2012 River Herring Stock Assessment for Peer Review

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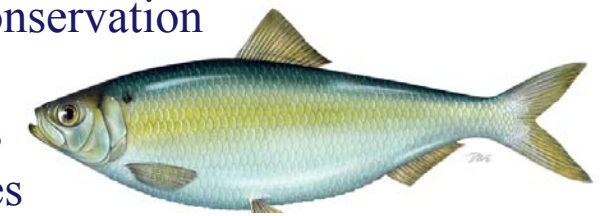
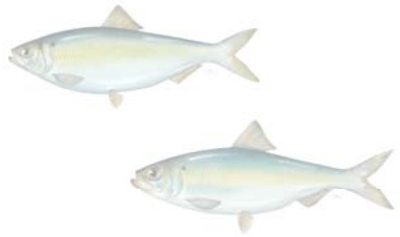


Outline



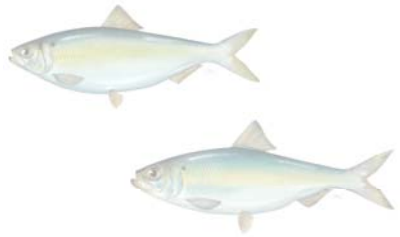
- Overview of state & regional data sets
- Coast-wide comparisons & trend analysis
  - Total landings & incidental catch
  - Biological data
  - Total mortality estimates
- Stock assessment models
- Conclusions

Data Overview

- **57 "systems"** on Atlantic coast
  - 9 FI & FD data categories
- **54% are blank**
- **Only 26% have complete or "good" data**
  - Most occurs in NE states

State	River	By species	Harvest	Age	Length	Weight	Repeat Spawner	FI Adult	FI JAI	FD CPUE
ME	Damariscotta		•							
	St. George		•							
	Union		•							
	Orland		•							
	Androscoggin	•		•	•					
	Sebasticook	•		•	•					
	Merrymeeting Bay/Tribs	•			•				•	
	Gulf of Maine	•			•			•		
NH	Exeter/Squamscott	•	•	•	•		o	•		
	Lamprey	•	•	•	•		o	•		
	Winnicut	•	•	•	•		o	•		
	Oyster	•	•	•	•		o	•		
	Cocheco	•	•	•	•		o	•		
	Taylor	•	•	•	•		o	•		
	Great Bay Estuary	x			x				x	
MA	Mattapoisett	•	•	o	o	o		•		
	Monument	•	•	o	o		o	•		
	Nemasket	•	•	o	o	o				
	Parker	•	•	o	o			•		
	Town		•					•		
	Agawam		•	o	o					
	Back	•	•	•	•			•		
	Charles		•	•	•	•	•	•		
	Mystic	•		•	•	•	•			
	Quashnet	•		•	•	•	•			
	Stony Brook	•		o	o	o	o	o		
RI	Gilbert Stuart			•	•	•	•	•	o	
	Nonquit			•	•	•	•	•	o	
	Buckeye Brook							•		
	Pawcatuck			x	x	x	x	o	•	
	Ocean waters				•			•	•	
	Naragansett Bay				•			•	•	
	Coastal ponds				•			•	•	
CT	Bride Brook	•			o			•		
	Connecticut River	•			o			•	o	
	Farmington River	•						•		
	Thames River	•						•		
NY	Hudson	•	•	o	•		o	•	•	o
DE, NJ, PA	Delaware River	o	o		o			o	o	o
	Delaware Bay	o	o		o			o	o	o
MD	Nanticoke	o		o	o		o		o	o
	Susquehanna	o						x		
	Chesapeake Bay			o						o
MD, VA, DC	Potomac River		•		o			o	o	o
VA	James	o	•	o	o	o	o	o	o	o
	Rappahannock	o	•	o	o	o	o	o	o	o
	York	o	•	o	o	o	o	o	o	o
NC	Albemarle Sound		o				o	o	•	
	Chowan River	•	•	•	•	•	o			•
SC	Wynah Bay								x	
	Santee-Cooper	o	•	o	o	o	o	o	x	•
	Savannah River								x	
	Ashley-Combahee-Edisto Basin								x	
GA	Altamaha River								x	
	Ogeechee River								x	
	Savannah River								x	
FL	St. Mary's River									

Data Overview

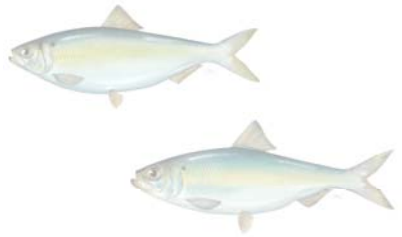


- River herring management
  - Ideal: manage stock(s) by individual river system
    - Difficult as majority of life spent in the marine environment
- Complex life history complicates a coast-wide scale assessment
  - Data quantity & quality varies greatly among systems
  - River herring are often a low management priority

River Herring Stock Assessment

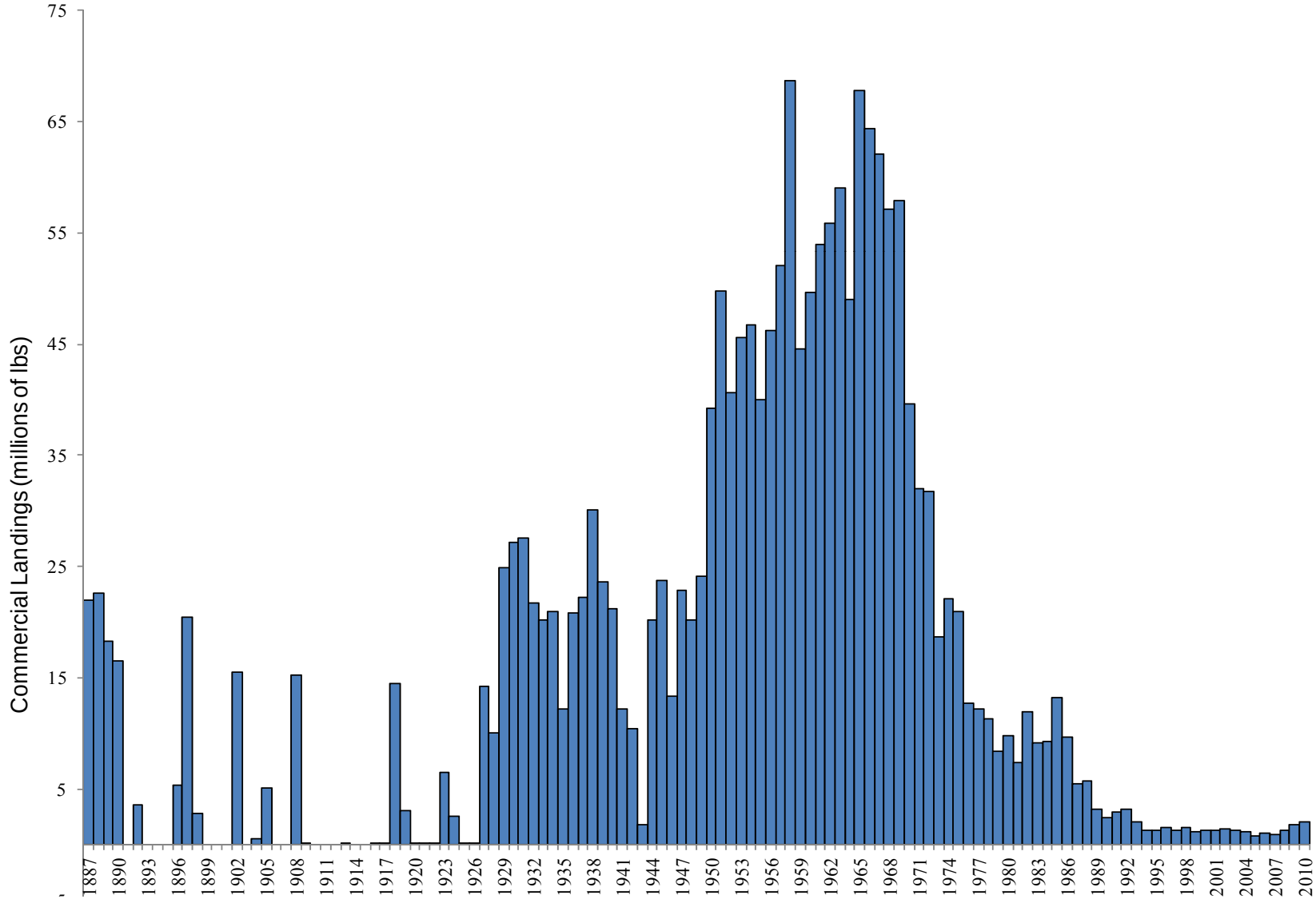
REPORTED LANDINGS

Reported Landings

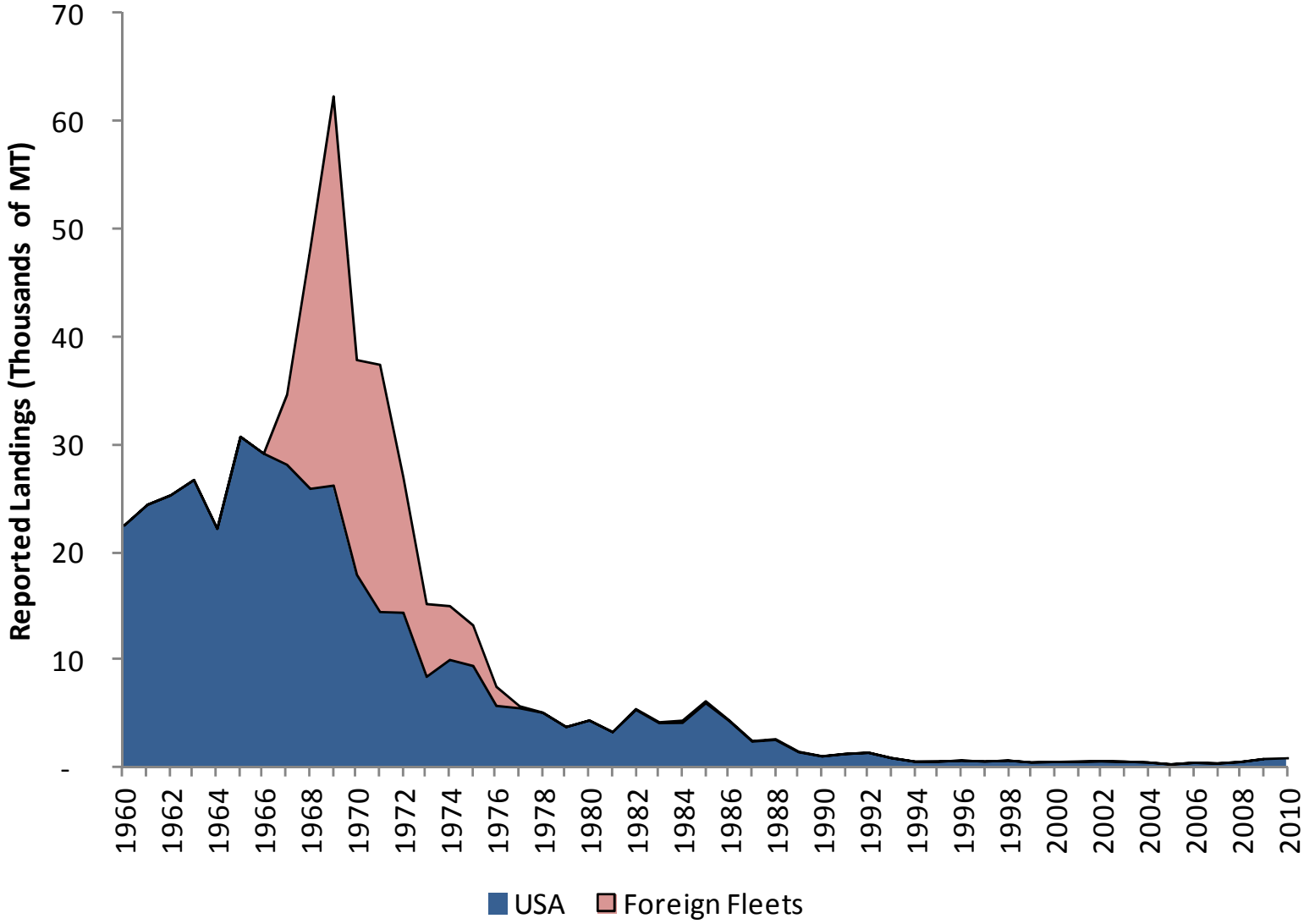


- Data sources:
  - Bulletin of the U.S. Fish Commission
  - U.S. Fish Commission Annual Report
  - State Reports
  - NAFO
  - 1887 - 2010
- Mainly in-river fisheries
- Reporting requirements variable over time
- Not identified to species level

Reported US Landings



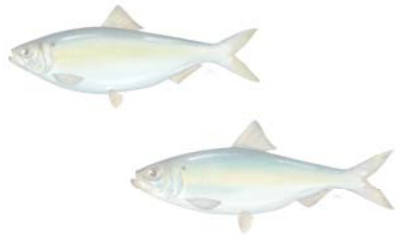
Reported NAFO Landings



River Herring Stock Assessment

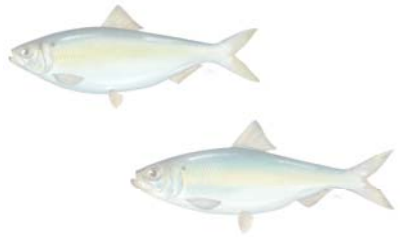
TOTAL INCIDENTAL CATCH ESTIMATES

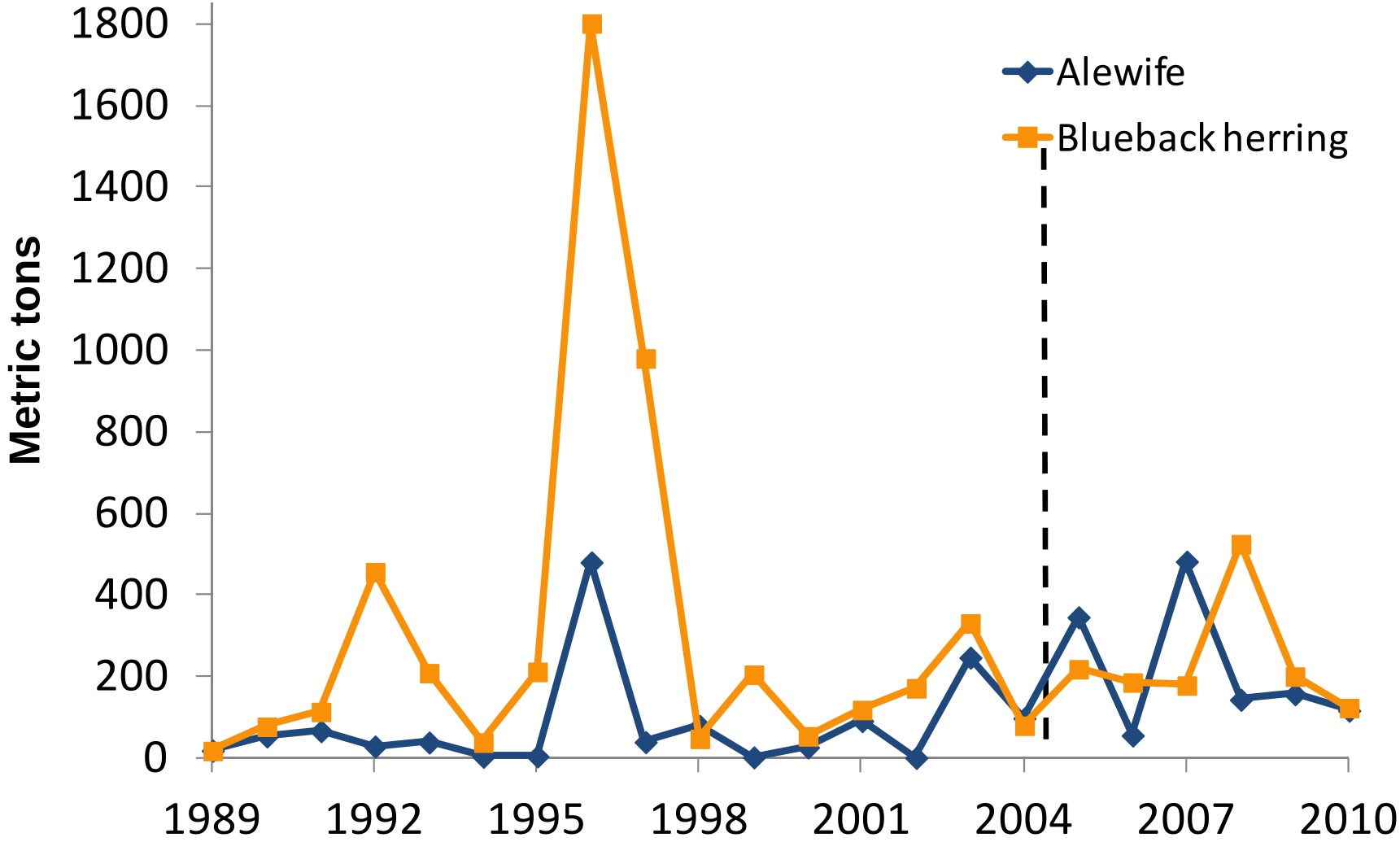
Total Incidental Catch



- **Total catch = discarded + retained catch**
- **Estimated by fleet; Stratified by:**
  - Region fished (New England, Mid-Atlantic)
  - Time (year, quarter)
  - Gear (13 groups)
    - →Ex: bottom trawls, paired MWT, single MWT, gillnets, longlines , purse seines....
  - Mesh (bottom trawl and gillnet only)
- **Time frame:**
  - MWT fleets: 2005 – 2010
  - All other fleets: 1989 – 2010
- **Combined ratio method; Analyzed at trip level**

Total annual incidental catch by species



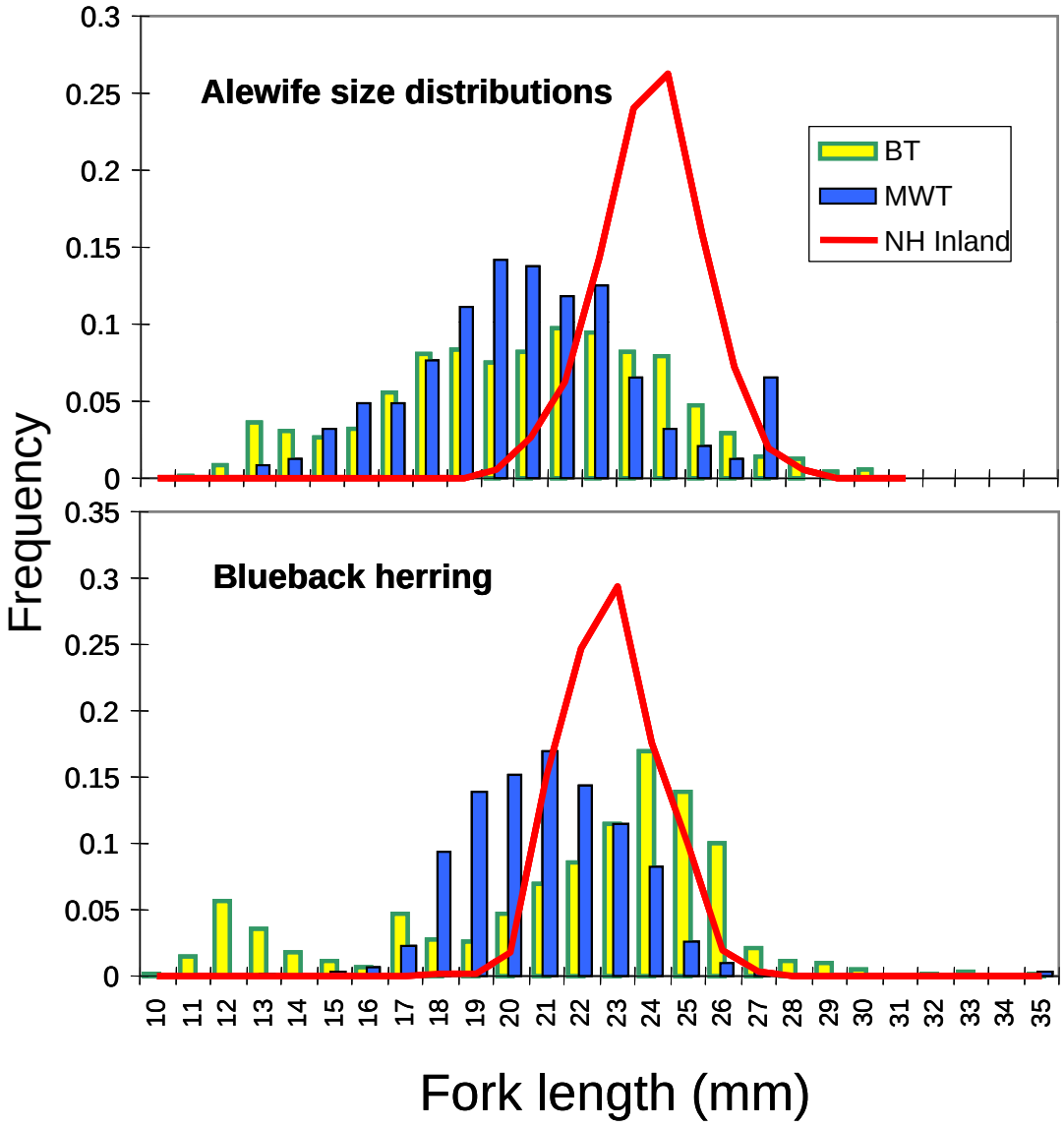


CV's: alewife: 0.20 – 3.86
blueback: 0.20 – 2.10

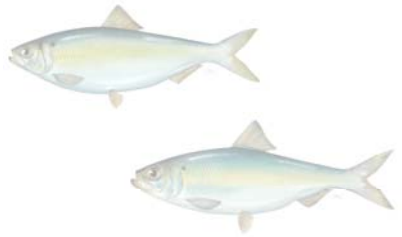
**MWT estimates only included beginning in 2005*

Biological Data

- Observers also collect data on length frequency of incidental catch
- **Incidental catch included small fish of size classes not observed in river samples**



Incidental Catch

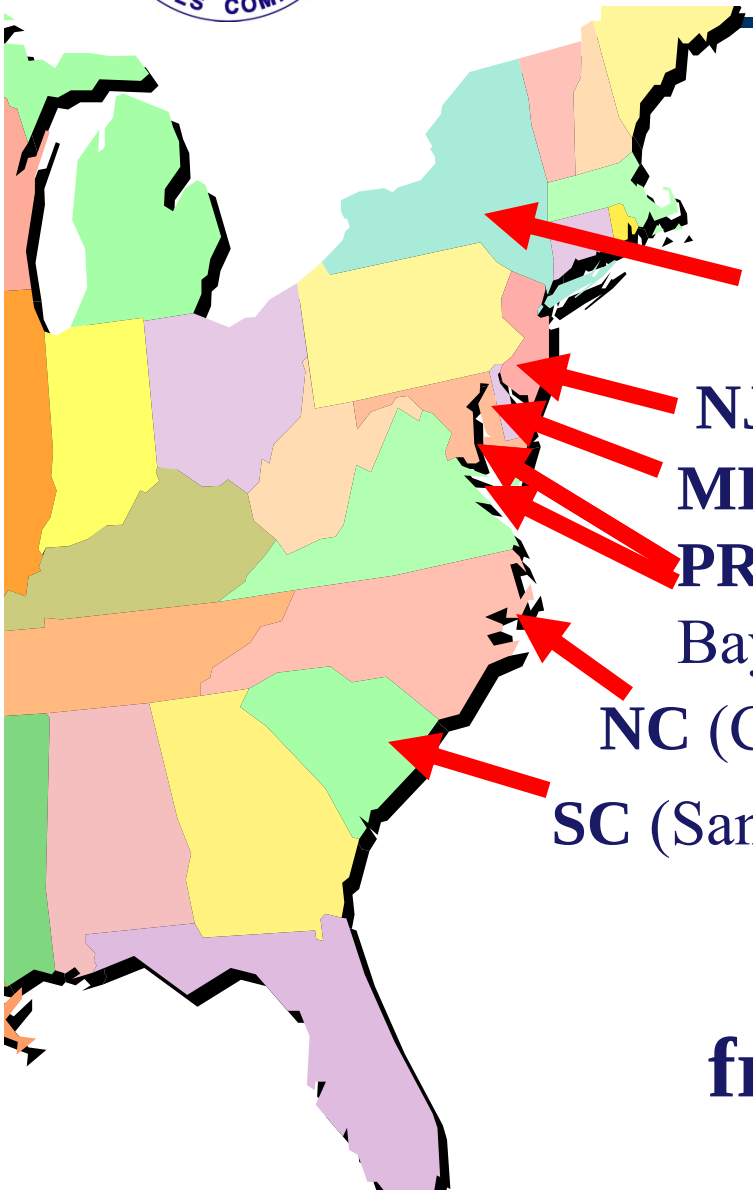


- Total incidental catch in other ocean fisheries **averaged 459 MT from 2005 – 2010**
  - Unknown reporting rates makes direct comparisons to reported landings problematic
  - Incidental catch of "Herring NK [not know]" ranged from 7 - 328 MT from 2005 – 2010, and the proportion of river herring in this category is unknown

River Herring Stock Assessment

COASTWIDE COMPARISONS & TREND ANALYSIS

Commercial CPUE



NY (Hudson River – Combined Spp.)

NJ (Del Bay – Combined Spp.)

MD (Nanticoke R. – Combined Spp.),

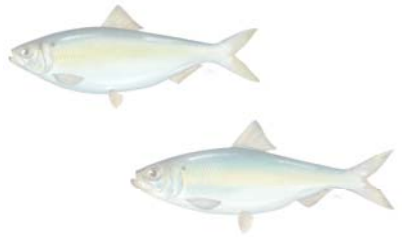
PRFC (Potomac R.- Both),**VA** (Chesapeake Bay, James R., Rapp. R, York R. - Alewife)

NC (Chowan R. – Alewife and Blueback)

SC (Santee-Cooper R. - Blueback)

11 rivers/estuaries
from gillnets and pound nets

Commercial CPUE



Alewife:

3 of 4 series showed historical declines and some increases in recent years.

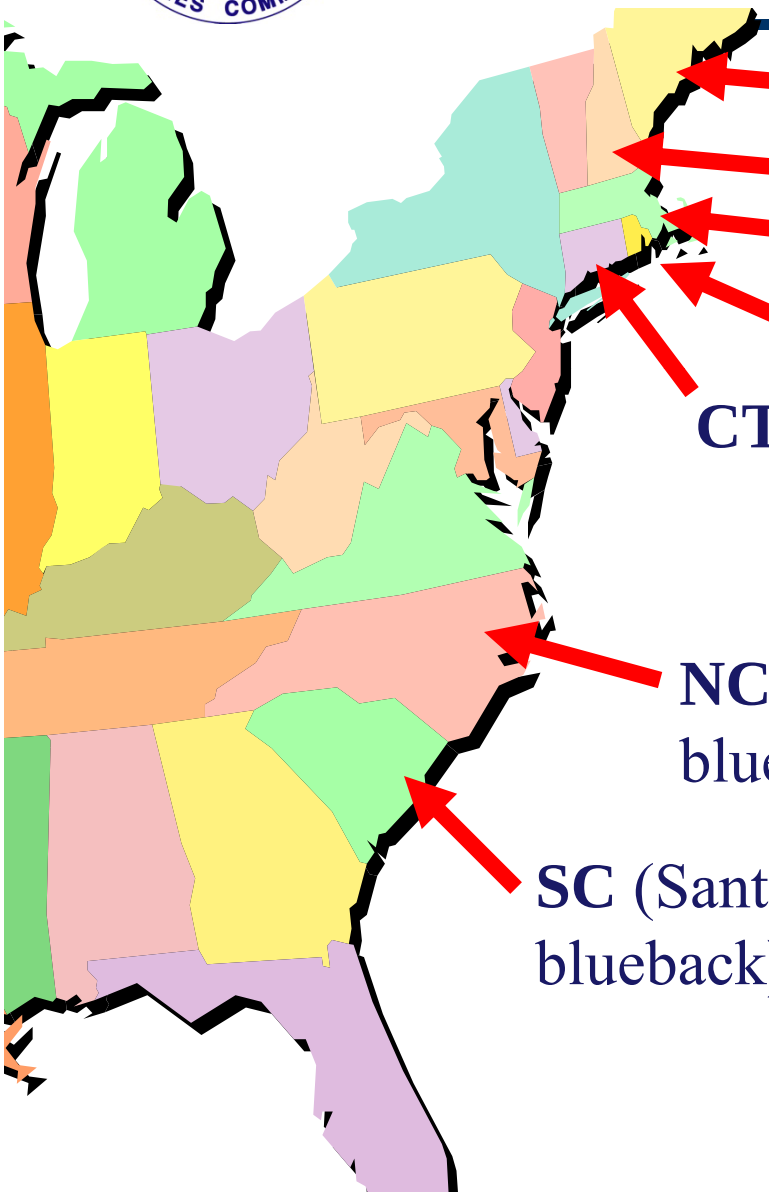
Blueback:

2 of 3 series have declined or are showing declines in recent years.

Combined Species:

3 of 4 series have declined.

Run Size Estimates



ME (5 Rivers - alewife)

NH (6 Rivers – combined species)

MA (4 Rivers – alewife and blueback)

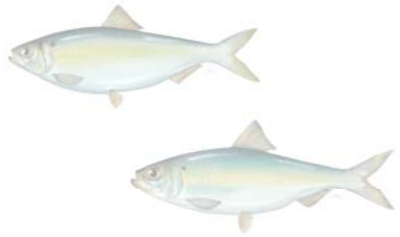
RI (3 Rivers - alewife)

CT (8 Rivers – alewife and blueback)

NC (Chowan R. –1972-2009 assessment, blueback)

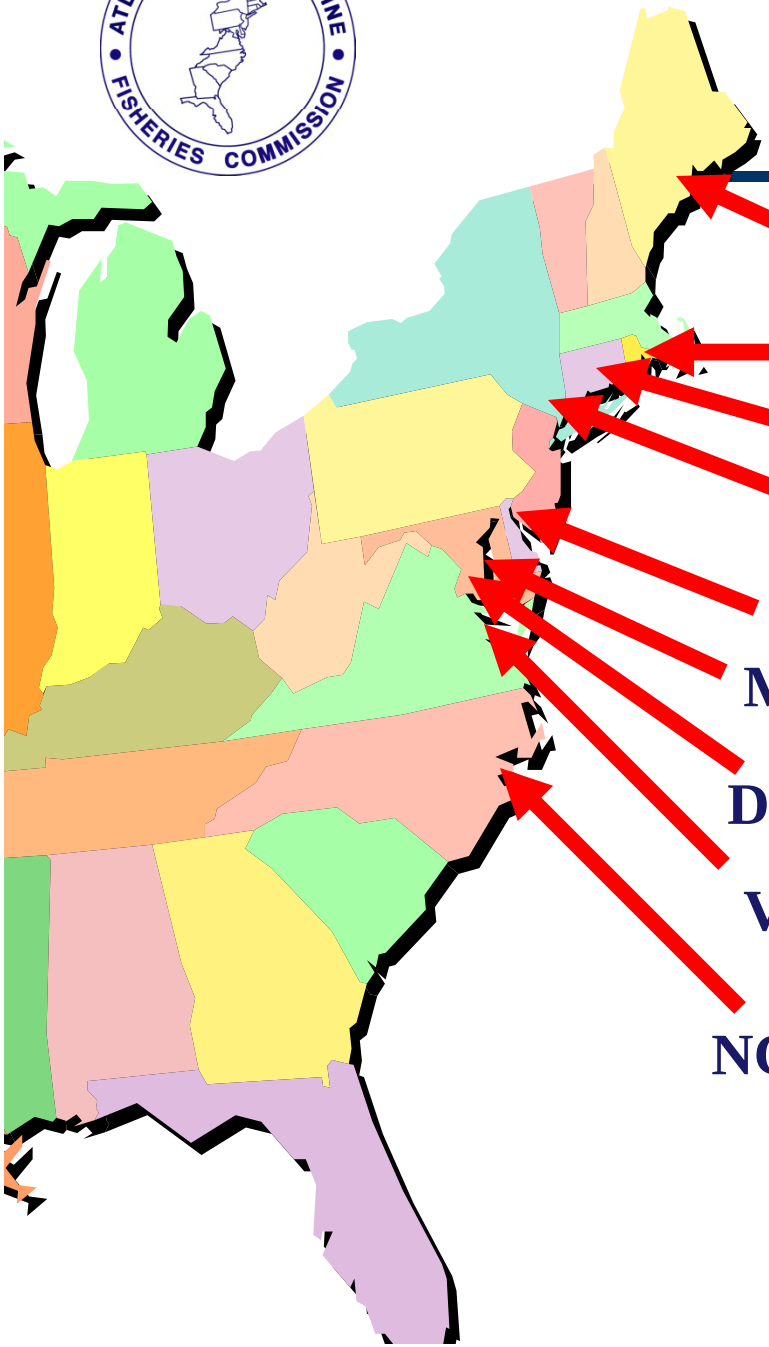
SC (Santee R. – 1980-1990 mark-recapture - blueback)

Run Sizes



- Run sizes for alewife, blueback herring and combined species showed historical and recent (1999-2007) declines in abundance.
- Alewife/Combined Species run sizes in eight of nine NE rivers (with long time series: 1984-2010) showed historical declines (mid 1990s or after 1999-2000) but have increased in the last 2-3 years.
- Blueback run sizes in two of two NE rivers declined over time (as early as 1985).
- Population sizes in Chowan River, NC declined precipitously after 1985 and abundance remains low.

YOY FI Surveys



ME (6 Rivers – alewife & blueback)

RI (Pawcatuck R. – combined species)

CT (Connecticut R.- blueback)

NY (Hudson R. – blueback & alewife)

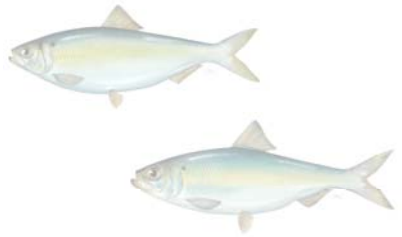
NJ (Delaware R. – blueback & alewife)

MD (Upper CB – blueback & alewife)

DC (Anacostia &Potomac R. blueback & alewife)

VA (Lower CB – blueback & alewife)

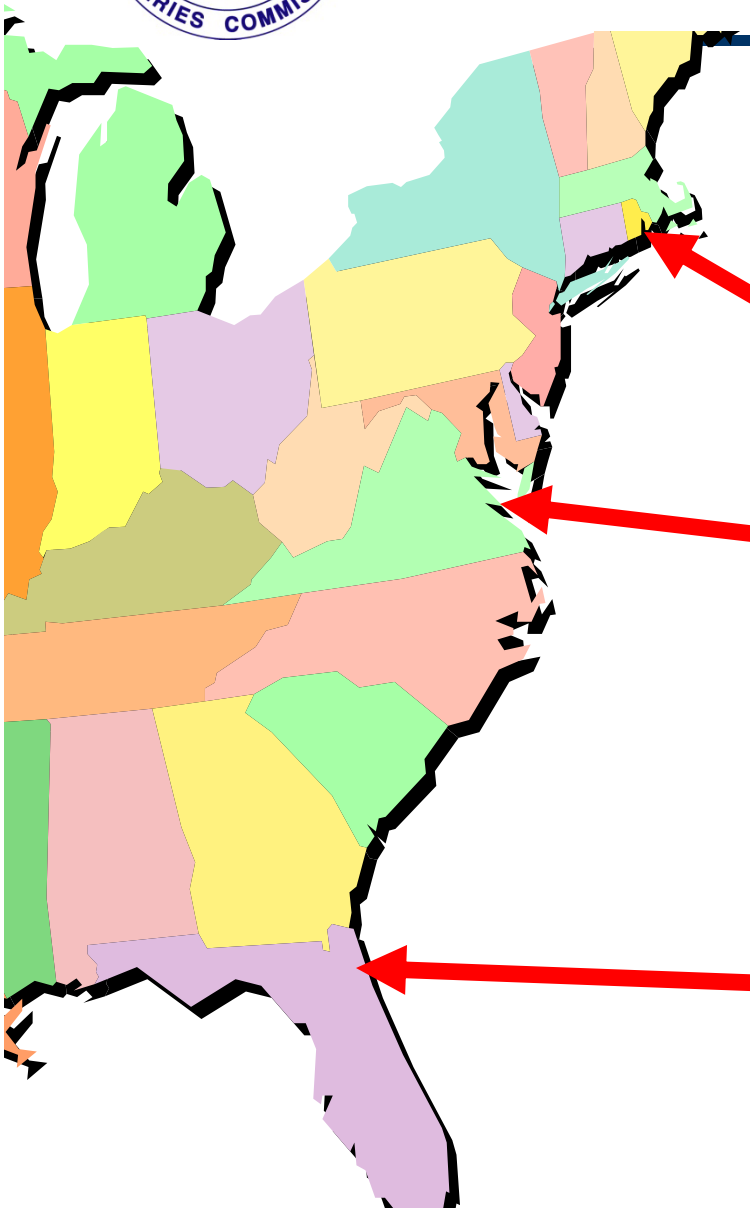
NC (Albemarle Sound – blueback & alewife)



YOY FI Surveys

- For recent years (2000-2007):
  - Alewife:
    - → 3 indices declining
    - → 3 indices showed no trend
    - → 1 index increasing
  - Blueback from eight rivers showed:
    - → 4 rivers showed no trend
    - → 4 rivers declining
- Similar patterns among indices from the same region

YOY/Juvenile/Adult FI surveys



Large Seine, Gillnet, Electrofishing Surveys

RI (Seine – Narraganset Bay, Pond Survey)

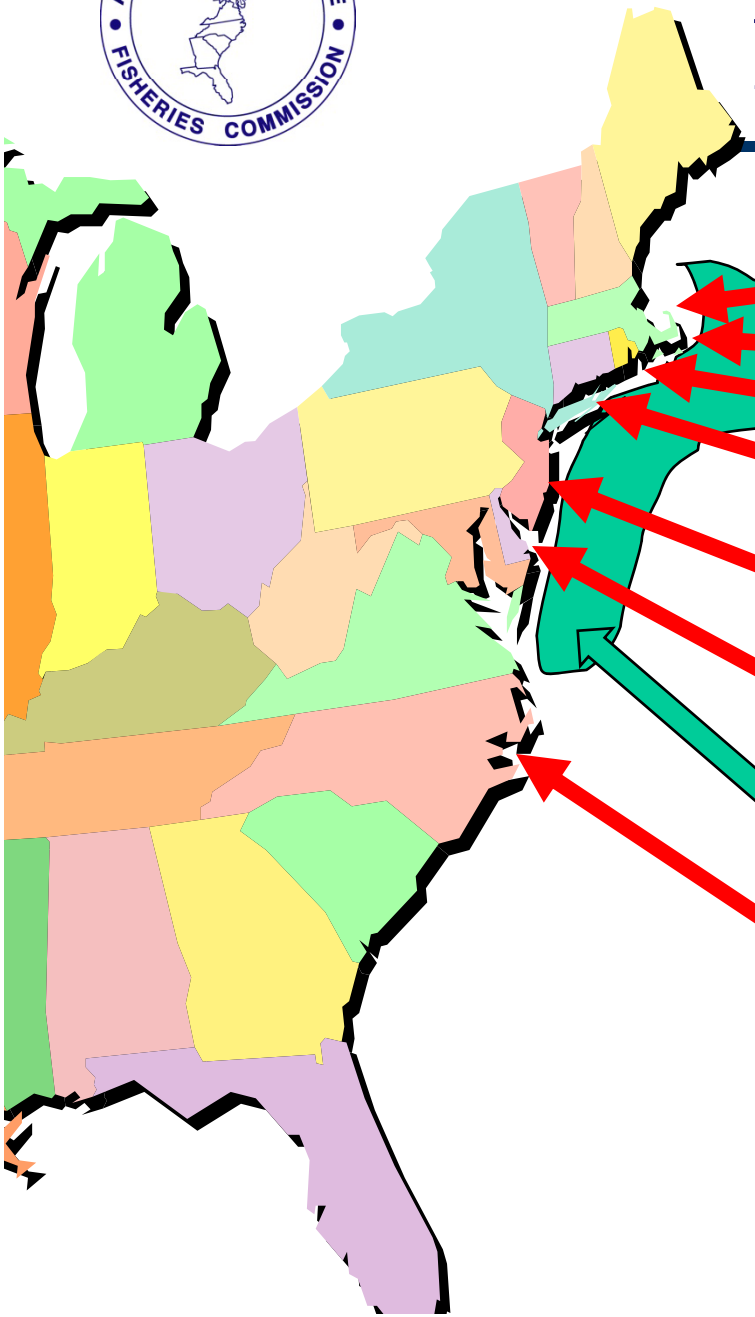
VA (Rapp. R. – Gillnet, Electrofishing
James R. – Electrofishing)

FL (St. John's – Electrofishing)

YOY/Juvenile/Adult FI surveys

- **Indices for alewife and blueback herring showed declines:**
  - **after 1995 – Rappahannock River, VA**
  - **after 2001 – St John's River, FL**
  - **after 2004 – James River, VA and RI Pond Survey**

FI Trawl Surveys



MA Inshore N of Cape Cod

MA Inshore S of Cape Cod

RI Coastal Trawl Survey

CT Long Island Trawl Survey
Spring & Fall

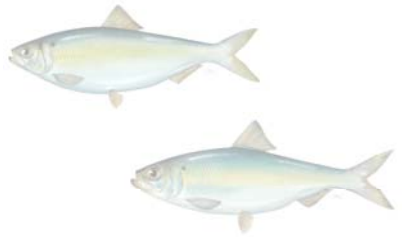
NJ Ocean Trawl Survey

DE River & Bay Trawl Survey
Adult Survey & Juvenile Survey

NEFSC Bottom Trawl Survey

NC Northern Sound Survey

FI Trawl Surveys

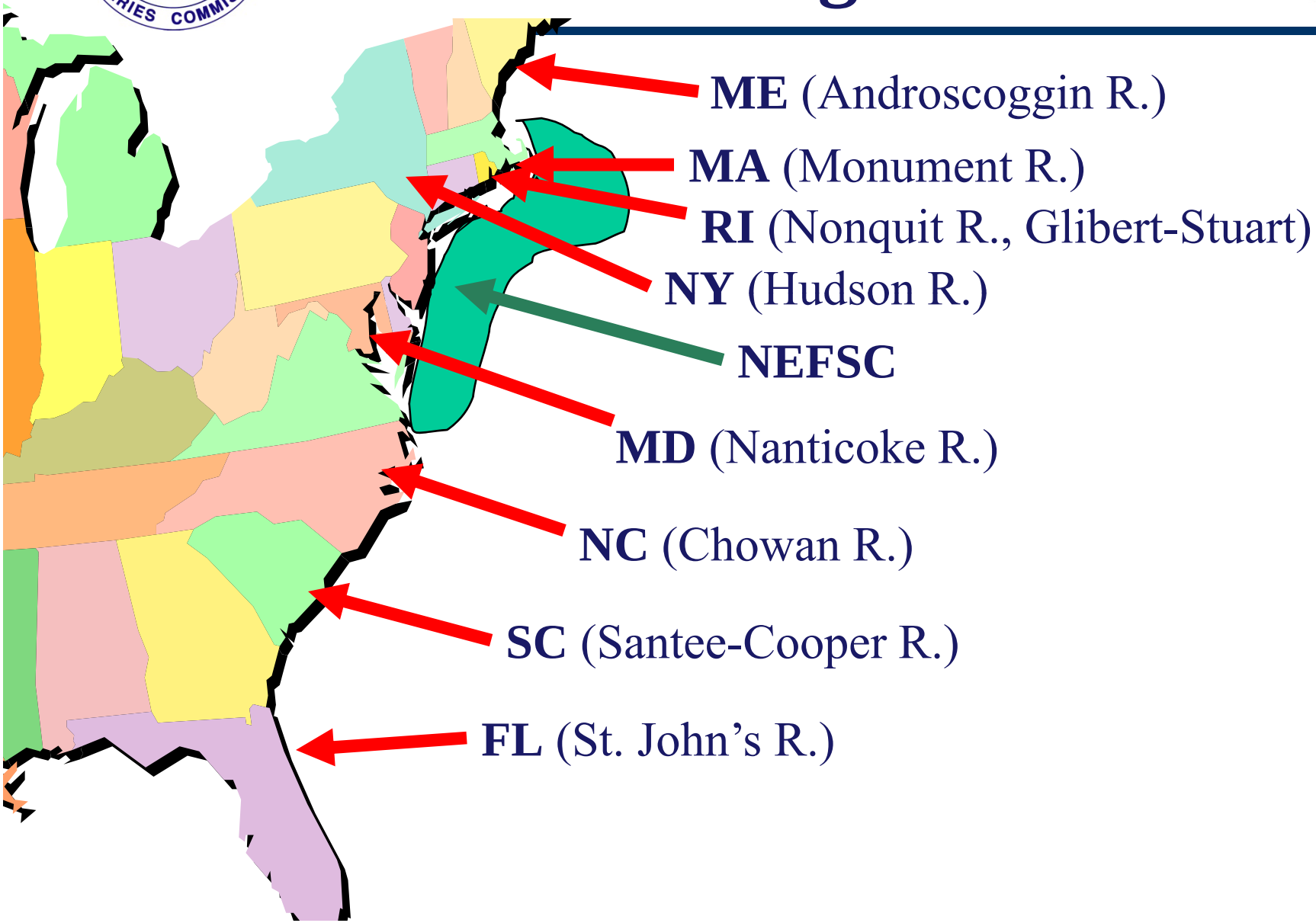


- **Alewife**
  - **Increasing trend: 4 surveys**
  - **Flat/no trend: 3 surveys**
  - **Decreasing trend: 1 survey**
- **Blueback herring**
  - **Increasing trend: 2 surveys**
  - **Flat/no trend: 4 surveys**
  - **Decreasing trend: 2 survey**

Trends in Juvenile and Adult Trawl Surveys

- **Trawl surveys quite variable** – some increase, some decrease, some were stable
- Trawl surveys in **southern regions showed decreasing trends** more frequently than those in northern regions
- Could be distributional changes in river herring due to climatic factors

FI & FD Length Data



ME (Androscoggin R.)

MA (Monument R.)

RI (Nonquit R., Glibert-Stuart)

NY (Hudson R.)

NEFSC

MD (Nanticoke R.)

NC (Chowan R.)

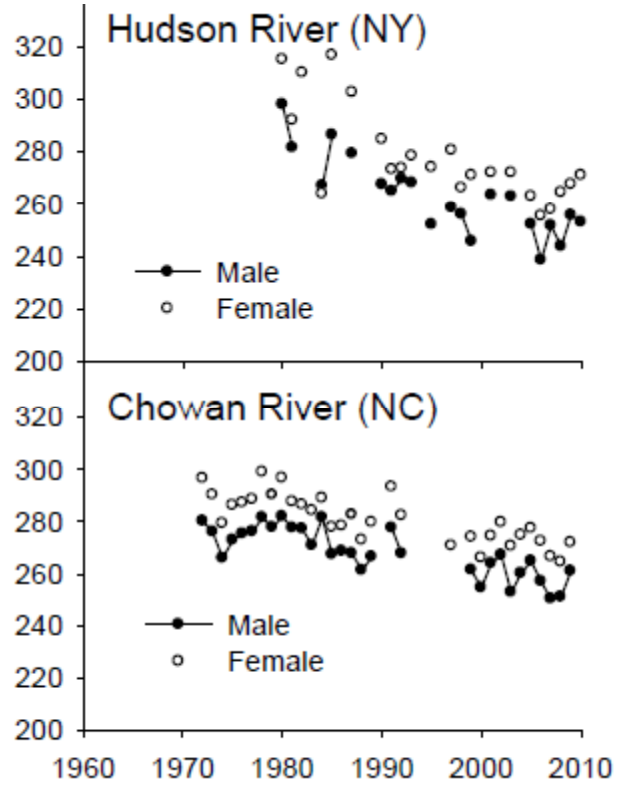
SC (Santee-Cooper R.)

FL (St. John's R.)

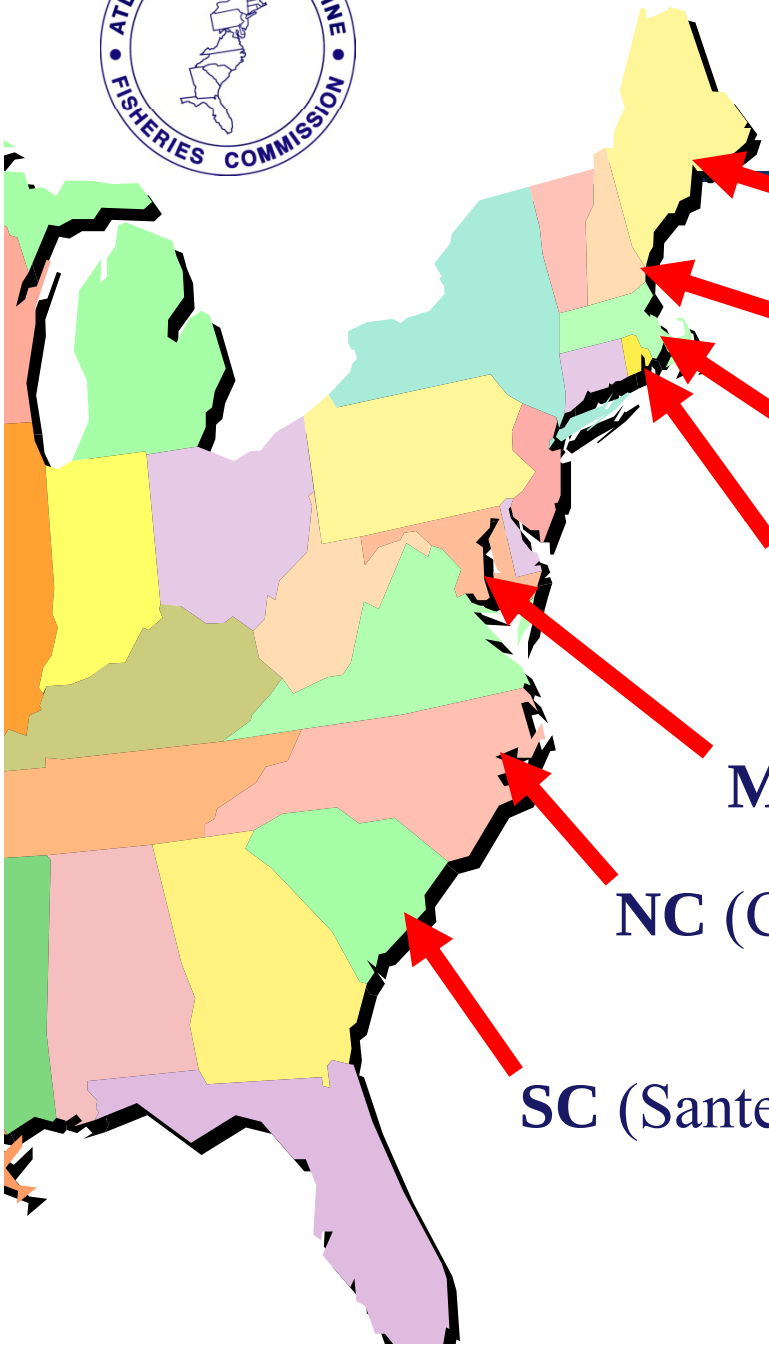
Mean Length

- Mean length of male and female alewife and blueback herring have **declined** over time by 13-45 mm TL in 7 of 13 rivers examined

- **Significant declines for rivers with long time series**



FI & FD Age Data



ME (Androscoggin R.)

NH (Oyster, Winnicut, Cocheco, Lamprey, Exeter)

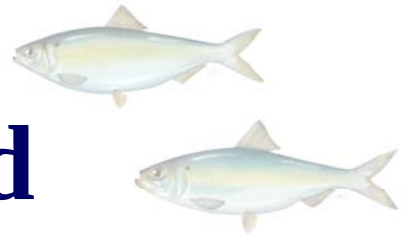
MA (Monument R.)

RI (Nonquit R., Glibert-Stuart)

MD (Nanticoke R.)

NC (Chowan River)

SC (Santee-Cooper R.)

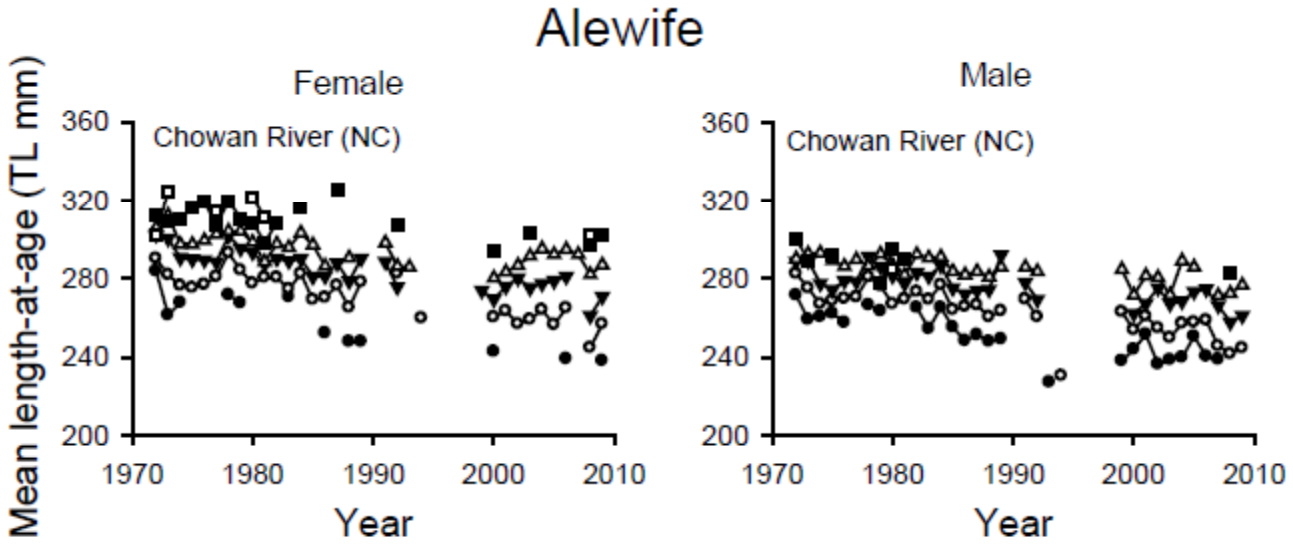


Maximum Age Observed

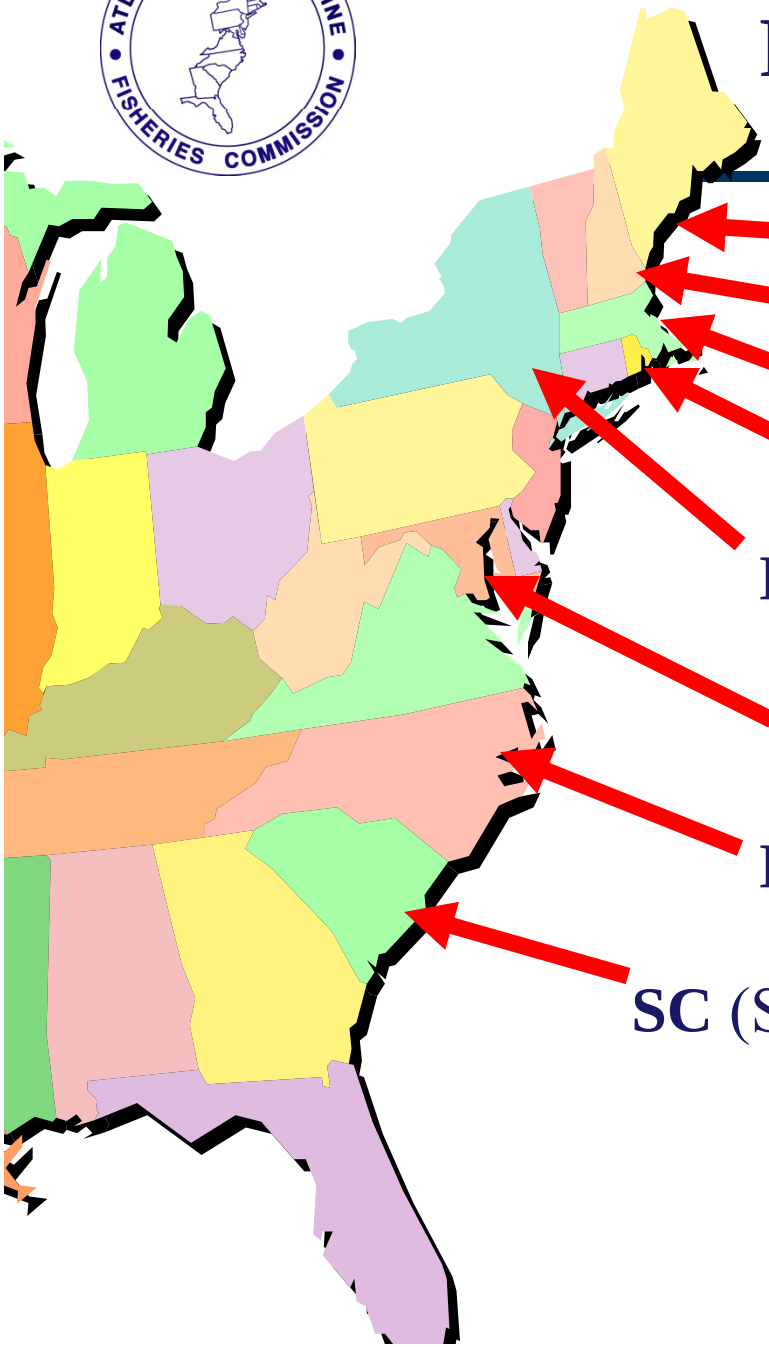
- **Alewife maximum age has declined by 1 to 2 ages in MA, RI, MD and NC. Trends in ME and NH have been stable or increasing.**
- **Blueback maximum age has declined by 1 to 4 ages in MA, MD and NC. Trends in NH have been stable or increasing.**

Length-at-Age

- Significant **declines** in mean length for one or more ages in:
  - Alewife – ME, NH, RI, MD and NC
  - Blueback – NH, MD, NC



FI & FD Repeat Spawner



ME (Androscoggin R.)

NH (5 rivers)

MA (Monument, Nemasket R. & Town B.)

RI (Nonquit R., Glibert-Stuart)

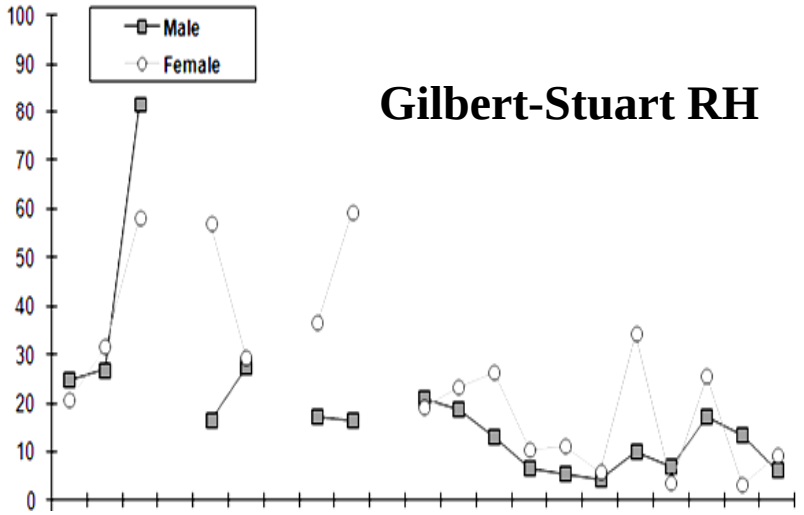
NY (Hudson R.)

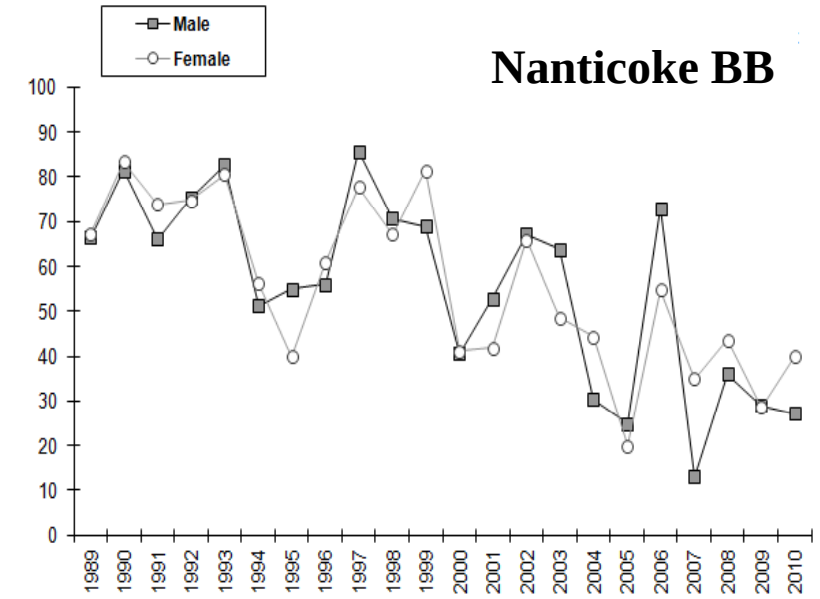
MD (Nanticoke R.)

NC (Chowan, Scuppernong, Alligator)

SC (Santee R.)

Repeat Spawner Data



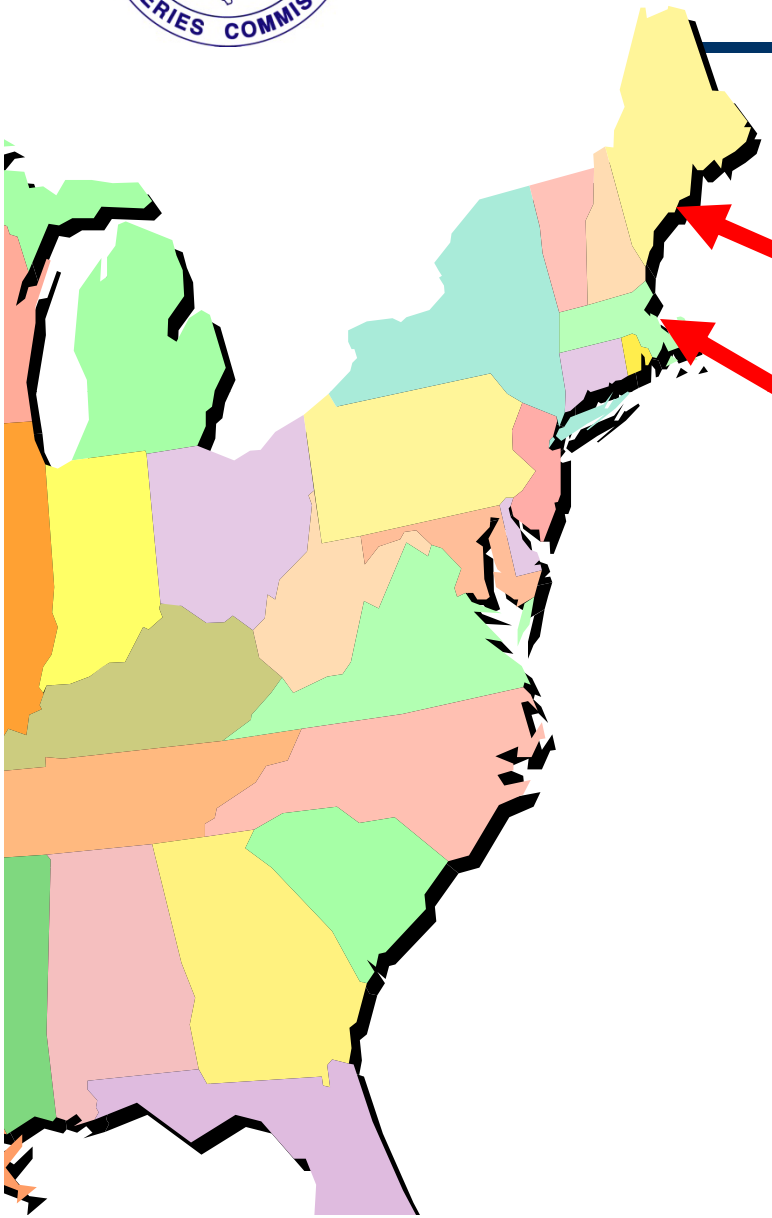


- Data available from 12 rivers
- Few datasets with time series

- **Declining** trends in the **Gilbert-Stuart River (RI)** for combined species and **Nanticoke River** for blueback herring only

- **No or little trends in the remaining rivers**

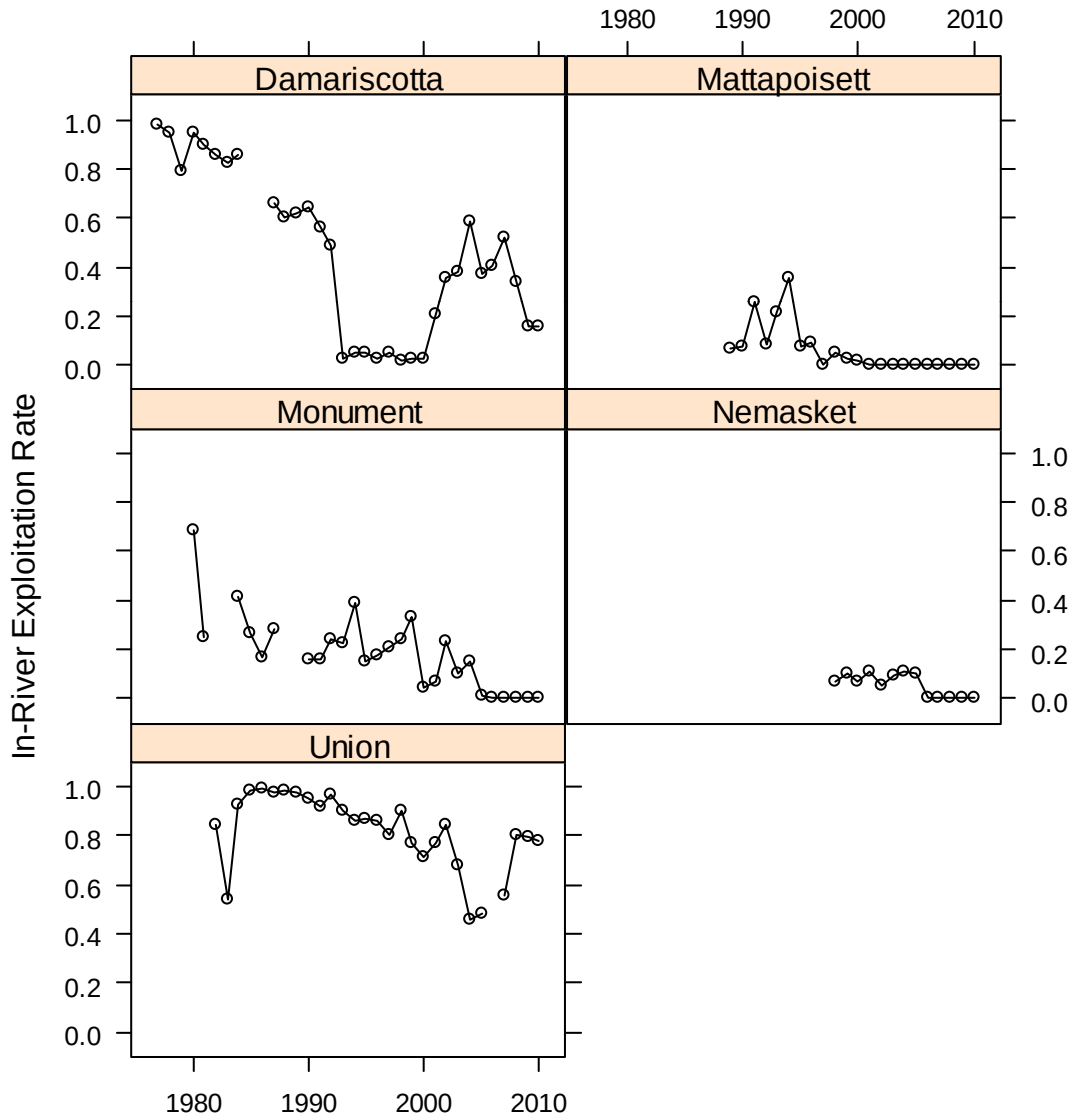
In-River Exploitation Rates



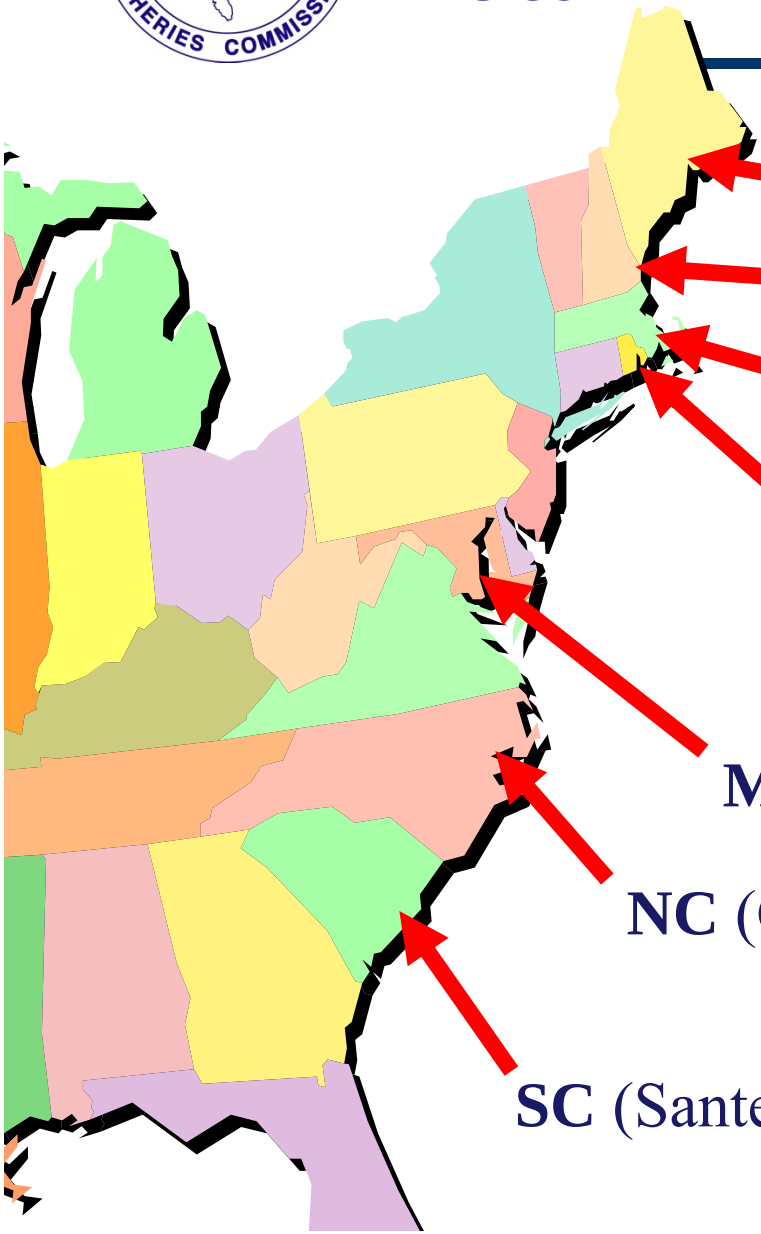
ME (Damariscotta R., Union R.)

MA (Mattapoisett R. Monument R., Nemasket R.)

In-river Exploitation Rates



Total Mortality Estimates



ME (Androscoggin R.)

NH (Oyster, Winnicut, Cocheco, Lamprey, Exeter)

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RI (Nonquit R., Glibert-Stuart)

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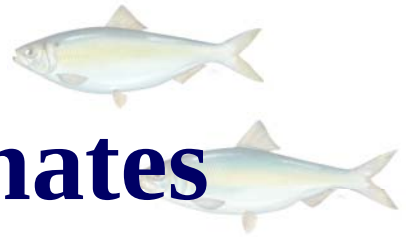
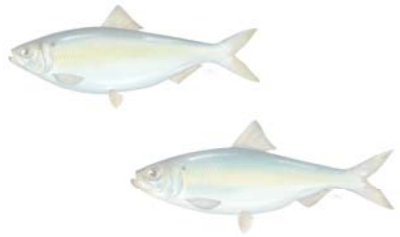


Total Mortality (Z) Estimates

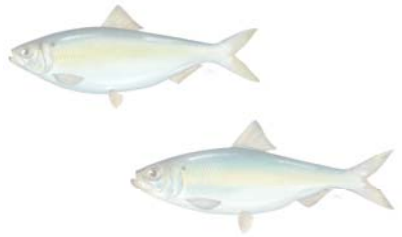
- **Developed from observed age-structure**
- **Chapman-Robson – least biased estimator**
- **At least 3 age classes must be present**

Z Benchmarks



- Spawning Potential Ratio (SPR)
- The total mortality rate that reduces the spawning stock biomass to a specified percent of the virgin (unfished) SSB
  - Usually, 20 – 40%
  - Similar to $F_{20\%SPR}$ used for other species
- Sensitive to estimate of natural mortality (M)
- **Considered both a low (0.3) and a high (0.7) value for M; only M=0.7 shown here**

Z Benchmarks

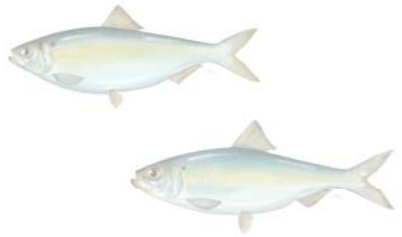


- **Total mortality was high for all stocks examined**
- Three year average of observed Z values were **above** the $Z_{20\%SPR}$ **benchmark for 12 of the 18 stocks.**
- Three year average of observed Z values were **between** the $Z_{40\%SPR}$ and $Z_{20\%SPR}$ **benchmarks for the remaining 6 stocks.**

River Herring Stock Assessment

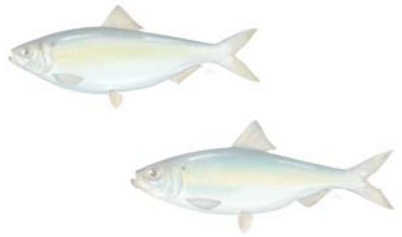
STOCK ASSESSMENT MODELS

River-Specific SCAA



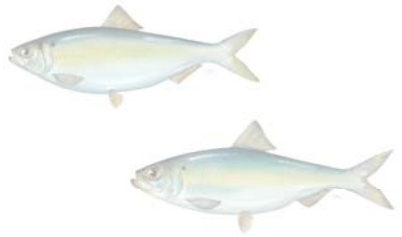
- **Developed for 3 rivers**
  - Monument River, MA
  - Nanticoke River, MD
  - Chowan River, NC
- **Results agree with status determination from trend analysis**
- See assessment report for more details

Coastwide Model



- Depletion-Based Stock Reduction Analysis (**DB-SRA**)
- Developed on the west coast to generate management parameters (e.g., MSY) for data-poor species
- Requires a time-series of catch, assumptions about the biology of the species, and the current status of the stock

Coastwide Model

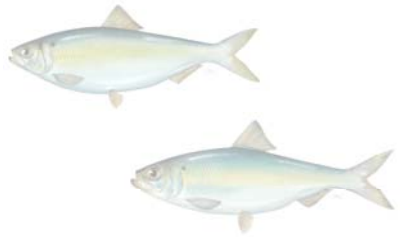


- Results were relatively robust to different assumptions, but estimates of U_{MSY} were extremely low and not considered realistic
- SASC had concerns about model structure and assumptions and recommends further development

River Herring Stock Assessment

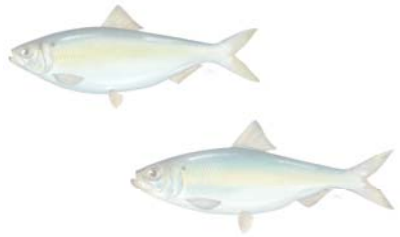
CONCLUSIONS AND STOCK STATUS

Conclusions



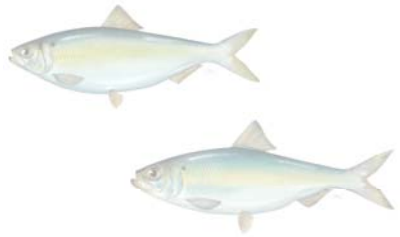
- **River herring have declined coast-wide**
  - Declining commercial landings following the 1960s
  - Declining commercial CPUE
  - Declining run counts in many rivers
  - Declines in average length and size-at-age in many rivers
  - SCAA and DB-SRA model runs
- **Fisheries independent indices were quite variable**
  - Most started after the decline in commercial landings
  - Currently observing relatively small amounts of inter-annual variation
  - Regional (north vs. south) patterns may be due to climate change

Conclusions

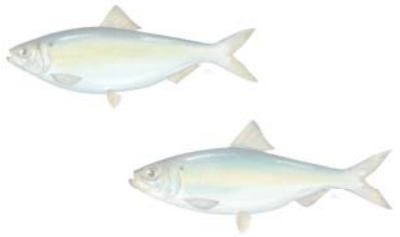


- At low levels, stocks are sensitive to both biotic and abiotic perturbations and truncated age structure reduces population resilience.
- **Recovery of river herring stocks will need to address multiple factors** (e.g., fish passage, predation, water quality, climate change, etc.) in addition to harvest.

Stock Status



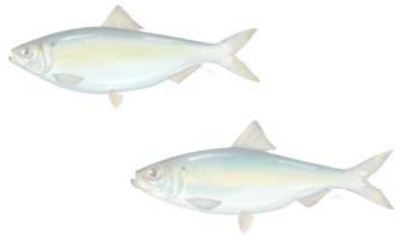
- **The coastwide meta-complex of river herring on the US Atlantic coast is depleted to near historic lows**
- "Depleted" status indicates that there was evidence for declines in abundance due to a number of factors, but the relative importance of these factors in reducing river herring stocks could not be determined.



Stock Status

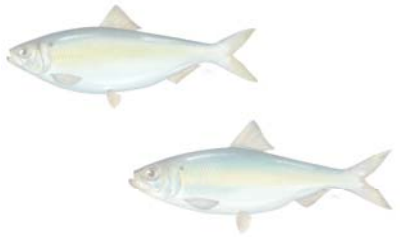
- **52 in-river stocks** for which data were available
  - **Historically:**
    - → **22 were depleted**
    - → **1 stock was increasing**
    - → **28 stocks could not be determined**
  - **In most recent years:**
    - → **2 were increasing**
    - → **4 were decreasing**
    - → **9 were stable**
    - →**38 rivers did not having enough data**

Stock Status



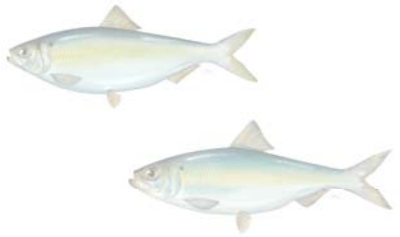
- **Overfished and overfishing status could not be determined for the coastwide stock complex**
- **Management actions to reduce total mortality are needed.**

Stock Status



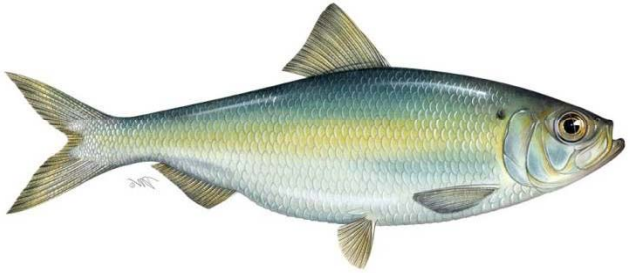
State	River**	Commercial CPUE		Run Counts		YOY survey		Z		Trawl Survey†		Mean Length	Max Age	Percent Repeat Spawners	Status Relative to Historic Levels / Recent Trends*
		5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series				
ME	Androscoggin			$\leftrightarrow^{A}$	$\uparrow^{A}$			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$			n.s	$\leftrightarrow^{A}$		Unknown^{A}, Unknown^{A}
	Kennebeck			$\uparrow^{RH}$	$\uparrow^{RH}$										Unknown^{RH}, Unknown^{RH}
	Sebasticook			$\uparrow^{RH}$	$\uparrow^{RH}$	$\leftrightarrow^{A}, \downarrow^{B}$	$\leftrightarrow^{A}, \nearrow\searrow^{B}$	$\leftrightarrow^{A}$	$\leftrightarrow^{A}$						Unknown^{A}, Unknown^{A}
	Damariscotta			$\uparrow^{A}$	$\downarrow^{A}$										Depleted^{A}, Stable^{A}
	Union			$\uparrow^{A}$	$\leftrightarrow^{A}$										Increasing^{A} , Stable^{A}
NH	Cocheco			$\uparrow^{RH}$	$\nearrow\searrow^{RH}$			$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\uparrow^{A}, \downarrow^{B}$	n.s	$\uparrow^{A}, \leftrightarrow^{B}$	n.s	Unknown^{A,B}, Stable^{A,B}
	Exeter			$\leftrightarrow^{RH}$	$\nearrow\searrow^{RH}$							n.s	$\leftrightarrow^{A}$	n.s.	Depleted^{A}, Increasing^{A}
	Lamprey			$\leftrightarrow^{RH}$	$\nearrow\searrow^{RH}$			$\leftrightarrow^{A}$	$\downarrow^{A}$			n.s	$\uparrow^{A}$	n.s.	Depleted^{A}, Unknown^{A}
	Oyster			$\leftrightarrow^{RH}$	$\nearrow\searrow^{RH}$			$\leftrightarrow^{B}$	$\leftrightarrow^{B}$				$\uparrow^{B}$	n.s.	Depleted^{B}, Stable^{B}
	Taylor			$\leftrightarrow^{RH}$	$\downarrow^{RH}$									n.s.	Depleted^{B}, Decreasing^{B}
	Winnicut			$\leftrightarrow^{RH}$	$\leftrightarrow^{RH}$			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$			n.s	$\uparrow^{A}, \leftrightarrow^{B}$	n.s.	Depleted^{A,B}, Unknown^{A,B}
MA	Mattapoisett			$\uparrow^{A}$	$\nearrow\searrow^{A}$										Depleted^{A}, Unknown^{A}
	Monument			$\uparrow^{A}$	$\nearrow\searrow^{A}$			$\leftrightarrow^{A,B}$	$\uparrow^{A}, \leftrightarrow^{B}$			$\downarrow^{A,B}$	$\downarrow^{A,B}$	$\downarrow^{A,B}$	Depleted^{A}, Unknown^{A}
	Nemasket			$\uparrow^{A}$	$\leftrightarrow^{A}$			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$					n.s.	Unknown^{A}, Unknown^{A}
	Parker			$\uparrow^{A}$	$\downarrow^{A}$			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$						Depleted^{A}, Unknown^{A}
	Stony Brook											$\downarrow^{A}$			Depleted^{A}, Unknown^{A}
RI	Buckeye			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$										Depleted^{A}, Unknown^{A}
	Gilbert			$\uparrow^{A}$	$\nearrow\searrow^{A}$	$\leftrightarrow^{RH}$	$\nearrow\searrow^{RH}$	$\leftrightarrow^{A}$	$\uparrow^{A}$	$\leftrightarrow^{A}, \downarrow^{B}$	$\uparrow^{A}, \nearrow\searrow^{B}$	$\downarrow^{A}$	$\downarrow^{A}$	$\downarrow^{RH}$	Depleted^{A}, Decreasing^{A}
	Nonquit			$\downarrow^{A}$	$\downarrow^{A}$			$\leftrightarrow^{A}$				$\downarrow^{A}$		n.s.	Depleted^{A}, Decreasing^{A}

Stock Status



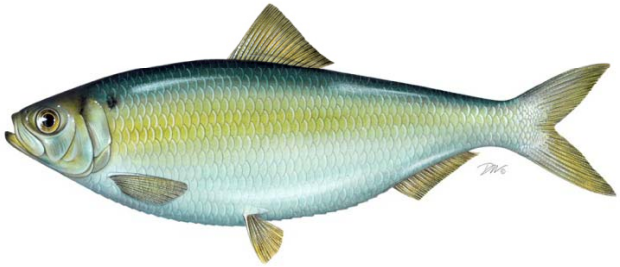
State	River**	Commercial CPUE		Run Counts		YOY survey		Z		Trawl Survey†		Mean Length	Max Age	Percent Repeat Spawners	Status Relative to Historic Levels / Recent Trends*
		5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series	5-year Trend	Time-series				
CT	Bride Brook			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$										Unknown^{A}, Unknown^{A}
	Connecticut			$\leftrightarrow^{B}$	$\nearrow\searrow^{B}$	$\uparrow^{B}$	$\downarrow^{B}$								XXX
	Farmington			$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$					$\leftrightarrow^{A,B}$ (Fall)					Unknown^{A,B}, Unknown^{A,B}
	Mianus			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$					$\leftrightarrow^{A}$ (Spring)	$\leftrightarrow^{A,B}$ (Fall)				Unknown^{A,B}, Unknown^{A,B}
	Mill Brook			$\leftrightarrow^{A}$	$\downarrow^{A}$					$\uparrow^{B}$ (Spring)	$\uparrow^{A,B}$ (Spring)				Unknown^{A}, Unknown^{A}
	Naugatuck			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$										Unknown^{A,B}, Unknown^{A,B}
	Shetucket			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$										Unknown^{A,B}, Unknown^{A,B}
NY	Hudson	$\uparrow^{RH}$	$\searrow\nearrow^{RH}$			$\leftrightarrow^{A,B}$	$\uparrow^{A}$, $\leftrightarrow^{B}$					$\downarrow^{A,B}$			Depleted^{A,B}, Stable^{A,B}
NJ, DE,PA	Delaware	$\leftrightarrow^{RH}$	$\downarrow^{RH}$			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$			$\leftrightarrow^{A}$, $\uparrow^{B}$	$\leftrightarrow^{A,B}$				Unknown^{A,B}, Unknown^{A,B}
MD, DE	Nanticoke	$\downarrow^{RH}$	$\downarrow^{RH}$			$\uparrow^{A,B}$	$\leftrightarrow^{A,B}$	$\leftrightarrow^{A}$, $\uparrow^{B}$	$\leftrightarrow^{A}$, $\uparrow^{B}$			$\downarrow^{B}$	$\leftrightarrow^{A}$, $\downarrow^{B}$	$\downarrow^{B}$	Depleted^{A,B}, Decreasing^{A,B}
VA, MD, DC	Potomac	$\leftrightarrow^{A}$	$\downarrow^{A}$			$\leftrightarrow^{A}$	$\leftrightarrow^{A}$								Depleted^{A,B}, Unknown^{A,B}
VA	James	$\leftrightarrow^{A}$	$\leftrightarrow^{A}$			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$								Unknown^{A,B}, Unknown^{A,B}
	Rappahannock	$\leftrightarrow^{A}$	$\nearrow\searrow^{A}$			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$					n.s.			Unknown^{A,B}, Unknown^{A,B}
	York	$\uparrow^{A}$	$\rightarrow\nearrow^{A}$			$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$								Unknown^{A,B}, Unknown^{A,B}
NC	Alligator							$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$					n.s	Unknown^{A,B}, Unknown^{A,B}
	Chowan	$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\leftrightarrow^{A,B}$	$\downarrow^{A,B}$	$\downarrow^{A,B}$	n.s.	Depleted^{A,B}, Stable^{A,B}
	Scuppernog							$\leftrightarrow^{A,B}$	$\leftrightarrow^{A,B}$					n.s.	Unknown^{A,B}, Unknown^{A,B}
SC	Santee-Cooper	$\uparrow^{B}$	$\searrow\nearrow^{B}$		$\uparrow^{B}$				$\downarrow^{B}$			n.s			Depleted^{B}, Increasing^{B}

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by 2015



River Herring

Peer Review Report



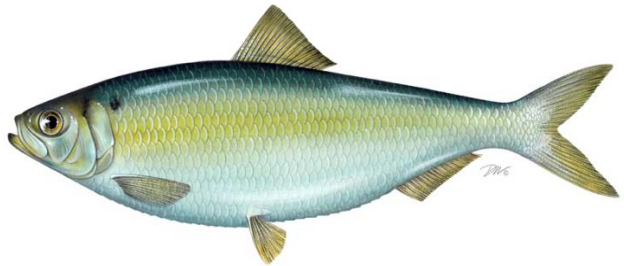
The Peer Review Team:

Karin E. Limburg, SUNY-ESF (chair)

Robert O'Boyle, Beta Scientific Cons.

Ken Oliveira, U. Mass. Dartmouth

John Weidemann, Rutgers U.



Terms of Reference

Evaluate/assess data collection and analysis

Evaluate bycatch analysis

Evaluate models used

Evaluate uncertainty analysis

Evaluate stock status, recommendations

Data gathering/evaluation

Because the assessment is of two species that spawn in inland waters large and small, the data search was comprehensive across all member states – 57 systems, regional and within-state analyses

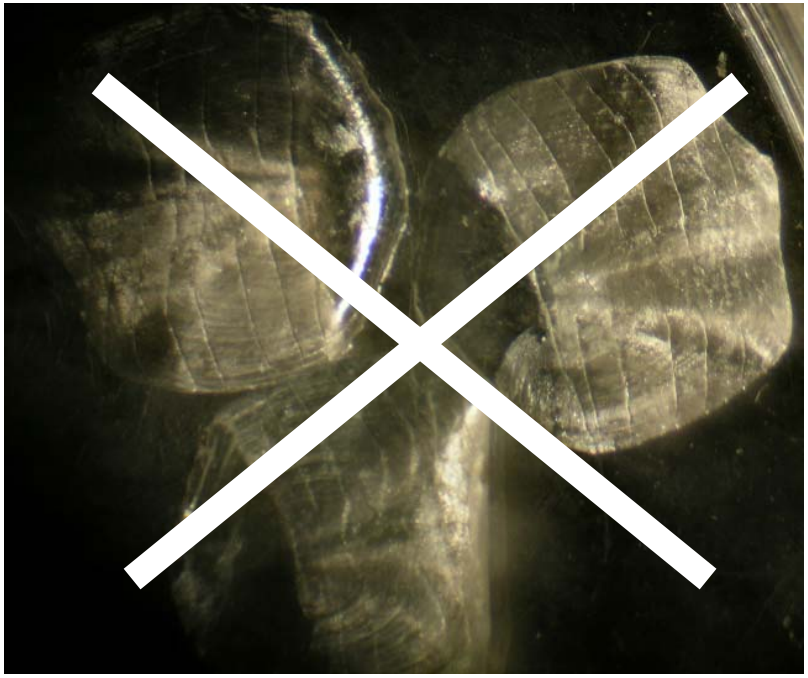
State	River	By species	Harvest	Age	Length	Weight	Repeat Spawner	FI Adult	FI JAI	FD CPUE
ME	Damariscotta		•							
	St. George		•							
	Union		•							
	Orland		•							
	Androscoggin	•		•	•					
	Sebasticook	•		•	•					
	Merrymeeting Bay/Tribs	•			•				•	
	Gulf of Maine	•			•			•		
NH	Exeter/Squamscott	•	•	•	•		o	•		
	Lamprey	•	•	•	•		o	•		
	Winnicut	•	•	•	•		o	•		
	Oyster	•	•	•	•		o	•		
	Cocheco	•	•	•	•		o	•		
	Taylor	•	•	•	•		o	•		
	Great Bay Estuary	x			x				x	
MA	Mattapoisett	•	•	o	o	o		•		
	Monument	•	•	o	o		o	•		
	Nemasket	•	•	o	o	o				
	Parker	•	•	o	o			•		
	Town		•					•		
	Agawam		•	o	o					
	Back	•	•	•	•			•		
	Charles		•	•	•	•	•	•		
	Mystic	•		•	•	•	•			
	Quashnet	•		•	•	•	•			
	Stony Brook	•		o	o	o	o	o		
RI	Gilbert Stuart			•	•	•	•	•	o	
	Nonquit			•	•	•	•	•	o	
	Buckeye Brook							•		
	Pawcatuck			x	x	x	x	o	•	
	Ocean waters				•			•	•	
	Naragansett Bay				•			•	•	
	Coastal ponds				•			•	•	
CT	Bride Brook	•			o			•		
	Connecticut River	•			o			•	o	
	Farmington River	•						•		
	Thames River	•						•		
NY	Hudson	•	•	o	•		o	•	•	o
DE, NJ, PA	Delaware River	o	o		o			o	o	o
	Delaware Bay	o	o		o			o	o	o
MD	Nanticoke	o		o	o		o		o	o
	Susquehanna	o						x		
	Chesapeake Bay			o						o
MD, VA, DC	Potomac River		•		o			o	o	o
VA	James	o	•	o	o	o	o	o	o	o
	Rappahannock	o	•	o	o	o	o	o	o	o
	York	o	•	o	o	o	o	o	o	o
NC	Albemarle Sound		o				o	o	•	
	Chowan River	•	•	•	•	•	o			•
SC	Wynah Bay								x	
	Santee-Cooper	o	•	o	o	o	o	o	x	•
	Savannah River								x	
	Ashley-Combahee-Edisto Basin								x	
GA	Altamaha River								x	
	Ogeechee River								x	
	Savannah River								x	
FL	St. Mary's River									

A few comments:

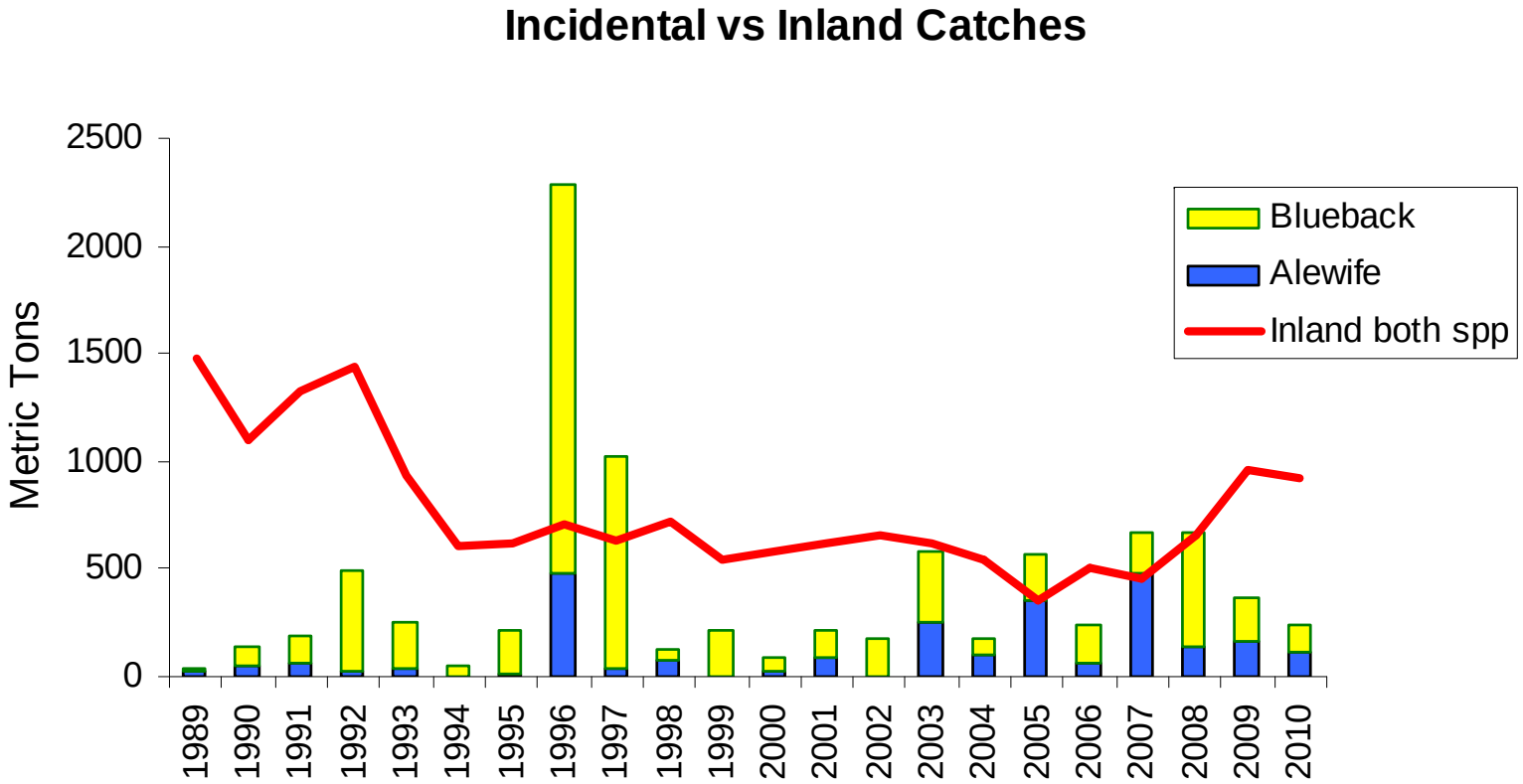
Regional trend analysis could have benefited from GLM to explore uncertainties

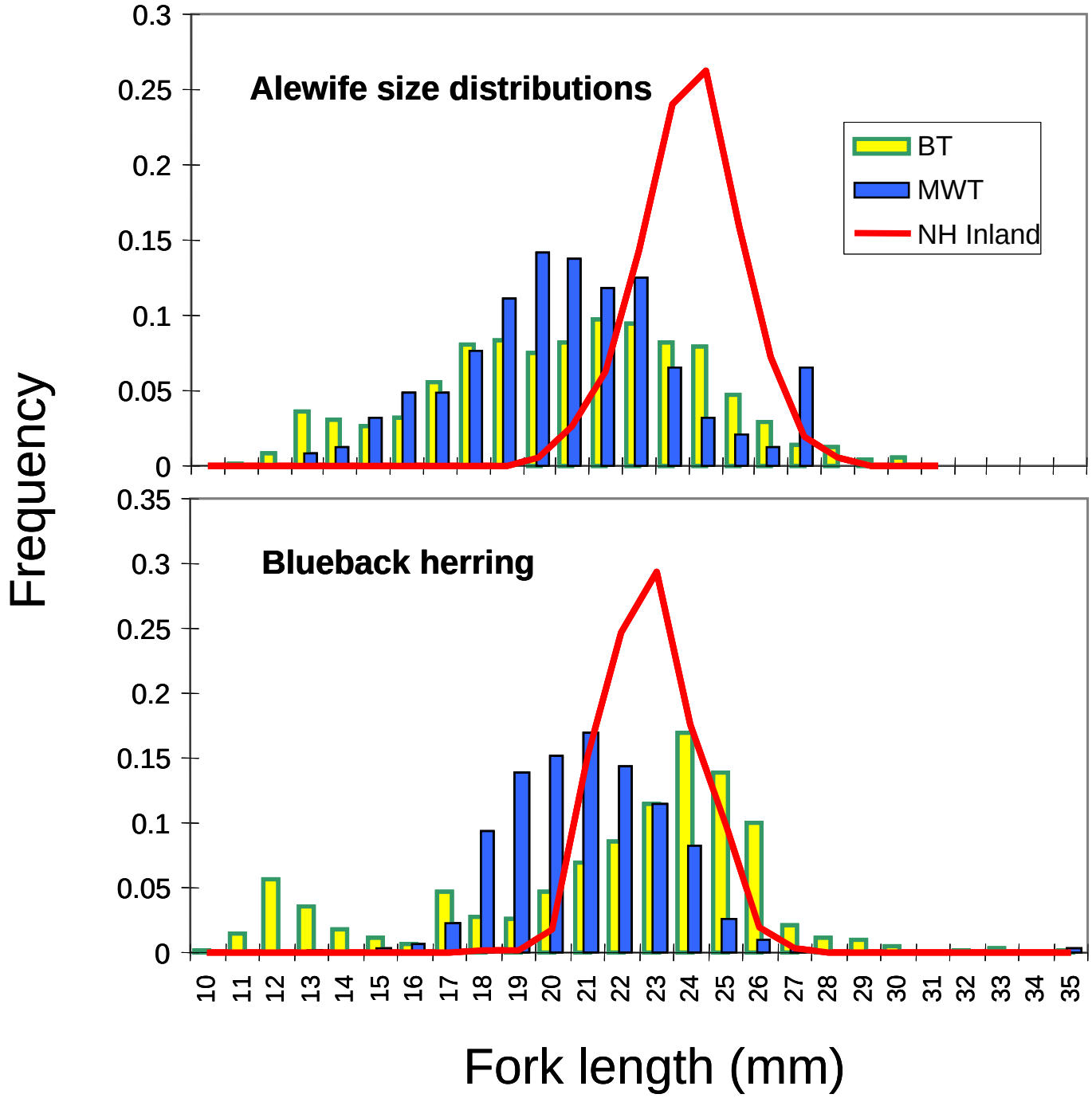
Longer time series of trend data will be helpful, though indicators are certainly there

Age determination is problematic and therefore undermines other analyses (potentially)



Bycatch evaluation




Alewife size distributions
BT
MWT
NH Inland
Blueback herring
Frequency
Fork length (mm)
0.3
0.25
0.2
0.15
0.1
0.05
0
0.35
10
11
12
13
14
15
16
17
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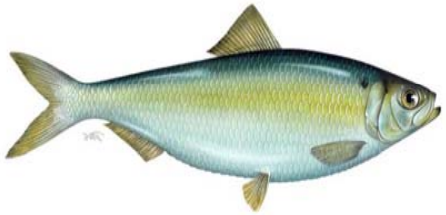
Evaluate methods/models for estimating key biological parameters and reference points

- **Mortality rates** (Z): panel prefers age-based estimates even while acknowledging current problems with current age estimation

- Spawner per recruit (SPR) NMFS package used to develop Z reference points – considered appropriate by panel

cont'd.

- **Exploitation rates** (u):
  - Est'd. for 5 New England rivers
  - Also est'd coast-wide, using total catch (incl. bycatch) and spring biomass (NMFS surveys). Panel felt this was interesting but needed more verification.



cont'd.

- **Population models**

  - **Statistical catch-at-age** for 3 rivers spanning geographic range and 2 species; still need work, but moving in good direction

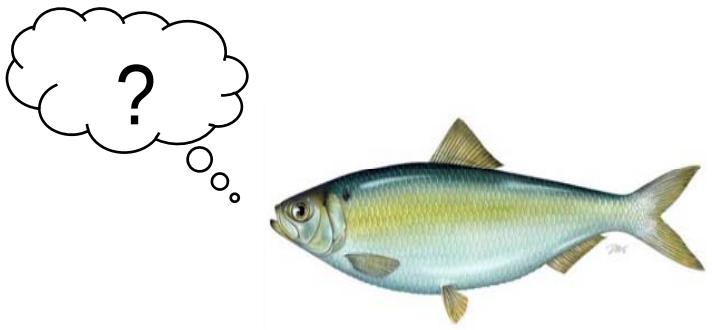
  - **DB-SRA**: used in data-poor situations; the use here was constrained by input assumptions and possibly a mis-specified production function. However panel felt it was a good heuristic tool (as did SASC).

Evaluate uncertainty

- Could be better in est. of abundance – panel recommends more statistical approach (e.g., GLM) in future
- Z uncertainty due to aging issues
- ARIMA models used to smooth trend data – considered appropriate, but concern about dependence on 1st datum in time series

Evaluate uncertainty (cont'd.)

- DB-SRA and SCAA models had good characterization of uncertainty, although panel felt the distribution of B_{MSY}/K was set too high (in DB-SRA). Could be cause of issues in estimating F_{MSY}.



Evaluate recommended est.s of biomass, abundance, mortality, a nd choice of reference points

- No estimates of B, abundance, or F were recommended by SASC – models are currently "works in progress"

- Several Z reference points calculated: $Z_{collapse}$, $Z_{20\%}$, and $Z_{40\%}$. The latter two were very sensitive to choice of M (natural mortality). Panel recommended $Z_{40\%}$, with M set to 0.7 as reference point.

Evaluate stock status determination from assessment

- SASC acknowledged that DB-SRA could not produce reliable estimates of stock status; modeled F_{MSY} and historical exploitation rates appear too low.

- SCAA models all showed steep declines

- Biological indices show “warning signals” (mean length, max. length, length at age all declined)

Evaluate stock status determination (cont'd.)

- Where possible, SASC compared Z to Z reference points. *In 2008-2010, Z exceeded $Z_{40\%}$ in all cases, and also the higher $Z_{20\%}$ in most cases.*

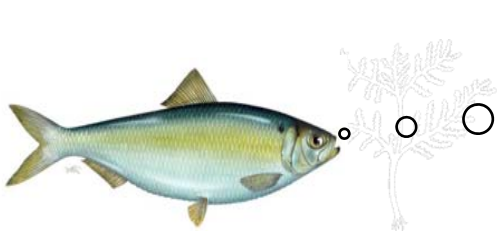
- Based on weight-of-evidence approach, SASC concluded that the coast-wide meta-complex of river herring **is at or near historic lows.**

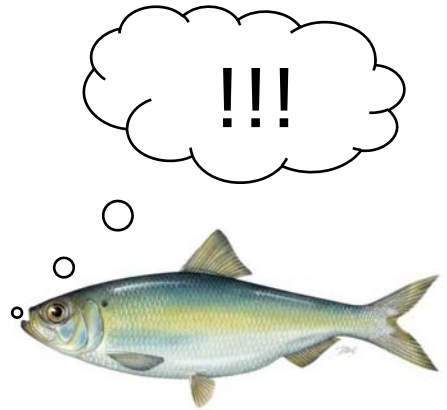
Evaluate stock status determination (cont'd.)

- Of 52 rivers assessed, 22 have depleted stocks, 1 has increasing stocks, and 28 are unknown.

- Connecticut River consensus not reached, though all but 1 member of the SRH Technical Committee concluded it is also depleted.

- Possible northward shift in both spp.



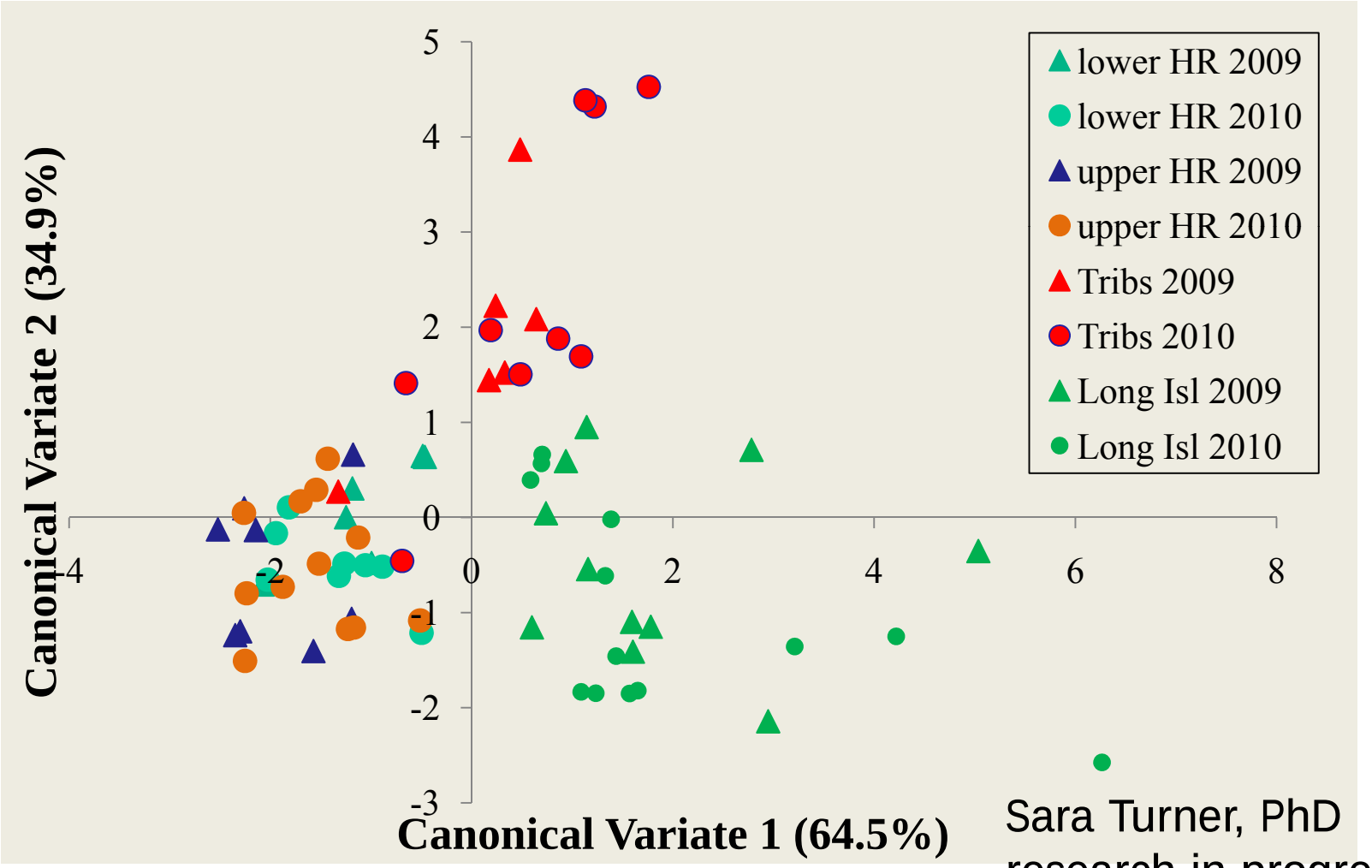


Recommendations

(some of many)

- Determine impacts of bycatch
- Determine “who” is getting caught in bycatch
- Determine which stocks are vulnerable to mixed stock fisheries
- Hold age-determination workshops
- Monitor success of river restoration efforts
- Improve monitoring where it is poor

Some recommended work already under-way – river herring stock discrimination in NYS

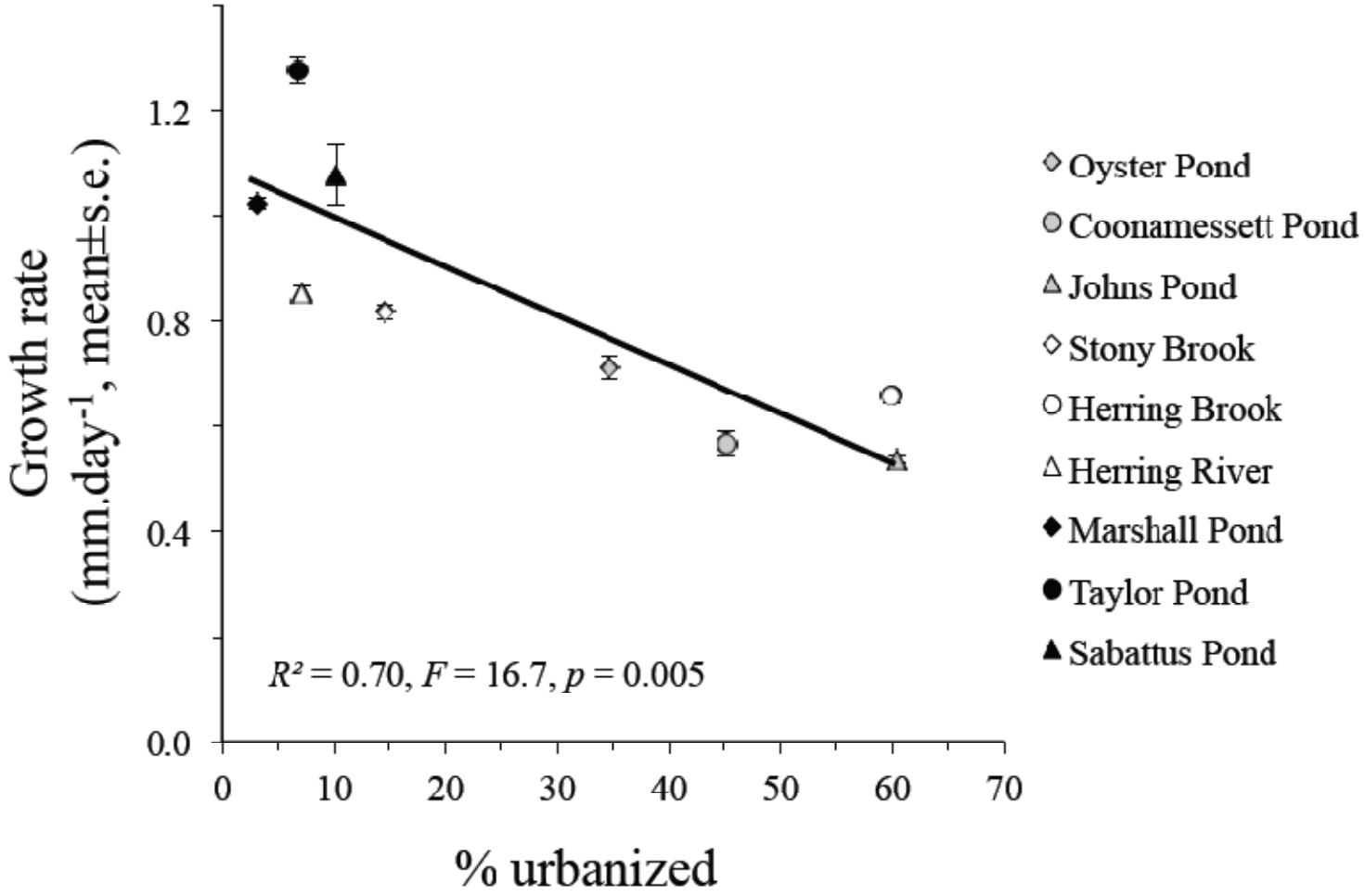


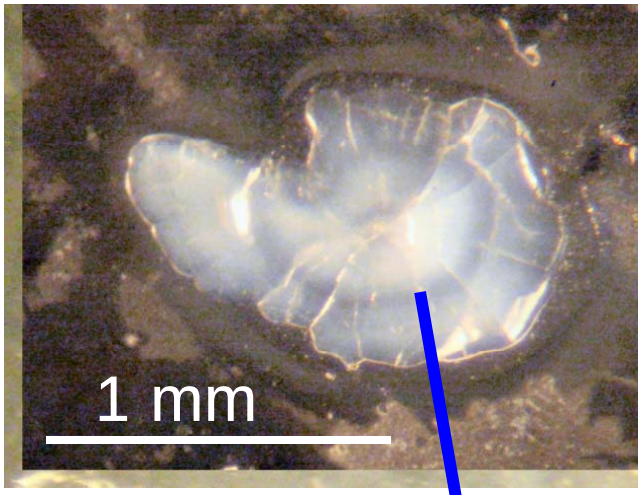
Sara Turner, PhD
research in progress

Urbanization and sprawl growth

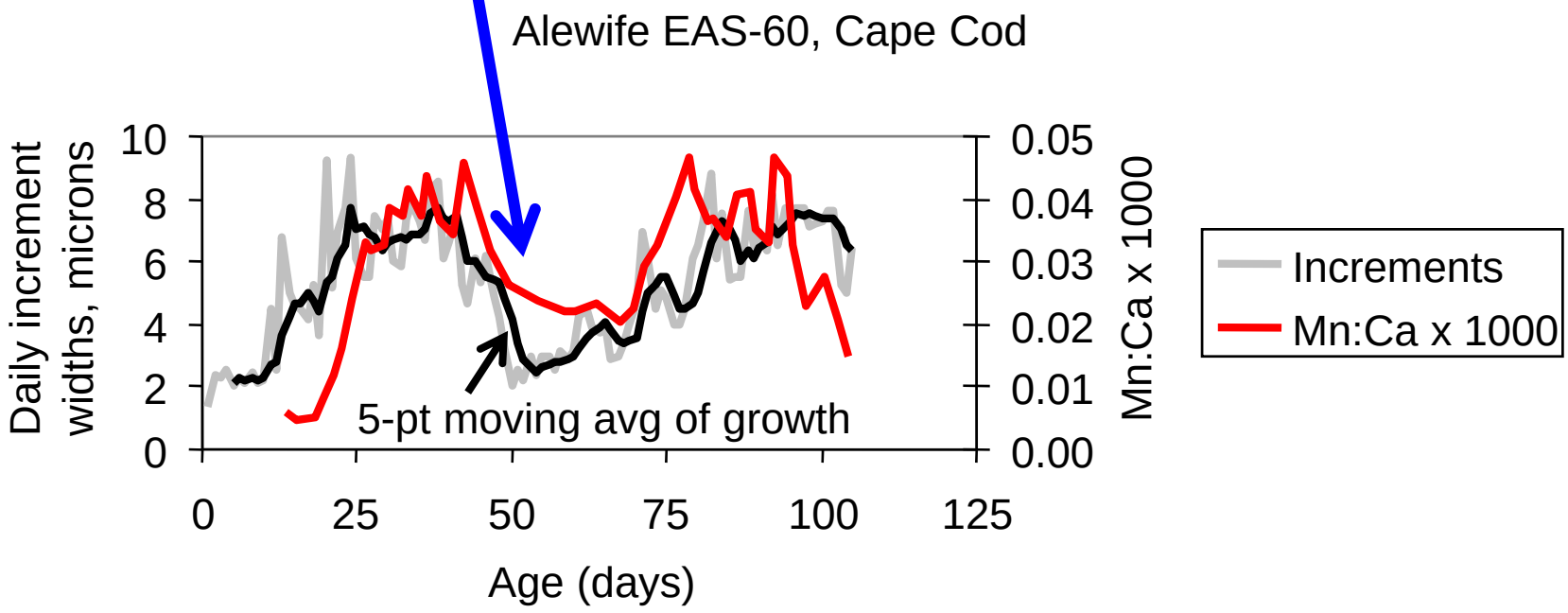
Growth and condition of YOY alewives reduced by urbanized watersheds

(R. Monteiro et al. in revision)

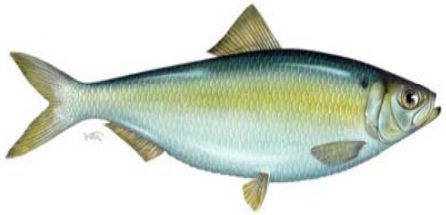




YOY alewife otolith from an urbanized Cape Cod watershed (Herring Brook) subject to seasonal hypoxia – with no escape...



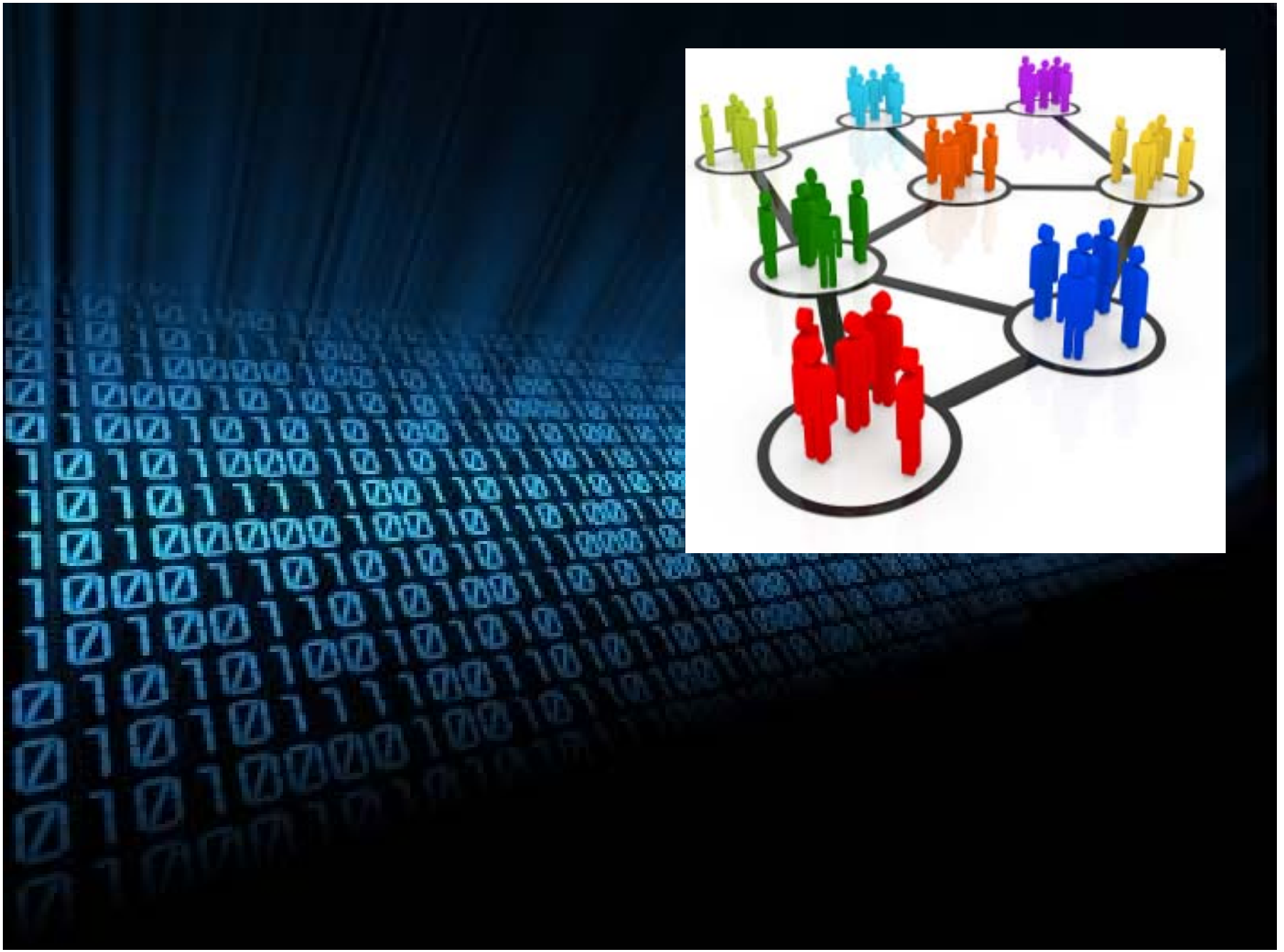
Limburg, unpub. data



Overall

Panel approves the assessment and lauds the cautious, careful work

Encourages ASMFC to follow recommendations and hold next assessment in 5 yr (trend) and 10 yr (benchmark)



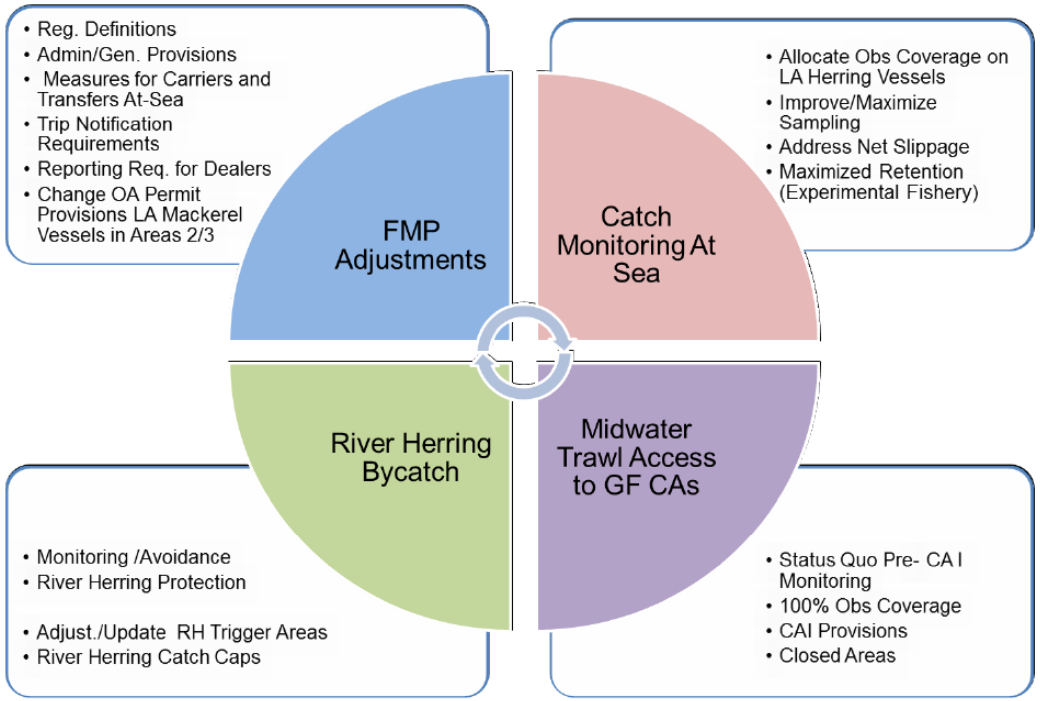
Alewives

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by 2015

Draft NEFMC Amendment 5 to the FMP for Atlantic Herring Alternatives

4 Parts of Amendment 5

- 3.1 Adjustments to the FMP
- 3.2 Catch monitoring at sea
- 3.3 Measures to address RH bycatch
- 3.4 MW trawl access to groundfish closed areas



Herring Fishery

Herring Permit Category		Year		
		2008	2009	2010
	A	45	45	42
	B	5	4	4
	C	58	55	55
	D	2,409	2,394	2,258

Source: NMFS Permit databases, May 2011

Permit	Gear	Total Trips	% Obs	RH Catch/Discards
A	Pair Trawl	882	37%	183,395
A/B	Single Trawl	123	44%	
A	Purse Seine	398	25%	1,044
A	BT	1,020	12%	6,240
B/C	BT	5,278	9%	
D	BT	36,511	7%	8,775

3.1 Adjustments to the Fishery Management Program

Page 8 of Public Hearing Document

3.1.5 Reporting Requirements for Herring Dealers

Option 1. No Action

Option 2. Accurately Weigh All Fish

- 2A. Document Annually in Dealer App.
- 2B. Document for Ind. Landing Submissions
- 2C. Dealer Confirmation, Vessel Validation

PDF Page 19 of Public Hearing Document

3.2 Catch Monitoring At Sea

(applies to A,B,C permit only)

Begins on Page 21 of Public Hearing Document

Summary Table on Page 28

3.2.2 Measures to Improve/Maximize Sea Sampling

3.2.2.2: Option 2: **Additional Measures to Improve Sampling**

2A. Safe Sampling Station (adjacent to deck)

2B. Reasonable Assistance (to carry out duties)

2C. Provide Notice (pumping begin/end and sample)

2D. (observer on) Trips w/ Multiple Vessels

2E. Communication on Pair Trawl Vessels

2F. Visual Access to Net/Codend (or purse seine bunt)

3.2.3 Measures to Address Net Slippage

- 3.2.3.1: Option 1. No Action (release catch affidavit)
- 3.2.3.2: Option 2. Release Catch Affidavit for Slippage Event with additional information
- 3.2.3.3: Option 3. Closed Area I Sampling Provision
- 3.2.3.4: Option 4. Catch Deduction and/or Termination for Slippage Events

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3.2.4 Maximized Retention Alternative

3.2.4.1: Alternative 1. No Action

3.2.4.2: Alternative 2. Evaluate MR Through Annual Exempted Fishing Permits

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3.3 River Herring Bycatch

- 3.3.2: Alternative 2. River Herring Monitoring/Avoidance
- 3.3.3: Alternative 3. River Herring Protection
- 3.3.4 Mechanism to Adjust/Update RH Areas/Triggers
- 3.3.5 River Herring Catch Caps

Page 39 of PHD

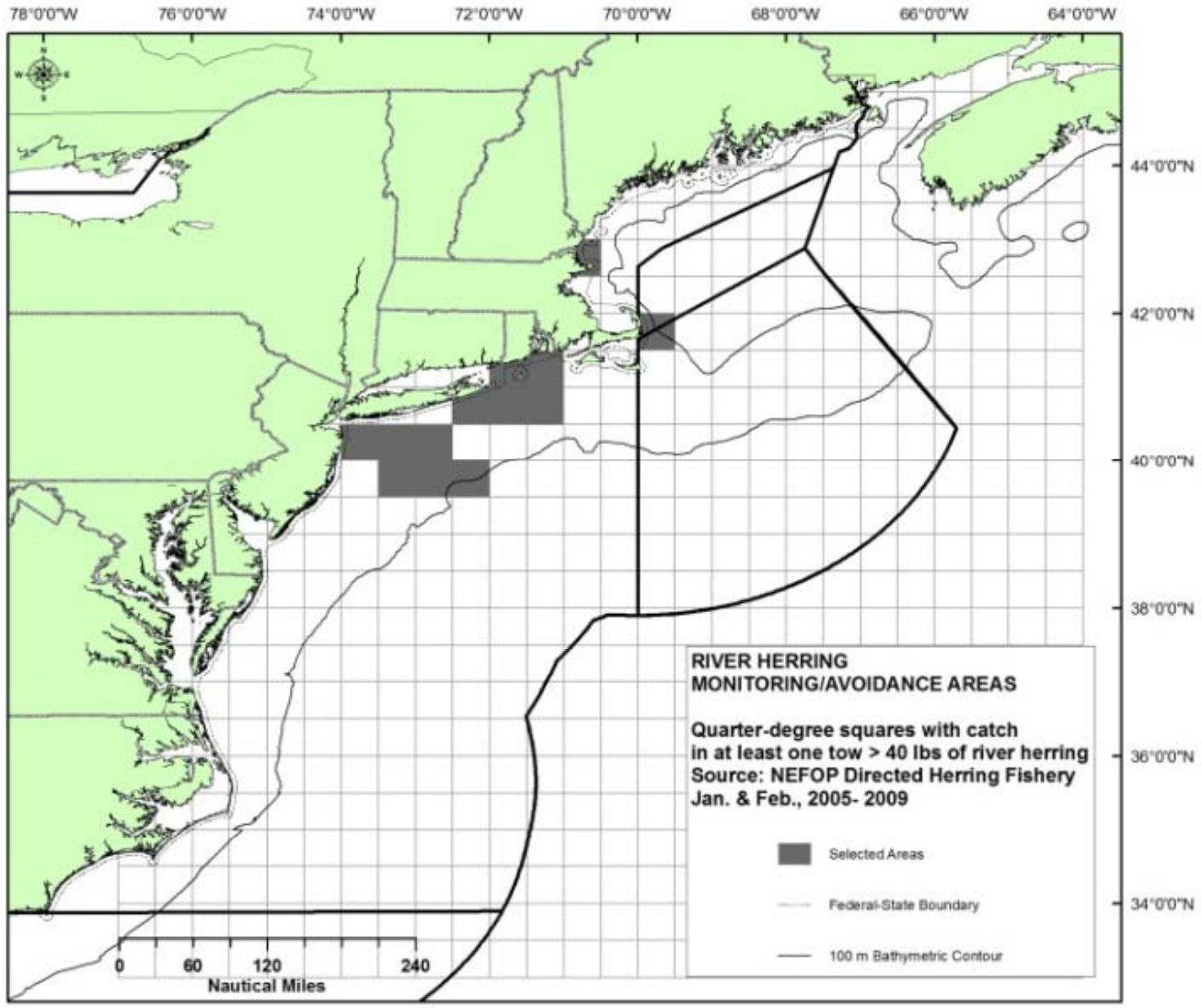
3.3.2: Alternative 2. River Herring Monitoring/Avoidance

3.3.2.1 Identification of Monitoring/Avoidance Areas (>40 lbs)

3.3.2.2.1: Option 1. 100% Observer Coverage when fishing in RH avoid area

3.3.2.2.2: Option 2. Closed Area I Sampling Provisions (pump all fish on board, exit area if slip)

January/February



3.3.2: Alternative 2. River Herring Monitoring/Avoidance

3.3.2.1 Identification of Monitoring/Avoidance Areas (>40 lbs)

3.3.2.2.1: Option 1. 100% Observer Coverage when fishing in RH M/A areas

- **S.O. A – Applies to A/B/C only**
- **S.O. B. – Applies to all vessels**

3.3.2.2.2: Option 2. Closed Area I Sampling Provisions (pump all fish on board, exit area if slip)

3.3.2: Alternative 2. River Herring Monitoring/Avoidance

3.3.2.1 Identification of Monitoring/Avoidance Areas

3.3.2.2.1: Option 1. 100% Observer Coverage when fishing in RH avoid area

3.3.2.2.2: Option 2. CAI Sampling Provisions (pump all fish on board, exit area if slip)

- **S.O. A. – 100% Observer coverage**
- **S.O. B. – Less than 100% Observer coverage**
- **S.O. C. – Applies to A/B/C only**
- **S.O. D. – Applies to all vessels**

3.3.2: Alternative 2. River Herring Monitoring/Avoidance

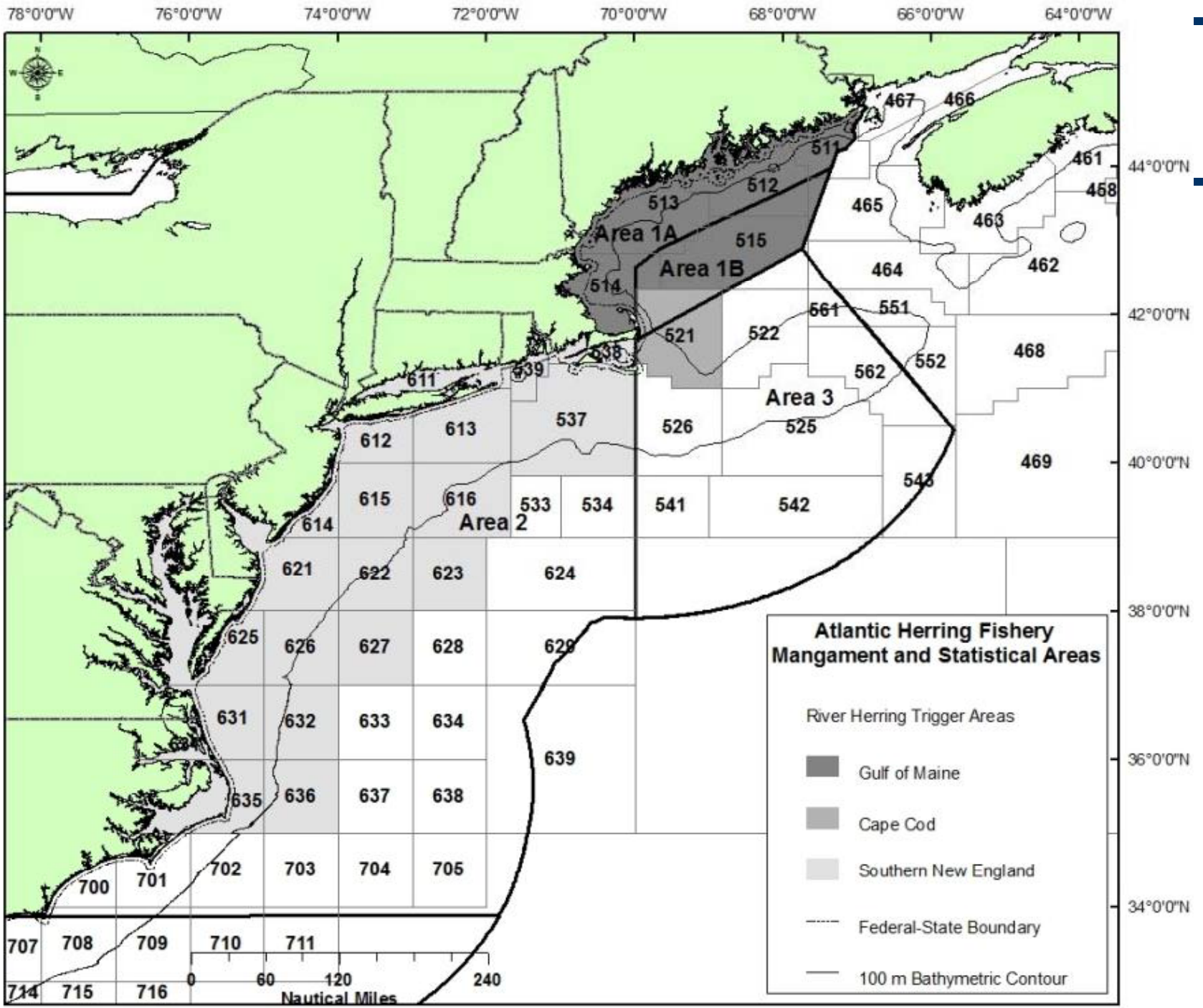
➢ 3.3.2.2.3: Option 3 Trigger-Based

- If reached – Observer or CAI provisions
  - Proposed catch triggers

Sub-Options for River Herring Catch Triggers (Pounds)

Area	SUB-OPTIONS		
	3A (Max)	3B (Median)	3C (Mean)
CC	1,159,700	93,400	269,600
GOM	294,000	92,400	127,100
SNE	729,500	585,000	478,500

  - Reporting by trigger area or stat area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76°0'0"W
74°0'0"W
72°0'0"W
70°0'0"W
68°0'0"W
66°0'0"W
64°0'0"W
44°0'0"N
42°0'0"N
40°0'0"N
38°0'0"N
36°0'0"N
34°0'0"N
Area 1A
Area 1B
Area 2
Area 3
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240
Nautical Miles
Atlantic Herring Fishery
Mangament and Statistical Areas
River Herring Trigger Areas
Gulf of Maine
Cape Cod
Southern New England
Federal-State Boundary
100 m Bathymetric Contour

3.3.2: Alternative 2. River Herring Monitoring/Avoidance

- 3.3.2.2.4: Option 4 – Two-Phase Bycatch Avoidance SFC/SMAST/ DMF Project
  - Identify bycatch avoid area, framework additional bycatch avoidance strategy

3.3.3 Alternative 3. River Herring Protection

- **3.3.3.1: Establish Protection Areas (>1,233 lbs RH)**
  - 3.3.3.2.1: Option 1. Closed Areas
  - 3.3.3.2.2: Option 2. Trigger-Based Closed Areas
  - 3.3.3.2.3 Options for exemptions

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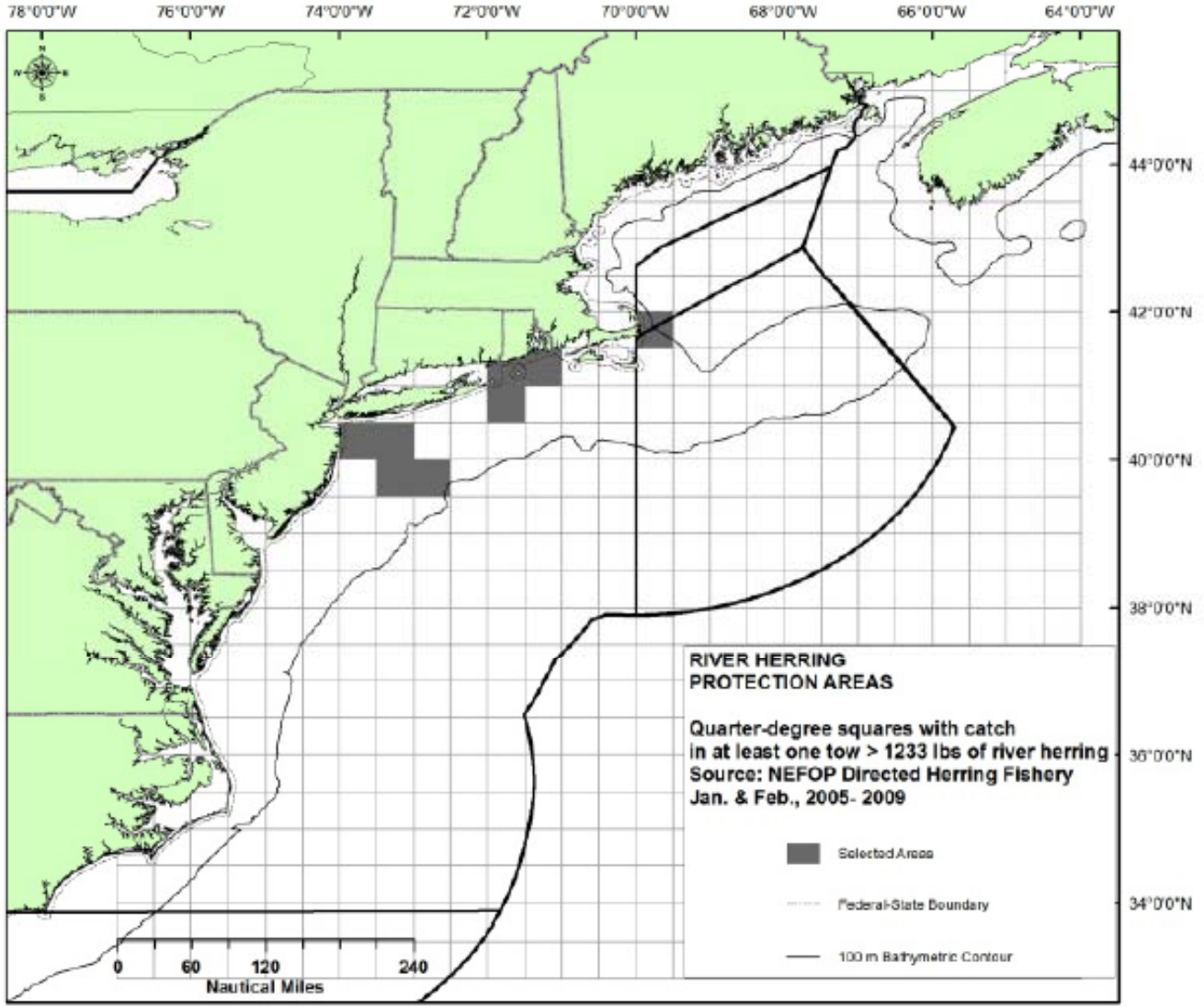
January/February



3.3.3 Alternative 3. River Herring Protection

- 3.3.3.1: Establish of Protection Areas
- **3.3.3.2.1: Option 1. Closed Areas**
- 3.3.3.2.2: Option 2. Trigger-Based Closed Areas
  - •Sub Option: RH Catch Triggers (page 56)
  - •Reporting Option 1: Total Catch by Trigger Area
  - →Reporting Option 2: Total Catch by Stat Area
- 3.3.3.2.3 Options for Exemptions (SMNS or > 5.5”)

3.3.3 Alternative 3. River Herring Protection

- 3.3.3.1: Establish of Protection Areas
- 3.3.3.2.1: Option 1. Closed Areas
- **3.3.3.2.2: Option 2. Trigger-Based Closed Areas**
- 3.3.3.2.3 Options for Exemptions

3.3 River Herring Bycatch

- **3.3.4: Mechanism to Adjust/Update RH Areas/Triggers**
  - Framework or Amendment.
  - PRT review every 3 years
  - Consult ASMFC & MAFMC

- **3.3.5: River Herring Catch Caps**
  - Council will consider establishing a river herring catch cap through a framework adjustment to the FMP or specs process after completion of the RH stock assessment.

3.4: Midwater Trawl Access to Groundfish Closed Areas

Working Group Recommendations

Catch Monitoring

- Observer Coverage (Section 3.2.1.2) - 100% observer coverage, funded by Federal resources, with phased-in, cost sharing alternatives be considered and the differences in observer costs between the east and west coasts be examined.

- Measures to Improve Sampling (Section 3.2.2.1)
- States As Service Providers (Section 3.2.1.2.2.)

Working Group Recommendations

River Herring Bycatch

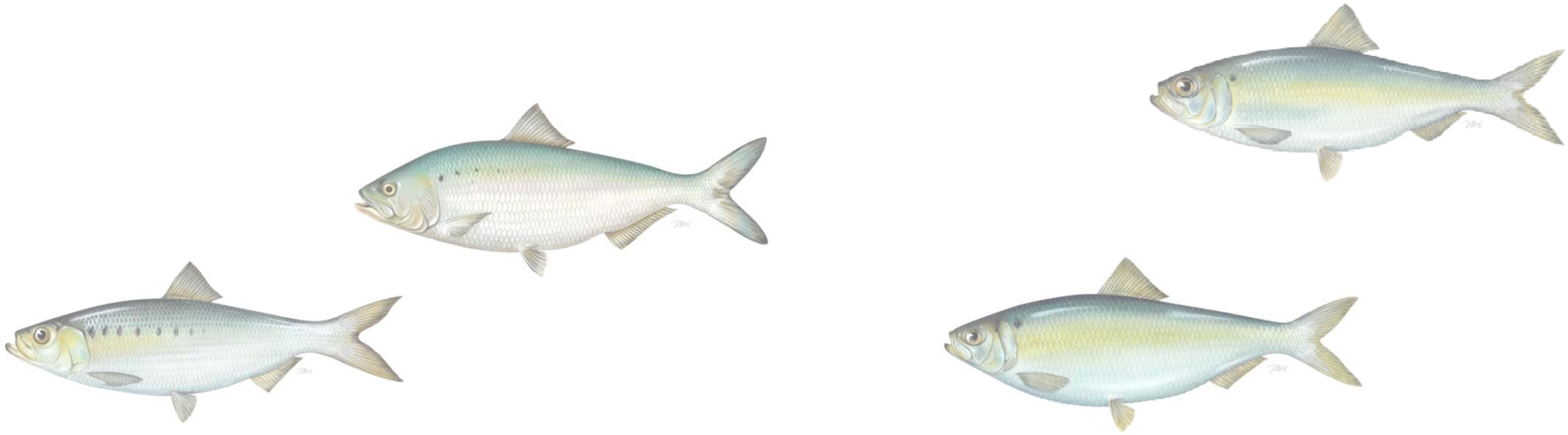
- Observer Coverage (Section 3.3.2.2.1) - 100% observer coverage
- Closed Area I Sampling Requirements (Section 3.3.2.2.2) –supports the CAI Sampling Provisions when fishing in the River Herring M/A Areas.
- SMAST/DMF/SFC Approach (Section 3.3.2.2.4)

Working Group Recommendations

- **Closed Area and Triggers** (Section 3.3.3.2.1 and 3.3.3.2.2) - does not recommend the use of triggers without a method to link the trigger to a peer reviewed biological estimate of RH populations.
- However, if the NEFMC approves the use of closures in the RH Protection Areas, then these closures should be implemented through a trigger system rather than occurring automatically. The working group notes that the trigger levels are based off of the levels of bycatch from 2005-2009. Using this information in the development of a trigger may only sustain the current level of river herring bycatch, rather than reduce bycatch.

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by 2015

MAFMC Amendment 14



Management Options

1. *Vessel Reporting Measures*
2. *Dealer Reporting Measures*
3. *At-Sea Observation Optimization Measures*
4. *Port-side and Other Sampling/Monitoring Measures*
5. *At-Sea Observer Coverage Requirements*
6. *Mortality Caps*
7. *Restrictions in areas of high RH/S catch*
8. *Hotspot Restrictions*
9. *Addition of RH/S as "Stocks in the Fishery" in the MSB FMP*

Timeline

- **April/May 2012**– Public hearings for Am 14
- **June 4, 2012** – Public Comment Period Closes
- **June 12-14, 2012 -** Council reviews comments, approves alternatives to send to NMFS
- **Sept 2012** – Proposed Rule and FEIS made available for public comment
- **Nov 2012** – Comment Period Closes
- **Feb 1, 2013** – Final Rule Publishes
- **Mar 1, 2013** – Rule Effective

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by 2015

Proposed River Herring ESA Listing

Timeline

- Petition – August 1, 2011
- Positive 90 Day Finding – November 2, 2011
- Status Review – currently in progress
- Proposed listing (if any) published – August 2012
- Final rule published – August 2013

Status Review

- NMFS conducting three workshops in development of status review
  - Climate change
  - Extinction Risk
  - Genetics
- Workshops occurring in MA in June/July