

Assessing the Stock of American Eel: Past Results, Current Data Needs, and Future Goals



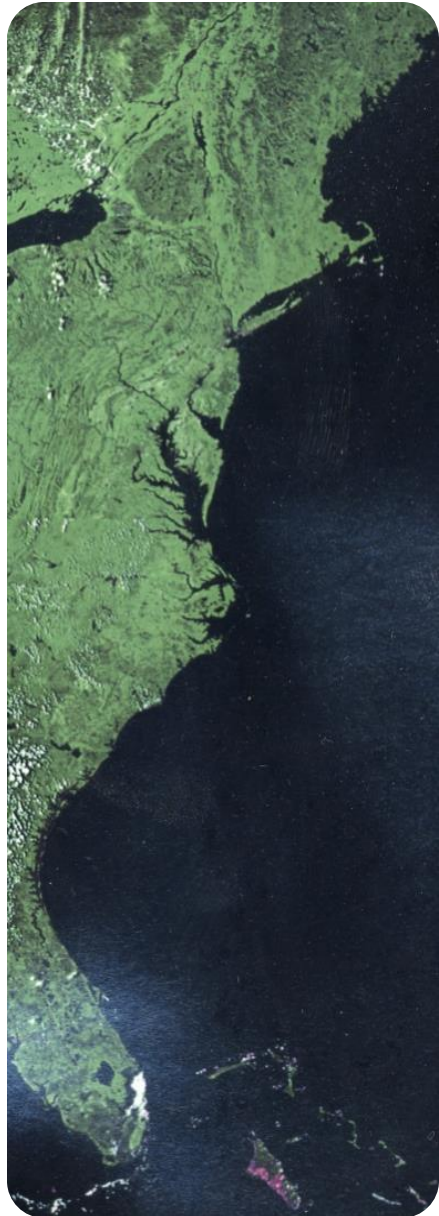
Presented by Kristen Anstead, on behalf of the ASMFC American
Eel Stock Assessment Subcommittee & Technical Committee

Authors



- 2017 ASMFC American Eel Stock Assessment Subcommittee:
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 - Bradford Chase, Massachusetts Division of Marine Fisheries
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- Also a product of the American Eel Technical Committee

ASMFC Overview



- Formed in 1942 – Interstate Compact
- 15 Atlantic coast states: ME – FL
- 0 – 3 miles from shore
- Cooperative management of transboundary resources
 - Manages portion of the American eel population in territorial seas and inland waters along the US Atlantic coast
- 3 Commissioners from each state
 - Each state has one vote

Stock Assessments



- Benchmark
 - a new stock assessment or a stock assessment for which existing data inputs and model structure are modified and must therefore be subject to an external peer review
- Update
 - consists of adding the most recent years of data to an existing, peer reviewed, and board-accepted stock assessment model without changing the model type or structure
- For American eel:
 - 2005, 2012 benchmark; 2017 update

Benchmarks



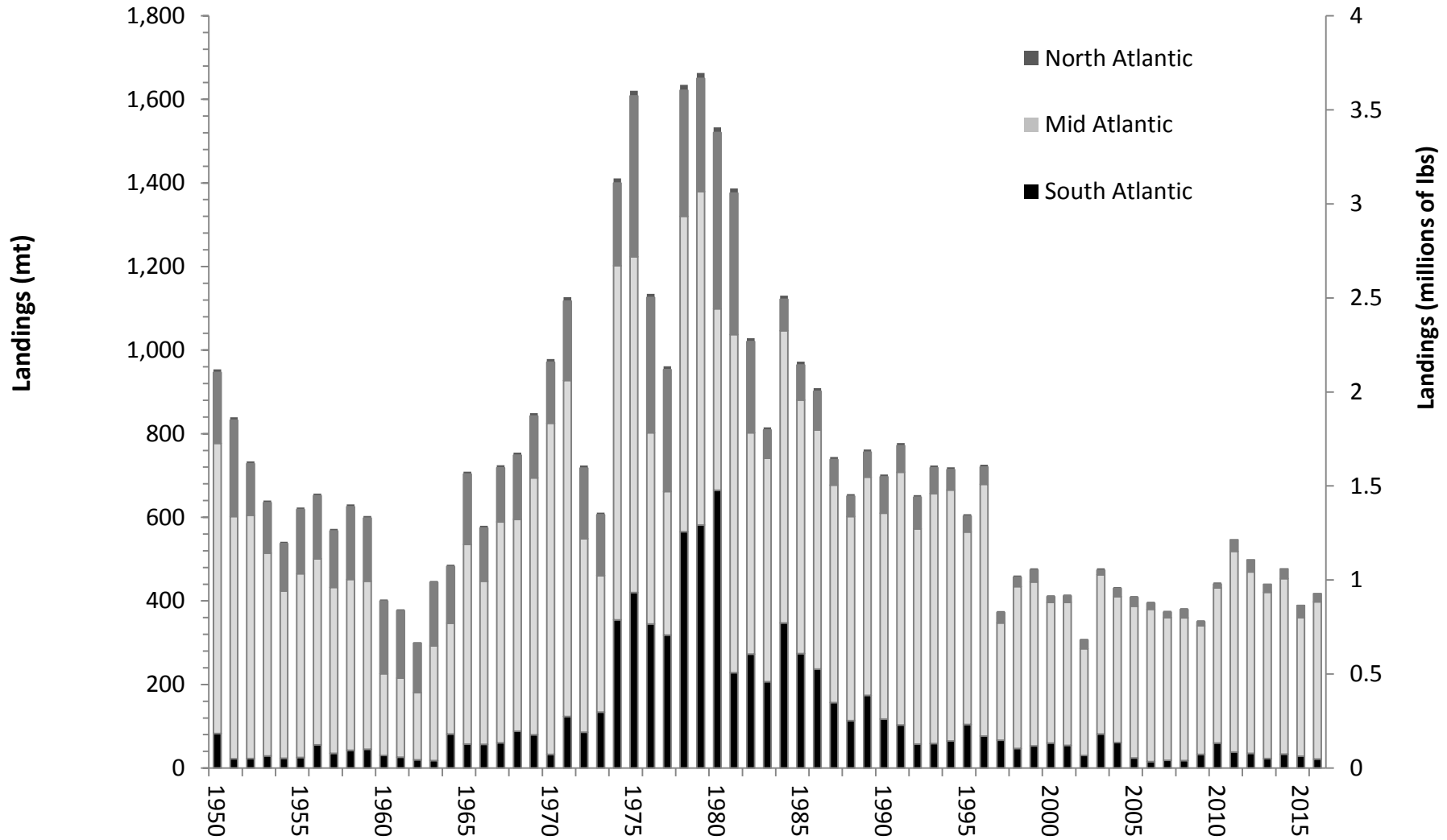
- Benchmark stock assessment in 2005 failed peer review
- Benchmark stock assessment 2012 methods:
 - Local, regional, coastwide indices
 - Trend analyses
 - Mann-Kendall test
 - ARIMA (autoregressive integrated moving average)
 - Manly meta-analysis
 - Models:
 - SLIME (Study Leading to Informed Management of Eels)
 - Surplus Production Models (both age-structured and catch-free)
 - Traffic Light Analysis (TLA)
 - Depletion-Based Stock Reduction Analysis (DB-SRA)

American Eel Stock Assessments

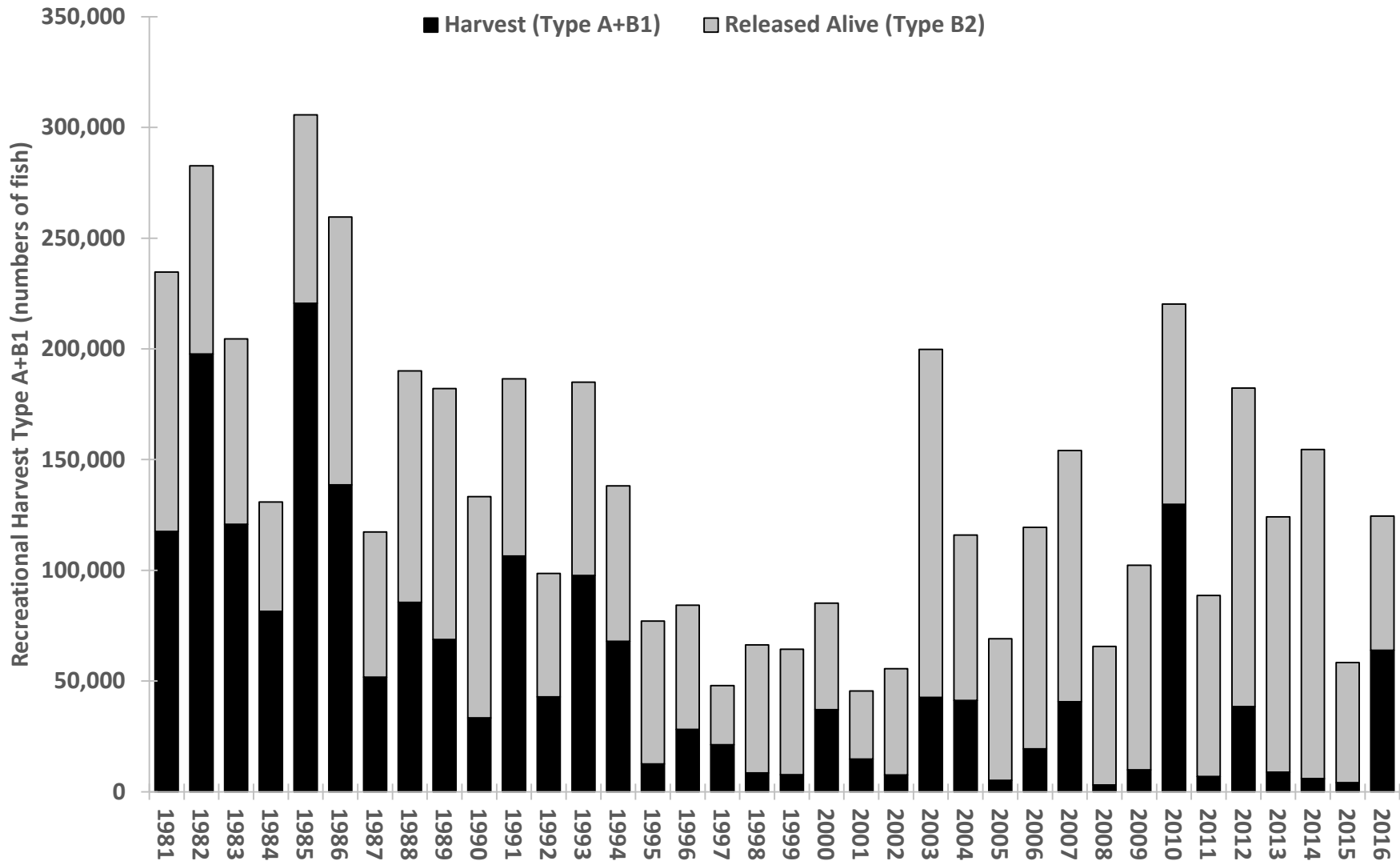


- Benchmark stock assessment in 2012
 - Coast-wide, regional, local trend analyses
 - Significant downward trends in multiple surveys
 - Peer review panel did not endorse use of models
 - No overfishing, overfished determination could be made based on analyses performed
 - **Stock status: depleted**
- Update 2017
 - reviewed data, research, literature since benchmark
 - Update trend analyses, no overfishing determination
 - Maintained depleted status

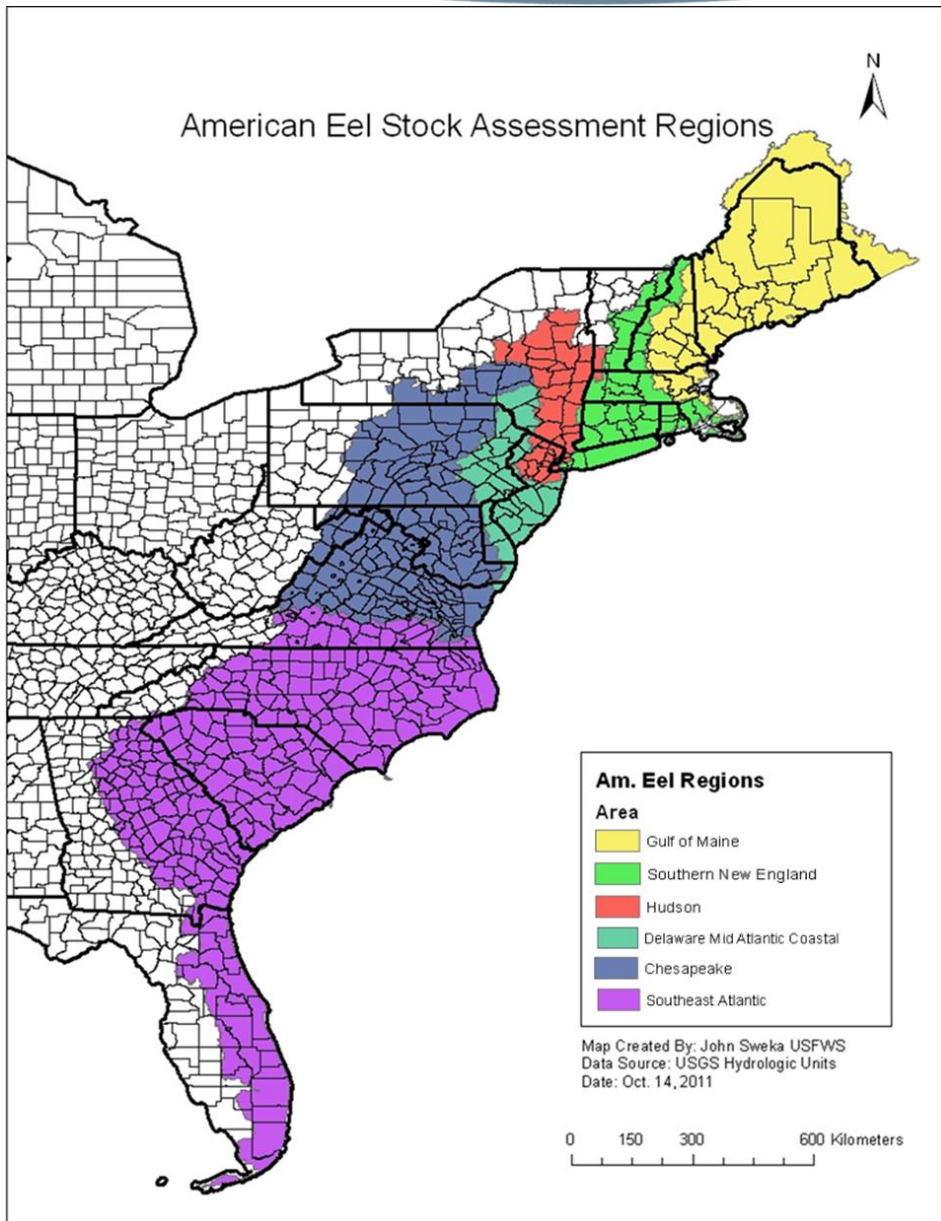
Total Commercial Landings



Recreational Harvest

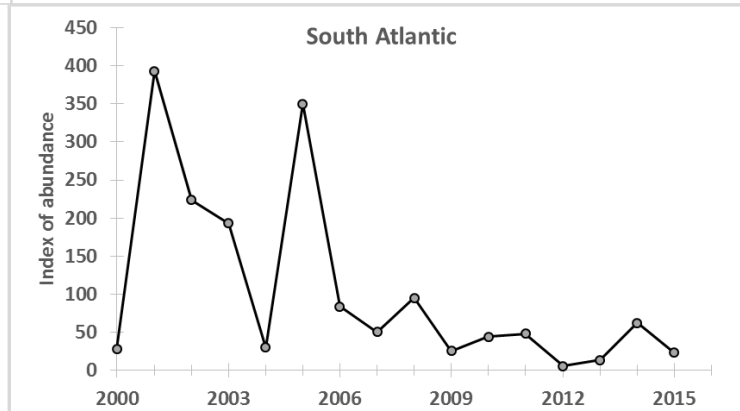
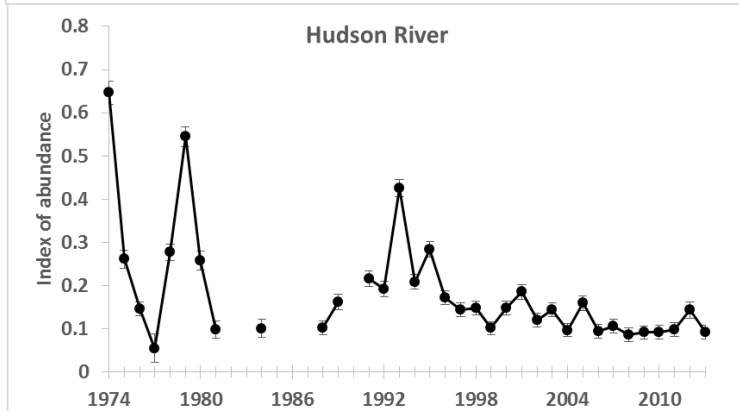
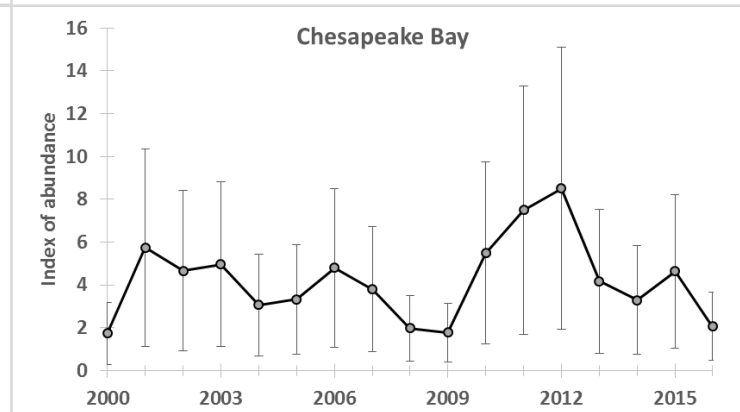
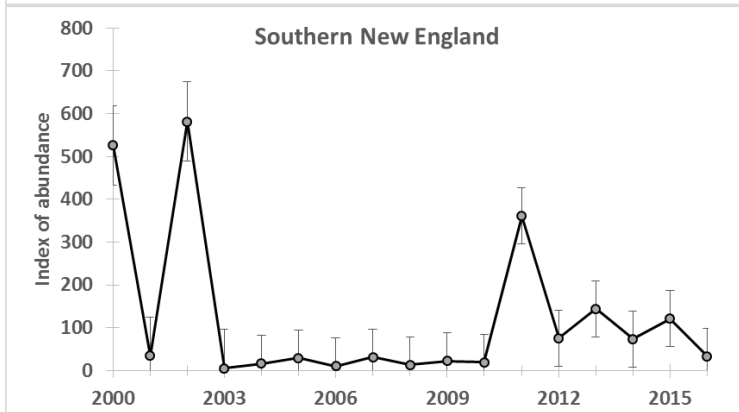
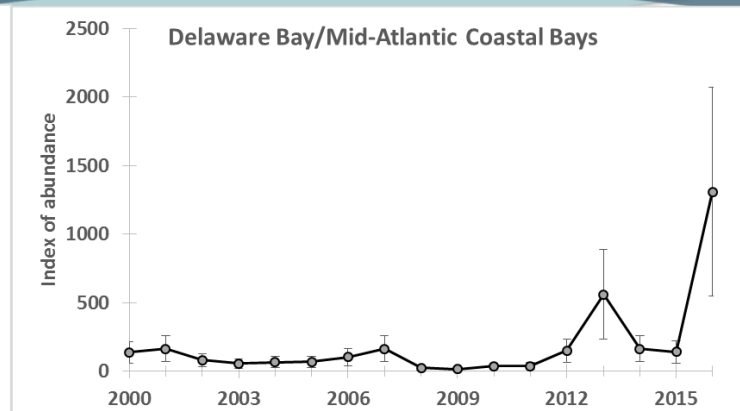
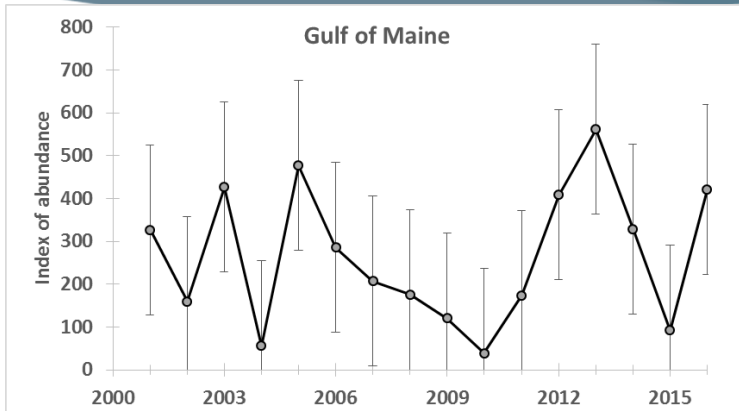


Regions & YOY Surveys

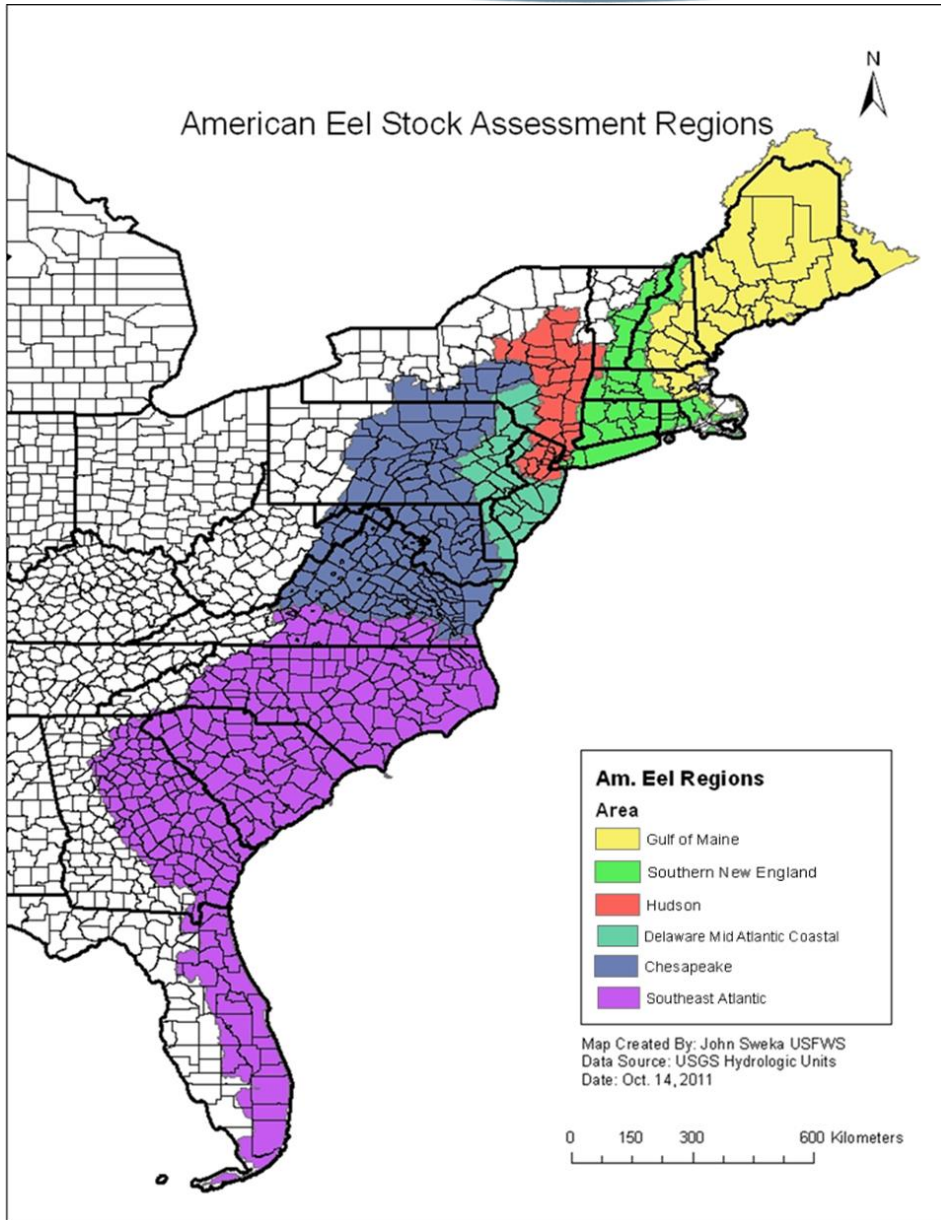


Region	State	Site
Gulf of Maine	ME	West Harbor Pond
	NH	Lamprey River
	MA	Jones River
Southern New England	CT	Ingham Hill
	RI	Gilbert Stuart Dam
	RI	Hamilton Fish Ladder
	NY	Carman's River
Hudson	NY	HRE Monitoring
Delaware Bay/ Mid-Atlantic Coastal Bays	NJ	Patcong Creek
	NJ	Little Egg Inlet Ichthyo
	DE	Millsboro Dam
	MD	Turville Creek
Chesapeake Bay	PRFC	Clarks Millpond
	PRFC	Gardys Millpond
	VA	Brackens Pond
	VA	Kamps Millpond
	VA	Warehams Pond
South Atlantic		Beaufort Bridgenet Ichthyo
	NC	Goose Creek
	SC	Altamaha Canal
	GA	Guana River Dam
	FL	

YOY Regional Plots

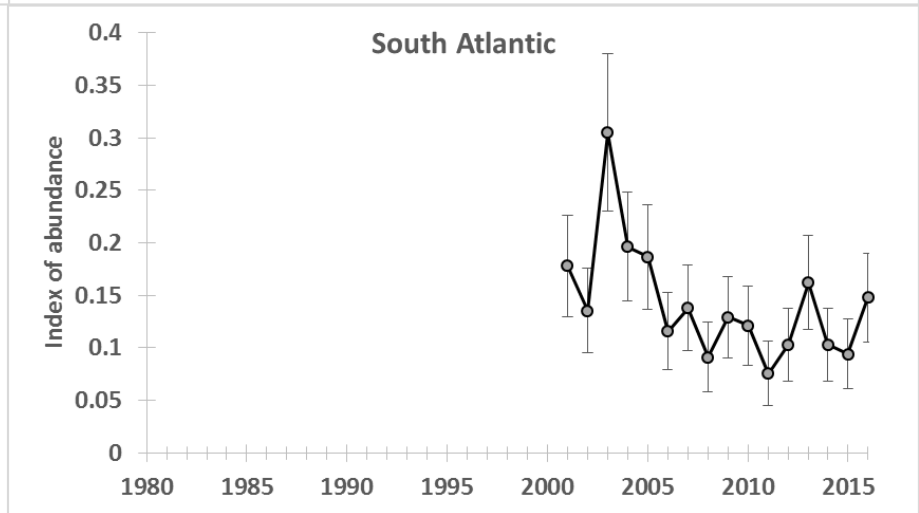
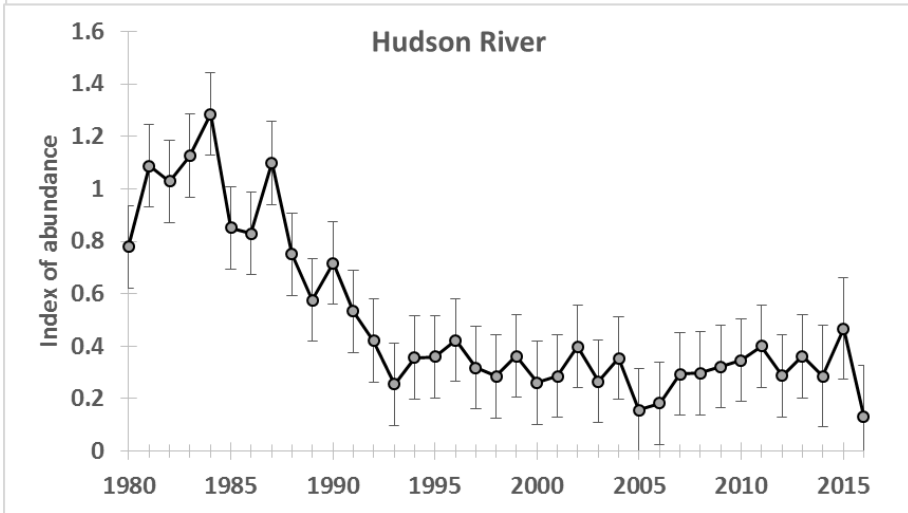
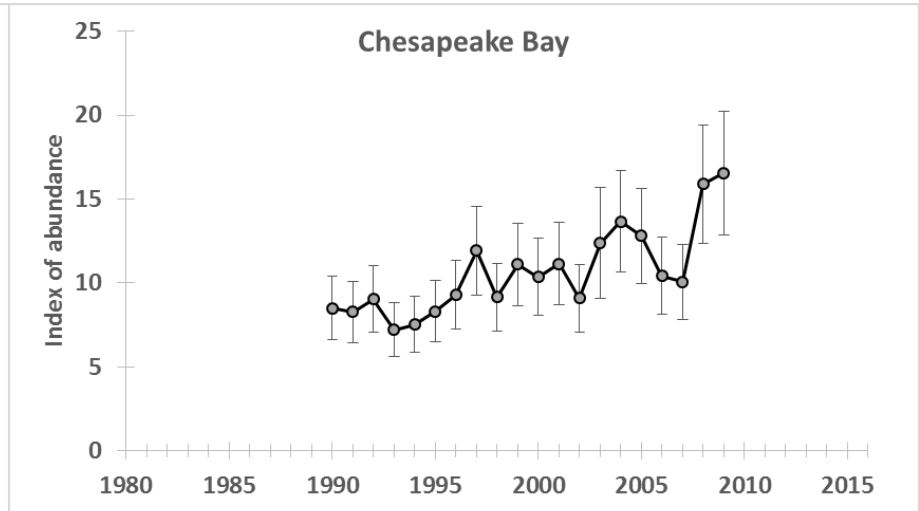
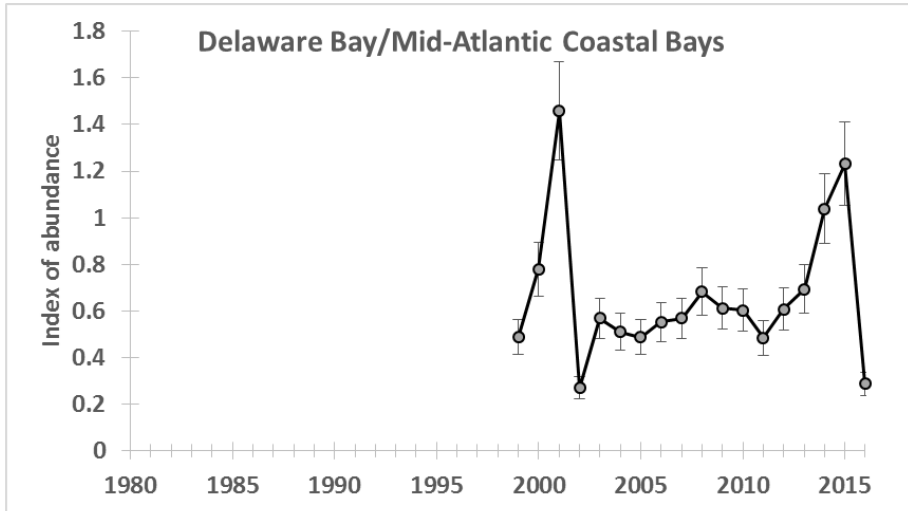


Regions & Yellow Eel Surveys

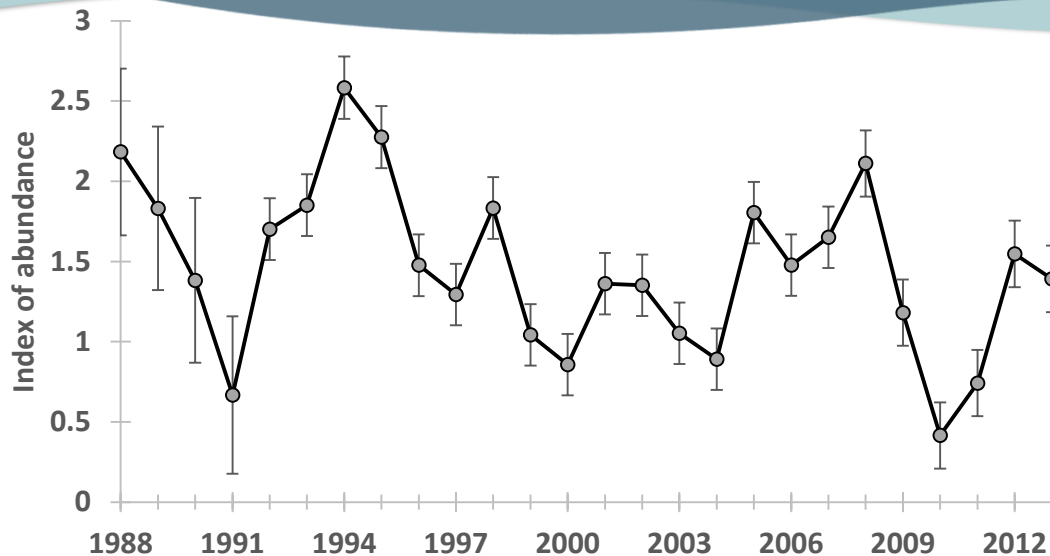


Region	Survey
S. New England	CTDEP (CT)
	W. Long Island Study (NY)
Hudson River	HRE Monitoring (NY)
	NYDEC Alosine Beach Seine (NY)
	NYDEC Striped Bass Beach Seine (NY)
Delaware Bay/Mid-Atl	NJDFW Striped Bass Seine (NJ)
	Delaware Trawl (DE)
	PSEG Trawl Survey (DE)
	Area 6 Electrofishing Survey (PA)
Chesapeake Bay	MDDNR Striped Bass Seine (MD)
	North Anna (VA)
	VIMS Juvenile Striped Bass Seine —short (VA)
South Atlantic	NCDMF Estuarine Trawl Survey (NC)
	SC Electrofishing Survey (SC)

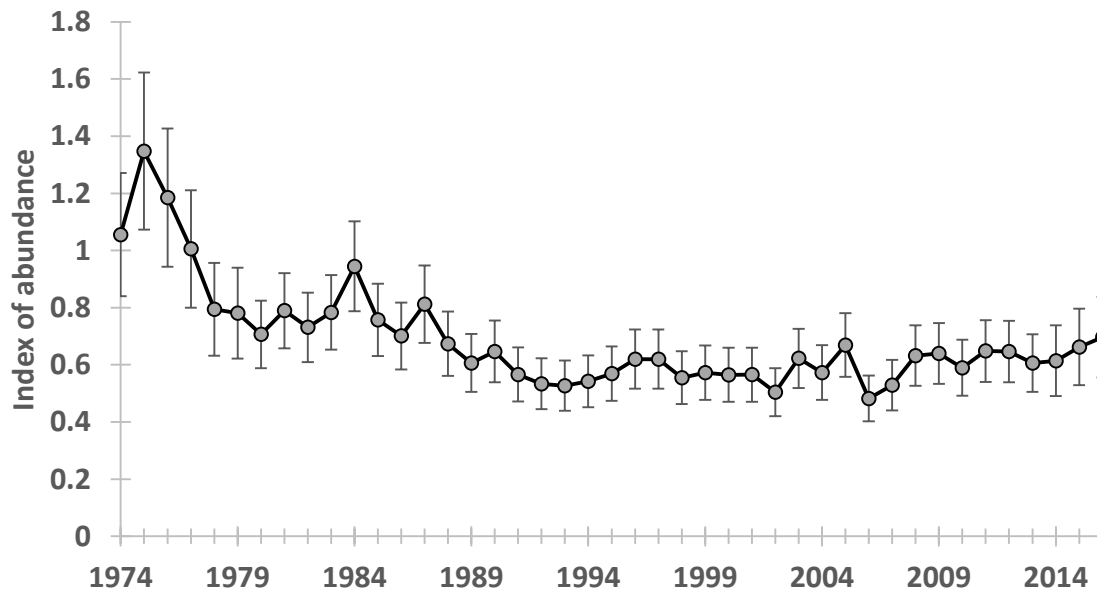
Yellow Regional Plots



Coastwide Indices



- GLM-standardized, long-term index of abundance for YOY American eels along the Atlantic Coast, 1988–2013



- GLM-standardized index of abundance for yellow eels along the Atlantic Coast, 1974–2016

Mann-Kendall Test



Region	Life Stage	Time Period	2012 Trend	2017 Trend
Gulf of Maine	YOY	2001–2016	NS	NS
Southern New England	YOY	2000–2016	NS	NS
	Yellow	2001–2010	NS	-
Hudson River	YOY	1974–2009	↓	-
	Yellow	1980–2016	↓	↓
Delaware Bay/ Mid-Atlantic Coastal Bays	YOY	2000–2016	NS	NS
	Yellow	1999–2016	NS	NS
Chesapeake Bay	YOY	2000–2016	NS	NS
	Yellow	1990–2009	↑	↑
South Atlantic	YOY	2001–2015	NS	↓
	Yellow	2001–2016	↓	↓
Atlantic Coast	YOY (short-term)	2000–2016	NS	NS
	YOY (long-term)	1987–2013	NS	NS
	Yellow (40+ year)	1974–2016	NS	↓
	Yellow (30-year)	1987–2016	↓	↓
	Yellow (20-year)	1997–2016	NS	NS

ARIMA



Region	Survey	Life Stage	Years	P(<0.25) in 2010	P(<0.25) in terminal year
Hudson River	Western Long Island Sound Survey	Yellow	1984 - 2016	0.462	0.412
	Hudson River Estuary Monitoring Program	YOY	1974 - 2013	0.516	0.544
	Hudson River Estuary Monitoring Program	Yearling and Older	1974 - 2013	0.034	0.003
	NYDEC Alosine Beach Seine	Elver & Yellow	1980 - 2016	0.344	0.72
	NYDEC Striped Bass Beach Seine	Elver & Yellow	1980 - 2016	0.286	0.446
Delaware Bay/Mid-Atlantic Coastal Bays	Little Egg Inlet Ichthyoplankton Survey	YOY	1992 - 2015	0.722	0.755
	NJ Striped Bass Seine Survey	Yellow	1980 - 2016	0	0
	Delaware Trawl Survey	Elver & Yellow	1982 - 2016	0.479	0.242
	PSEG Trawl Survey	Elver & Yellow	1998 - 2016	0.002	0
Chesapeake Bay	MD Striped Bass Seine Survey	Yellow	1966 - 2016	0.155	0.202
	VIMS Juvenile SB Seine Survey - short	Yellow	1989 - 2016	0.085	0.066
	VIMS Juvenile SB Seine Survey - long	Yellow	1967 - 2016	0.006	0.009
South Atlantic	Beaufort Inlet Ichthyoplankton Survey	YOY	1987 - 2007		0.454
	NCDMF Estuarine Trawl Survey	Elver & Yellow	1989 - 2016	0.192	0.284

Manly Meta Analysis



- At least one of the indices for both life stages showed a decline through time (yellow eels: $S_1=115.88$, $P < 0.01$; YOY eels: $S_1 = 95.22$, $P < 0.01$)
- Also, there was consensus for a decline for both life stages through time (yellow eels: $S_2= -5.05$, $P < 0.01$; YOY eels: $S_2= -16.03$, $P < 0.01$)

Research Recommendations



- SAS and TC made several during ASMFC 2012 and updated the progress on items in ASMFC 2017
 - Data collection, future research, assessment methods
 - Short and long-term recommendations
 - See reports for full list (6 pages)
 - Several potential projects listed
- Identified improvements needed for the next benchmark

Research Recommendations



- Improve accuracy of commercial catch and effort data (Some progress was made through Addenda III and IV)
 - Buyer reports vs reported state landings
 - Improve compliance reports, ACCSP reporting
- Characterize the length, weight, age, and sex structure of commercially harvested American eels along the Atlantic Coast over time
 - Require states to collect biological information by life stage

Research Recommendations



- Improve understanding of the distribution and frequency of occurrence of American eels along the Atlantic Coast over time
 - Maintain FI surveys, include eel in more surveys
- Improve understanding of impact of *Anguillicoloides crassus* on American eel
 - Prevalence and incidence of infection
 - Impact on growth, maturation, migration, spawning
- Improve understanding of spawning and maturation

Research Recommendations



- Improve upstream and downstream passage for all life stages of American eels
 - Investigate, improve, and develop passage technologies
- Improve understanding of habitat needs and availability
 - Assess habitat characteristics, distribution, value
- Conduct intensive age and growth studies at regional index sites to support development of reference points and estimates of exploitation

Conclusions



- Stock assessments
 - Trend analyses detected significant downward trends in numerous indices
 - Depleted stock
 - Low but stable landings, stable indices
 - ASMFC 2012 and 2017
- Numerous opportunities for research
- Future goals
 - Collaborative stock assessment across borders
 - Develop statistical model to determine stock status
 - Continue to improve understanding of the American eel and maintain sampling programs

Questions?



Thank you to the ASMFC American Eel Stock Assessment
Subcommittee & Technical Committee