Working Group Summary and Next Steps for AMG Cobia

ASMFC Spring Meeting

Alexandria, Virginia

May 8, 2017

Working Group Meetings

- Fegley (Md), Cimino (Va), Duval (NC), Boyles (SC), Knowlton (Ga)
- 3 conference calls to discuss management options for Board review
- Data and discussion summaries provided to PDT

Primary Board Objectives

- Complement SAFMC Coastal Migratory Pelagics FMP for Cobia
- Constrain coastwide harvest to Allowable Catch Limits established by the SAFMC
- Provide states with maximum flexibility to manage their specific cobia fisheries

Working Group Issues

- Size Limits
- Bag Limits
- Vessel Limits
- State Allocations
- Seasons
- Other
- Commercial

Issue 1: Size Limits

- The SAFMC Framework 4 established a 36” FL size limit in federal waters
- Working group recommends a consistent, coastwide 36” FL size limit for FMP
- Different size limits can create enforcement and assessment concerns
- Lower minimum sizes: higher catch rates and shorter seasons
- Larger minimum sizes: longer seasons but increased discards and safety concerns

Issue 2: Bag Limits

- The SAFMC Framework 4 establishes a one (1) fish recreational bag limit in federal waters
- Working Group recommends consistent one (1) fish bag limit in the FMP
- Higher bag limits: higher catch rates and shorter seasons

Issue 3: Vessel Limits

- The SAFMC Framework 4 allows up to six (6) fish per vessel in federal waters
- Working Group has no specific recommendation regarding vessel limits
- Vessel limits could vary based on specific state objectives

Issue 4: State Allocations Time Series

- Landings time series considered: previous 3, 5, and 10 year periods and option that adds 50% of the 5 year average to 50% of the 10 year average
- Terminal Year: Working Group reviewed 2014 and 2015 as terminal years to develop allocations based on landings.
  - A PDT member proposed 2013, a period prior to some state specific cobia management changes.
  - The Working Group had no final opinion on terminal year but appeared to agree that 2015 provided the most recent information and did not include a year with a closure (e.g., 2016)
- **What time series should the PDT use to develop recreational allocation options for public comment?**

Issue 4: State Allocations
Landings in Weight or Numbers

- MRIP and SEFSC landings (in weight) differ due to differing methods for estimating average weight
- MRIP uses annual length-weight data regardless of sample size
- SEFSC requires a minimum sample size and may combine states or years depending on sample sizes

Issue 4: State Allocations
Landings in Weight or Numbers

- Landings and allocations based on weights (SEFSC and MRIP) and numbers of fish are in the Working Group memo
- Using numbers of fish removes inconsistencies in average weight estimates throughout the management unit and among estimation methods
- **Should the PDT use average weights (SEFSC or MRIP) or numbers?**

Issue 4: State Allocations
Landings in Weight or Numbers

- Example: Allocation using 5yr/10yr average landings (SEFSC used for avg. weights) for 2005-2014 time series with ACL=620,000 lbs.

State	5yr/10yr Pounds	Percent Allocation	ACL	5yr/10yr Numbers	Percent Allocation	ACL
GA	64,132 lbs.	9.5%	58,900 lbs.	2,221	10.2%	63,240 lbs.
SC	75,402 lbs.	11.2%	69,440 lbs.	2,521	11.6%	71,920 lbs.
NC	262,297 lbs.	39.0%	241,800 lbs.	8,932	41.2%	255,440 lbs.
VA	271,128 lbs.	40.3%	249,860 lbs.	7,999	36.9%	228,780 lbs.
Total	672,959 lbs	100%	620,000 lbs.	21,673	100%	620,000 lbs.

- **Should the PDT use average weights (SEFSC or MRIP) or numbers?**

Issue 5: Seasons

- The SAFMC Framework 4 provides analysis to examine coast wide seasons based on a suite of bag, size, and vessel limits
- Detailed analysis by NC DMF provides information for Georgia to Virginia
- Data include variable start dates (January 1, May 1, and June 1) for the recreational fishery
- Some state-specific data are extremely limited

Issue 5: Seasons

- Are state or regional specific season options wanted for the FMP, or
- Are season decisions best left to the states to develop and have approved by the TC and Board?
- If state or regional specific seasons are desired for the FMP, should they be based on a state-specific allocation?
- Other options to ensure equity and accountability?

Issue 6: Other Board Questions/Decisions

- South Carolina has implemented a spawning season closure in their southern management area
- **Should the FMP include options for similar closures in other states?**

Issue 6: Other Board Questions/Decisions

- Current vessel limits vary by state, up to 4 fish
- Vessel limits may impact the NMFS decision to open the EEZ
- **Should the FMP include options to complement federal actions sufficient to ensure EEZ openings?**
  - **For example, include request to extend state regulations in to the adjacent EEZ?**

Issue 6: Other Board Questions/Decisions

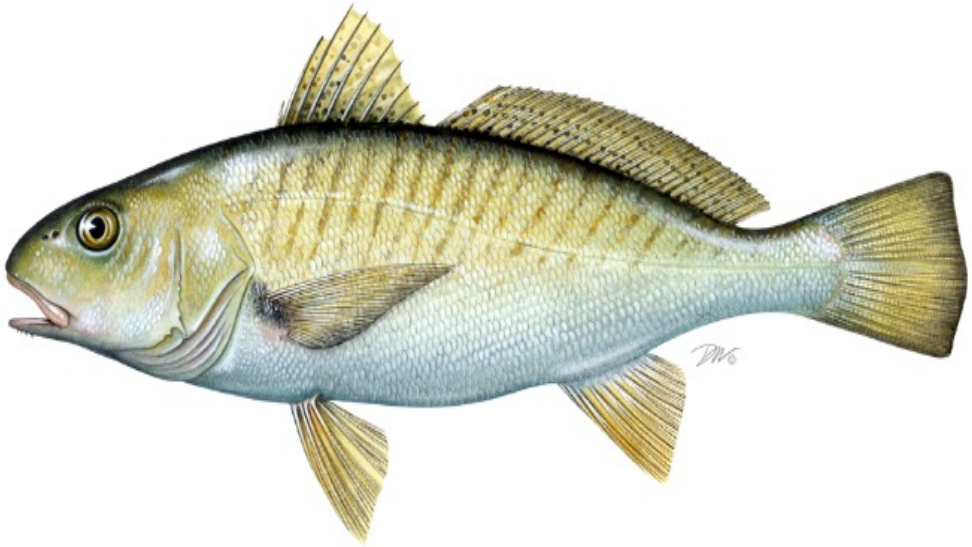
- Tracking the recreational ACL on an annual basis is a concern
- Effort data are unavailable until after a wave is complete and could result in significant overages despite best efforts
- **Should the FMP develop/discuss alternative ACL monitoring methods to track the ACL on a scale finer than waves?**

Issue 7: Commercial Management Options

- The Working Group did not discuss commercial measures
- SAFMC Framework 4 essentially maintains status quo
- Few specific commercial comments have been received
- Current bycatch allowance (coastwide 2 fish at 33” FL; 6 per vessel)
- Suggest commercial landings be reported in whole weight?

Questions?

Atlantic Croaker ASMFC Stock Assessment



South Atlantic State/Federal Fisheries Management Board

May 11, 2017

Outline

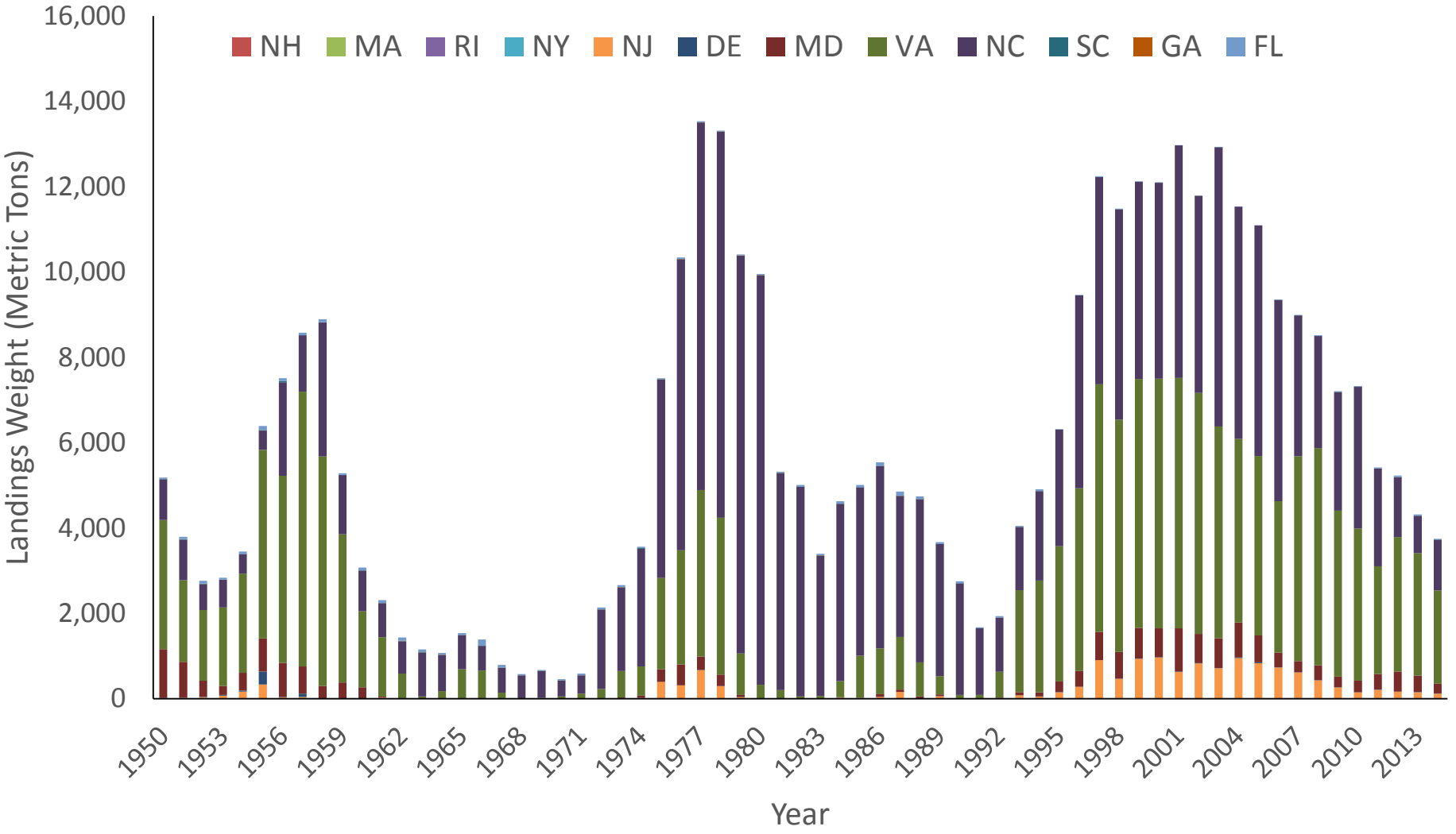
- Life History
- Data
  - Commercial (landings and Scrap/Bait Fisheries)
  - Discards (Shrimp Trawl Fishery & Net Fisheries)
  - Recreational (MRIP)
  - Fishery Independent Index Data
- Assessment Model
- Reference Points and Stock Status
- Research Recommendations

Atlantic Croaker: Life History

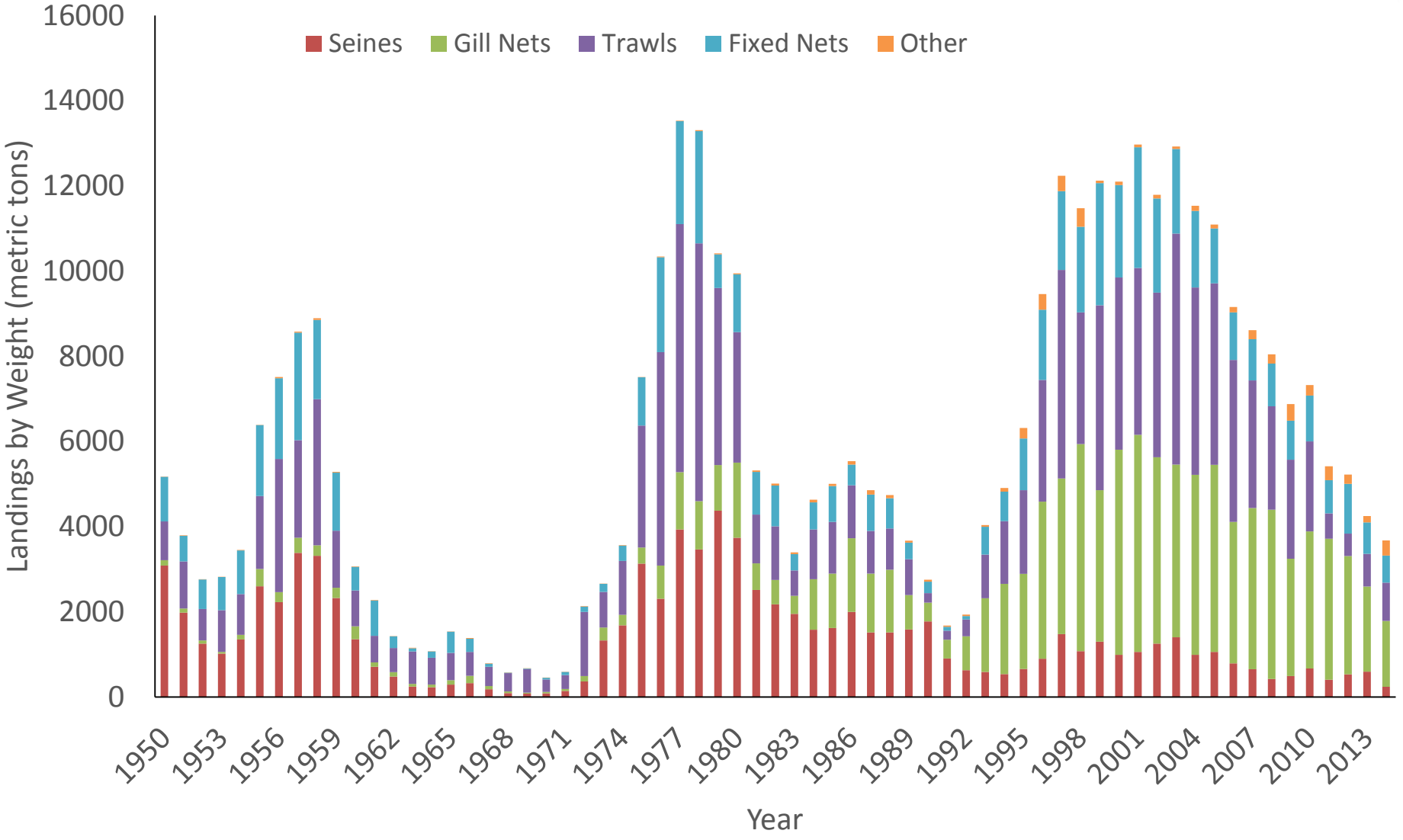
- Demersal Sciaenid commonly found in estuarine and nearshore waters from the Gulf of Maine to Argentina.
- Most abundant along the US coast from Florida to New Jersey.
- Fast growing, can reach 80% of their maximum size within 2 years.
- Maximum age: 17 years
- Generally begin to mature between 1 and 2 years of age with 100% maturity reached by age 3.
- Extended spawning season that can range from September to April depending on latitude.

Data

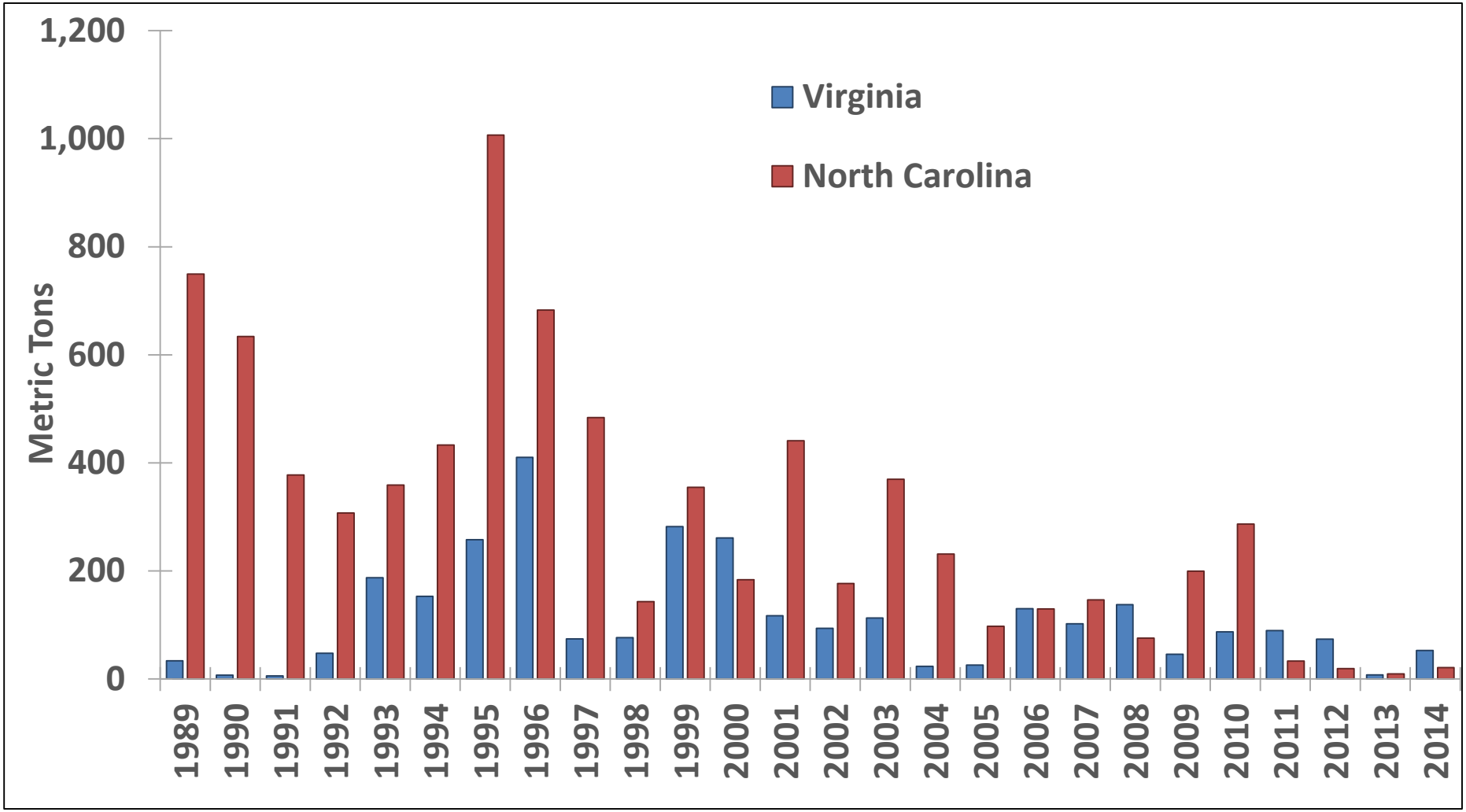
Commercial Landings by State



Commercial Landings (By Gear)



Scrap/Bait Landings (NC, VA)



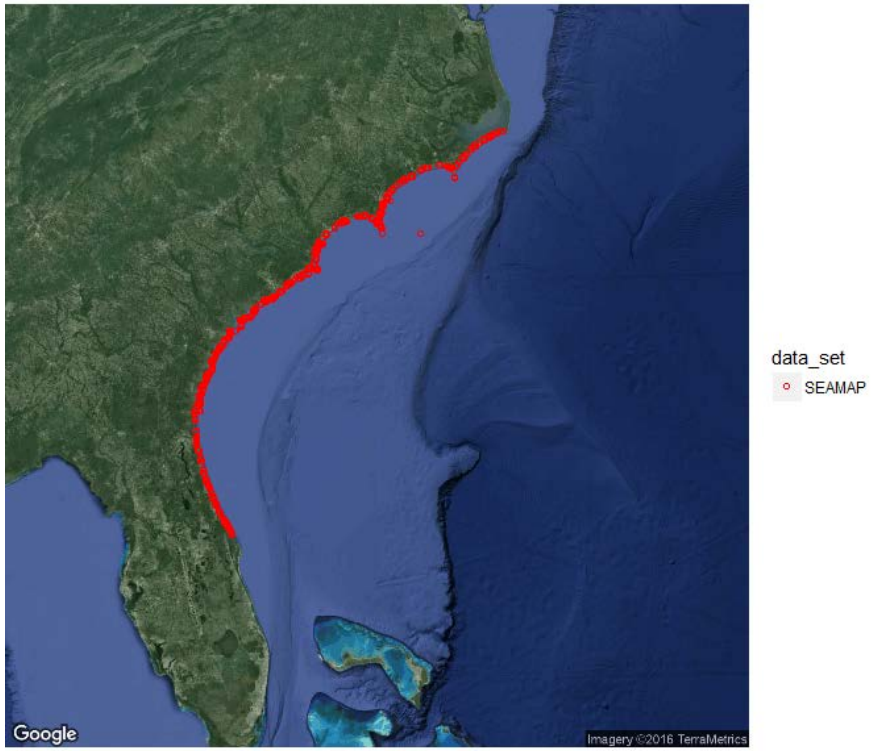
Commercial Fishery Discard Estimates

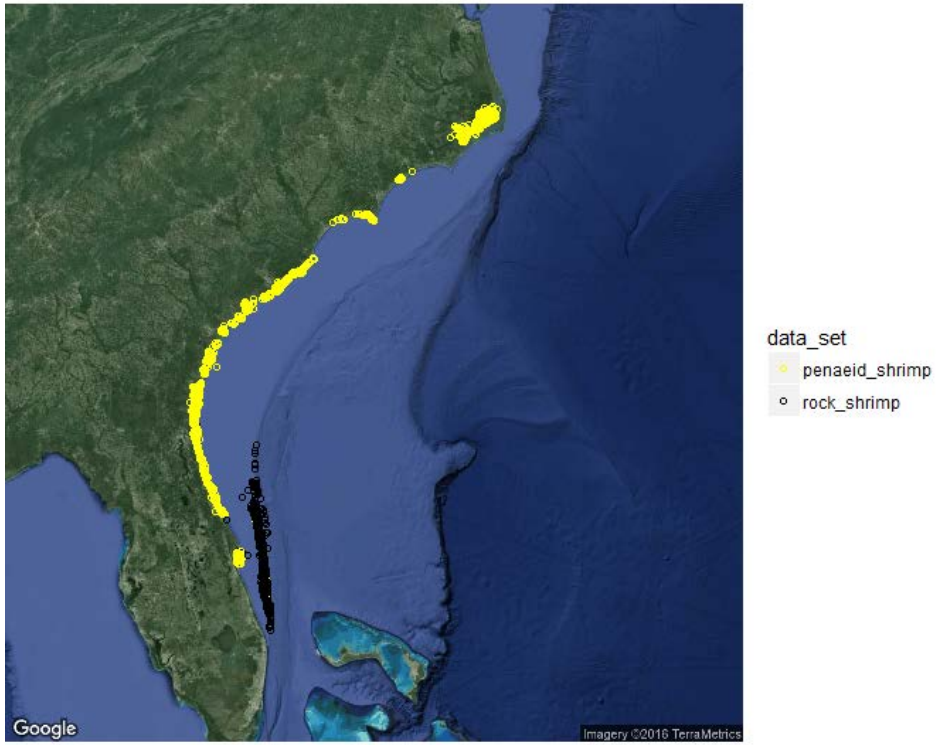
- South Atlantic Shrimp Trawl Fisheries
  - ❖Note: the GLM approach which was used was the same as that used in the king mackerel assessment (which passed).

- Mid-Atlantic Gillnet and Trawl Fisheries

South Atlantic Shrimp Trawl Discards

- Southeast Shrimp Trawl Observer Program data only available since 2001.
- SEAMAP survey covering the same range operating since 1989.

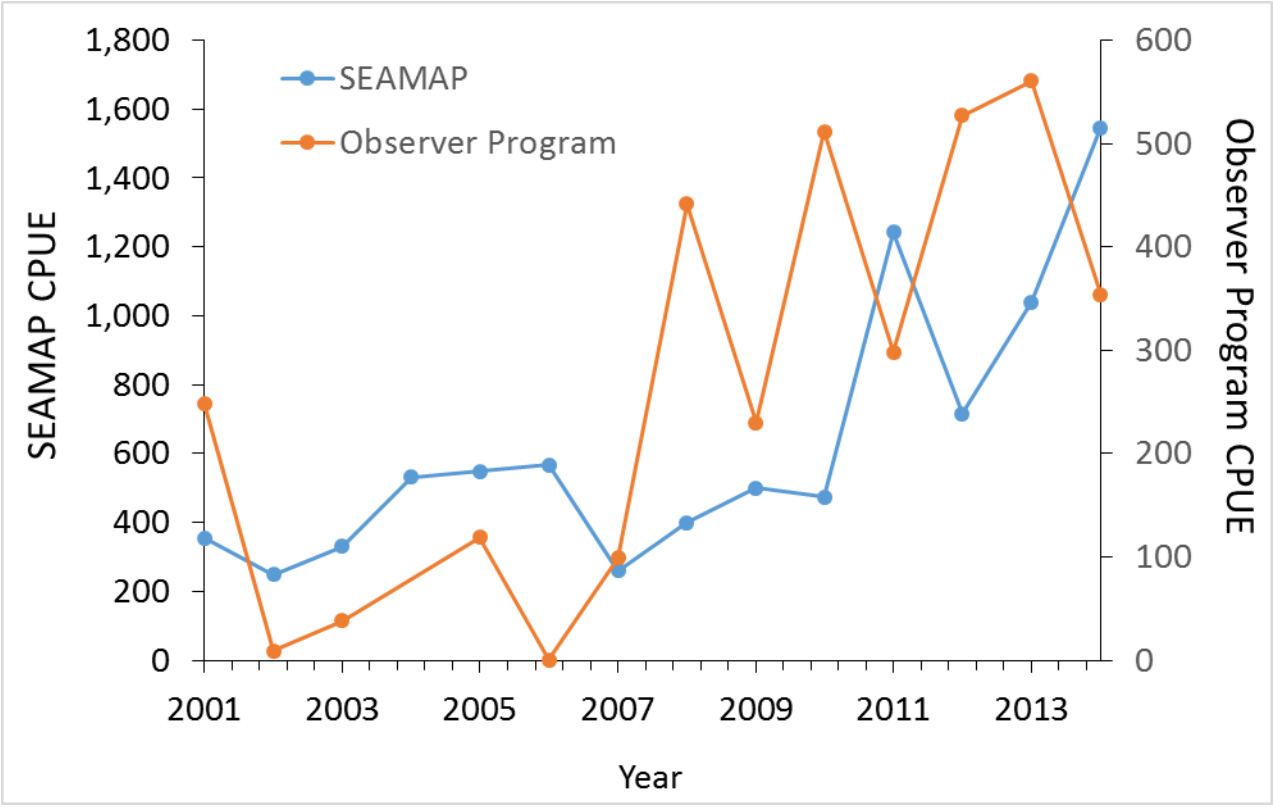


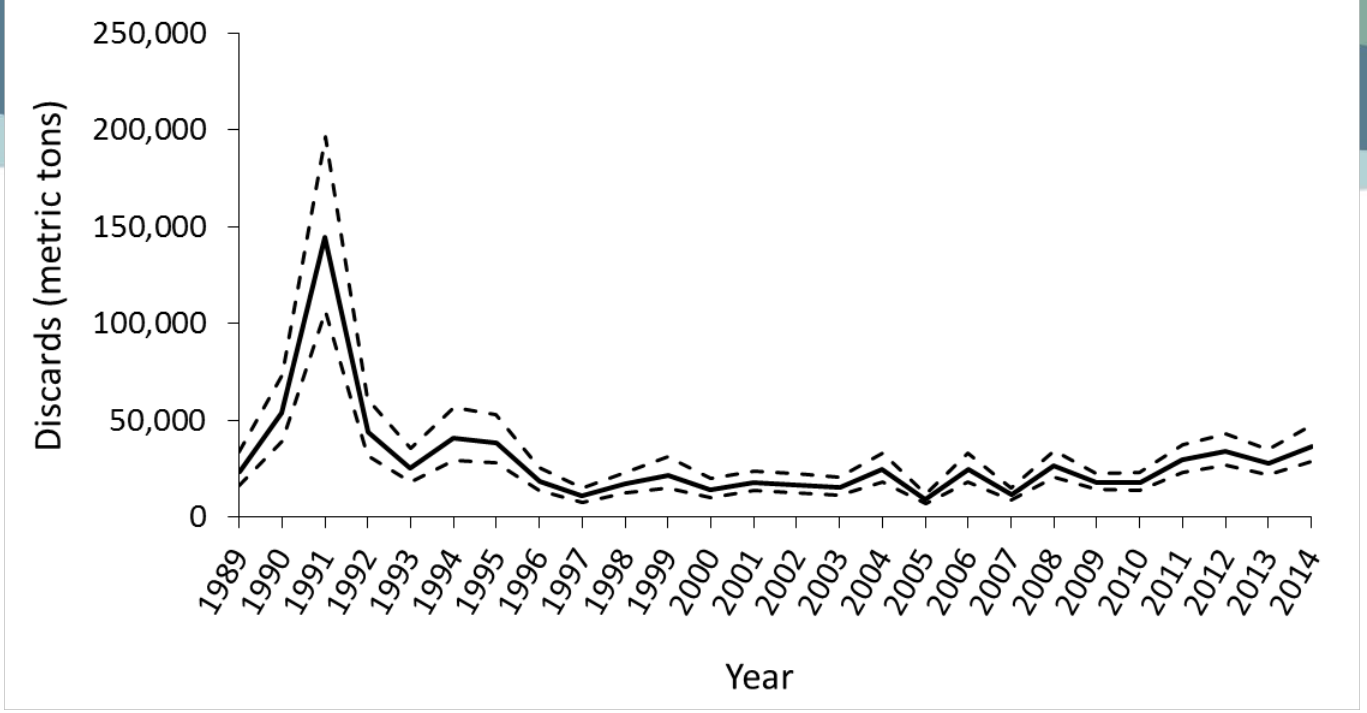


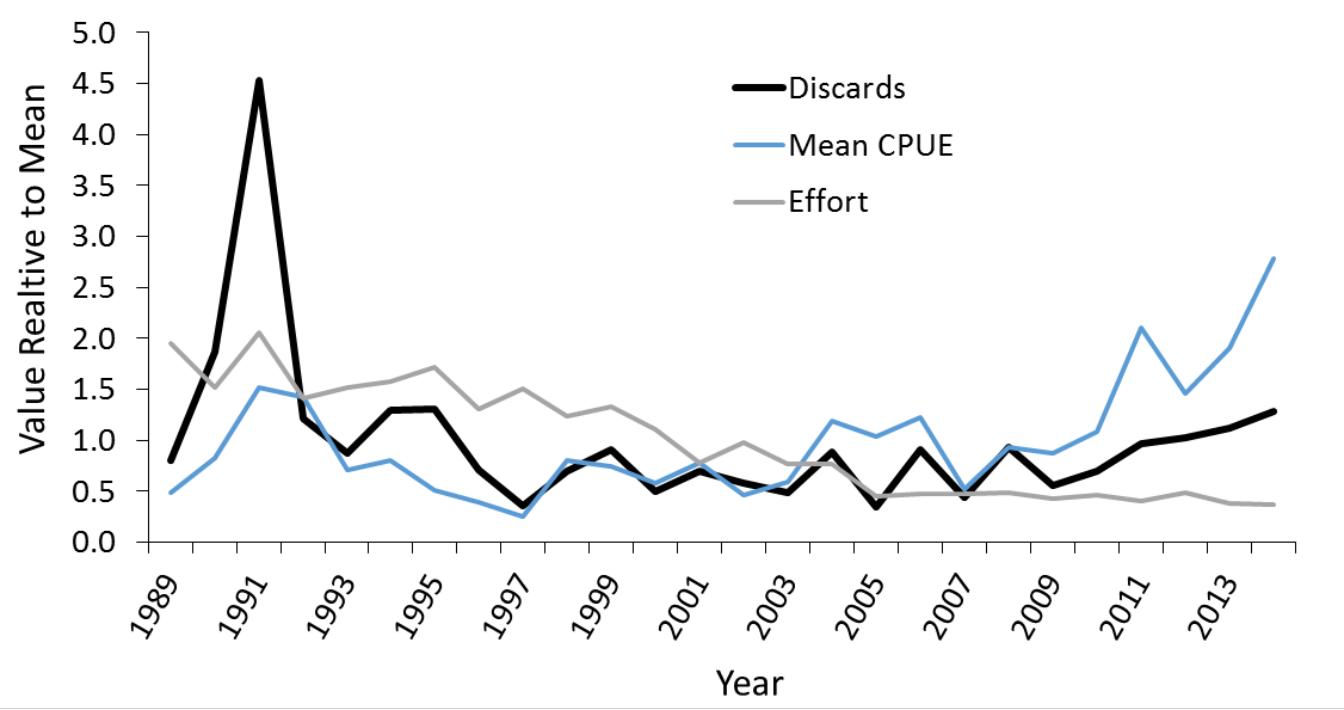
South Atlantic Shrimp Trawl Discards

- GLM combines FI survey catch rates to estimate trend of relative abundance and SESTOP catch rates to estimate magnitude and trend of discarding rates in fishery (SEDAR 38, Walter and Isley 2014)

- Assumption: As abundance changes, discarding changes proportionally

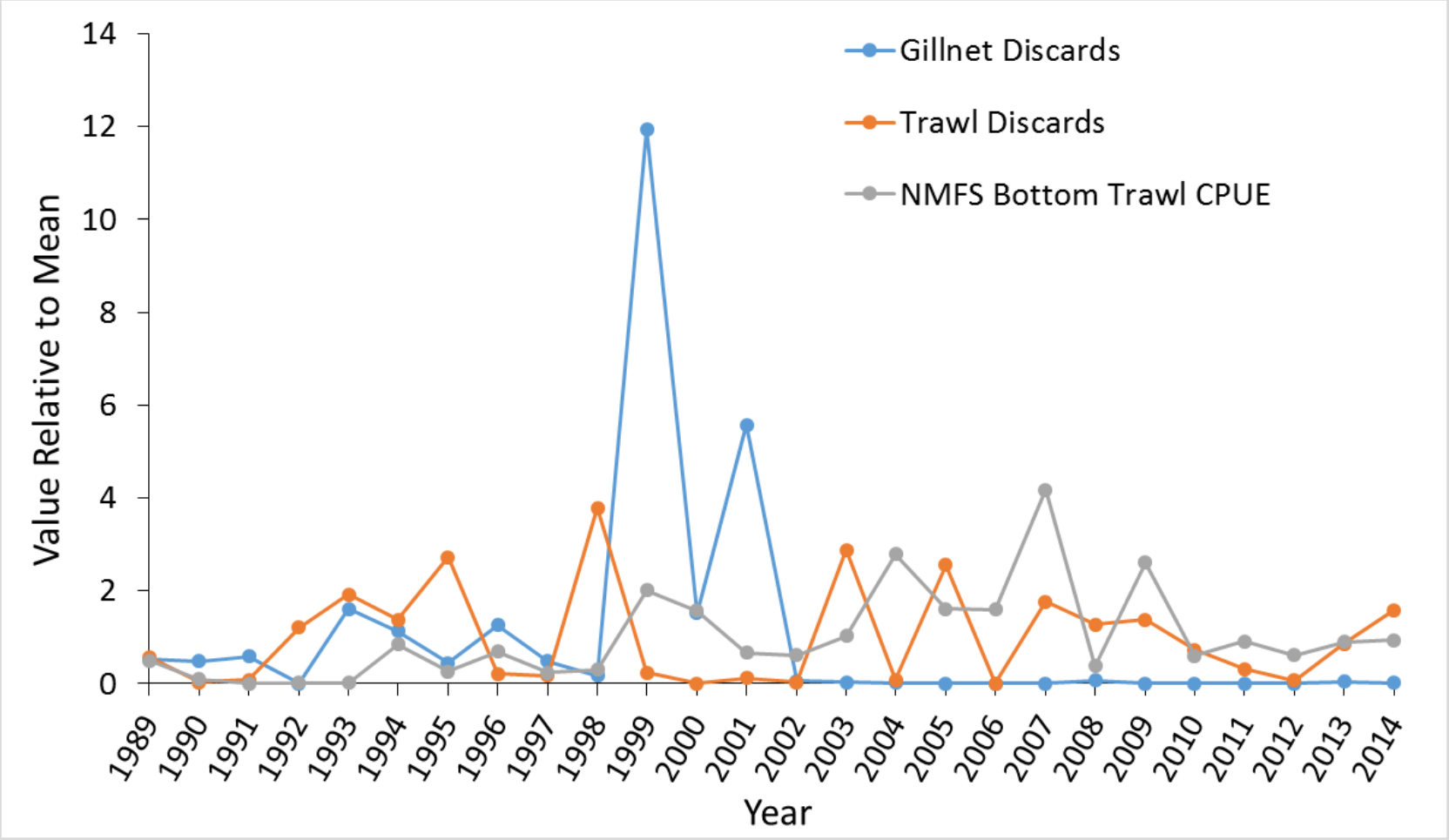



Discards (metric tons)
250,000
200,000
150,000
100,000
50,000
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

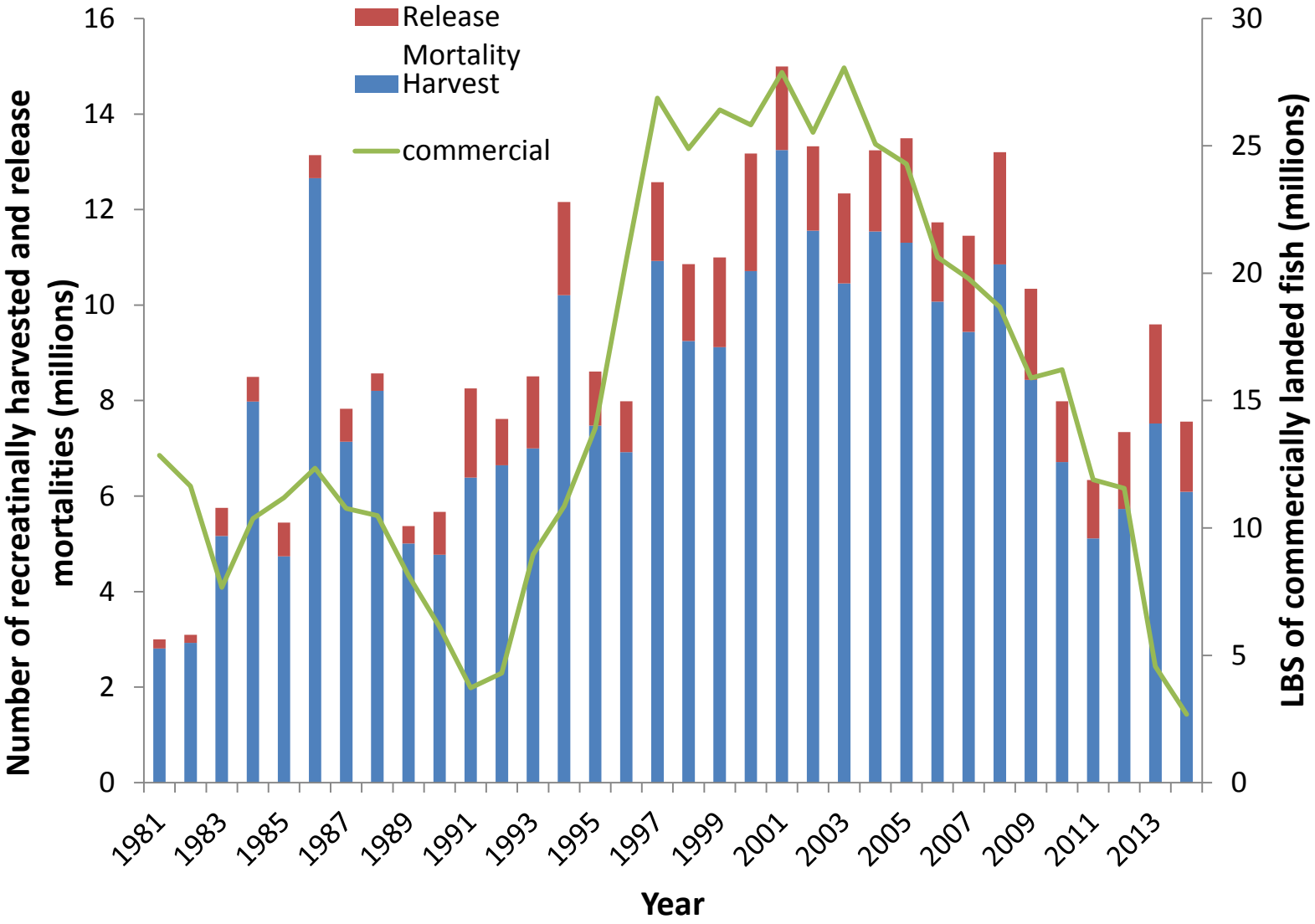

Value Realtive to Mean
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Discards
Mean CPUE
Effort
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year

Gillnet and Trawl Discards

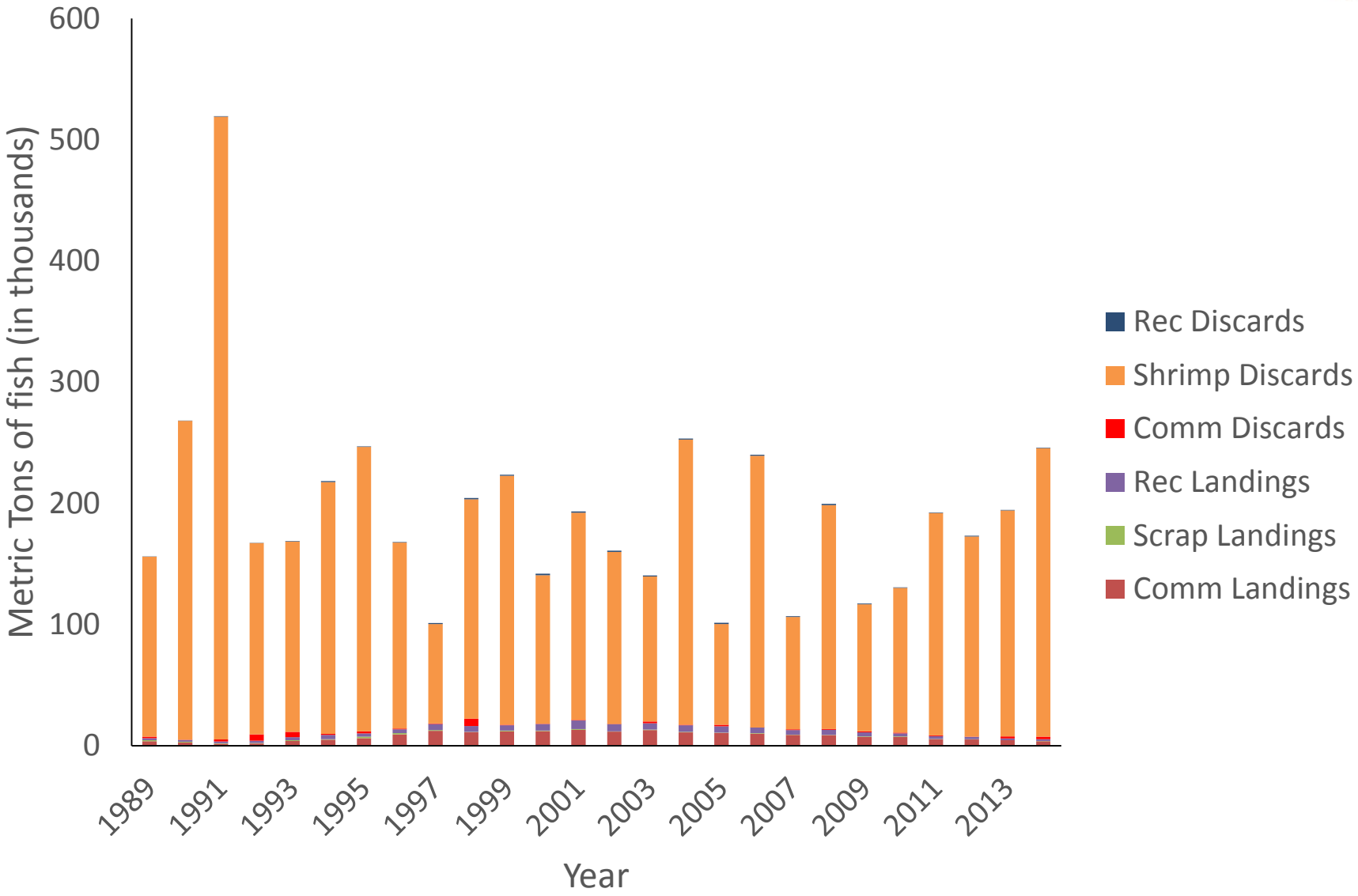
- Ratio estimator expanded by reported landings
  - Observed Atlantic Croaker Discards:Aggreagte Landings * Total Reported Landings



MRFSS and MRIP Total Harvest



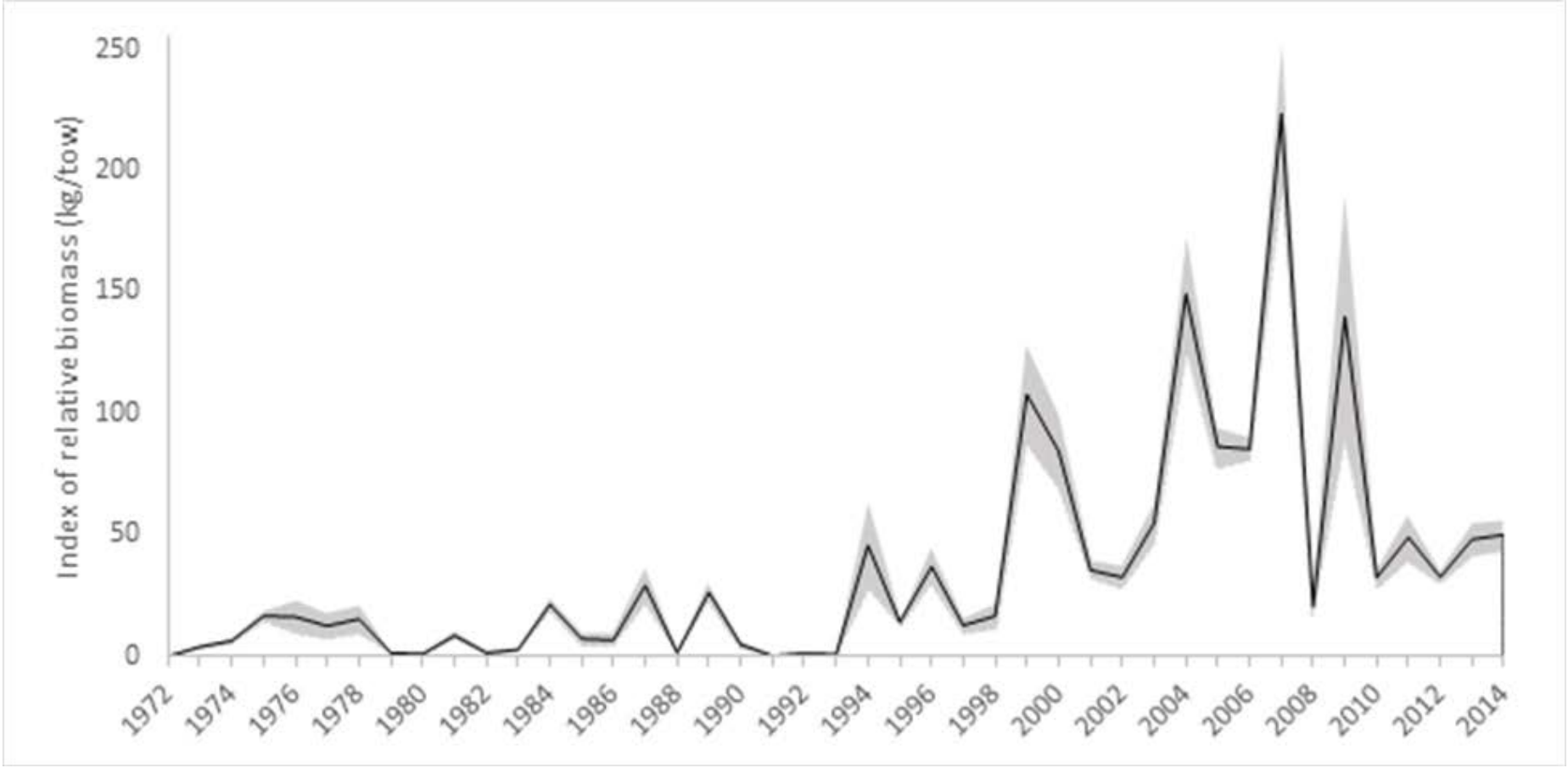
Total Removals



Fishery-Independent Data

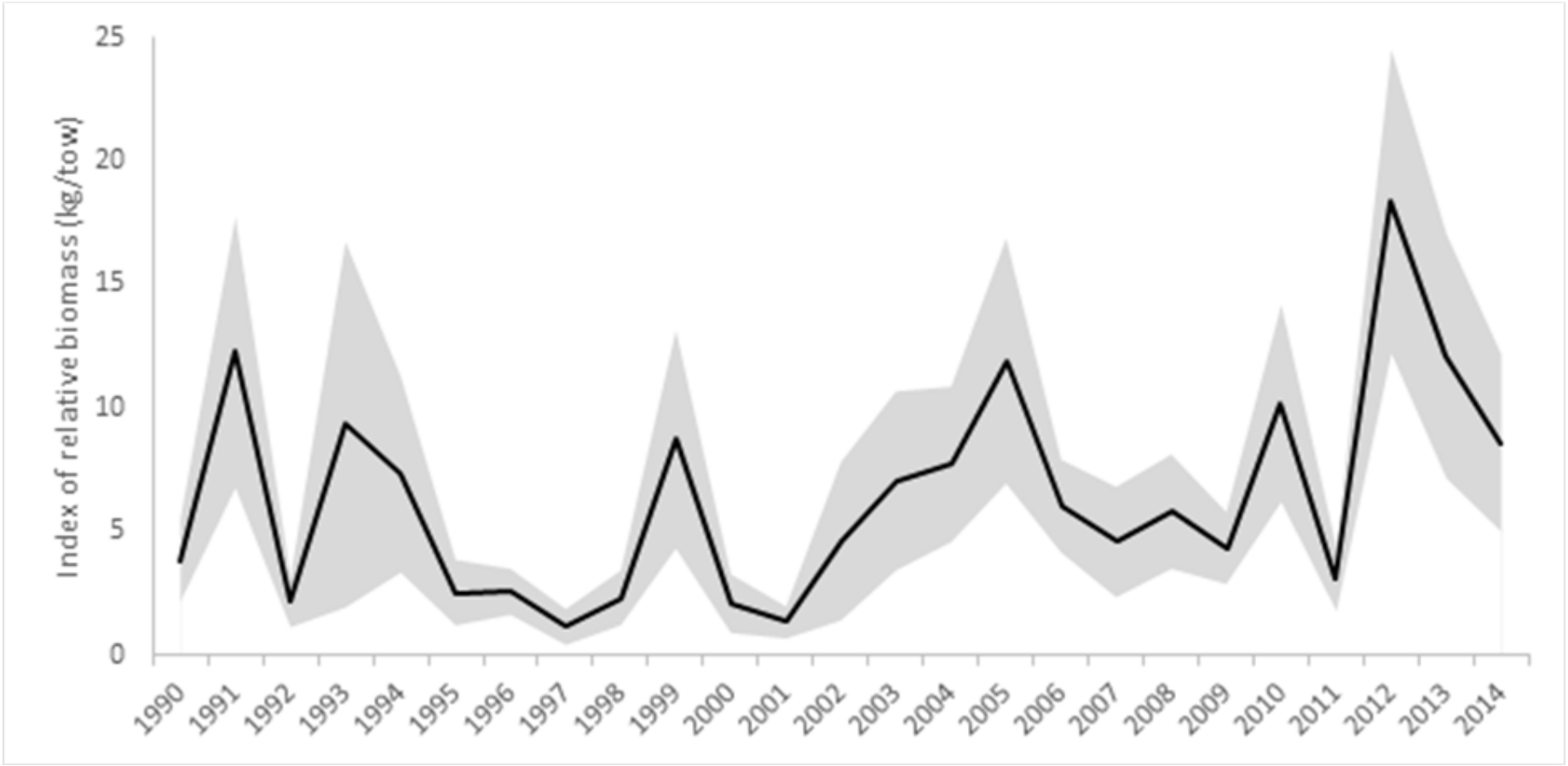
- Criteria for evaluating surveys:
  - Continuous time series, at least 17 years long
  - No changes in methodology or gear
  - Survey operates in a place and time where croaker are present and typically available
  - High proportion of positive tows
- Reviewed 43 FI surveys, narrowed to 6 surveys
  - NMFS, SEAMAP, VIMS, NC P195 (all used in 2010).
  - Two additional surveys (ChesMMAP, NEAMAP) were considered in sensitivity runs in the SS3 model.
- Used indices from 1989 (first year of complete removal data)-2014.

NMFS Trawl



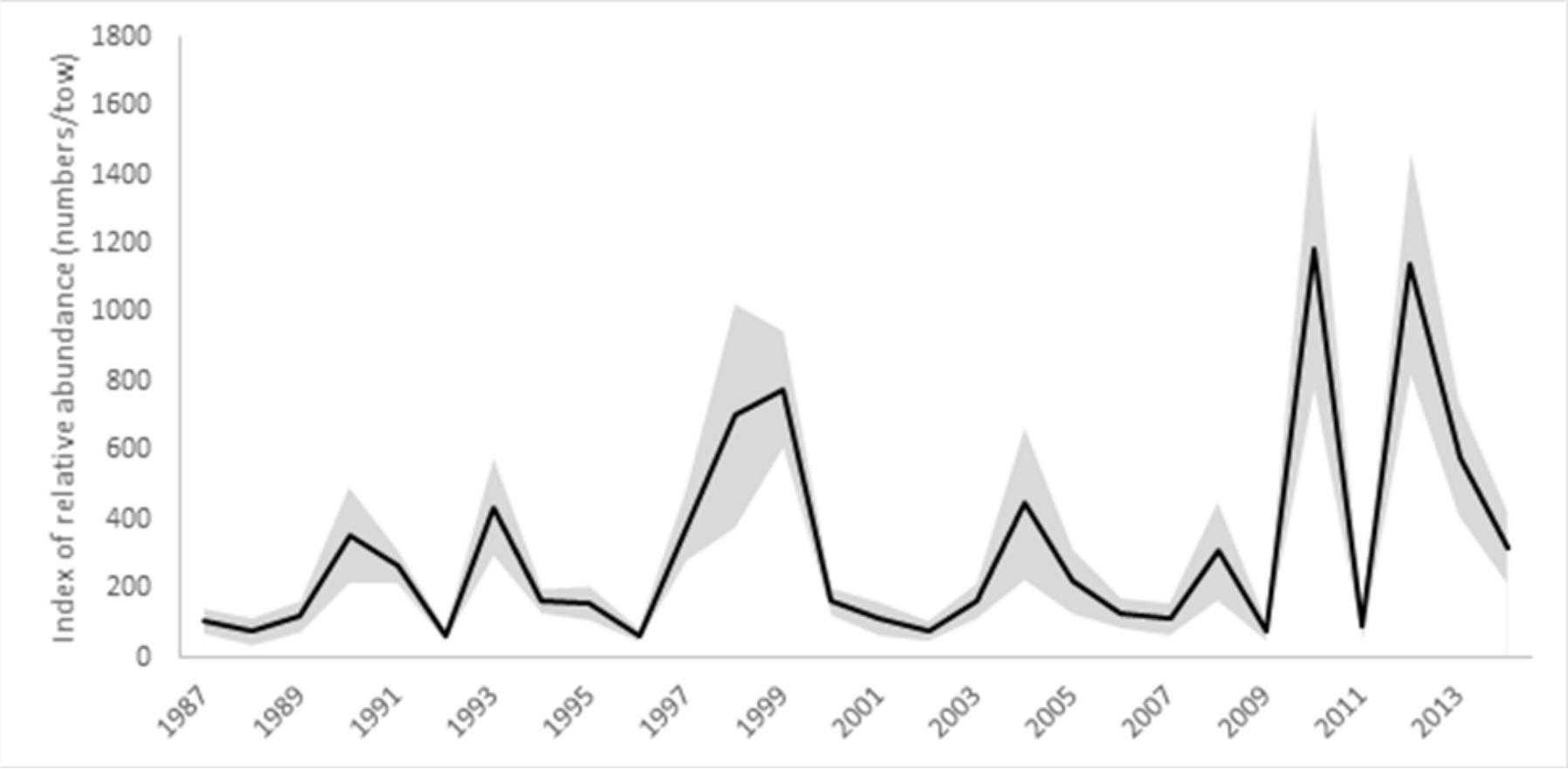
Index of relative biomass developed from the fall months (September – November) of the NMFS NEFSC survey for 1972-2014 with 95% confidence intervals.

SEAMAP Trawl



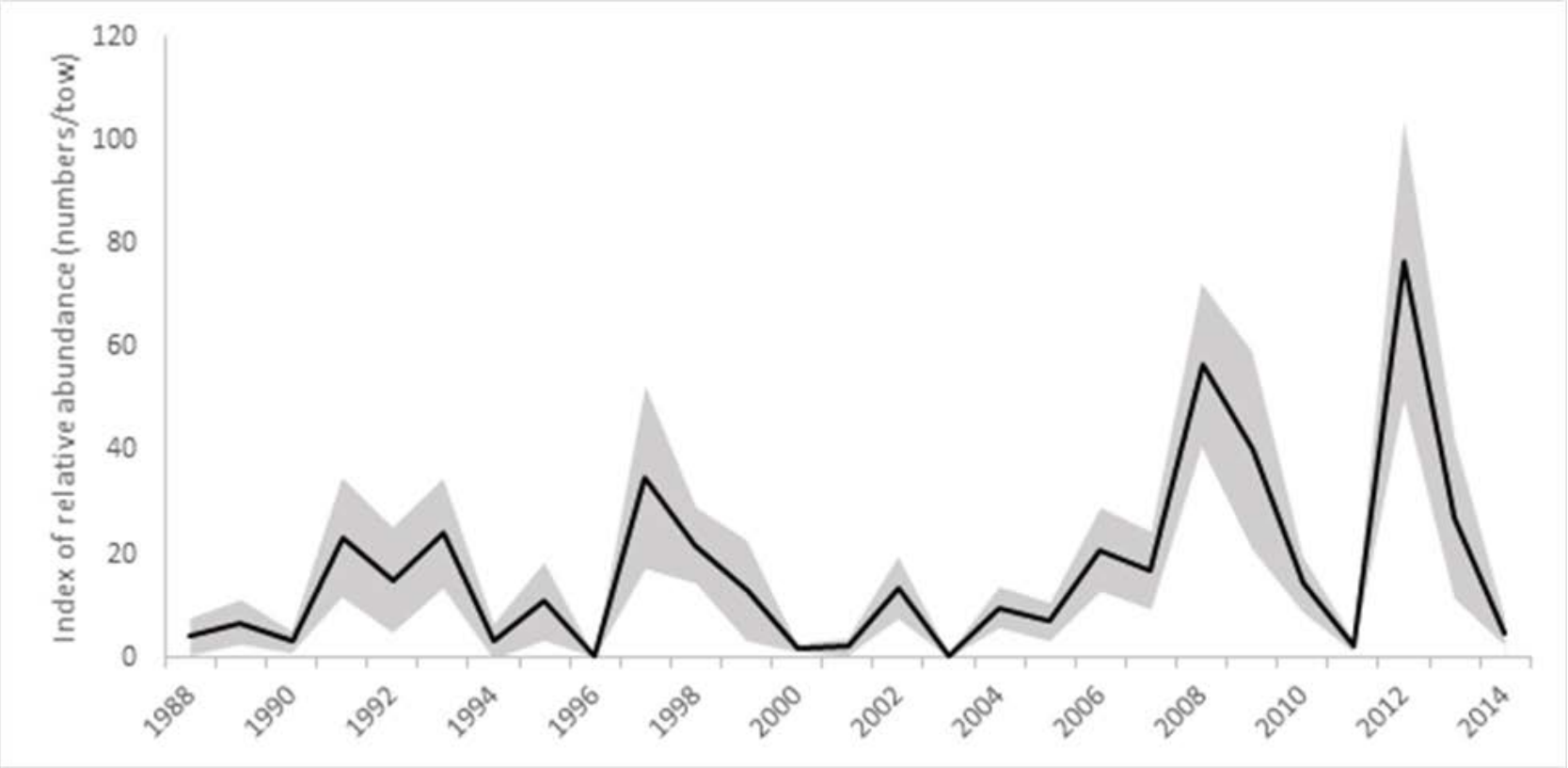
Index of relative biomass developed from the fall months of the SEAMAP survey for 1990-2014 with 95% confidence intervals.

NCDMF P195



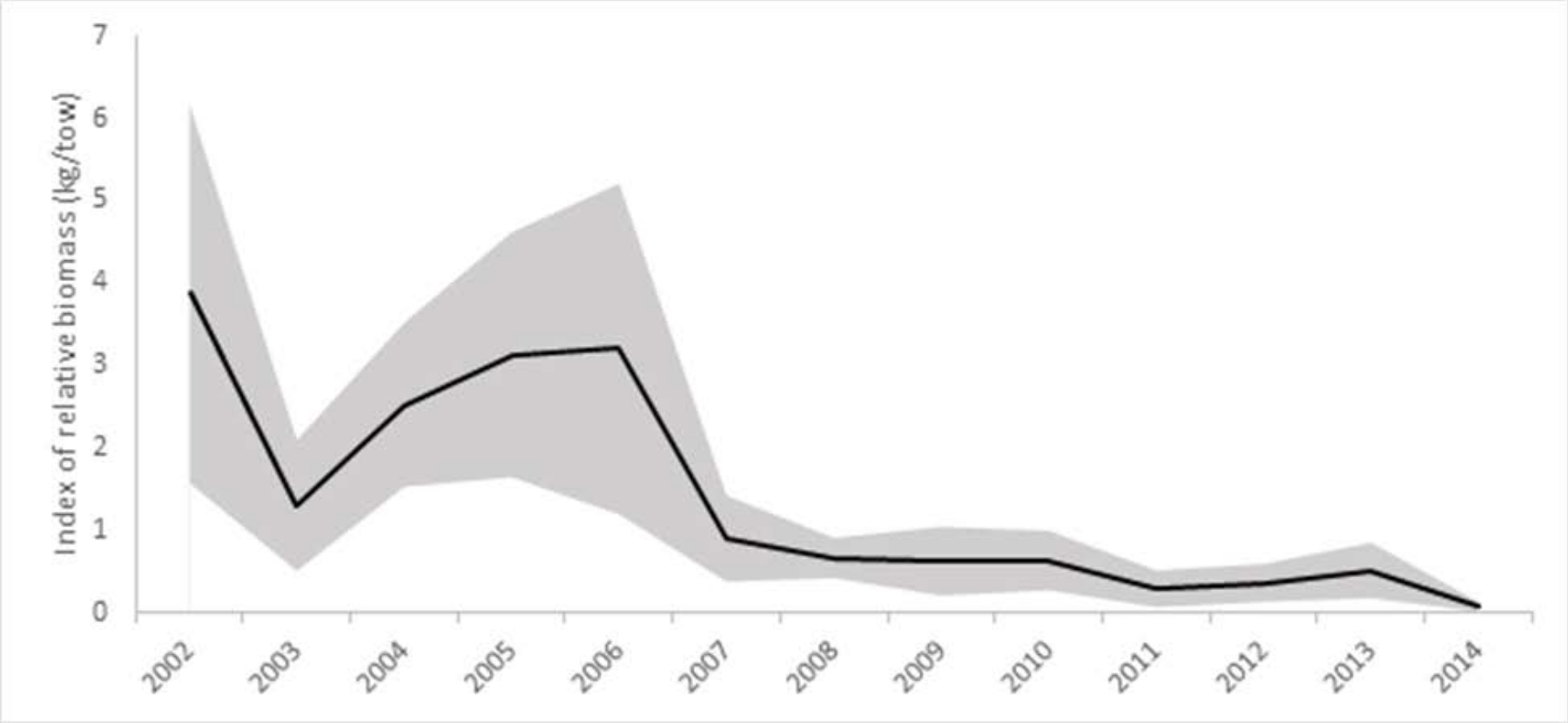
Index of relative YOY abundance developed from the June portion of the NC195 program survey for 1987-2014 with 95% confidence intervals.

VIMS Index



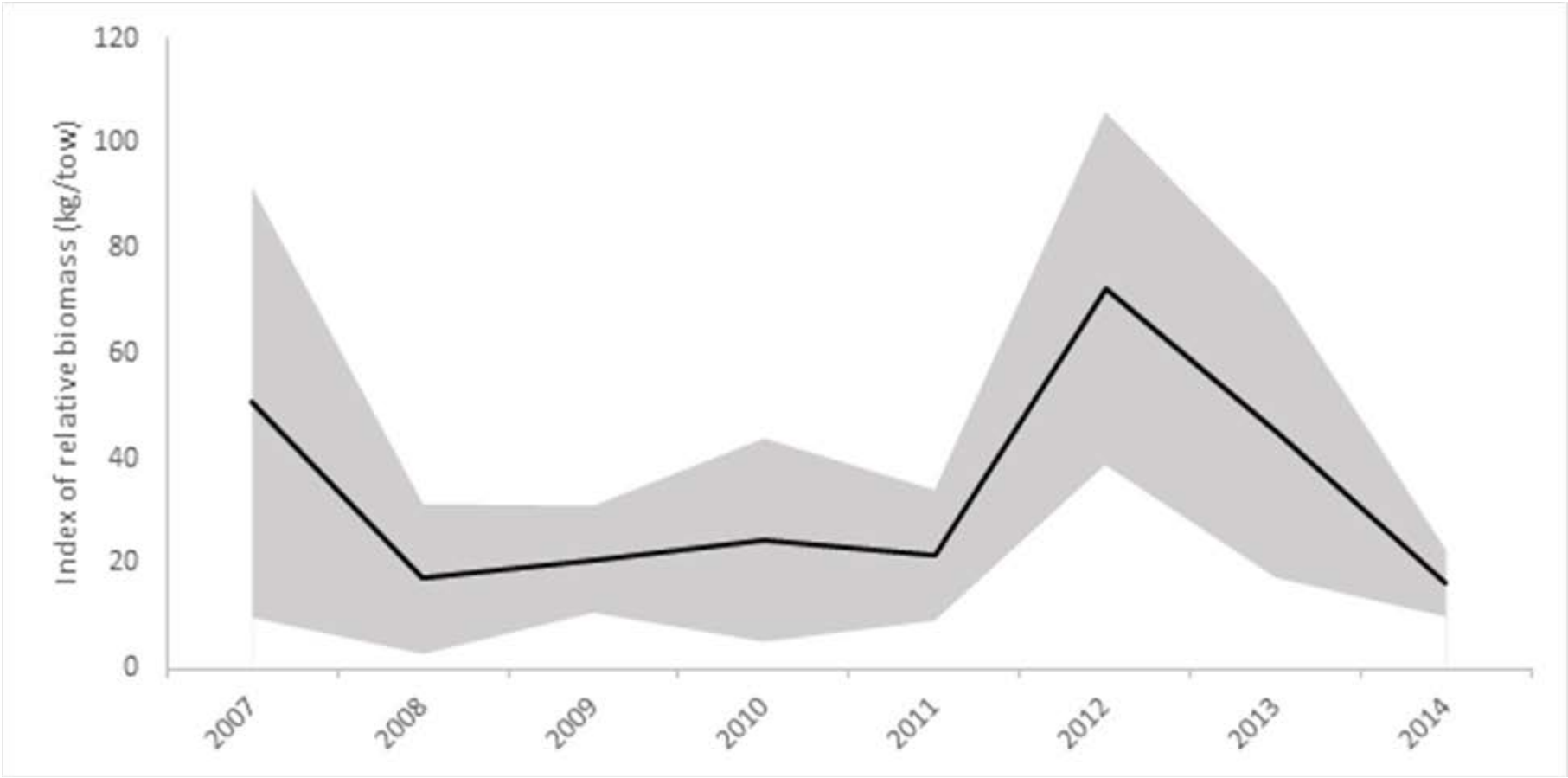
Index of relative YOY abundance developed from the May-June portion of the VIMS survey for 1988-2014 with 95% confidence intervals.

ChesMMAP



Index of relative biomass developed from May-September months of the ChesMMAP survey for 2002-2014 with 95% confidence intervals.

NEAMAP



Index of relative biomass developed from the fall months of the NEAMAP survey for 2007-2014 with 95% confidence intervals.

Conclusions

- Used in base run of SS3:
  - NMFS, SEAMAP indices of relative biomass
  - VIMS, NC P195 indices of YOY relative abundance
- ChesMMAP negatively correlated with other indices, provided a conflicting signal in the model (used in sensitivity)
- NEAMAP was too short, but should be considered in the future.

Assessment Methods

Stock Synthesis (v 3.24y)

- State-of-the-art
- Forward-projecting
- Length-based, age-structured
- Two-sex model
- Estimates stock size, fishing mortality, and reference points

<u>Model Set UP</u>

- Time period: 1989 to 2014
- Spatial extent: New Jersey to the east coast of Florida
- Fleets: Four
- Surveys: Five
- Beta prior on steepness (0.76)

Assessment Data Input

Fleets

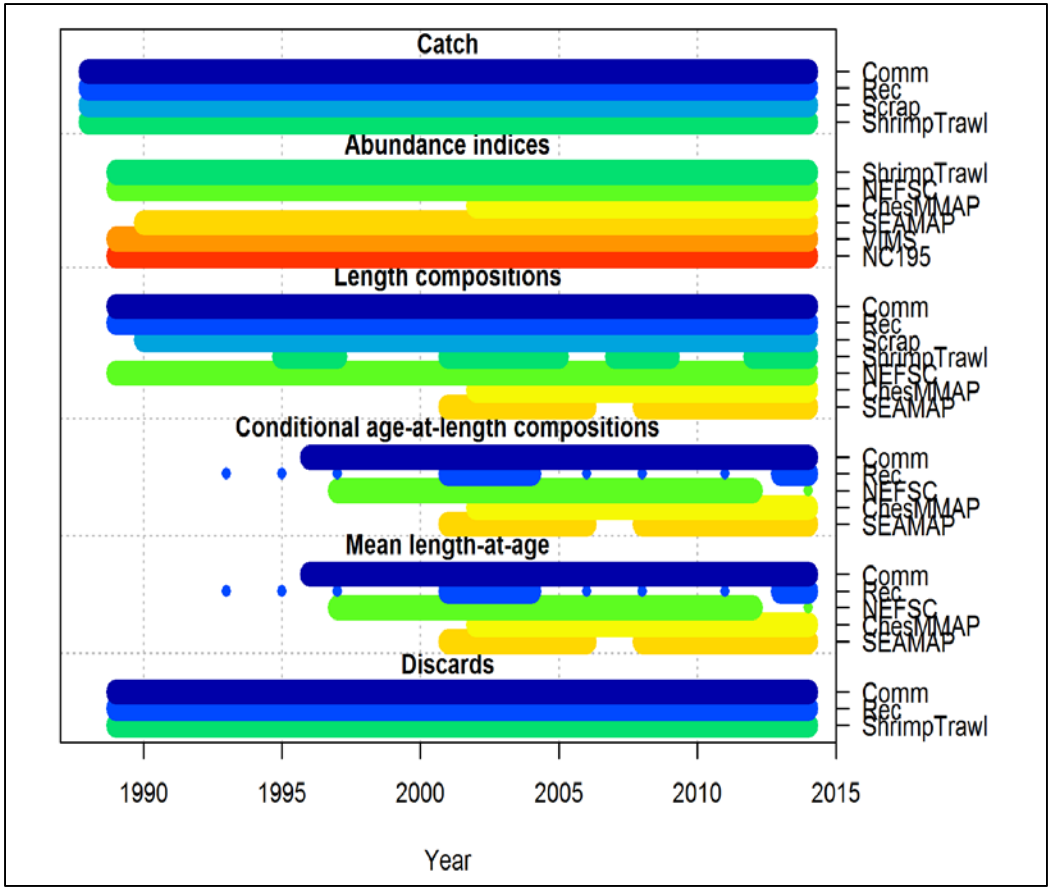
- Commercial with discards
- Commercial scrap
- Shrimp trawl (bycatch-only)
- Recreational with discards

Surveys

- NEFSC
- ChesMMAP (bio data only)
- SEAMAP
- VIMS Trawl (age-0 index)
- NCDMF Estuarine Trawl Survey (Program 195; age-0 index)

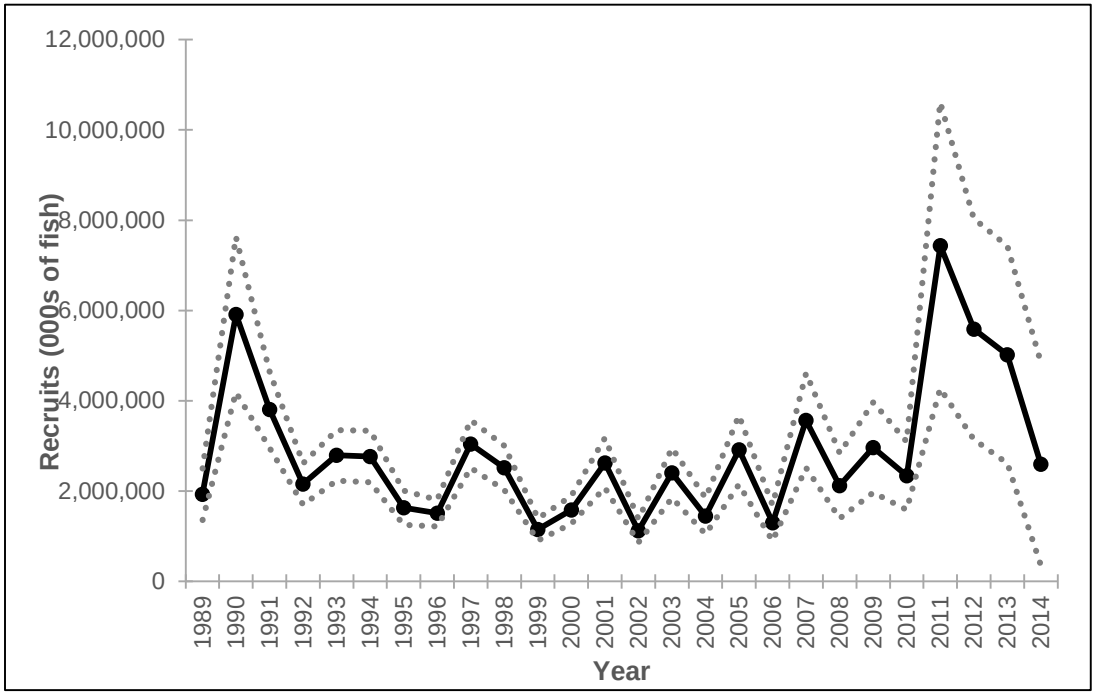
Biological Data

- Length frequencies
- Age at length
- Sex ratio at length
- Average length at age
- *M* at age and sex
- Growth by sex
- Maturity at length (females)
- Max age 17; age-8 plus group



Stock Synthesis: Results

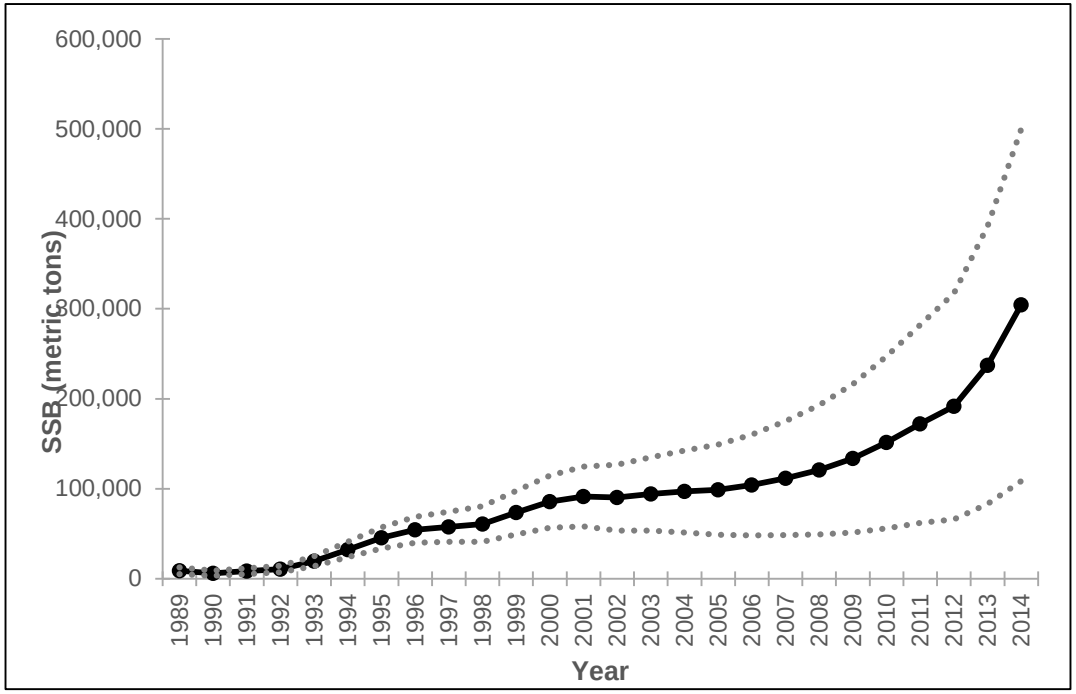
Predicted Recruitment



- Predicted recruitment was variable over the time series and demonstrated a decrease in the last few years
- Variance about the recruitment estimates increased with time.

Stock Synthesis: Results

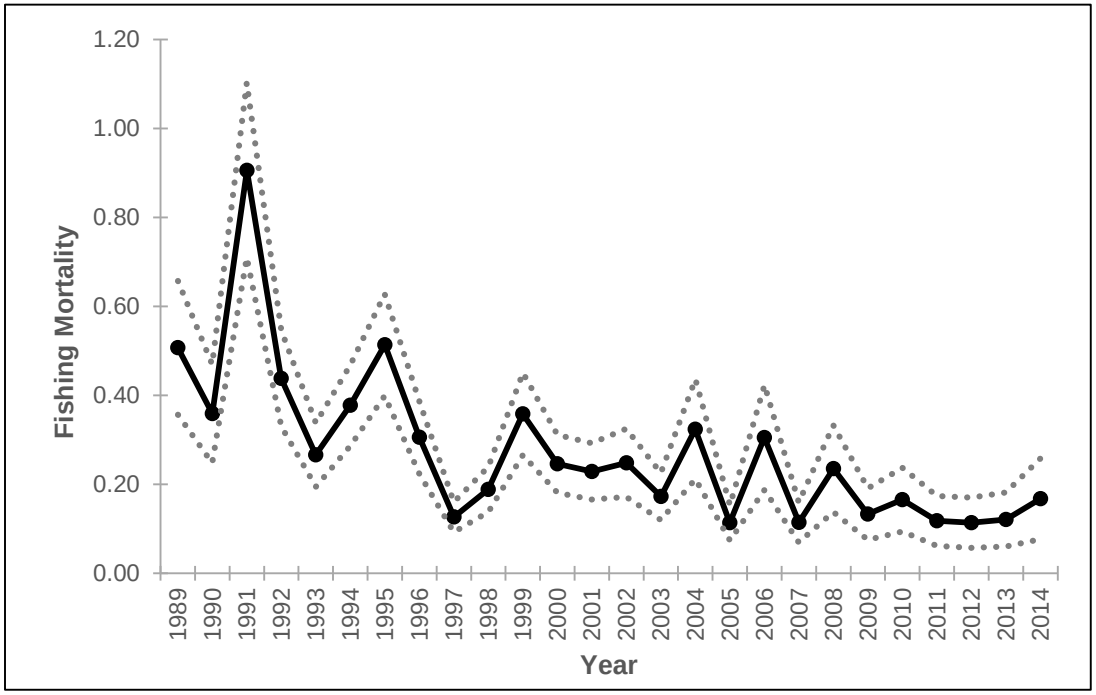
Predicted SSB



- Spawning stock biomass showed a steady increasing pattern over the assessment time period with increasing variability.
- Initial SSB levels were very low, at approximately 10% of unfished stock levels

Stock Synthesis: Results

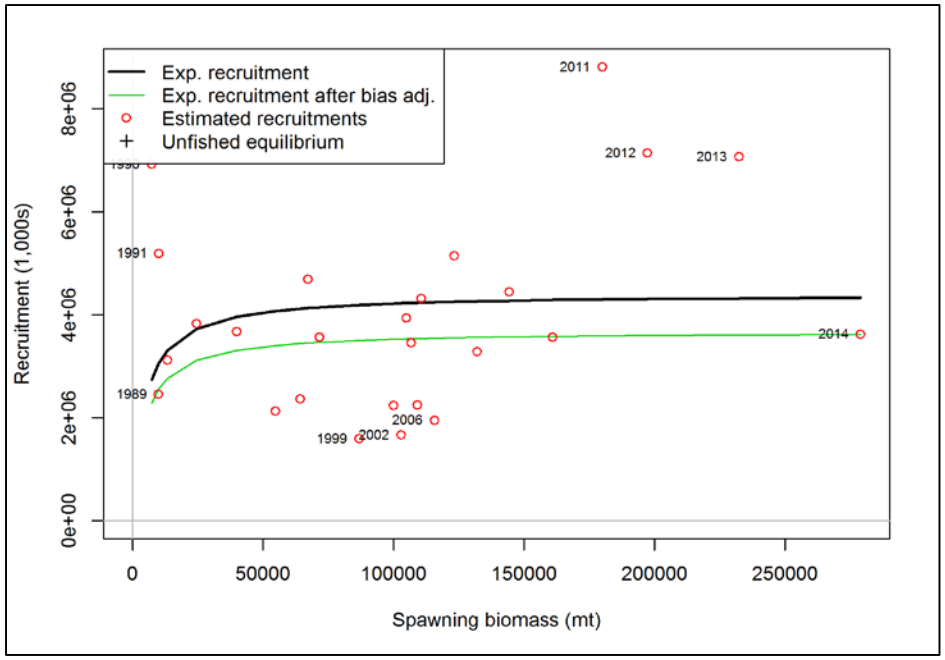
Predicted Fishing Mortality



- Predicted fishing mortality exhibited a peak in 1991 at 0.906 and showed an overall general decrease throughout the rest of the time series
- The smallest fishing mortality was observed in 2005 at a value of 0.113.

Stock Synthesis: Results

Predicted Stock-Recruit Relationship

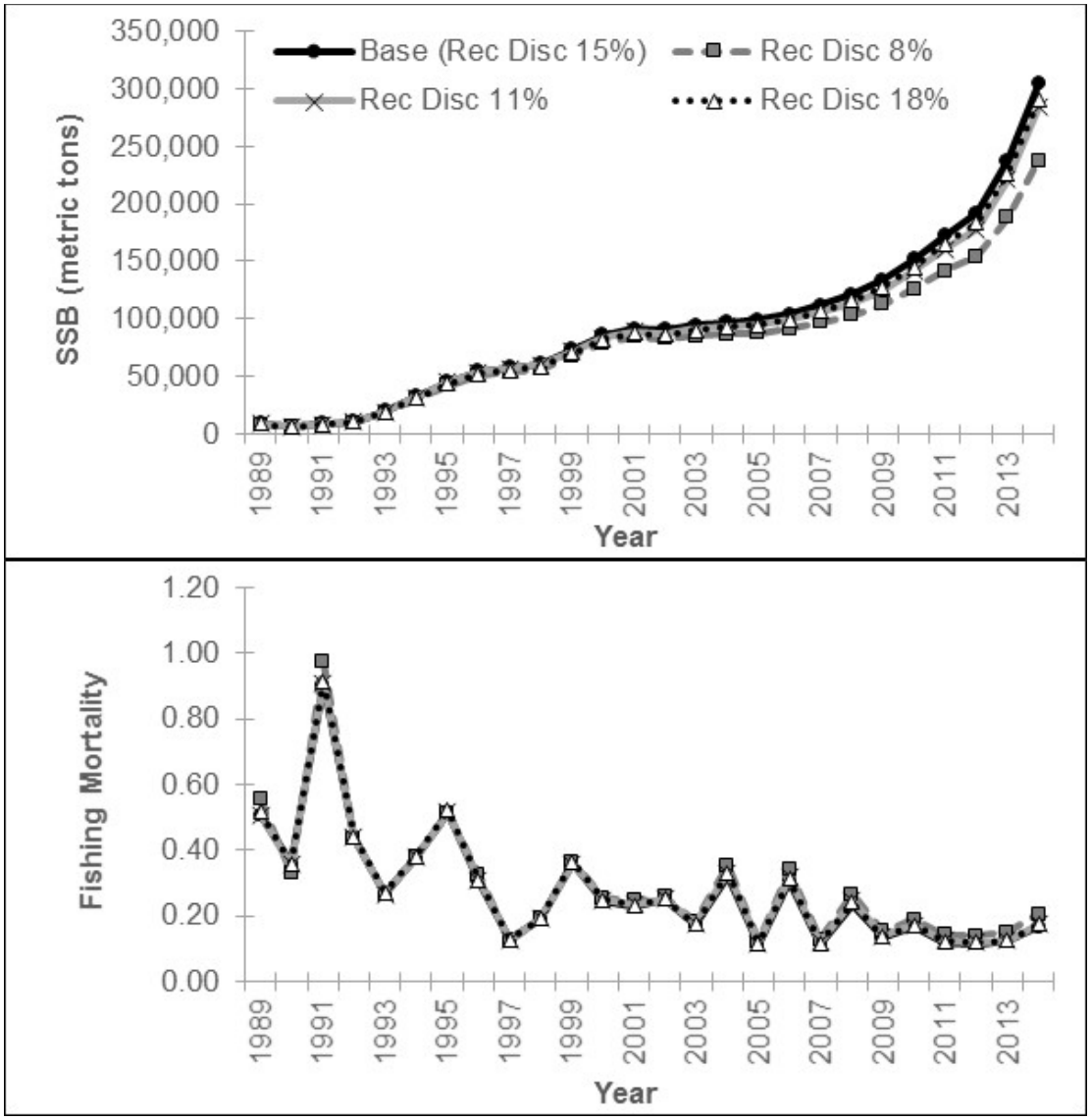


- The predicted stock-recruitment relationship suggests the relationship is not well estimated.
- This is further evidenced by the estimated value of 0.985 for the steepness parameter.

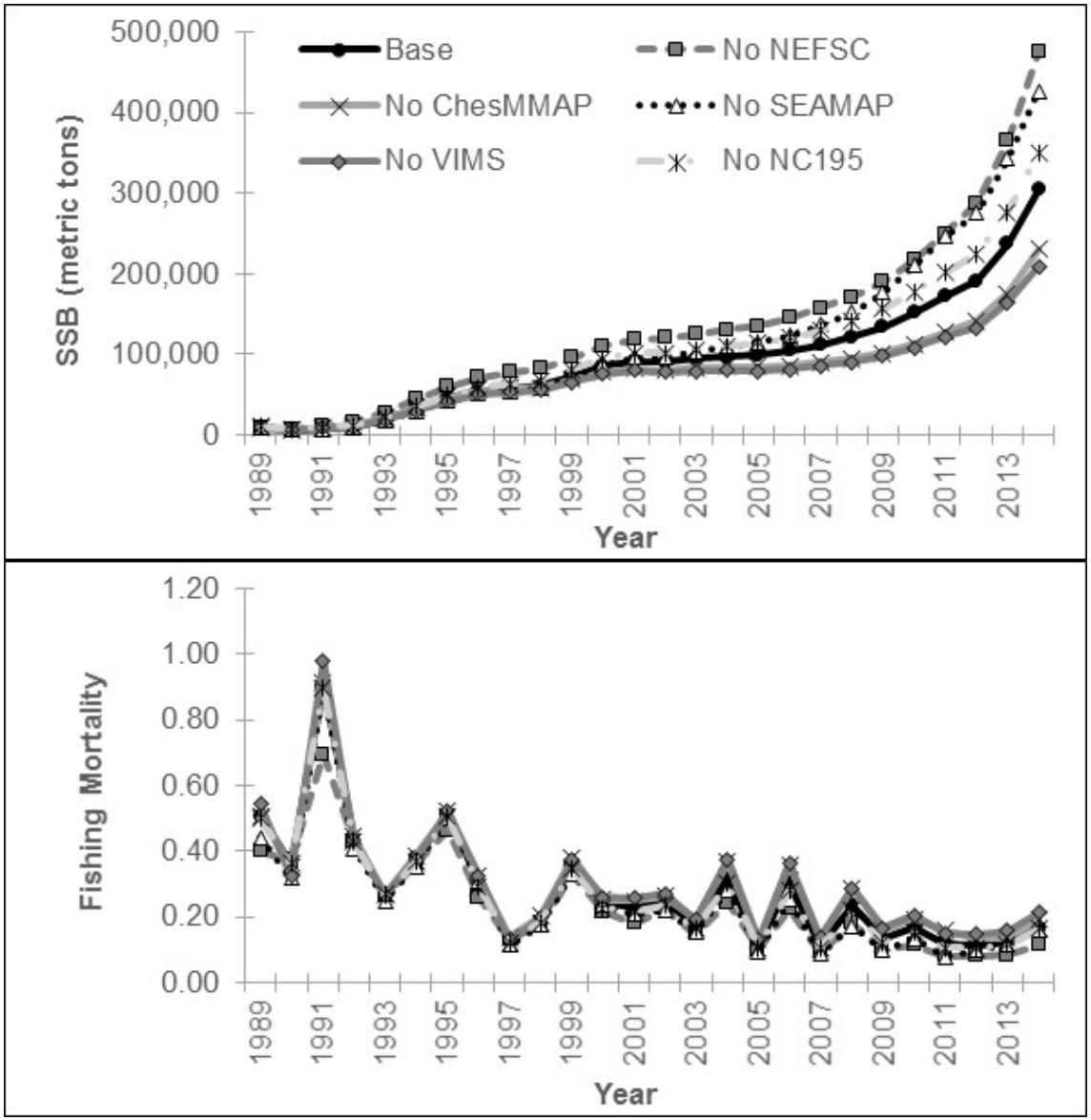
Sensitivity Analyses

- Recreational discard mortality
- Remove one survey at a time
- Steepness
- Shrimp trawl bycatch
- Retrospective analysis

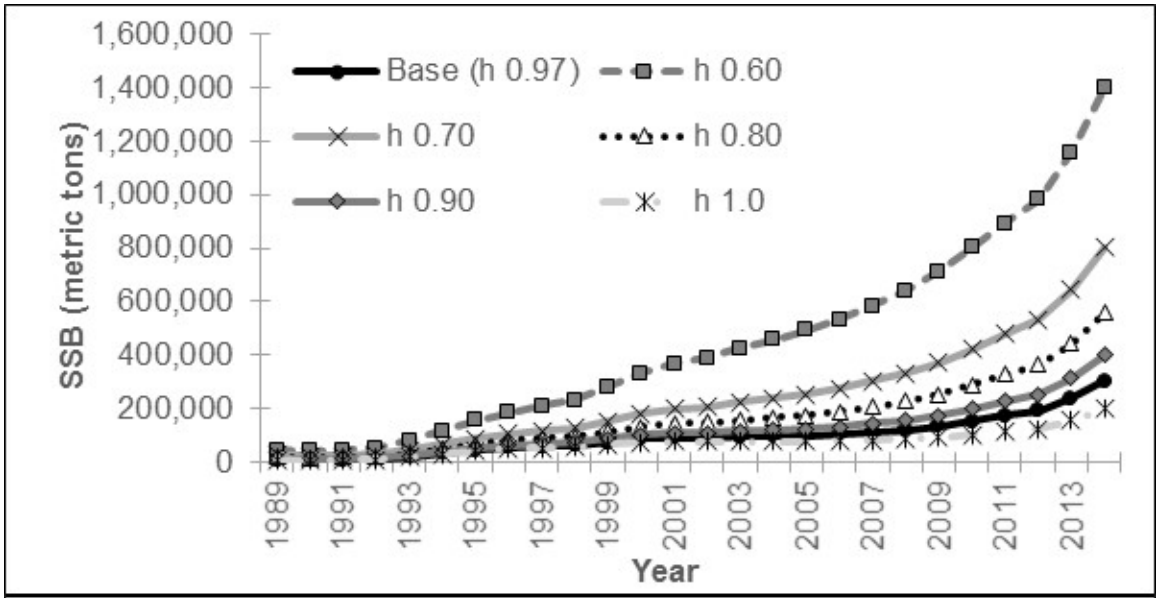
Recreational Discard Mortality

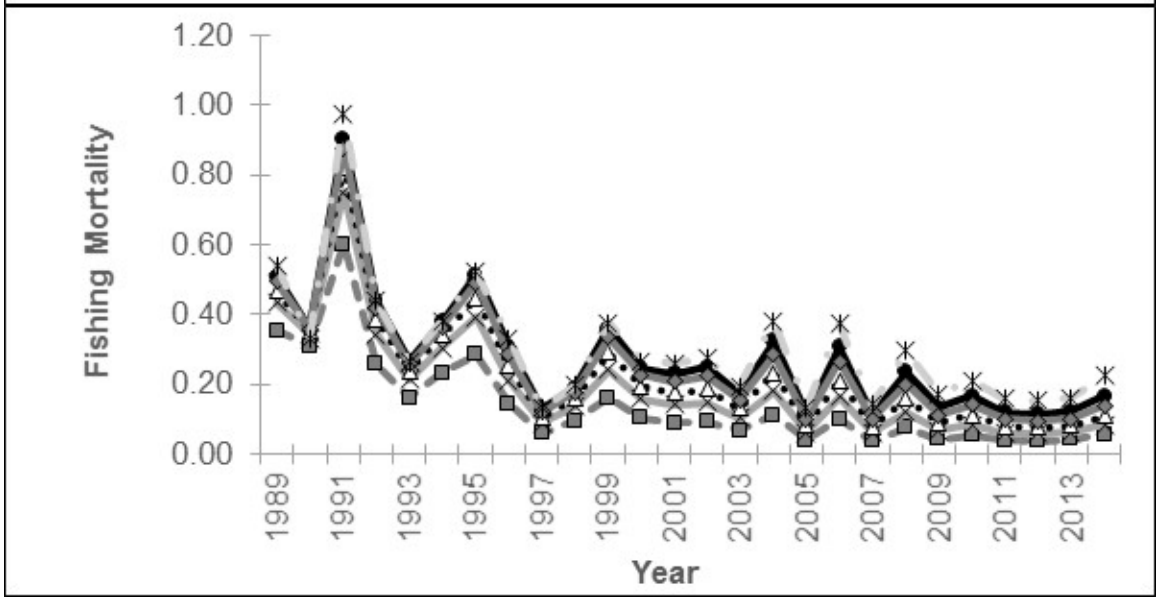


Remove Surveys Individually

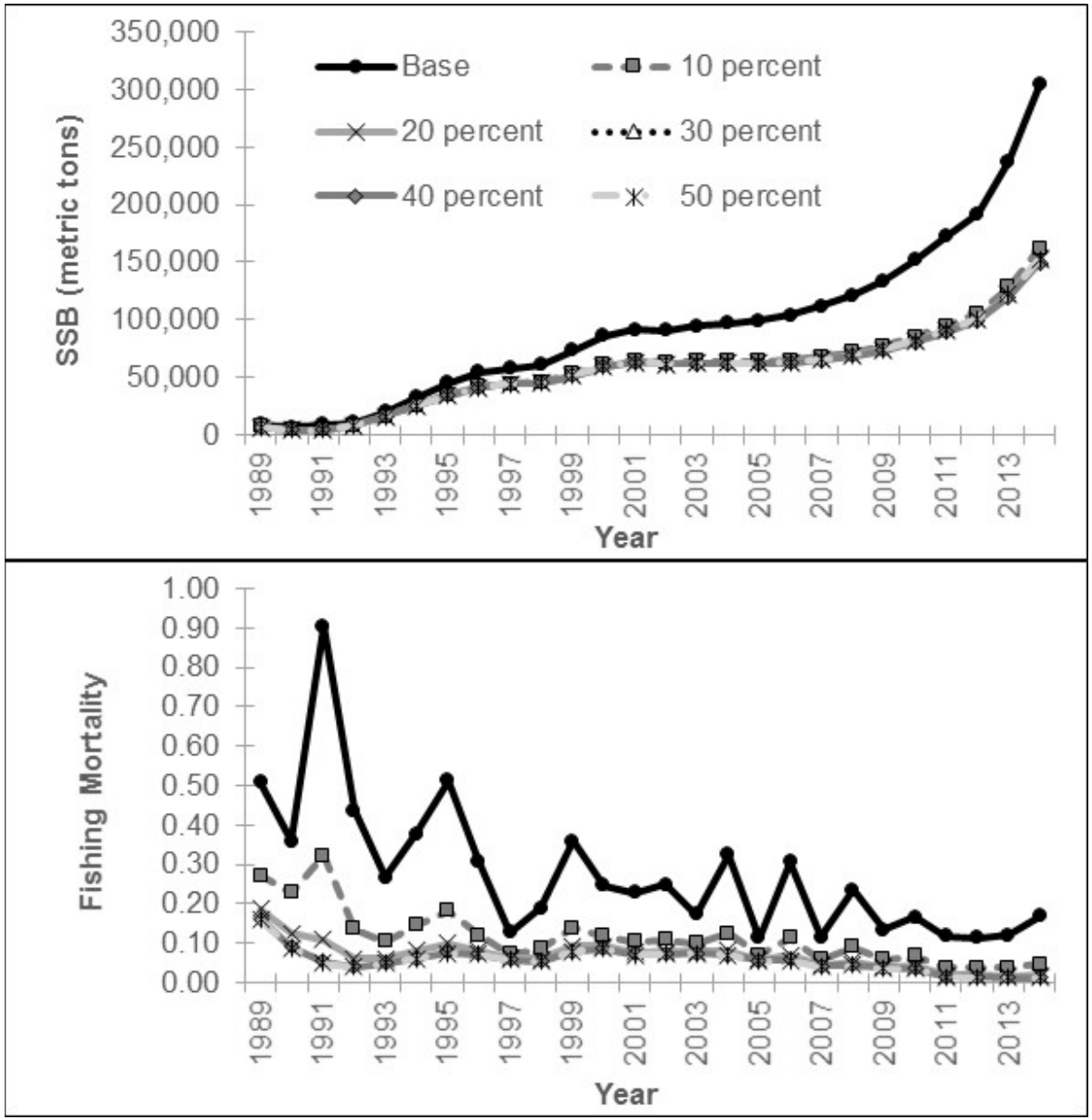


Steepness

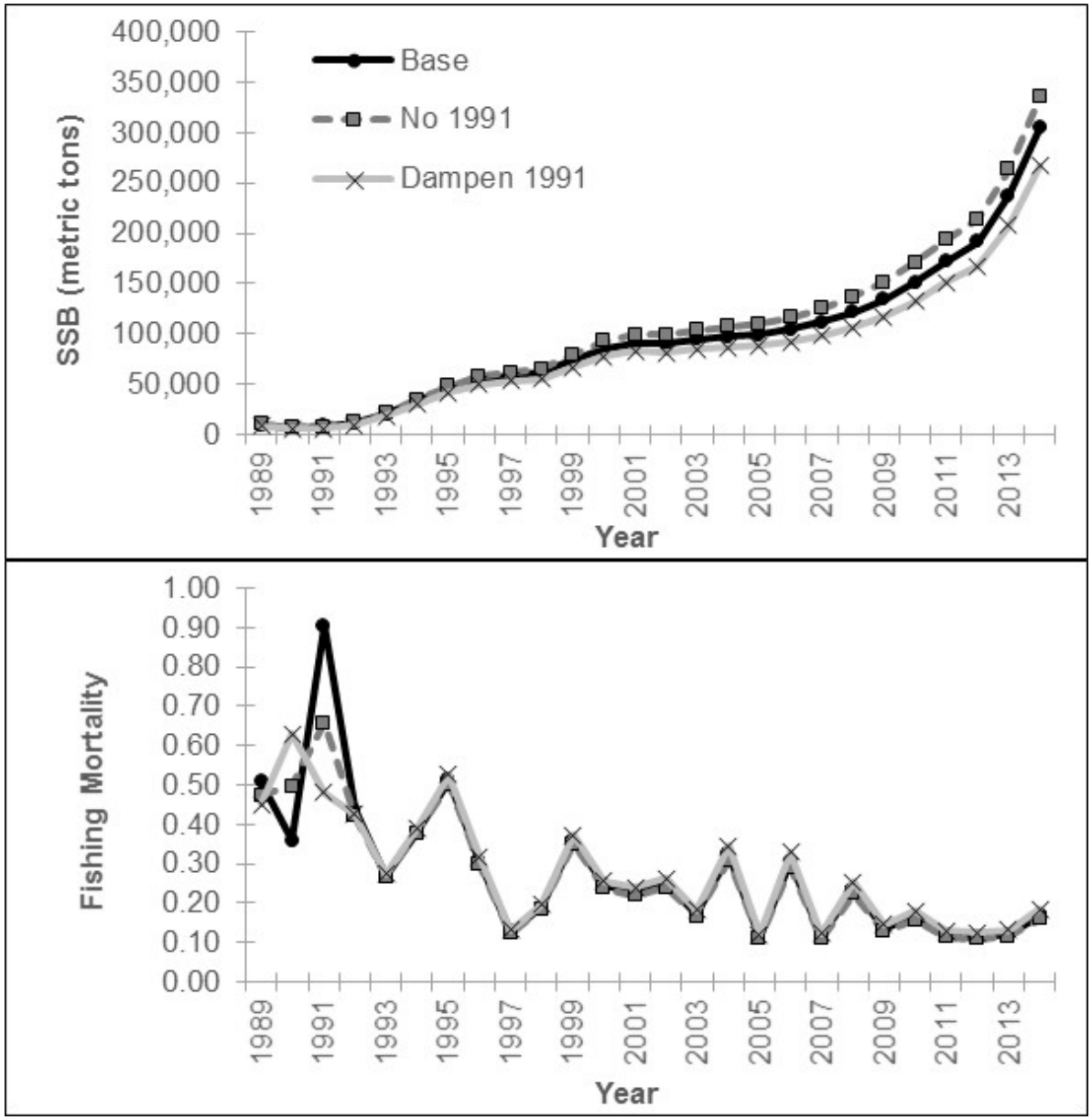

1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
SSB (metric tons)
Base (h 0.97)
h 0.60
h 0.70
h 0.80
h 0.90
h 1.0
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year


1.20
1.00
0.80
0.60
0.40
0.20
0.00
Fishing Mortality
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year

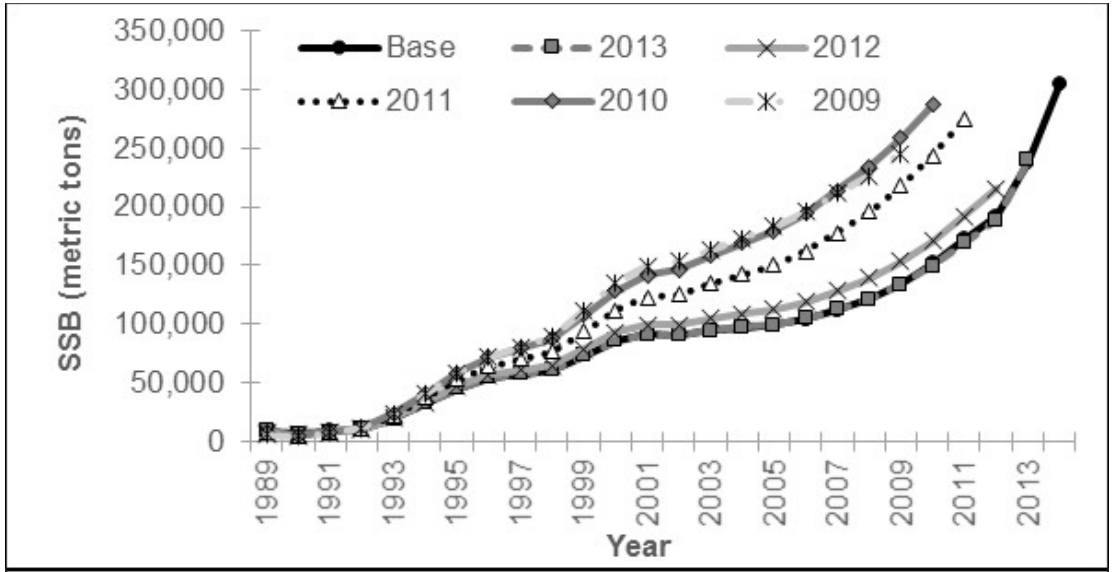
Shrimp Trawl Bycatch

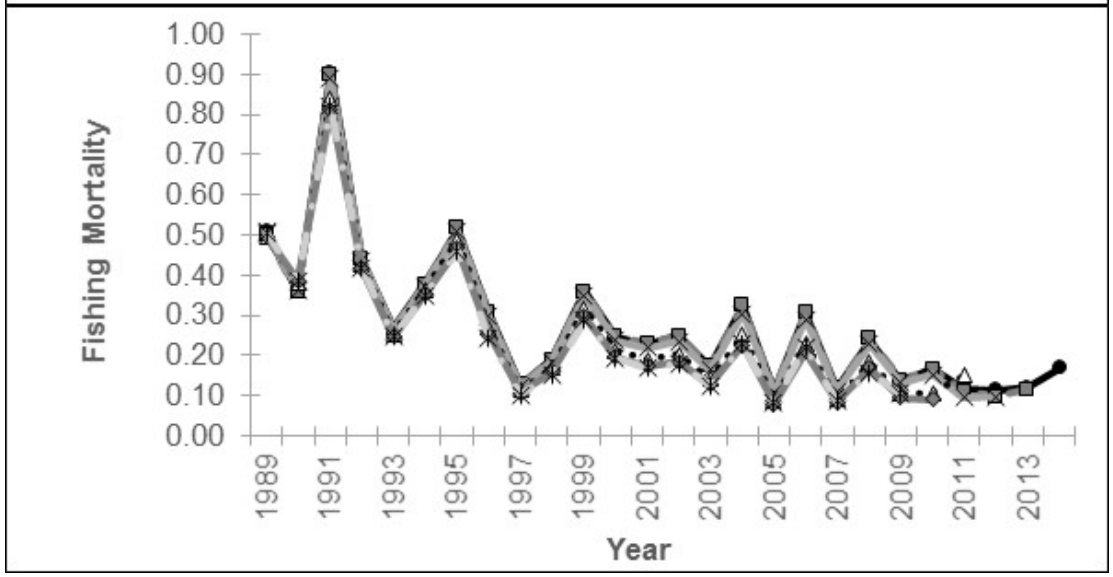


Shrimp Trawl Bycatch—1991 Value



Retrospective Analysis





Stock Status

Reference Points

- Defined in Addendum I to Amendment I of the FMP for Atlantic Croaker
  - $SSB_{Threshold} = 0.70 * SSB_{MSY}$
  - $SSB_{Target} = SSB_{MSY}$
  - $F_{Threshold} = F_{MSY}$
  - $F_{Target} = 0.75 * F_{MSY}$

Reference Point Values

- $SSB_{Threshold}$ = 55,607 metric tons
- SSB_{Target} = 79,438 metric tons
- $F_{Threshold}$ = 0.393
- F_{Target} = 0.295

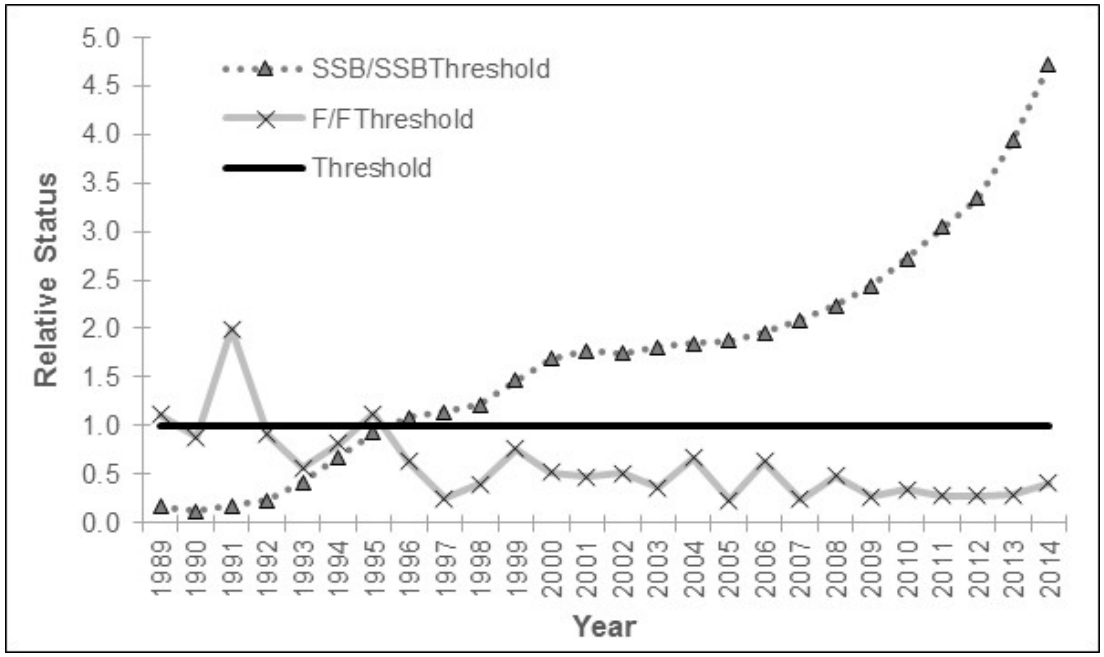
Stock Status

Overfishing/Overfished Definitions

- Stock status based on ratio of current *F* and SSB to their respective thresholds
- If $F_{Current} / F_{Threshold} > 1$ then overfishing occurring
- If $SSB_{Current} / SSB_{Threshold} < 1$ then stock overfished

Stock Status

Relative Status



- $SSB_{2014} / SSB_{Threshold} = 3.83$
- $F_{2014} / F_{Threshold} = 0.426$

Stock Status

- $SSB_{2014} / SSB_{Threshold} = 3.83$ ➔ not overfished
- $F_{2014} / F_{Threshold} = 0.426$ ➔ overfishing not occurring

Research Recommendations

Short term:

HIGH PRIORITY

- Increased observer coverage for commercial discards, particularly the shrimp trawl fishery. Develop a standardized, representative sampling protocol for collection of individual lengths and ages of discarded finfish.

- Describe the coast-wide distribution, behavior, and movement of croaker by age, length, and season, with emphasis on collecting larger, older fish.

MEDIUM PRIORITY

- Conduct studies of discard mortality for recreational and commercial fisheries by each gear type in regions where removals are highest.

- In the recreational fishery, develop sampling protocol for collecting lengths of discarded finfish and collect otolith age samples from retained fish.

- Encourage fishery-dependent biological sampling, with proportional landings representative of the distribution of the fisheries. Develop and communicate clear protocols on truly representative sampling.

Research Recommendations

Long term:

HIGH PRIORITY

- Continue state and multi-state fisheries-independent surveys throughout the species range and subsample for individual lengths and ages. Ensure NEFSC trawl survey continues to take lengths and ages. Examine potential factors affecting catchability in long-term fishery independent surveys.

- Quantify effects of BRDs and TEDs implementation in the shrimp trawl fishery by examining their relative catch reduction rates on Atlantic croaker.

- Continue to develop estimates of length-at-maturity and year-round reproductive dynamics throughout the species range. Assess whether temporal and/or density-dependent shifts in reproductive dynamics have occurred.

- Re-examine historical ichthyoplankton studies for an indication of the magnitude of estuarine and coastal spawning. Pursue specific estuarine data sets from the states (NJ, VA, NC, SC, DE, ME) and coastal data sets (MARMAP, EcoMon).

Research Recommendations

MEDIUM PRIORITY

- Investigate environmental covariates in stock assessment models, including climate cycles (e.g., Atlantic Multi-decadal Oscillation, AMO, and El Nino Southern Oscillation, El Nino) and recruitment and/or year class strength, spawning stock biomass, stock distribution, maturity schedules, and habitat degradation.

- Utilize NMFS Ecosystem Indicators bi-annual reports to consider folding indicators into the assessment; identify mechanisms for how environmental indicators affect the stock

- Encourage efforts to recover historical landings data, determine whether they are available at a finer scale for the earliest years than are currently reported.

- Collect data to develop gear-specific fishing effort estimates and investigate methods to develop historical estimates of effort.

- Investigate the relationship between estuarine nursery areas and their proportional contribution to adult biomass. I.e., are select nursery areas along Atlantic coast ultimately contributing more to SSB than others, reflecting better quality juvenile habitat?

Research Recommendations

MEDIUM PRIORITY Continued

- Develop gear selectivity studies for commercial fisheries with emphasis on age 1+ fish.

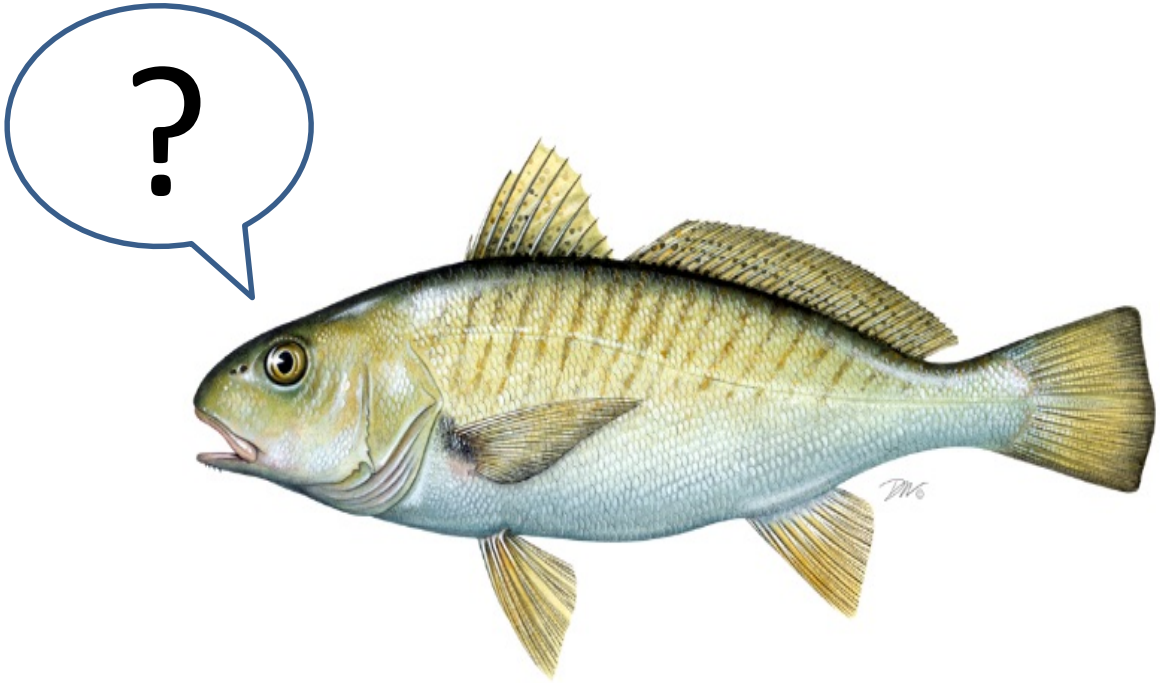
- Conduct studies to measure female reproductive output at size and age (fecundity, egg and larval quality) and impact on assessment models and biomass reference points

- Develop and implement sampling programs for state-specific commercial scrap and bait fisheries in order to monitor the relative importance of Atlantic croaker. Incorporate biological data collection into program.

The Next Assessment

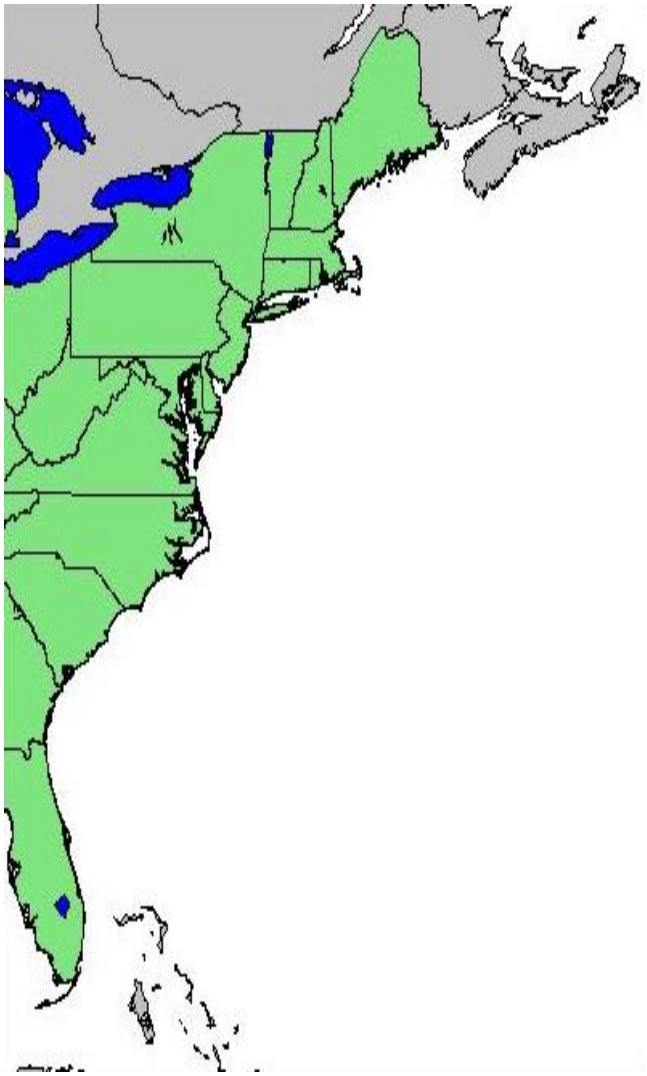
- The SAS and TC recommend that the next assessment be completed five years from the completion of this assessment (i.e., **2022**).
    - Though the completion of the spot and Atlantic croaker assessments together was useful for the first assessment of spot, the SAS and TC recommend a staggered schedule for future spot and Atlantic croaker assessments due to the overlap in personnel.

Questions?



Management Unit

A single management unit in United States Waters of the NW Atlantic Ocean, from estuaries to 3 nm inshore boundary of the Exclusive Economic Zone (EEZ)



Based on:

- tagging studies
- genetic studies
- historic harvest patterns

Discard Mortality

- Recreational discard mortality
  - A review of recreational angler discard mortality studies found a median discard mortality of 11% and a mean of 18% across studies (Bartholomew and Bohnsack 2005). The SAS believes a value approximately in the middle of the range between the median and mean (15%) is an appropriate approximation of the discard mortality rate for Atlantic croaker in recreational fisheries.
  - Sensitivity runs in the SS3 model were run for recreational discard mortalities ranging from 8-18%.

- Commercial discard and By-catch mortality
  - 100% for commercial by-catch and scrap fishery removals

Migration Patterns

- General pattern of inshore/offshore migration associated with maturity and spawning.
- Offshore migration (adults) August-December, depending on area of coast.
- Inshore migration (adults) March-May
- YOY inshore migration/recruitment occurs from fall to spring (depending on coastal area), to estuarine nursery grounds.
- Larvae and juveniles tend to settle near the freshwater/saltwater interface and move down estuary towards higher salinity habitat as they grow larger.

South Atlantic Shrimp Trawl Discards – Data Sets

- Southeast Shrimp Trawl Observer Program (SESTOP)
  - Federal observer program; voluntary from 2001-2007, combined mandatory and voluntary observers since 2008
- North Carolina Shrimp Trawl Observer Study
  - Mandatory observer program operating in NC state waters since 2007
  - Unreliable count data
- South Atlantic Shrimp System
  - Cooperative state and federal commercial shrimp monthly catch and effort data collection since 1982
  - Number of trips
- State Trip Tickets
  - State commercial fishing trip catch and effort data collection
  - 1986 (FL), 1994 (NC), 2001 (GA), 2004 (SC)
  - Number of trips, nets, hours fished

South Atlantic Shrimp Trawl Effort

- Net hours = # trips * avg hrs fished/trip * avg # nets/trip

- Effort allocated into depth zones and fisheries (penaeid or rock) based on proportion of observed tows in each
  - Assuming observed tows are representative of all tows and fishing at depth and proportional effort between fisheries is static

South Atlantic Shrimp Trawl Discards

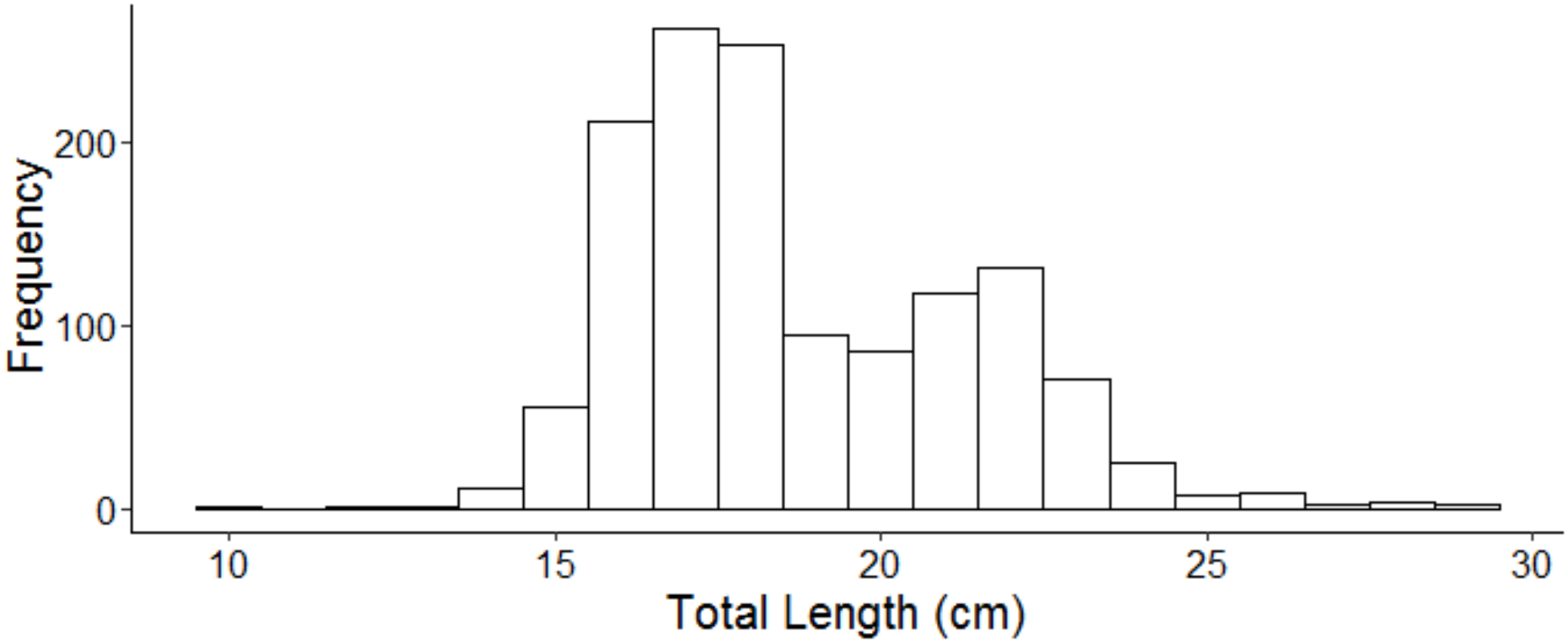
- Delta-GLM method (Lo et al. 1992)
  - Discarding rate is the product of probability of being a positive Atlantic croaker discard observation as estimated with binomial GLM and discard rate of positive observation as estimated with lognormal GLM
  - Negative binomial GLM with number of fish discarded as response variable did not converge

- Model factors
  - Depth zone (0-10 meters, 10-30 meters, 30+ meters)
  - State (NC, SC, GA, FL)
  - Season (peak season April through November, offseason December through March)
  - Data set (observer penaeid, observer rock shrimp, and SEAMAP)

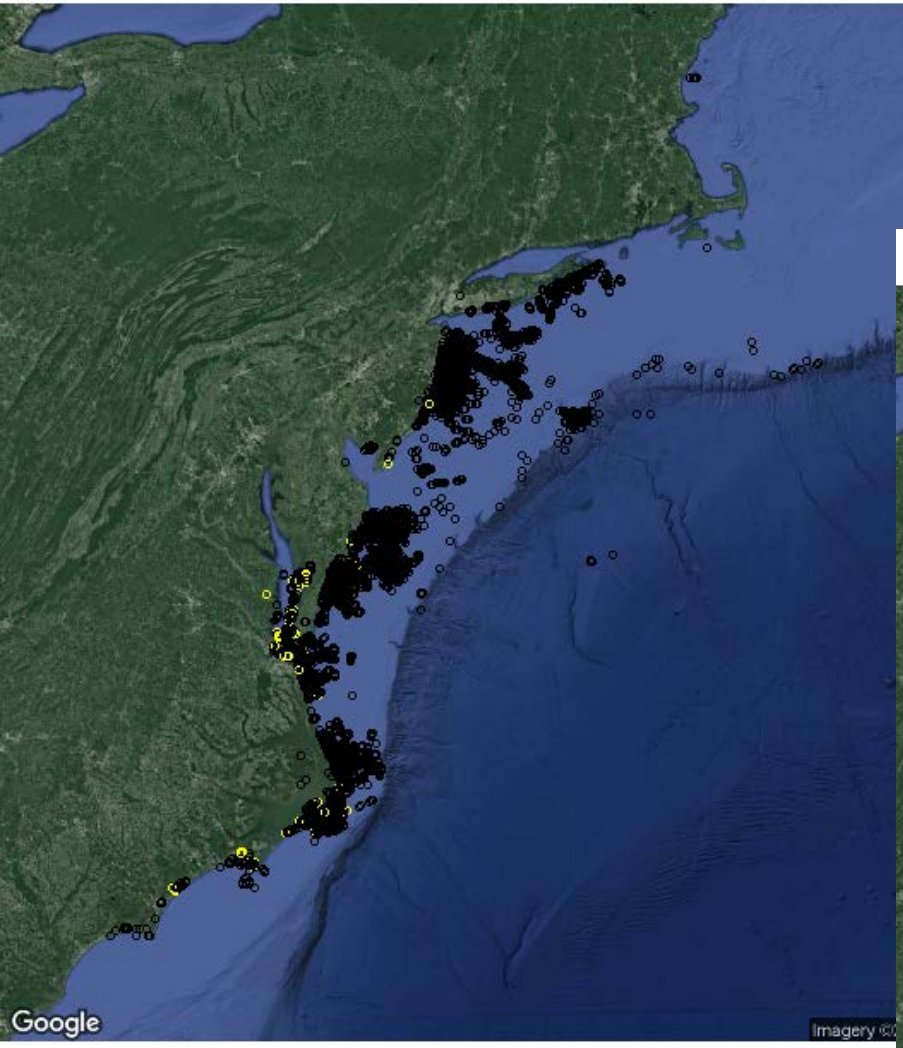
BRD Requirements

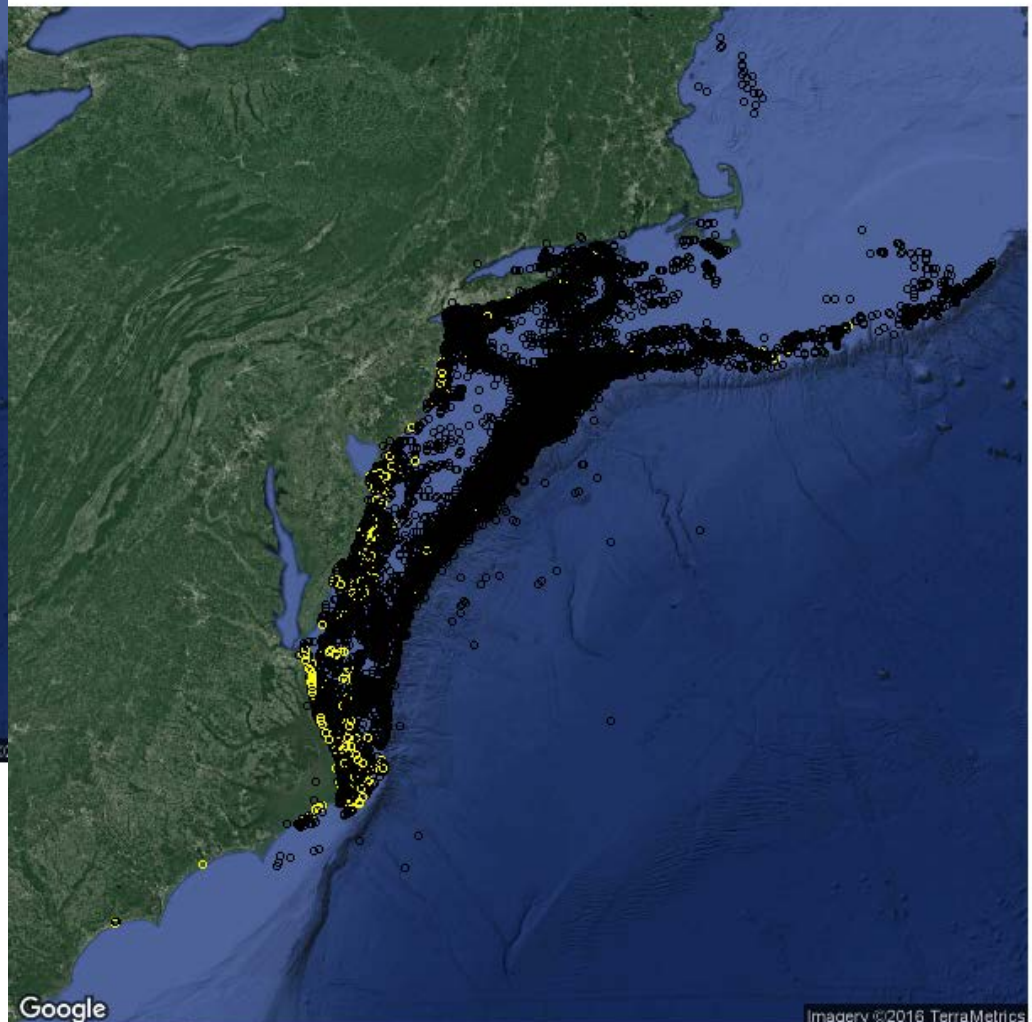
- State Regulations
  - Required in NC in 1994 and SC, GA, and FL in 1996
- Amendment 2 to SA Shrimp FMP (1996)
  - Required the use of certified BRDs for all penaeid shrimp trawls in the South Atlantic EEZ
- Amendment 6 to SA Shrimp FMP (2005)
  - Required BRDs for rock shrimp fishery
- Observer data primarily collected after the requirement of BRDs
- A weighted average adjustment of 0.23 (i.e., adjusted discard = discard*1/(1-adjustment)) was used to adjust by-catch estimates in years where BRD's were required.

SESTOP Atlantic Croaker Length Data



NEFOP Observations





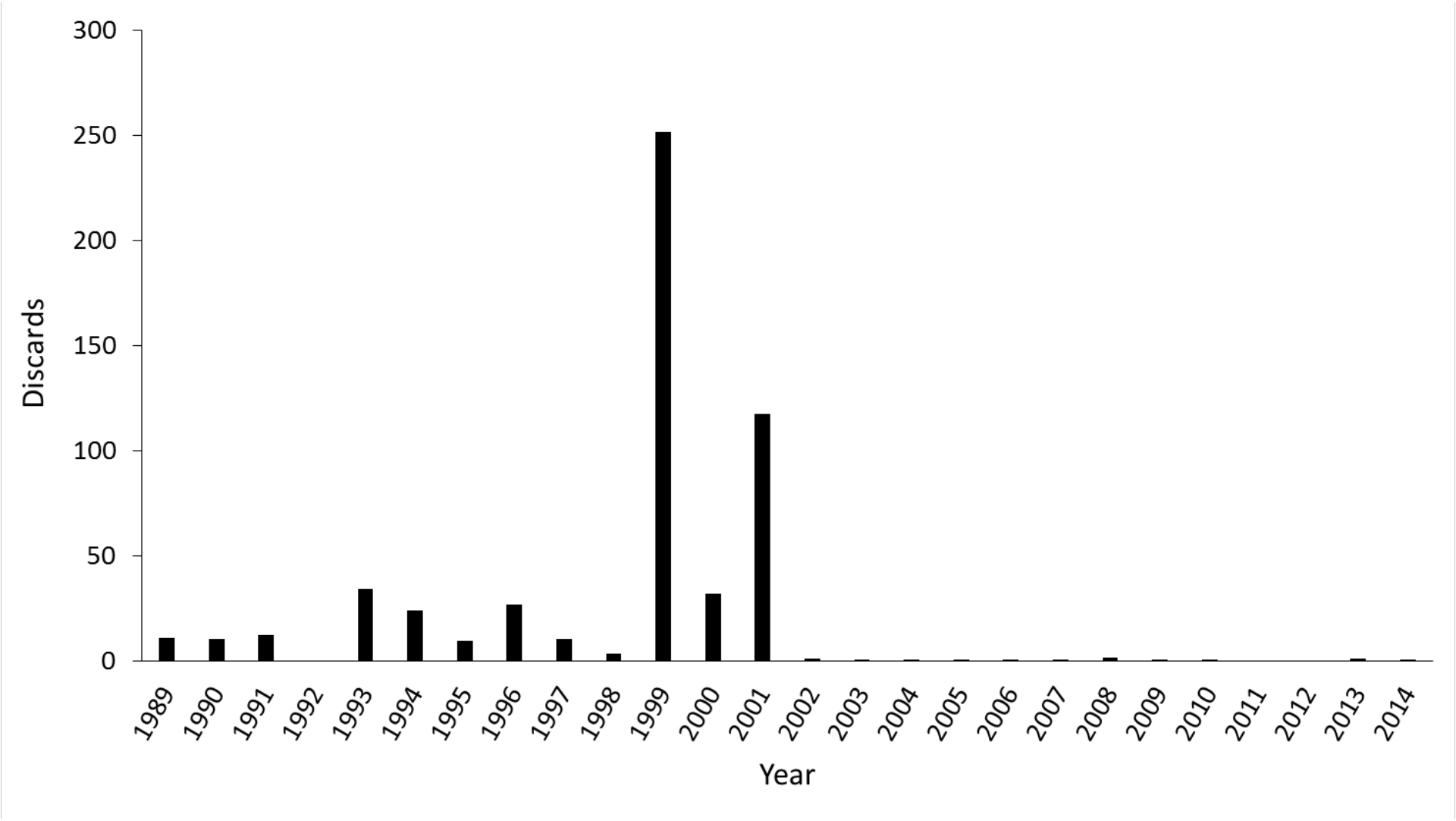
Mid-Atlantic Discard Estimates

$$R = \frac{\overline{D}}{\overline{L}} = \frac{\sum_1^n D_i}{\sum_1^n L_i}$$

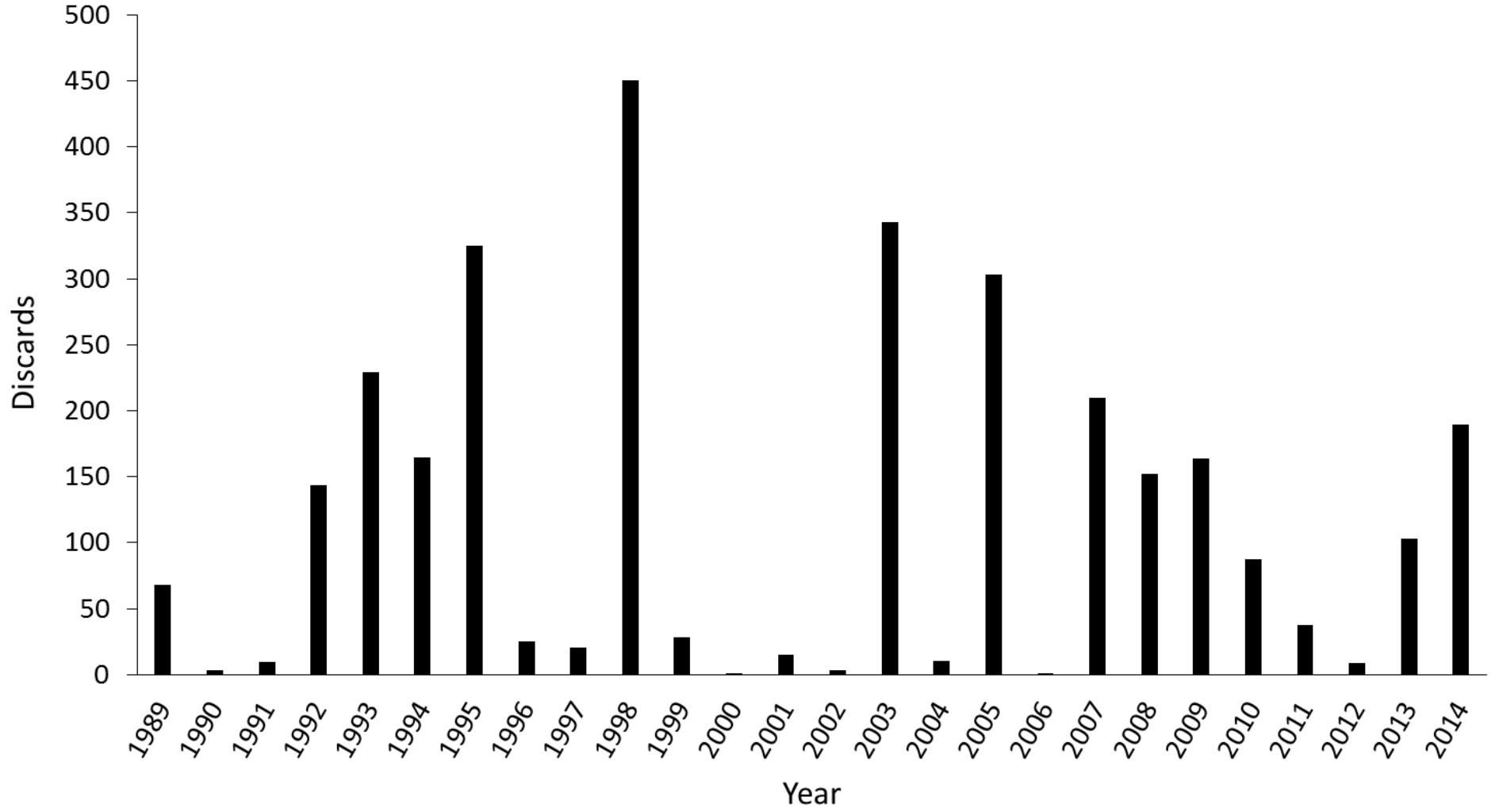
$$Var(R) = \frac{1}{n(n-1)\overline{L}^2}\left(\sum_1^n D_i^2 + R^2 \sum_1^n L_i^2 - 2R \sum_1^n D_i L_i\right)$$

- where D is observed discards of target species, L is observed landings of all species combined, and n is number of observations
- Assumption: Observer data are representative of all vessels landing from NY-NC and vessels fishing in NOAA stat areas off NY- NC land from NY-NC
- Mean weights of subsampled fish applied to discard estimates in weight to estimate number discarded
- 100% discard mortality assumed

Mid-Atlantic Gillnet Discards (mt)



Mid-Atlantic Trawl Discards (mt)



NMFS Trawl Survey

- Fall component conducted consistently since 1972
  - Change in boats in 2009, conversion factors used from side-by-side tows
- Samples from Cape Cod to Cape Hatteras
- Stratified random statistical design
- Encounters croaker
  - Limited to fall months
  - 70% positive tows
- Developed an index of relative biomass (kg/tow)

SEAMAP Trawl Survey

- Survey began in 1986, samples in the spring, summer, and fall
- Stratified random design
- Sampling from the coastal zone of the South Atlantic Bight (SAB) between Cape Hatteras, NC, and Cape Canaveral, FL
- Encounters croaker year round
  - 54% positive tows, 61% for fall months
- An index of relative biomass (kg/tow) was calculated using data from the fall component (September-November)
- 1989 excluded due to low n (also for 2010 assessment)

NCDMF Trawl

- Pamlico Sound Survey Program 195 or P195
- Began in 1987, samples in June and September
- Operates in waters of the Pamlico Sound and associated rivers and bays
- Random stratified sampling
- Encounters age-0 and age-1
- An index of relative YOY abundance (#/tow) was developed using the June observations of Atlantic croaker less than 14 cm TL

VIMS Juvenile Trawl Survey

- Implemented in 1955 (standardized in 1979)
- Samples monthly
- Occurs in the Chesapeake Bay and its tributaries
- Employs a mixed design, incorporating both stratified random sites and fixed (historical mid-channel) sites
- Encounters croaker
  - spring months (April-June), 29% positive tows
  - VIMS uses a length cutoff by month to differentiate YOY from age-1+
- Data from the spring months (April–June) used to develop an index of relative abundance (#/tow)

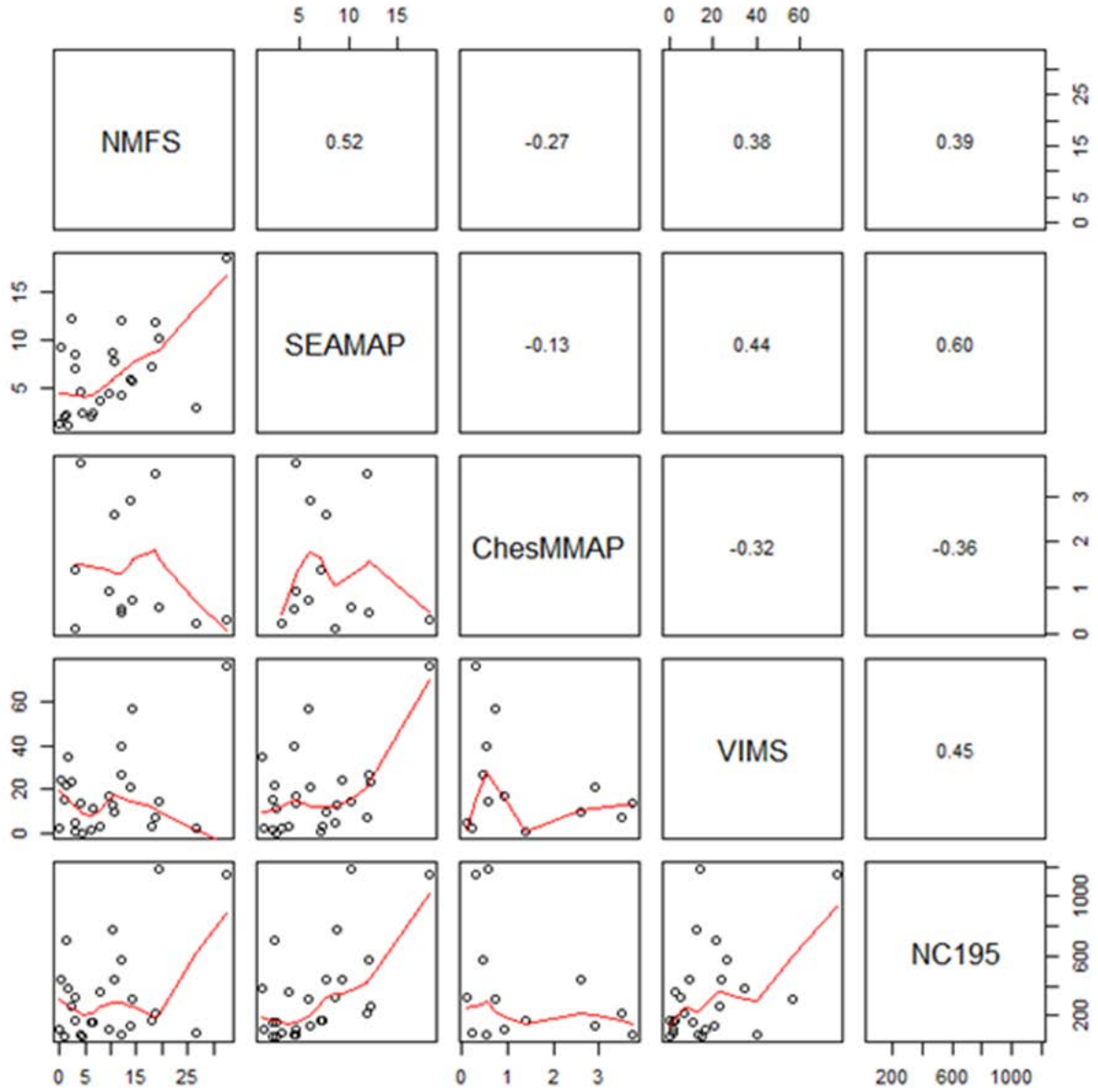
ChesMMAP Trawl Survey

- Samples the mainstem of the Chesapeake Bay
- In operation since 2002
- Random stratified sampling
- Cruises in March, May, July, September, and November
- Subset to May-September cruises, regions 4 & 5
  - 45% positive tows
  - Catches ages 0-13, predominantly 0-5 years old
- An index of relative biomass (kg/tow) was calculated using data from the May-September component of the ChesMMAP survey using only Regions 4 and 5

NEAMAP Trawl Survey

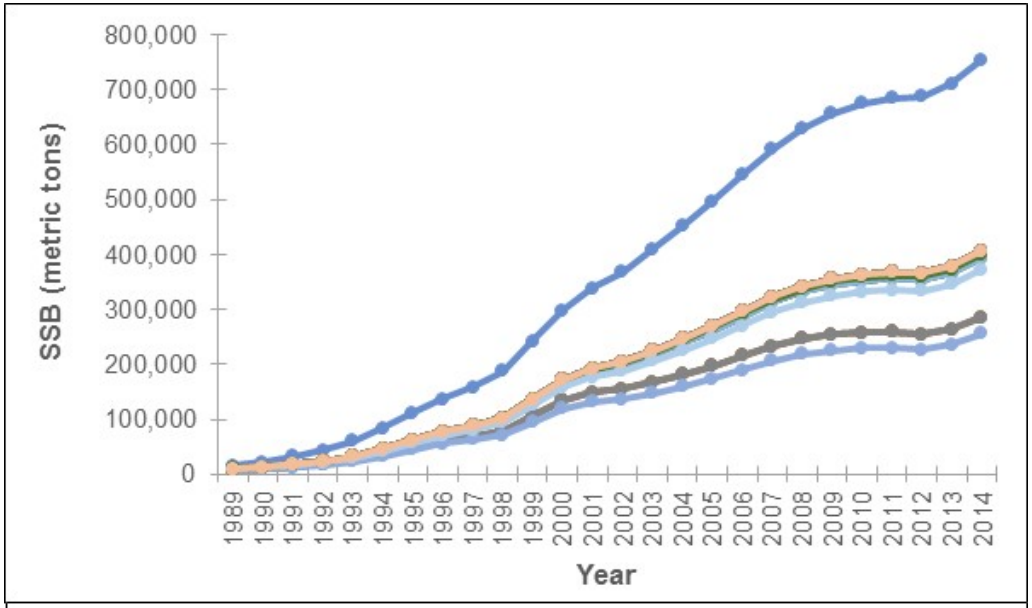
- Samples the coastal ocean from Martha's Vineyard, MA to Cape Hatteras, NC
- Random stratified design, by region and depth
- In operation since the fall of 2007
  - Samples in the spring (April-May) and fall (September-November)
- An index of relative biomass (kg/tow) was calculated using data from the fall component
- Time series too short, but SAS recommends it be considered for future assessments

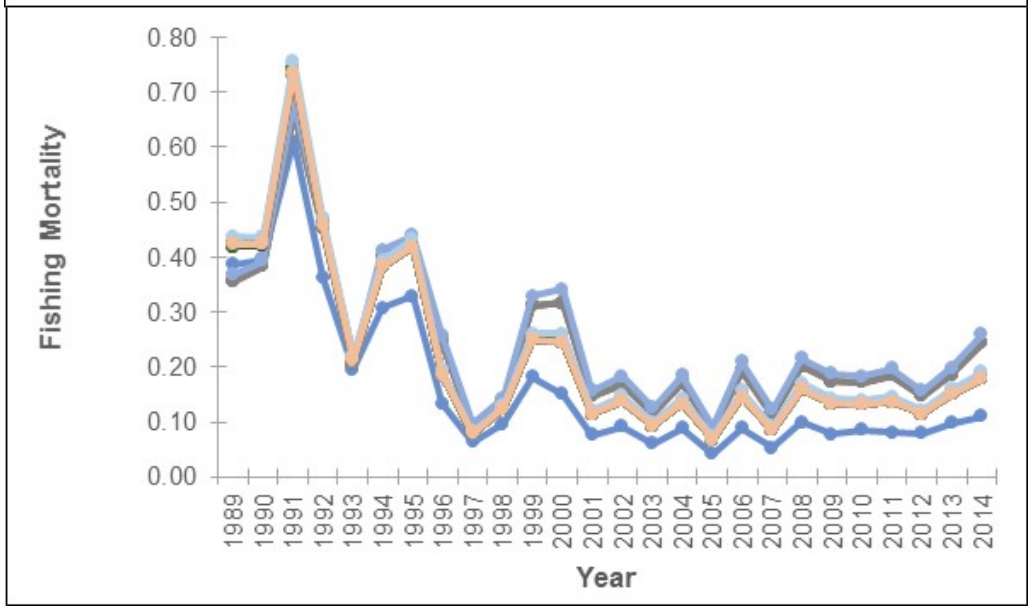
Correlation coefficients & plots



- Indices positively correlated except for with ChesMMAP

Jitter Analysis





Atlantic Croaker Stock Assessment Peer Review Report

South Atlantic State-Federal

Fisheries Management Board

May 11, 2017

ASMFC Stock Assessment Peer Review Process

Croaker Stock Assessment Subcommittee and TC

- Developed new coast wide assessment

Scientific Peer Review Panel

- Chair + 2 additional Technical Reviewers, with combined expertise in population dynamics, stock assessment modeling, statistics, and croaker biology
- Scientific review focusing on data inputs, model results and sensitivity, overall assessment quality

Products

- Stock Assessment Report
- Review Panel Report

ASMFC Stock Assessment Peer Review Process

Croaker Stock Assessment Review Workshop

Raleigh, North Carolina

April 18-21, 2017

Review Panel:

Dr. Ken Able (Chair), Rutgers University,
Institute for Marine & Coastal Sciences

Dr. Shannon Cass-Calay, NMFS Southeast Fisheries Science Center, Population Dynamics Branch

Dr. Michael Wilberg, University of Maryland, Center for Environmental Science

Peer Review Overall Findings

- Stock assessment provides best available science
- Stock status determinations uncertain
  - Biomass increasing in most model runs
  - Assessment shows increasing biomass estimates, while population age and length structures static
  - Stock status determinations sensitive to modeling assumptions, notably commercial fishery and NEFSC trawl survey gear selectivity options
- Panel does not recommend using absolute estimates of population size…however, **trends in landings and surveys suggest current removals are sustainable**

Review Terms of Reference

ToR 1: *Evaluate the collection, presentation, and treatment of fishery-dependent and fishery-independent data in the assessment*

Panel Conclusions

- All major sources of fishery removals accounted for
- Abundance index selection criteria adequate and correctly applied, provided subset of 5 from 35 indices
- Data source variances and uncertainties well described
- Data weighting procedure meets assessment standards
- ***Panel noted model stability highly sensitive to data source weighting***

Review Terms of Reference

ToR 1: *Evaluate the collection, presentation, and treatment of fishery-dependent and fishery-independent data in the assessment*

Panel Recommendations

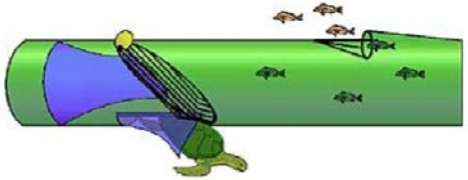
- ***Recommendation 1:*** *estimate pre-1989 removals to evaluate sensitivity of initial estimates of depletion*
- ***Recommendation 2:*** *develop fishery-dependent CPUE indices → enhances understanding of fishery trends*
- ***Recommendation 3:*** *consider standardizing survey indices (for base or sensitivity runs)*
- ***Recommendation 4:*** *develop criteria to better evaluate reliability of each data source for model data weighting*

Review Terms of Reference

ToR 2*:* Evaluate methods used to develop discard and bycatch estimates

Panel Conclusions:

- Southern shrimp trawl fishery bycatch estimation methods innovative and similar to SEDAR assessments' methods, **major improvement from last croaker assessment**
- Mid-Atlantic gillnet and trawl fishery discard estimation acceptable and relatively small portion of total removals



Review Terms of Reference

ToR 3: *Evaluate the methods and models used to estimate population parameters and biological reference points.*

<u>Panel Conclusions:</u>

- Stock Synthesis catch-at-age base model configuration and parameterization reasonable
- Alternative configurations requested by Review Panel resulted in different stock status results

Review Terms of Reference

ToR 3: *Evaluate the methods and models used to estimate population parameters and biological reference points.*

Panel Recommendations:

- Panel questioned 1989 model start year – promoted model stability, reduced confidence in initial depletion starting point ***(see Recommendation 1)***
- Some selectivity and retention parameters poorly estimated
- ***Recommendation 5:*** *use asymptotic fleet/survey selectivity, fix retention parameters, discard estimation 'super year' method, phased approach to problem parameters*

Review Terms of Reference

ToR 4: *Evaluate the sensitivity and retrospective analyses performed to determine model stability and consequences of model assumptions*

Panel Conclusions:

- Range of sensitivity analyses was reasonable
- Model insensitive to rec discard mortality and index selection
- ***Recommendation 6:*** *additional sensitivity analyses for commercial fleet selectivity and effective sample sizes*
- Retrospective analyses conducted appropriately, revealed modest pattern of overestimating biomass and minimal pattern in F

Review Terms of Reference

ToR 5: *Evaluate the methods used to characterize uncertainty in the stock assessment*

Panel Conclusions:

- Asymptotic standard errors used to characterize uncertainty in model estimates
- ***Recommendation 7:*** *Try likelihood profiles for better understanding parameter uncertainties*

  Example - steepness of Stock-Recruitment relationship

Review Terms of Reference

ToR 6: *Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management*

- Panel does not recommend using assessment estimates of absolute biomass, abundance, and exploitation due to model sensitivity to key assumptions (e.g., commercial fishery selectivity)

<u>Assessment and Review Panel Take Homes:</u>

1) abundance indices increasing across most of stock range

2) Catch stable or declining over time

3) Catch and indices patterns together indicate declining fishing mortality rates → relative status of the stock in recent years better than late 1980s-early 1990s.

4) Shrimp fishery effort and croaker bycatch magnitude declining; review shrimp bycatch estimates annually given their substantial contribution to overall removals and mortality

Review Terms of Reference

ToR 7: *Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment*

Panel Conclusions:

- Review Panel does not recommend specific values for reference points due to uncertainty in scale of biomass and fishing mortality
- Stock status cannot be determined reliably; models with alternative plausible selectivity assumptions resulted in different estimates of stock status
- ***Recommendation 8:*** *use Spawning Potential Ratio reference points, MSY reference points not well estimated*

Review Terms of Reference

ToR 8: *Review and prioritize the research, data collection, and assessment methodology recommendations; make additional recommendations to improve future assessments*

Top Priority Research Recommendations

- Increase shrimp trawl fishery observer coverage; increase collection of discarded croaker lengths and ages
- Continue state and multi-state fisheries-independent surveys and subsample for individual lengths and ages; examine factors affecting catchability in surveys

ToR 9: *Recommend timing of the next benchmark assessment*

- Next benchmark in 5 years; consider adding shrimp bycatch estimation to annual Traffic Light Analyses