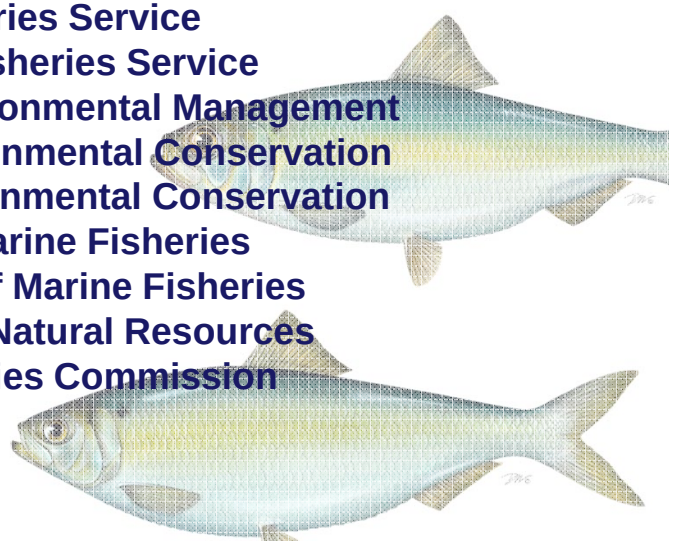
River Herring Stock Assessment for Peer Review

Dr. John Sweka, U.S. Fish and Wildlife Service, Chair
Dr. Michael Bailey, U.S. Fish and Wildlife Service
Michael Brown, Maine Department of Marine Resources
Kiersten Curti, National Marine Fisheries Service
Dr. Katie Drew, Atlantic States Marine Fisheries Service
Phil Edwards, Rhode Island Department of Environmental Management
Kathryn Hattala, New York Department of Environmental Conservation
Andrew Kahnle, New York Department of Environmental Conservation
Laura Lee, North Carolina Division of Marine Fisheries
Dr. Gary Nelson, Massachusetts Division of Marine Fisheries
Robert Sadzinski, Maryland Department of Natural Resources
Kate Taylor, Atlantic States Marine Fisheries Commission



DATA OVERVIEW

State	River	Time series	By species	Harvest	Age	Length	Weight	Repeat Spawner	FI Adult	FI JAI	FD CPUE
ME	Damariscotta	1943-2010		•							
	St. George	1943-2010		•							
	Union	1975-2010		•							
	Orland	1943-2010		•							
	Androscoggin	1983-2010	•		•	•					
	Sebasticook	2000-2010	•		•	•					
	Merrymeeting Bay/Tribs	1979-2009	•			•				•	
	Gulf of Maine	2000-2010	•			•			•		
NH	Exeter/Squamscott	1991-2010	•	•	•	•		o	•		
	Lamprey	1991-2010	•	•	•	•		o	•		
	Winnicut	1991-2010	•	•	•	•		o	•		
	Oyster	1991-2010	•	•	•	•		o	•		
	Cocheco	1991-2010	•	•	•	•		o	•		
	Taylor	1991-2010	•	•	•	•		o	•		
	Great Bay Estuary	1997-2010	x			x				x	
MA	Mattapoisett	1988-2010	•	•	o	o	o		•		
	Monument	1980-2010	•	•	o	o		o	•		
	Nemasket	1996-2010	•	•	o	o	o				
	Parker	1971-1978, 2000-2010	•	•	o	o			•		
	Town	2000-2010		•					•		
	Agawam	2006-2010		•	o	o					
	Back	2007-2010	•	•	•	•			•		
	Charles	2008-2009		•	•	•	•	•	•		
	Mystic	2004-2010	•		•	•	•	•			
	Quashnet	2004	•		•	•	•	•			
	Stony Brook	1978-2004	•		o	o	o	o	o		
RI	Gilbert Stuart	1981-2010			•	•	•	•	•	o	
	Nonquit	1999-2010			•	•	•	•	•	o	
	Buckeye Brook	2003-2010							•		
	Pawcatuck	1988-2010			x	x	x	x	o	•	
	Ocean waters	1979-2010				•			•	•	
	Naragansett Bay	1988-2010				•			•	•	
	Coastal ponds	1992-2010				•			•	•	
CT	Bride Brook	1966-1967, 2003-2011	•			o			•		
	Connecticut River	1975-2011	•			o			•	o	
	Farmington River	1976-2011	•						•		
	Thames River	1996-2011	•						•		
NY	Hudson	1975-2010	•	o	o	o		o	o	o	o
DE, NJ, PA	Delaware River	1980-2010	o	o		o			o	o	o
	Delaware Bay	1966-2010	o	o		o			o	o	o
MD	Nanticoke	1959-2010	o		o	o		o		o	o
	Susquehanna	1972-2010	o						x		
	Chesapeake Bay	1959-2010			o						o
MD, VA, DC	Potomac River	1959-2010		•		o			o	o	o
VA	James	1966-2010	o	•	o	o	o	o	o	o	o
	Rappahannock	1966-2010	o	•	o	o	o	o	o	o	o
	York	1966-2010	o	•	o	o	o	o	o	o	o
NC	Albemarle Sound	1972-2009		o				o	o	•	
	Chowan River	1972-2009	•	•	•	•	•	o			•
SC	Wynah Bay									x	
	Santee-Cooper	1969-2010	o	•	o	o	o	o	o	x	•
	Savannah River									x	
	Ashley-Combahee-Edisto Basin									x	
GA	Altamaha River	2010								x	
	Ogeechee River	2010								x	
	Savannah River	2010								x	
FL	St. John's River	2001 -2010	•			•			•	o	

- 57 "Systems" on Atlantic coast
  - 9 categories of FI &FD data
- 54% are blank
- Only 26% of remaining have "good" or complete (green) data
  - Most occurs in NE states

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

DATA OVERVIEW

- Most all time series:
  - Varied in length
  - Had data gaps - not continuous over long periods
- Assessment relied heavily on trend analysis in available data
- Catch-at-age analyses usable for only three stocks

Commercial landings

- Time period:1887 - 2010
- Historical Sources:
  - Bulletin of the U.S. Fish Commission
  - U.S. Fish Commission Annual Report
  - NAFO
- Recent years:
  - State & Jurisdiction Reports

Commercial CPUE

State	System
NY	Hudson
NJ	Delaware Bay
MD	Nanticoke
PRFC	Potomac
VA	James, Rappahannock, York
NC	Chowan
SC	Santee-Cooper

- Data series:
  - 11 – 42 years
- Gears:
  - Gill nets, Pound nets

Run Sizes

State	N - rivers
ME	5
NH	6
MA	4
RI	3
CT	8
NC	1
SC	1

- Data series
  - 8 - 38 years
- Cluster analysis to determine patterns of similar trends

YOY Surveys

State	System
ME	6 rivers
RI	3 rivers
RI	Pawcatuck
CT	Connecticut
NY	Hudson
NJ	Delaware
MD	Upper Chesapeake Bay
DC	Anacostia & Potomac
VA	Chesapeake Bay
NC	Albemarle Sound

- Data series:
  - 15 - 28 years
- Cluster analysis to determine patterns of similar trends

Other FI Surveys

State	Systems	Method
RI	Narragansett Bay	Pond seine survey
VA	Rappahannock	Gill net & Electro-fishing
FL	St. John's River	Electro-fishing

- Data series: 10 - 24 years

FI Trawl Surveys

- 19 trawl surveys
- Variable spatial coverage
- 3 – 36 years of data
- Trends examined with ARIMA models
- Compared trawl indices to run size estimates

Length data

State	System
ME	Androscoggin
NH	5 rivers
MA	Monument
NY	Hudson
NEFSC	Ocean Trawl Survey
MD	Nanticoke
NC	Chowan
SC	Santee-Cooper
FL	St. John's

- Data series
  - 7 - 36 years
- Non-parametric test for trends in mean length

Age data

State	System
ME	Androscoggin
NH	5 rivers
MA	Monument
RI	Nonquit & Gilbert-Stuart
MD	Nanticoke
NC	Chowan

- Data series:
  - 14 - 39 years
- Trends in:
  - Maximum age
  - Mean length-at-age
  - Age-based Z

Repeat Spawner data

State	System
ME	Androscoggin
NH	5 rivers
MA	4 rivers
RI	Nonquit & Gilbert-Stuart
NY	Hudson
MD	Nanticoke
NC	4 rivers
SC	Santee-Cooper
FL	St. John's

- Data series:
  - 5 - 33 years
- Trends in:
  - Percent repeat spawners
  - Repeat spawn based Z

Total Incidental Catch

- RH-SA definition:
  - Total incidental catch = retained + discarded
- Based on work for Amendment 14 to the Federal Atlantic Mackerel, Squid & Butterfish Fishery Management Plan
- Data:
  - NMFS observer program
  - Mid-water trawl fleets (2005 – 2010)
  - All other fleets (1989 – 2010)

Total Incidental Catch

- Total catch

$$\hat{C} = {}^{t}/_{k_{all}} * K_{all}$$

- t = Total catch of an individual species (e.g., alewife) within a trip
- k_{all} = Kept weight of all species within a trip
- K_{all} = Raising factor: Total landed weight of all species by fleet
- MWT fleets: Landings from VTR database; Otherwise: dealer database

Data Uncertainties

- Aging methods
  - Ages obtained from scales
  - Not validated with known-age fish
  - Differences in protocols among agencies / labs
- Mortality
  - Many sources
    - Direct & indirect fishing, predation, dams, etc.
  - No data to separate mortality by source

Assessment Approaches

- By River system:
  - Trend analyses
  - Estimates / Indices of exploitation
  - Statistical Catch-At-Age models (3 rivers)
  - Benchmarks
    - $Z_{collapse}$
    - Spawning stock biomass per recruit ($Z_{20\%SPR}$, $Z_{40\%SPR}$)
- Coast-wide approach
  - Depletion-based Stock Reduction Analysis