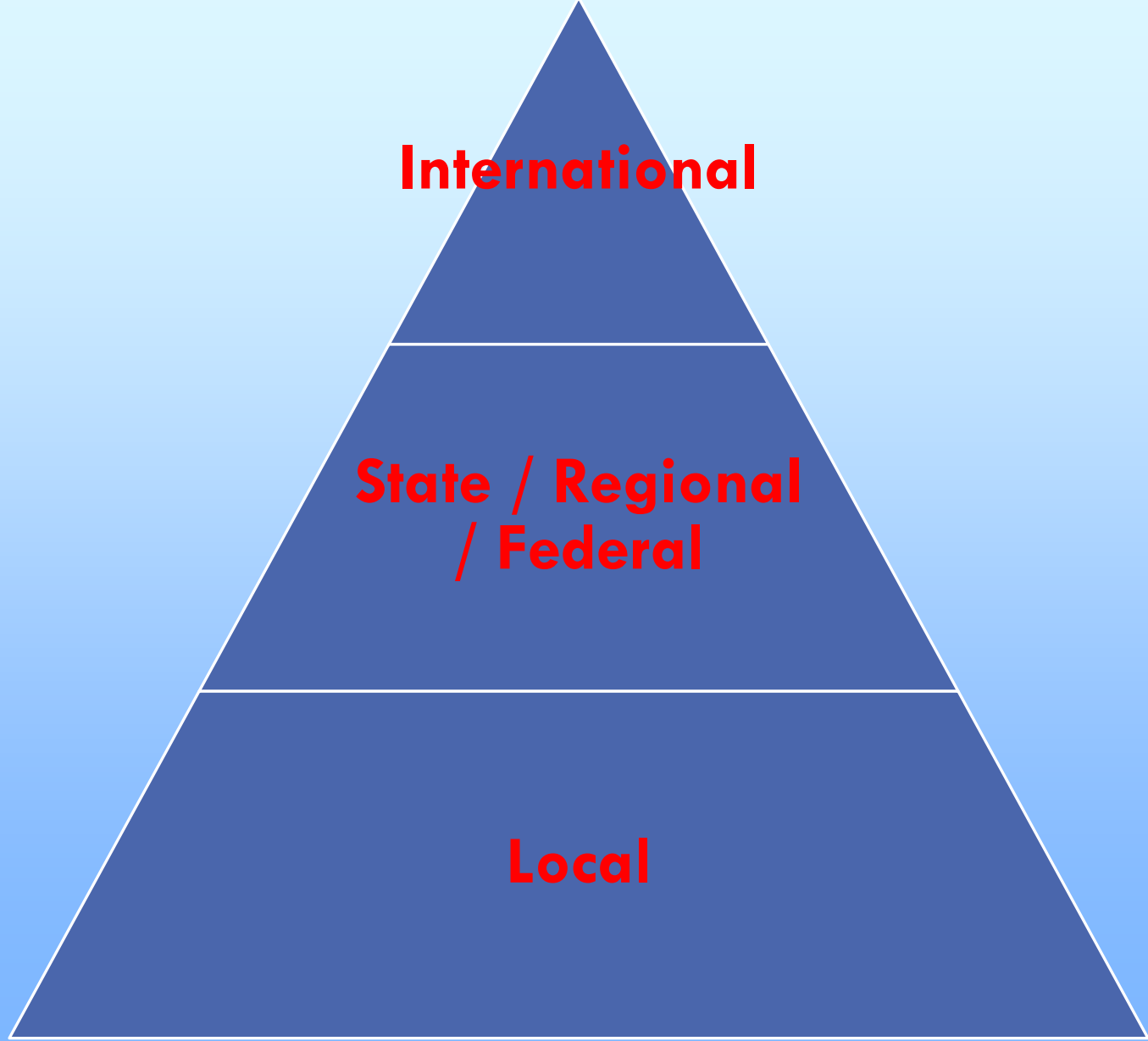
- “WE’D BETTER BE SURE OF THE SCIENCE BEFORE WE TAKE ACTION THAT SPELLS THE END OF THE AQUACULTURE INDUSTRY AND HAS SERIOUS IMPLICATIONS ON AGRICULTURE AND FORESTRY IN THIS REGION,” GOVERNOR KING SAID.
- “IF THE SCIENCE IS NOT RIGHT, THEY’RE TRIFLING WITH PEOPLE’S LIVES AND I RESENT THE HELL OUT OF IT,” THE GOVERNOR SAID.
- SNOWE, CHAIRWOMAN OF THE SENATE SUBCOMMITTEE ON OCEANS AND FISHERIES, DECRIED THE LISTING PROPOSAL FOR ITS ECONOMIC CONSEQUENCES.
- “AN ENDANGERED SPECIES ACT LISTING FOR ATLANTIC SALMON WOULD HAVE DISASTROUS CONSEQUENCES IN MAINE,” SNOWE SAID IN A STATEMENT. SHE PREDICTED FEDERAL OFFICIALS WILL GET LITTLE SUPPORT FOR THE PROPOSAL AND THAT MAINE INDUSTRIES WOULD FIGHT IT EVERY STEP OF THE WAY.

GENETICS DEBATE

- USFWS & NOAA STATED THAT:
 - REMNANT SALMON POPULATIONS IN THE GOM PERSISTED
 - WERE AFFECTED BY HATCHERY STOCKING, BUT
 - HATCHERY FISH HAD NOT SUBSTANTIALLY INTROGGRESSED WITH THE REMNANT POPULATIONS, IMPORTANT GENETIC LEGACY PERSISTED
- STATE OF MAINE AND INDUSTRY SUED USFWS & NOAA OVER 2000 LISTING; CLAIMED THAT DUE TO STOCKING, NO GENETIC LEGACY TO PROTECT; LISTING UPHELD IN COURT
- DUE TO CONTROVERSY, CONGRESS REQUESTED NATIONAL RESEARCH COUNCIL (NRC) EXAMINE THE SCIENCE RE: GENETICS AND RECOVERY
 - REPORT FOUND THAT MAINE SALMON WERE DISTINCT FROM BOTH EUROPEAN AND CANADIAN ATLANTIC SALMON



So, the species is listed, now what?



LOCAL LEVEL

- WATERSHED COUNCILS
- DOWNEAST SALMON FEDERATION
- ATLANTIC SALMON FEDERATION
- PROJECT SHARE

Local Level: Project SHARE

Salmon Habitat and River Enhancement

*To conserve and protect Atlantic
salmon habitat in the Dennys,
Machias, East Machias, Pleasant,
& Narraguagus rivers*

SHARE chartered as a 501©3
June 1994



TIMELINE AND MILESTONES

- 1994 PROJECT SHARE INCORPORATED
- FORMED BY THE FOREST INDUSTRY
 - COMMITTED TO TAKE NO POSITION REGARDING THE LISTING BUT INSTEAD TO FOCUS ON WHAT COULD BE DONE TO HELP SALMON
- JAN 2001 EXECUTIVE DIRECTOR HIRED
- 2001 SHARE'S IN-HOUSE RESTORATION PROGRAM INITIATED
 - OPEN BOTTOM ARCH CULVERTS
 - FOCUS AREA APPROACH
- OVER \$7.5M SPENT TO DATE ON-THE-GROUND PROJECTS & OUTREACH

Connectivity: Road Crossings



120 Arch Culverts
7 Bridges
45 Decommissions

Dam & Remnant Dam Removal



6 Dam Removals
31 Remnant Dam Removals



THE KEY TO SHARE'S SUCCESS:

- PROJECT SHARE IS A NEUTRAL FORUM WHERE STAKEHOLDERS INTERACT AS PEERS
- FOCUS ON THE MISSION OF HABITAT RESTORATION
- LEAD BY EXAMPLE AND ACTIONS/DON'T PUSH OR TELL PEOPLE WHAT TO DO
- ENCOURAGE COMMUNICATION BETWEEN STAKEHOLDERS
- VOLUNTARY PARTICIPATION OF STAKEHOLDERS
- PROMOTE COLLABORATION AND COOPERATION
- CAPACITY COMES FROM STAKEHOLDER CONTRIBUTIONS OF TIME AND EXPERTISE

STATE / REGIONAL / FEDERAL LEVEL

- PENOBSCOT RIVER TRUST
- JOINT LISTING
 - QUESTIONS OVER FEDERAL JURISDICTION FOR THE SPECIES
 - COLLABORATION & COOPERATION IN THE FIELD
 - FWS HAD HATCHERY EXPERTISE
 - NMFS HAD INTERNATIONAL EXPERTISE
- ATLANTIC SALMON RECOVERY FRAMEWORK – FEDERAL, STATE, TRIBAL

REGIONAL SCALE: PENOBSCOT RIVER RESTORATION TRUST

- >\$50M IN PUBLIC AND PRIVATE FUNDS TO PURCHASE 3 DAMS
 - 2 WERE REMOVED, A NATURAL BYPASS WAS BUILT AROUND THE THIRD
 - ENERGY PRODUCTION ON THE PENOBSCOT RIVER WAS INCREASED
- COMMITMENT TO PRE AND POST DAM REMOVAL MONITORING
- PENOBSCOT RIVER TRUST
 - *THE PENOBSCOT RIVER RESTORATION PROJECT IS AN UNPRECEDENTED COLLABORATION BETWEEN THE PENOBSCOT INDIAN NATION, SEVEN CONSERVATION GROUPS, HYDROPOWER COMPANIES PPL CORPORATION AND BLACK BEAR HYDRO, LLC, AND STATE AND FEDERAL AGENCIES, TO RESTORE 11 SPECIES OF SEA-RUN FISH TO THE PENOBSCOT RIVER, WHILE MAINTAINING ENERGY PRODUCTION.*

Veazie Dam, June 2013; slide courtesy George Aponte Clarke



Post dam removal



FRAMEWORK FOR RECOVERY AND RESTRUCTURING OF GOVERNANCE

Why Needed?

- Needed efficient and effective approach to management of the species under the ESA
- Declining budgets
- Large number and diversity of individuals, organizations, and entities interested in salmon recovery
- Struggles with priority and policy



USFWS

- Freshwater
- Hatchery Production/Evaluation
 - 2 hatcheries, 4 field offices, Northeast Fishery Center, Northeast Regional Office
- Habitat assessment
- ESA Section 10 Permits

NMFS

- Estuarine and marine
- Monitor and assess early marine survival
- Northeast Fisheries Science Center & Northeast Regional Office (ME, MA, RI)

Sec
7

Recovery
Implementation

Cooperative
Agreement

Maine Atlantic Salmon Commission

- State responsibility for Atlantic salmon management
 - Annual Stocking Plan & permits
 - Research and Monitoring

Framework Development

- Clear and Agreed Biological **Objectives**
- **Strategies** (Means Objectives) to achieve the biological objectives
- **Actions** to Achieve the Strategies
- **Structured Decision Making** to be more explicit and transparent
- Process is **Adaptive** – continuous learning and adjustment, with a commitment to accountability and tracking of progress toward agreed biological objectives

ACTION TEAMS

STRATEGIES

How do we Recover Atlantic salmon?

How Do We Do it ?

How Do We Assess Implementation and Effectiveness?

This step identifies the **ACTIONS** that need to be undertaken to implement the **STRATEGIES** identified in the previous steps

The **ACTIONS** should include **RESEARCH** that needs to be undertaken to fill critical information gaps

For each action identified, companion evaluation will be identified that assesses whether the action has actually been implemented **AND** whether it has had the intended effect

Description of Future Status of the GOM DPS of Atlantic Salmon = **RECOVERY** = Fundamental Objective

At this step we identify those **STRATEGIES** that can be utilized to increase survival and recovery of the GOM DPS

ADJUSTMENT

Description of Current Status of the GOM DPS of Atlantic Salmon

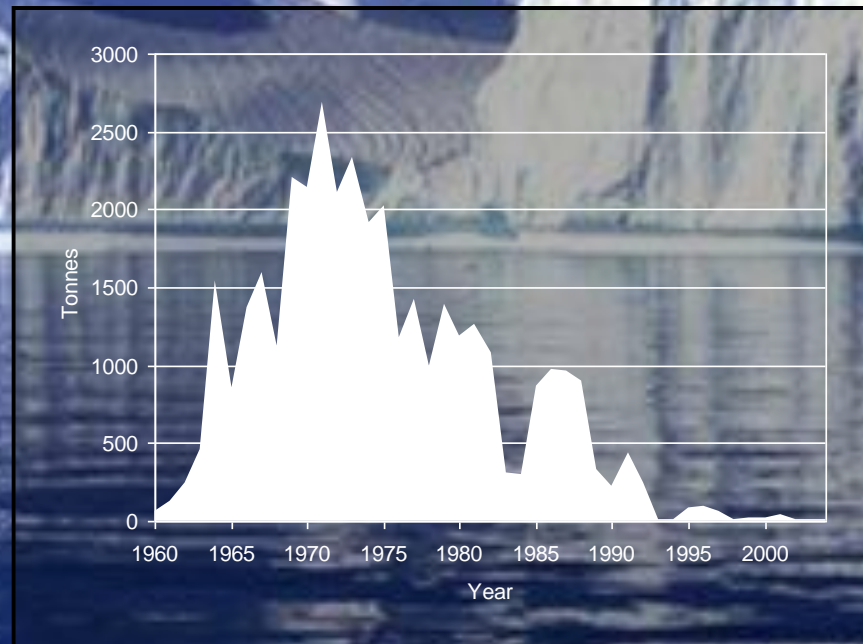
INTERNATIONAL

- 🐟 Regulatory Approaches
- 🐟 Exchanging and Establishing Best Management Practices
 - 🐟 Reporting, transparency, accountability
 - 🐟 “Name and Shame”
- 🐟 Cooperation for Research







Why international management?

- Up to late 1950s salmon management under national control
- Salmon reported off West Greenland as early as 1780
- Small-scale fishery since at least 1906
- 1960s – emergence of commercial fisheries



THE CONVENTION FOR THE CONSERVATION OF SALMON IN THE NORTH ATLANTIC




-  ENTERED INTO FORCE IN OCTOBER 1983
-  THE OBJECTIVE OF NASCO IS THE CONSERVATION, RESTORATION, ENHANCEMENT AND RATIONAL MANAGEMENT OF SALMON STOCKS THROUGH INTERNATIONAL COOPERATION
-  PROHIBITS SALMON FISHING MOST AREAS BEYOND 12 NAUTICAL MILES
-  PROMOTES THE ACQUISITION, ANALYSIS AND DISSEMINATION OF SCIENTIFIC INFORMATION

A photograph of a fish market stall. In the background, a worker in a blue jacket stands behind a counter. In the foreground, a worker in a pink jacket is visible. The stall is filled with various types of fish, including large red fish, laid out on metal tables. The background shows a building with blue corrugated metal siding and a window.

FISHERY MANAGEMENT IN STATES OF ORIGIN – BURDEN SHARING

- **US: COMMERCIAL FISHERY CLOSED SINCE 1940S**
- **CANADA: CLOSURE OF ALL COMMERCIAL FISHERIES SINCE 2000**
- **NORWAY: DRIFTNET FISHERY CLOSED IN 1989, 70% REDUCTION IN FIXED GEARS BETWEEN 1970-1999**
- **SCOTLAND: 90% REDUCTION IN NETTING EFFORT SINCE 1952**
- **ENGLAND AND WALES: MIXED STOCK FISHERIES PHASED-OUT**
- **IRELAND: 58% REDUCTION IN COMMERCIAL QUOTA SINCE 2002**
- **INCREASING PRACTICE OF CATCH AND RELEASE IN RECREATIONAL FISHERIES**

NEED FOR ACTION ON A BROAD FRONT

-  Distant water fisheries were initially considered to be the problem
-  It became clear however that NASCO would need to work on a broad front and that there was no single solution to the problem of declining stocks
-  NASCO has considerably broadened its base from an organization which focused only on the fisheries to one which is now addressing a very wide range of threats to the resource

Areas of International Cooperation - BMPs

- Adoption of the Precautionary Approach
- Management of salmon fisheries
- Habitat protection & restoration
- Stock rebuilding programs
- Salmon aquaculture, introductions & transfers, & transgenics
- By-catch
- Incorporation of socio-economic factors



International Atlantic Salmon Research Board

- Cooperate on research into the causes of marine mortality & the opportunities to counteract it
- Maintain an inventory of relevant research and identify gaps
- Raise funds to finance major new research projects

Salmon in the ocean

Global Change Biology

Global Change Biology (2013) 19, 3046–3061, doi: 10.1111/gcb.12298

Climate and ecosystem linkages explain widespread declines in North American Atlantic salmon populations

KATHERINE E. MILLS*†, ANDREW J. PERSHING*†, TIMOTHY F. SHEEHAN‡
and DAVID MOUNTAIN§

*School of Marine Sciences, University of Maine, Aubert Hall, Orono, ME 04469, USA, †Gulf of Maine Research Institute, 350 Commercial Street, Portland, ME 04101, USA, ‡Northeast Fisheries Science Center, National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543, USA, §University of Arizona, 2707 N. Orchard Avenue, Tucson, AZ 85712, USA

Bangor Daily News

Climate, ecosystem linkages explain salmon declines in Maine rivers



Atlantic salmon of the Penobscot strain swim in a pool at Craig Brook National Fish Hatchery in East Orland on Thursday, Aug. 1, 2013.

By John Holyoka, BDN Staff
Posted Aug. 09, 2013, at 1:36 p.m.

What to do, assuming climate change is real?

- Minimize mortality
- Maximize habitat quantity and quality
 - Region-specific approaches may be needed
 - Focus on the entire ecosystem (*both freshwater and marine environs*)
 - Maintain healthy woodlands
 - Minimize temperature increases, retain snow and delay melt, slow run off, attenuate extreme floods, reduce extreme summer events...
 - Protect refugia
 - Summer refugia from springs and groundwater, off-channel overwintering areas
 - Modeling can help identify land use changes to improve water management
 - Protect wetlands to buffer low summer flows, reduce drainage to rivers
- Improve connectivity
 - Eliminate all passage impediments, connect refugia, allow free migration...
- Maintain stock diversity
- Ensure that our rivers produce the maximum number of healthy wild smolts possible

What to do, assuming climate change isn't real?

- Minimize mortality
- Maximize habitat quantity and quality
 - Region-specific approaches may be needed
 - Focus on the entire ecosystem (*both freshwater and marine environs*)
 - Maintain healthy woodlands
 - Minimize temperature increases, retain snow and delay melt, slow run off, attenuate extreme floods, reduce extreme summer events...
 - Protect refugia
 - Summer refugia from springs and groundwater, off-channel overwintering areas
 - Modeling can help identify land use changes to improve water management
 - Protect wetlands to buffer low summer flows, reduce drainage to rivers
- Improve connectivity
 - Eliminate all passage impediments, connect refugia, allow free migration...
- Maintain stock diversity
- Ensure that our rivers produce the maximum number of healthy wild smolts possible

LESSONS LEARNED

- NEED CLEAR ROLES & RESPONSIBILITIES
- IDENTIFY, PRIORITIZE & ADDRESS THREATS THROUGHOUT THE LIFE CYCLE AND RANGE & IDENTIFY UNCERTAINTIES
- HAVE A SHARED CONCEPTUAL FRAMEWORK OF HOW IT ALL FITS TOGETHER
- STICK TO THE SCIENCE & FIND THE COMMON GROUND
- USE AN ECOSYSTEM APPROACH
 - SINGLE SPECIES → DIADROMOUS FISH COMMUNITY
 - SINGLE THREAT → CUMULATIVE IMPACTS