2013 Stock Assessment of Atlantic Striped Bass

Gary Nelson

Stock Assessment Subcommittee Chair

Alexei Sharov

Technical Committee Chair

Data Changes for Benchmark

- MRFSS recreational data (harvest and dead releases)
  - 2004-2012 re-estimated by MRIP
  - corrected some historical estimates
  - Used 0.09 release mortality (Diodati and Richards, 1996)

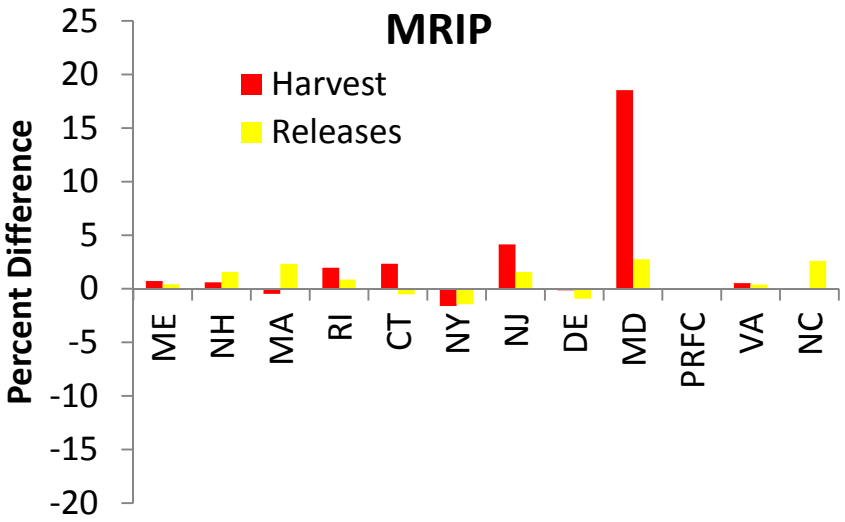
- Commercial landings data from state reports

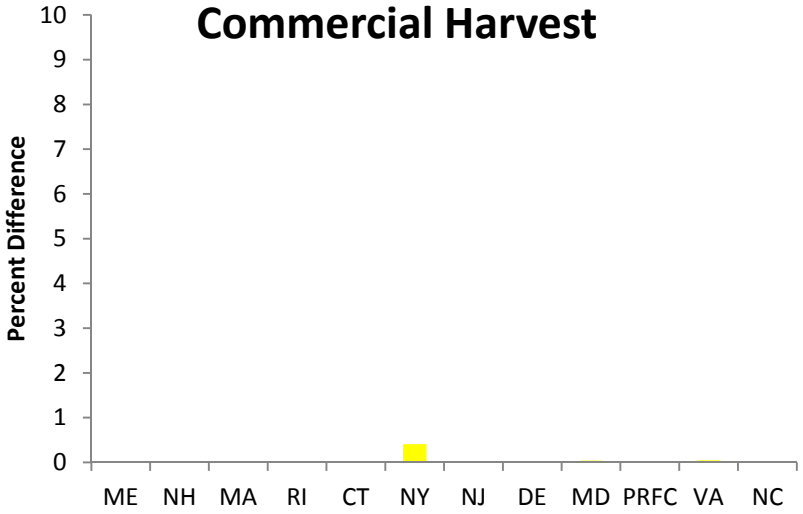
- Commercial discards calculated from tag recoveries and MRIP releases
  - Re-estimated 2004-2012 with new MRIP estimates of harvest and releases
  - Used 0.09 release mortality for hook & line

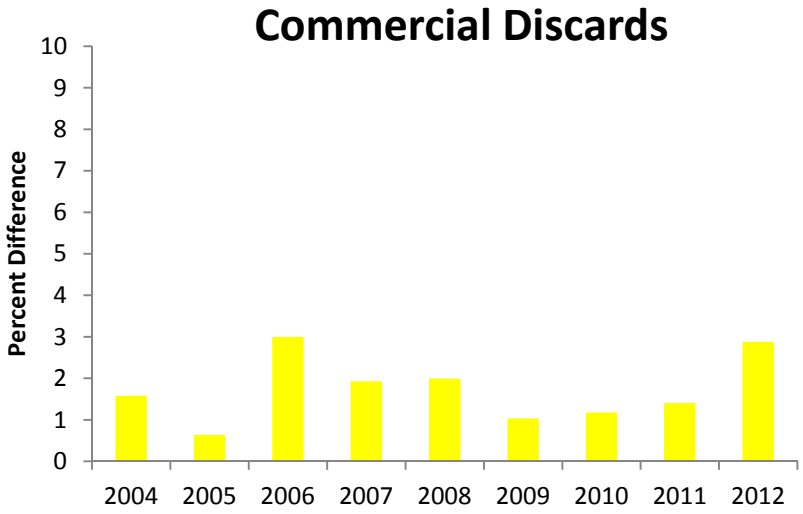
- States apportion catches into age classes by using scale-based ages

- Preliminary 2012 data used in benchmark; updated with final 2012 data

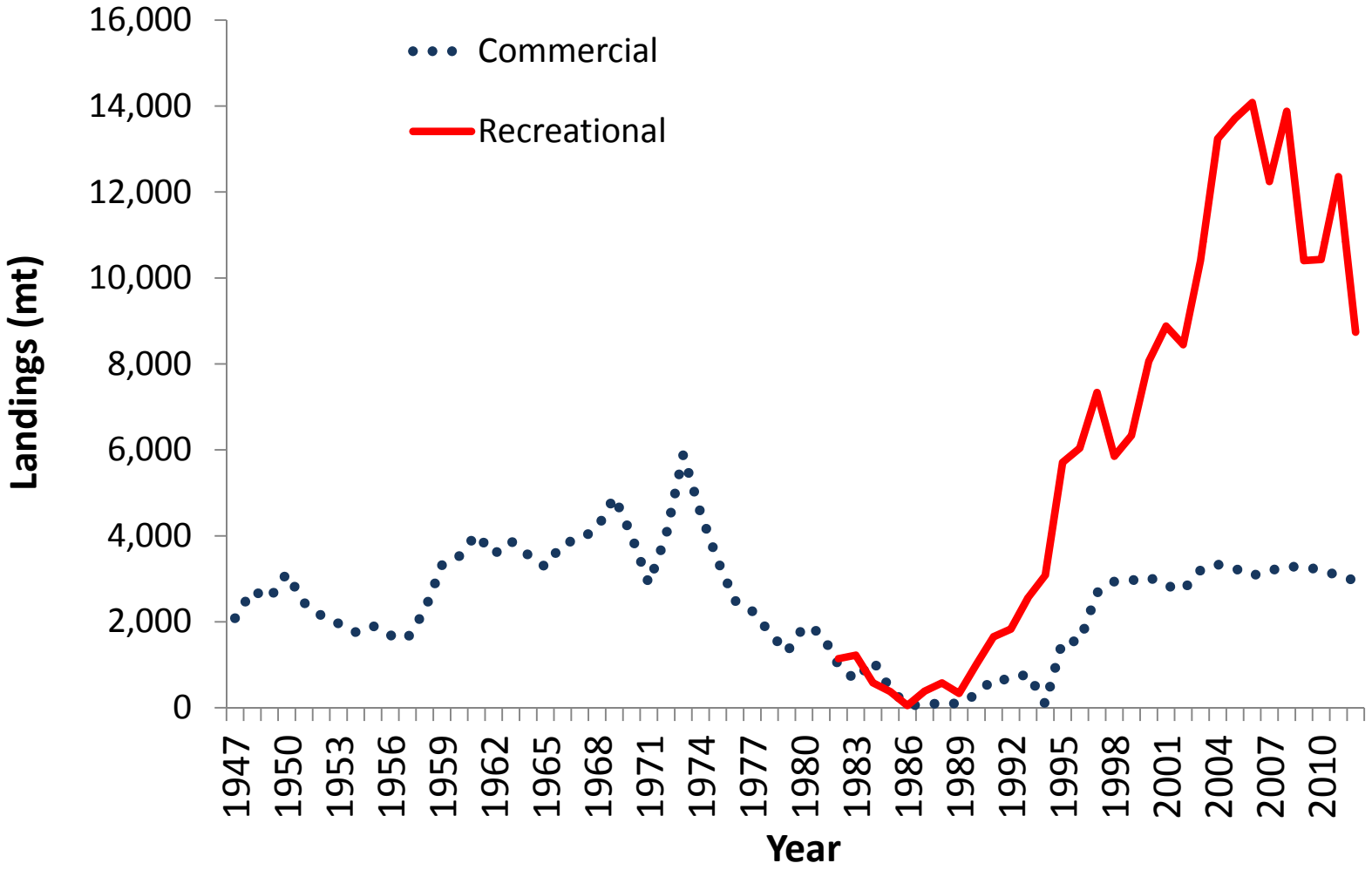
Percent Difference Between Final and Preliminary Data



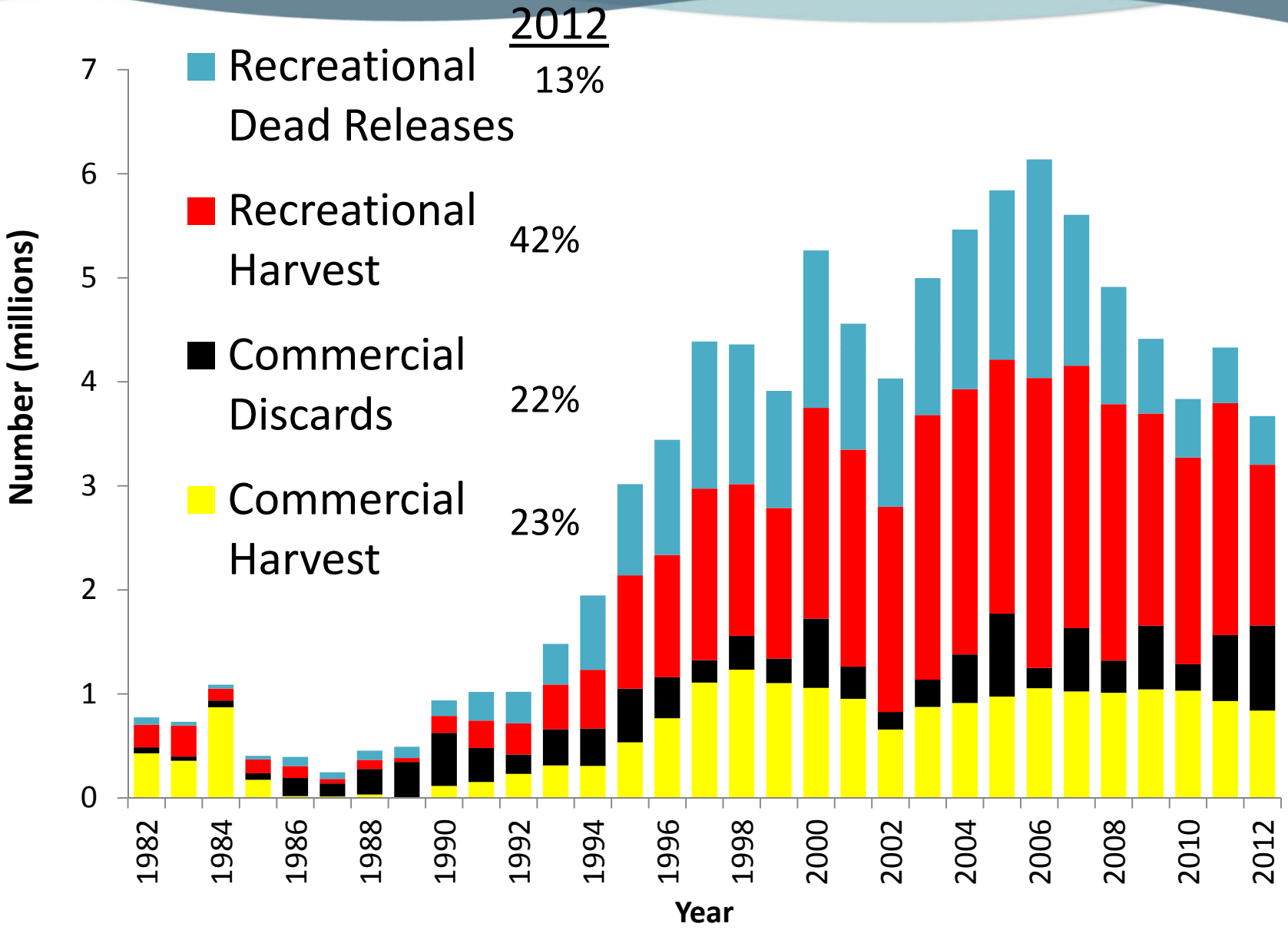




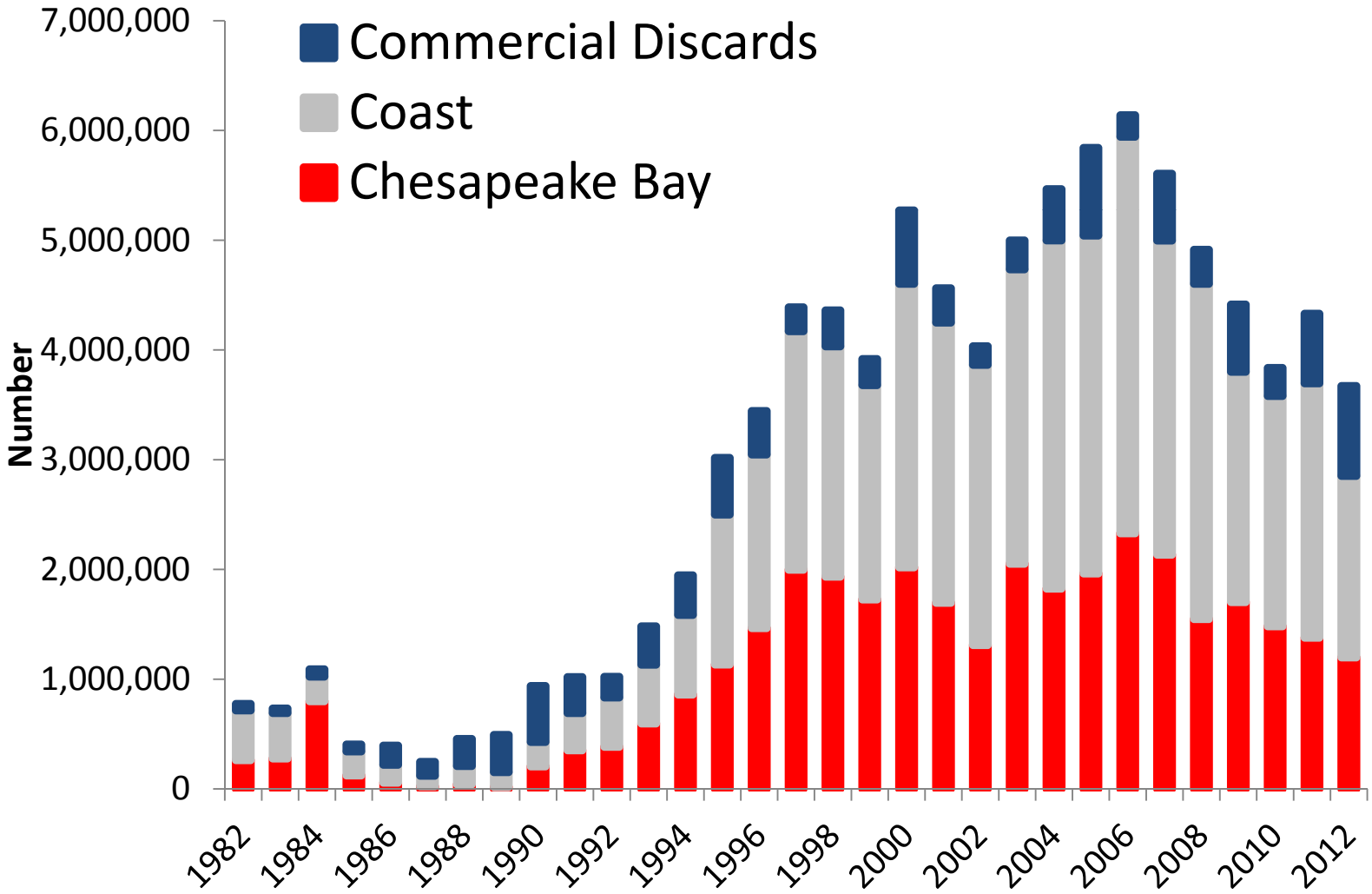
Coast-wide Landings (mt)



Coast-wide Removals

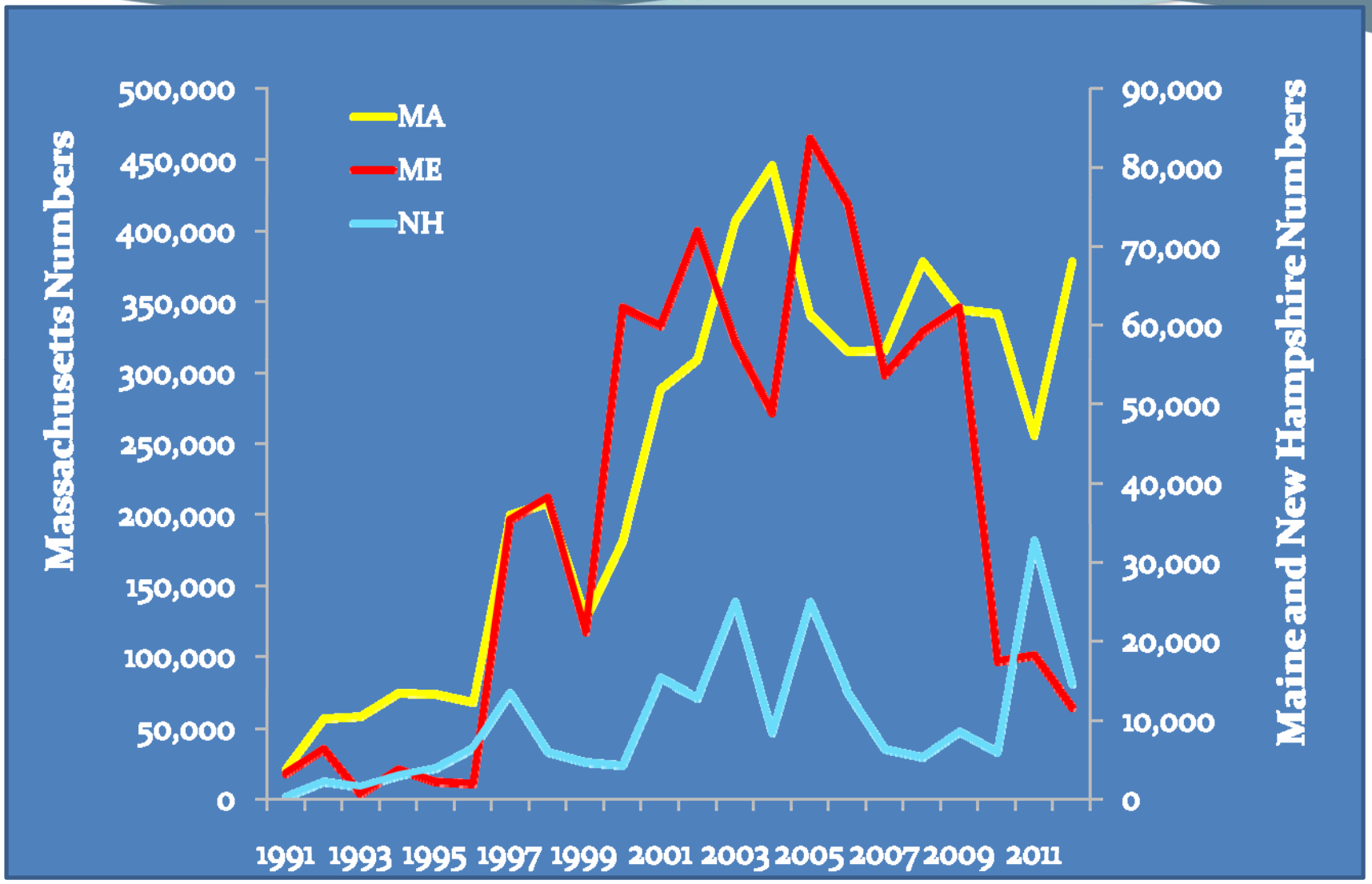


Total Removals By "Fleet"

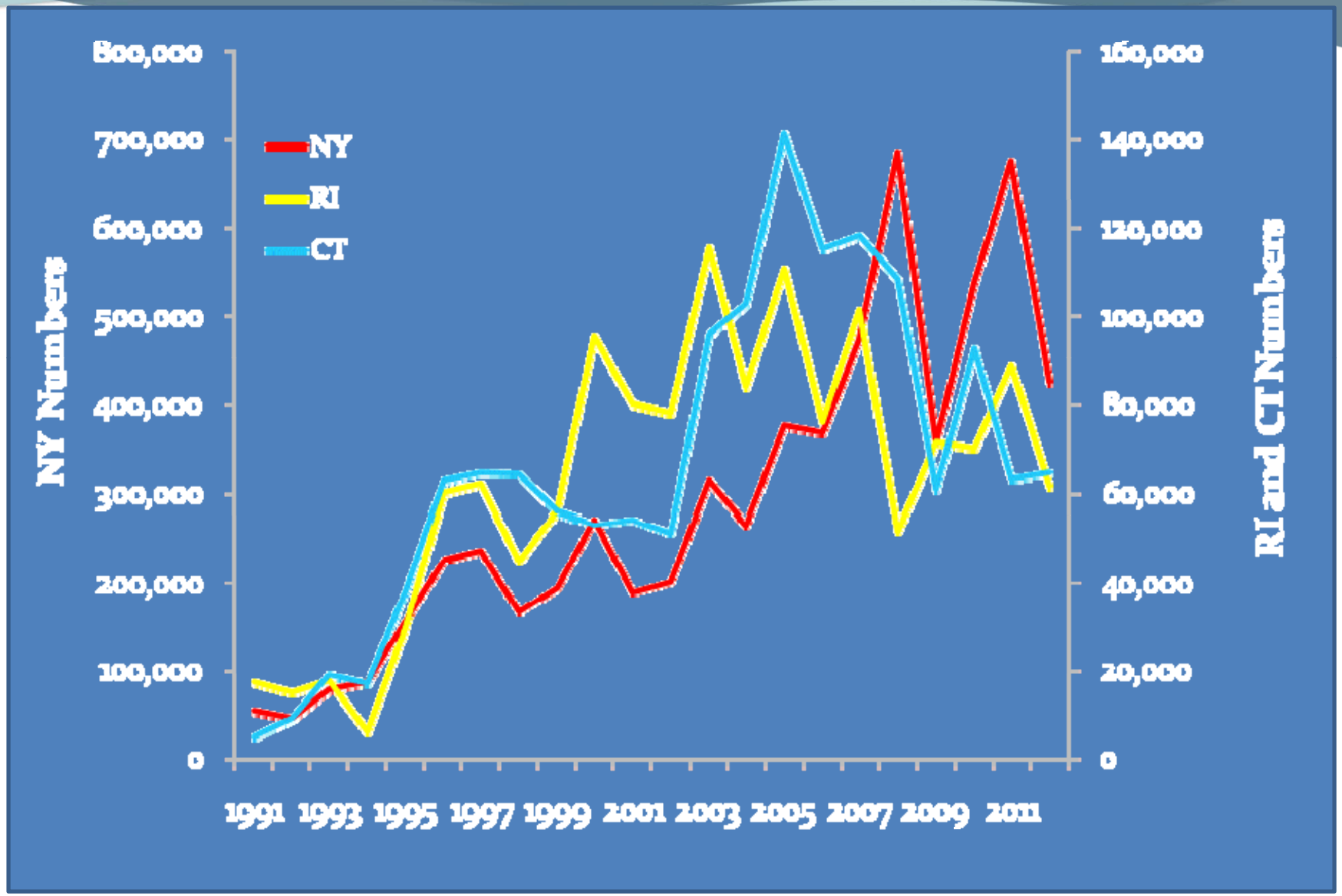


STATE TRENDS IN MRFSS HARVEST NUMBERS

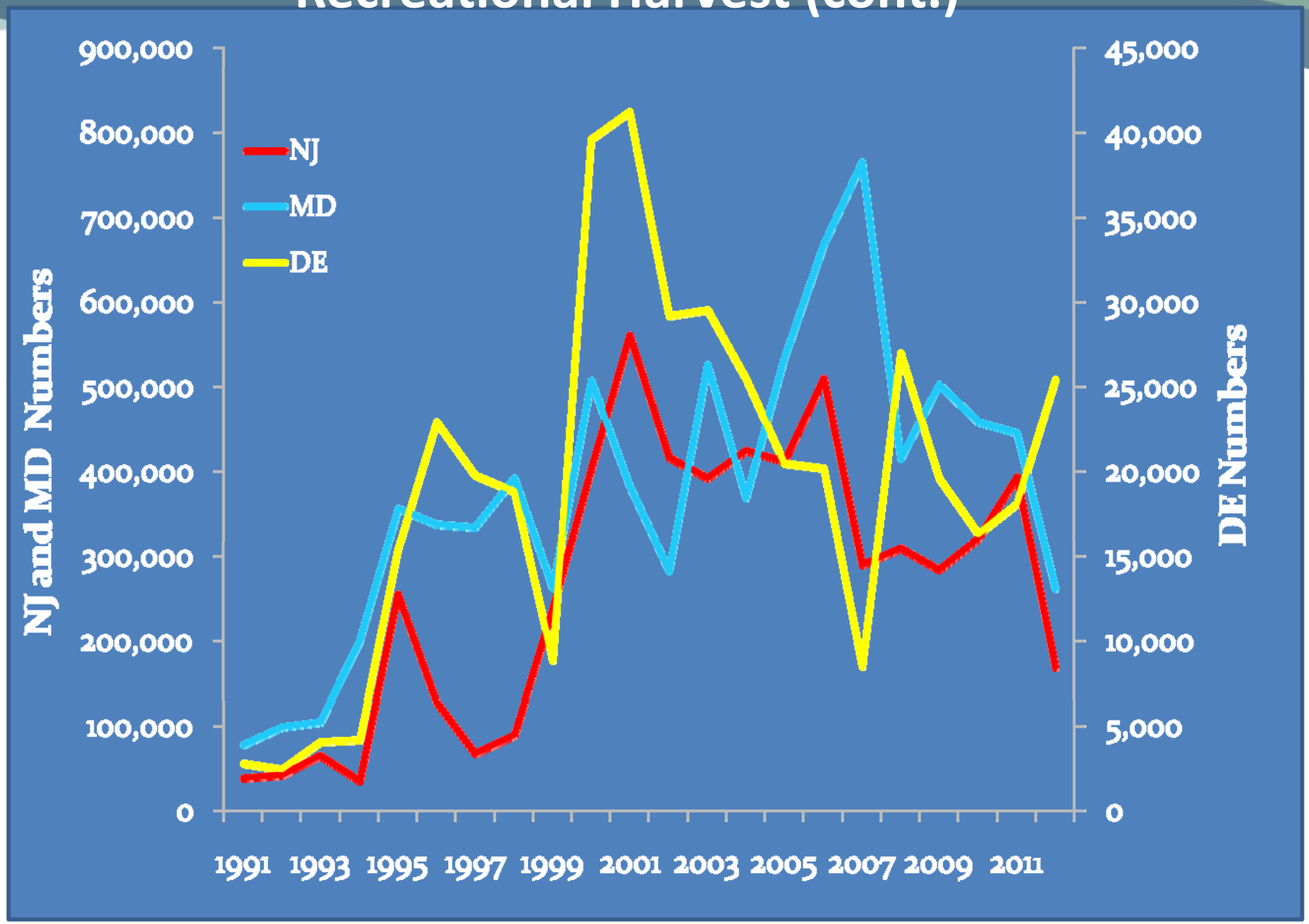
Recreational Harvest



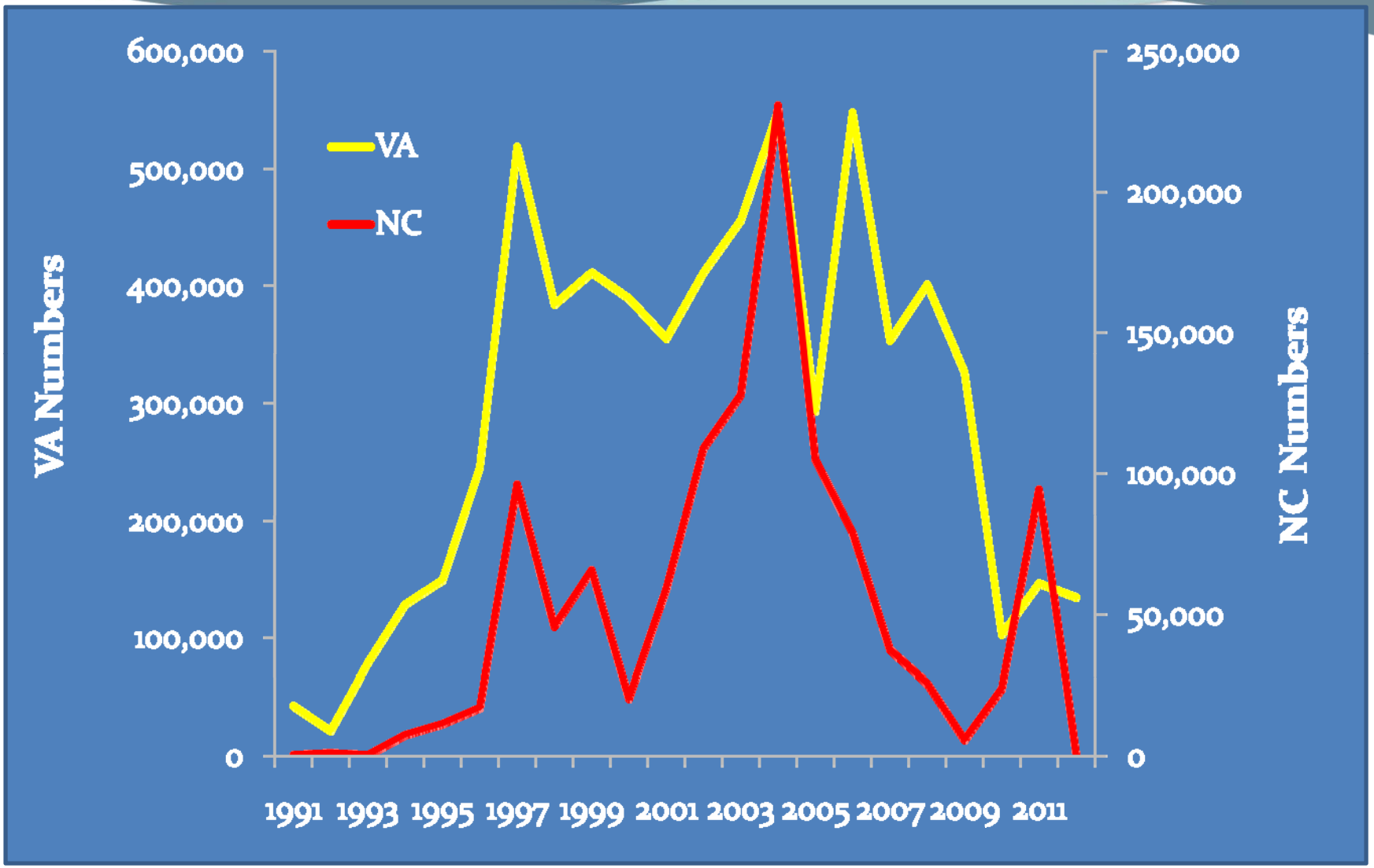
Recreational Harvest (cont.)



Recreational Harvest (cont.)

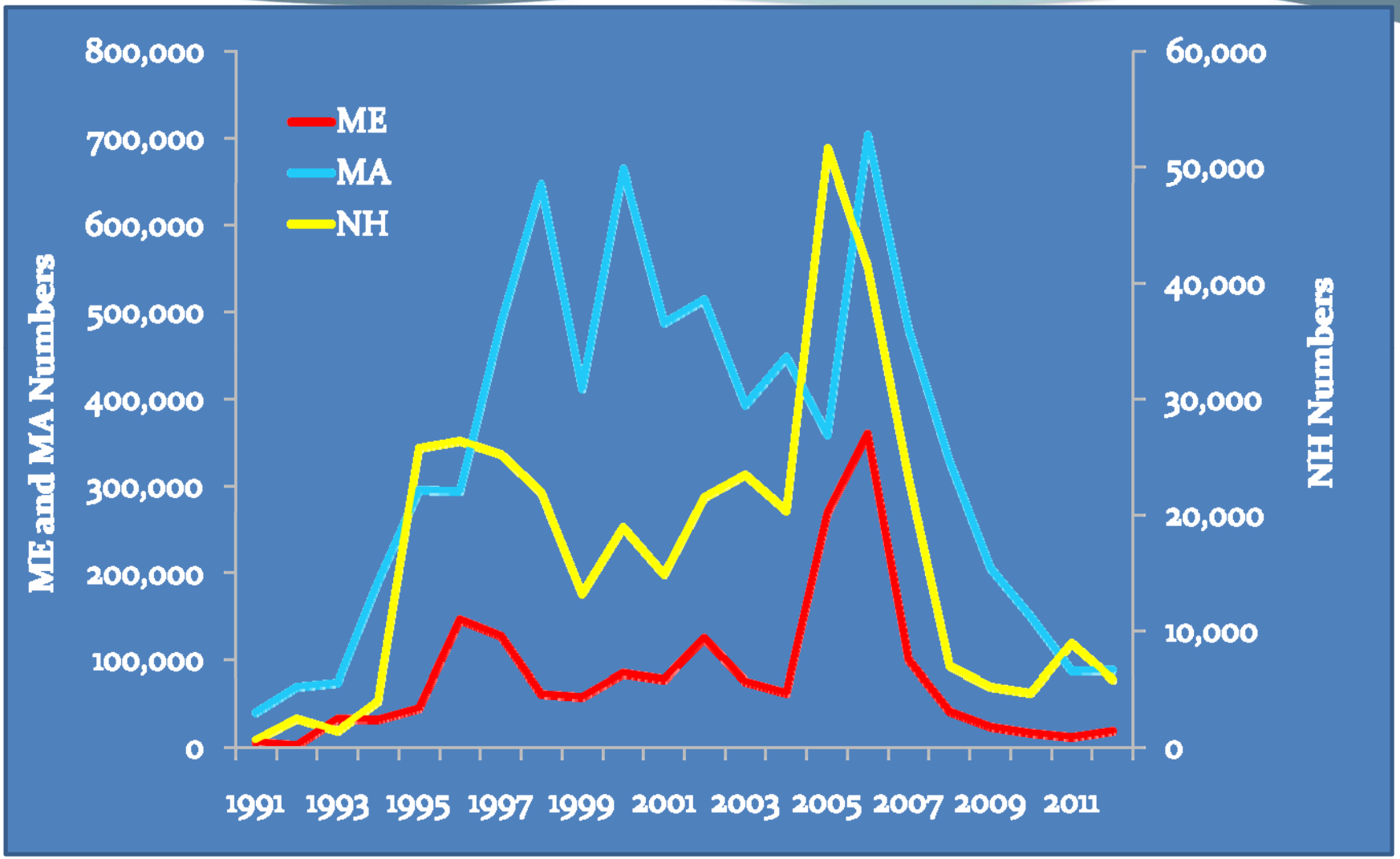


Recreational Harvest (cont.)



STATE TRENDS IN MRFSS RELEASE NUMBERS

Recreational Dead Releases



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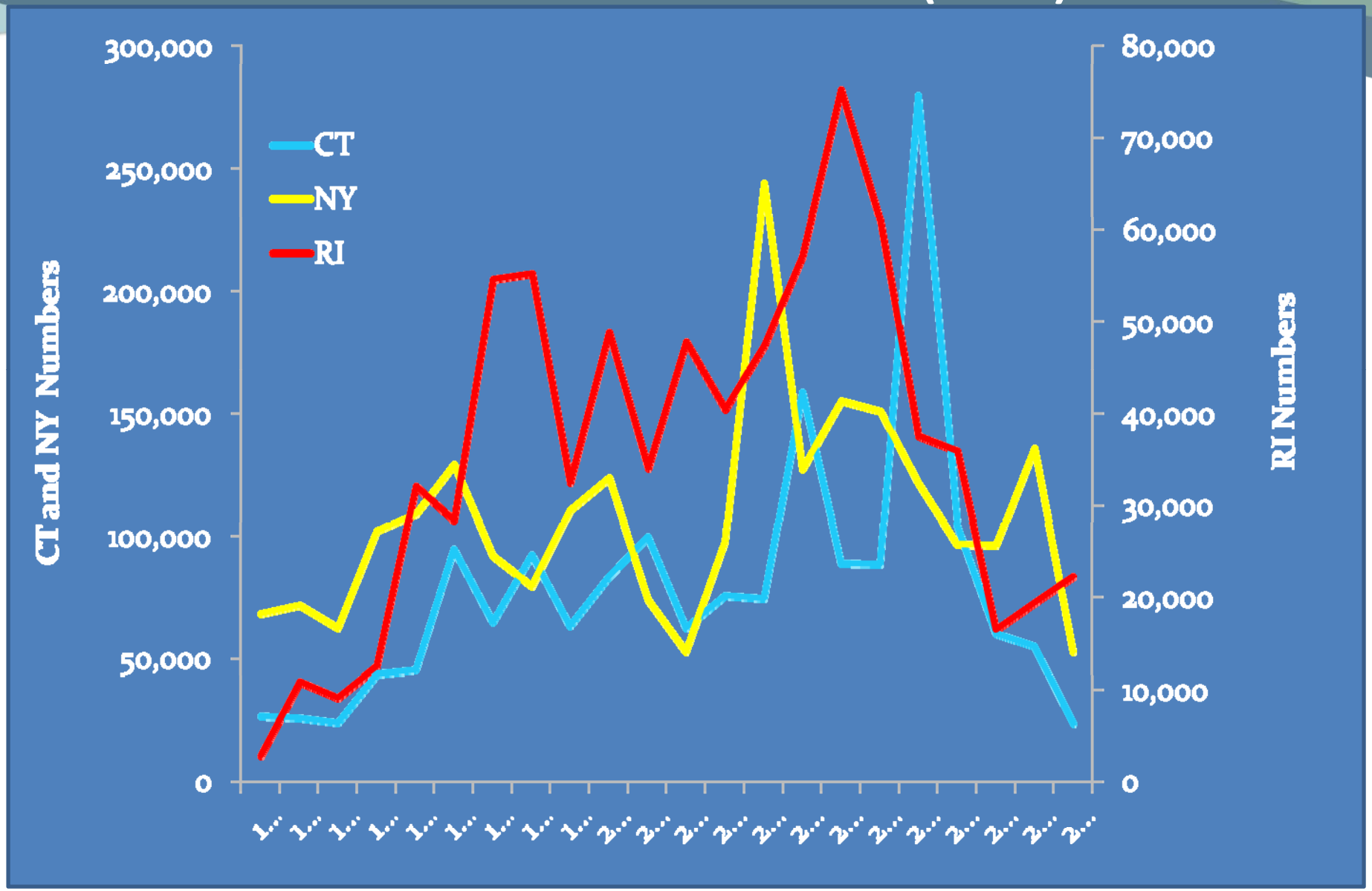
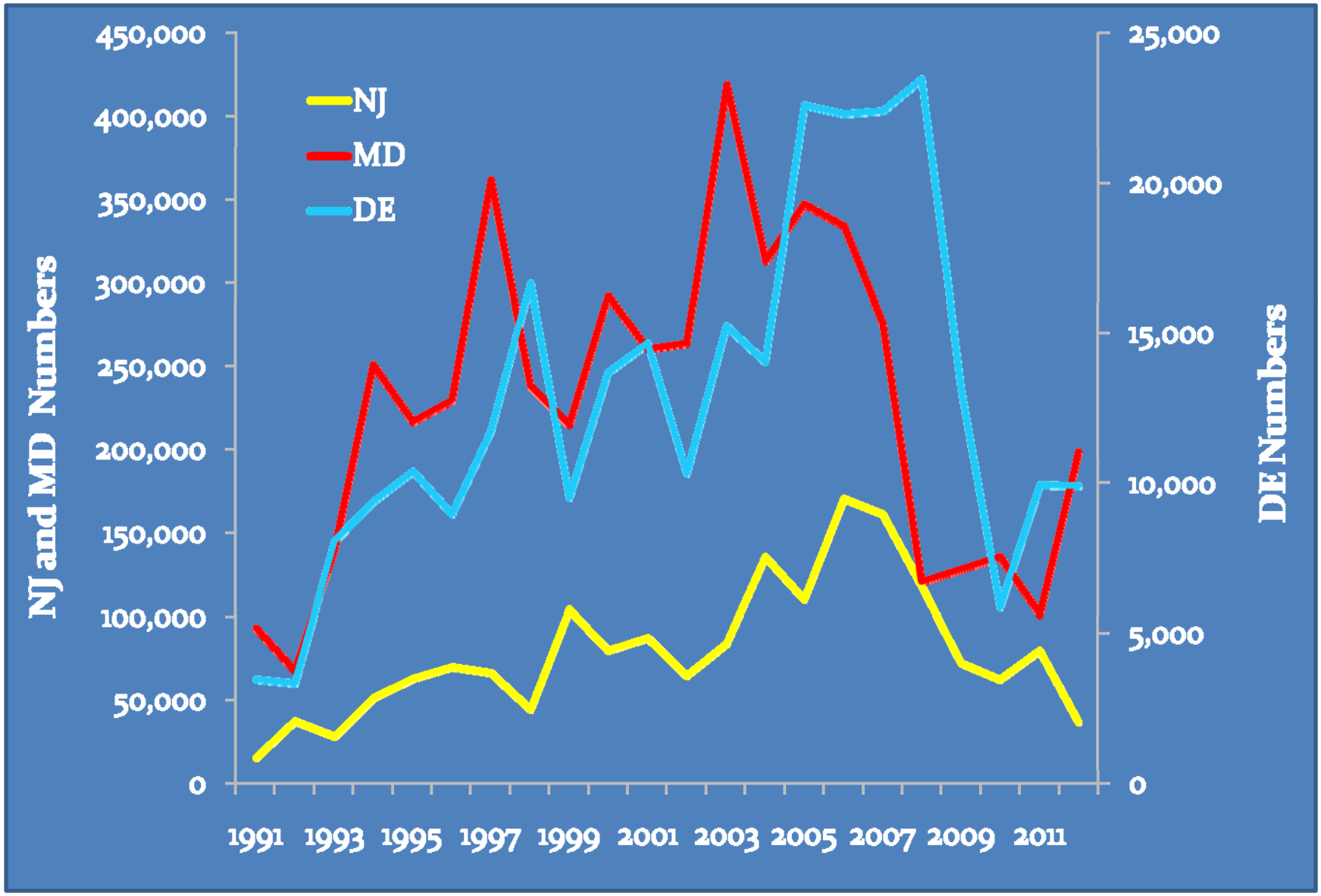
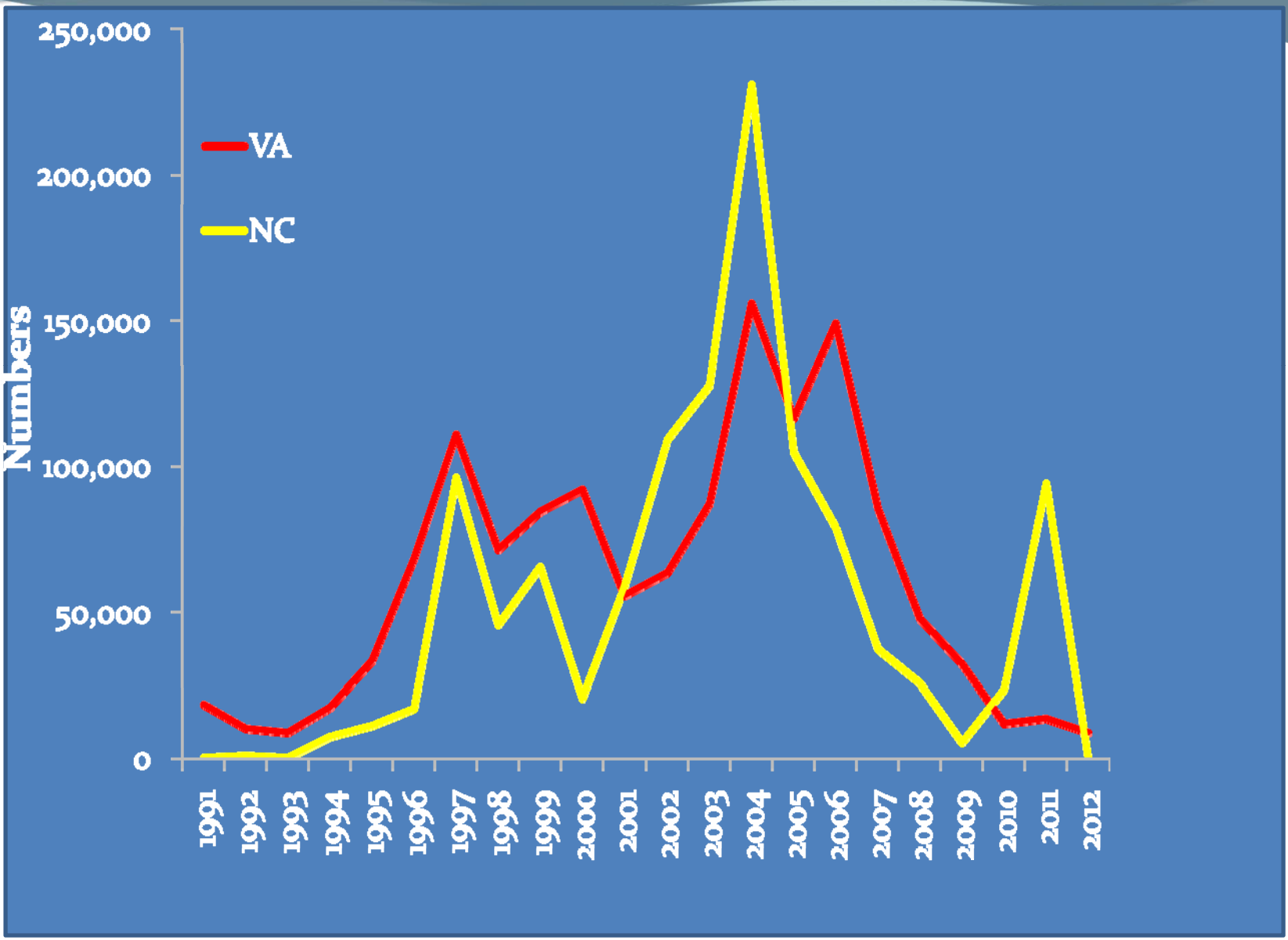


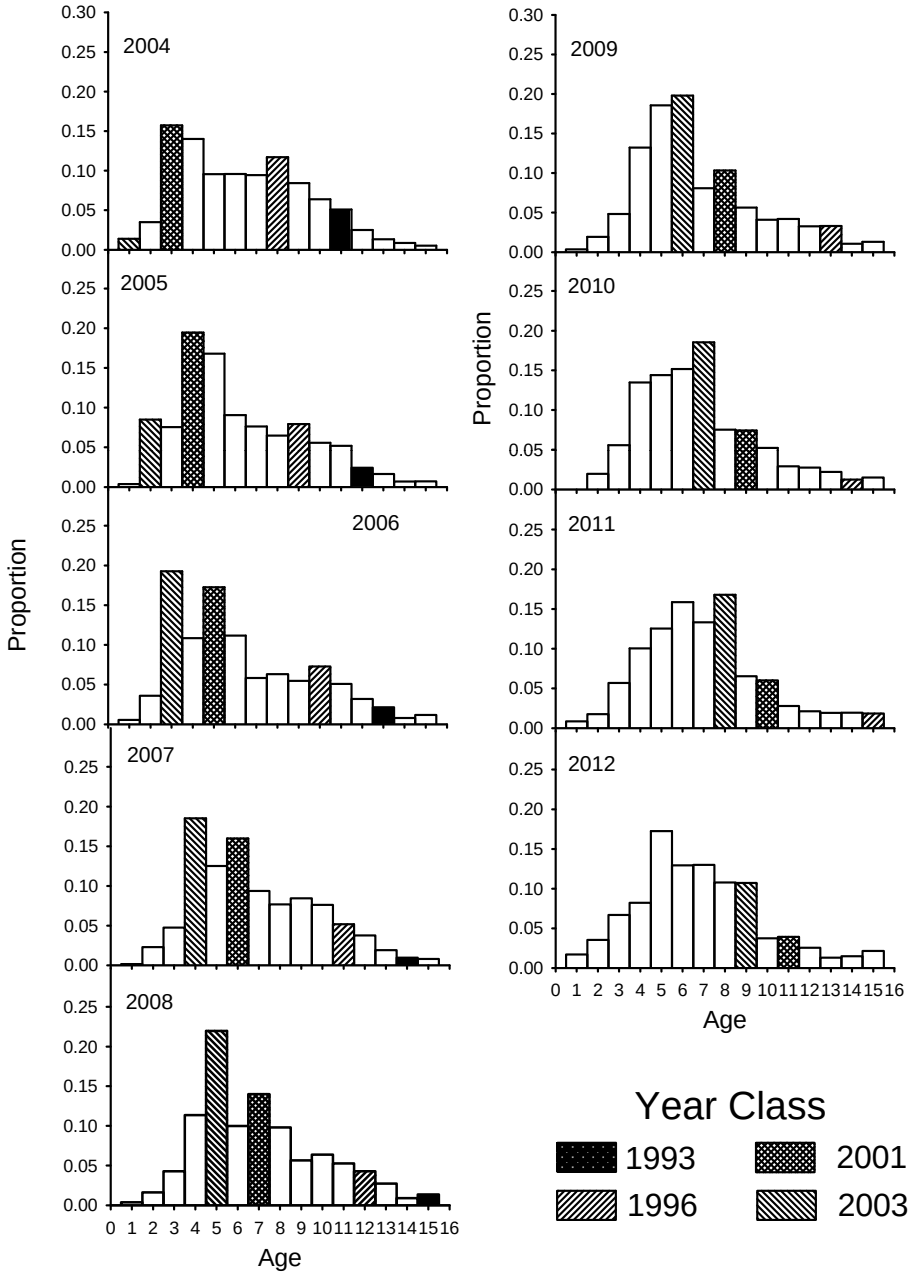
Recreational Dead Releases (cont.)



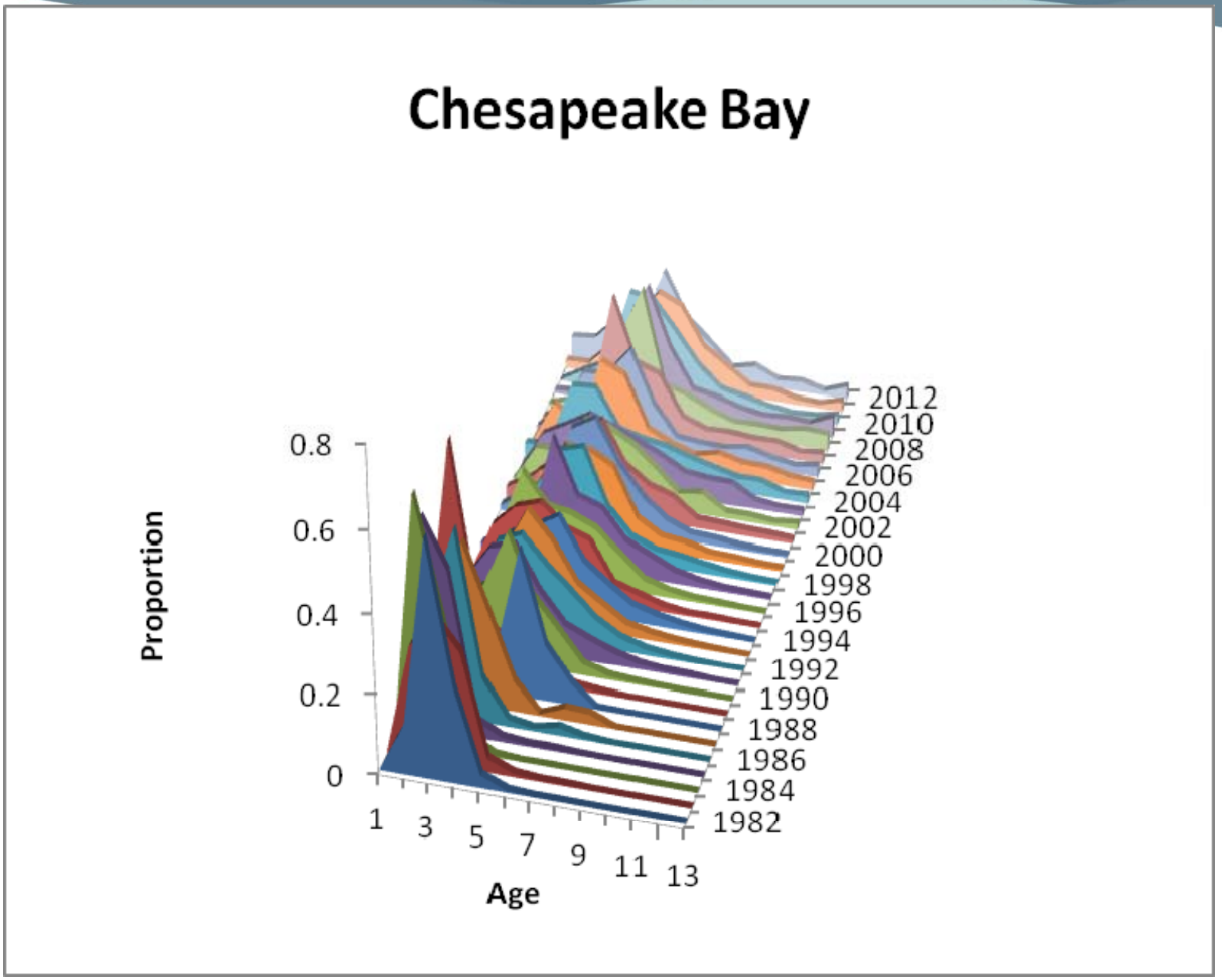
Recreational Dead Releases (cont.)



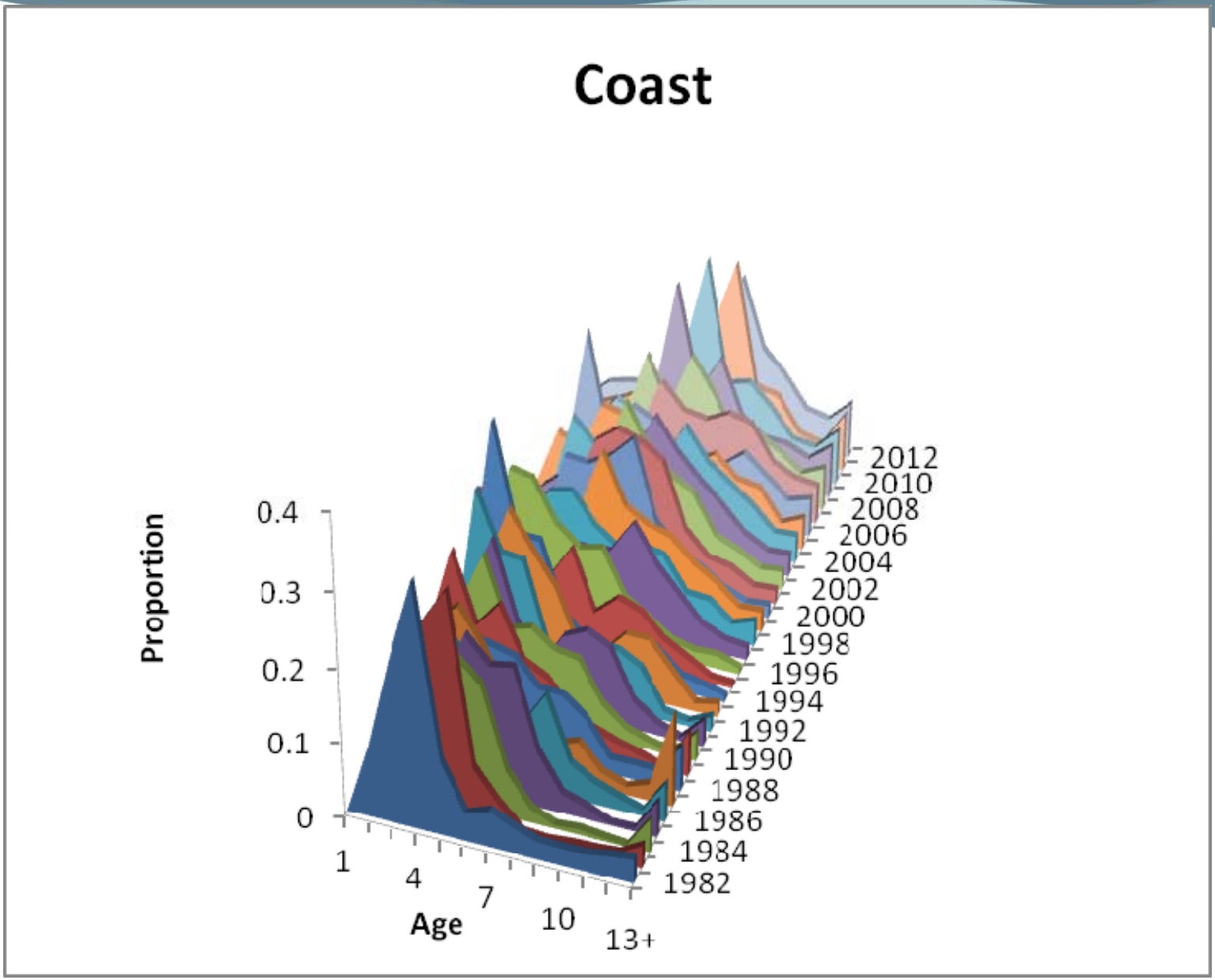
Total Catch Composition



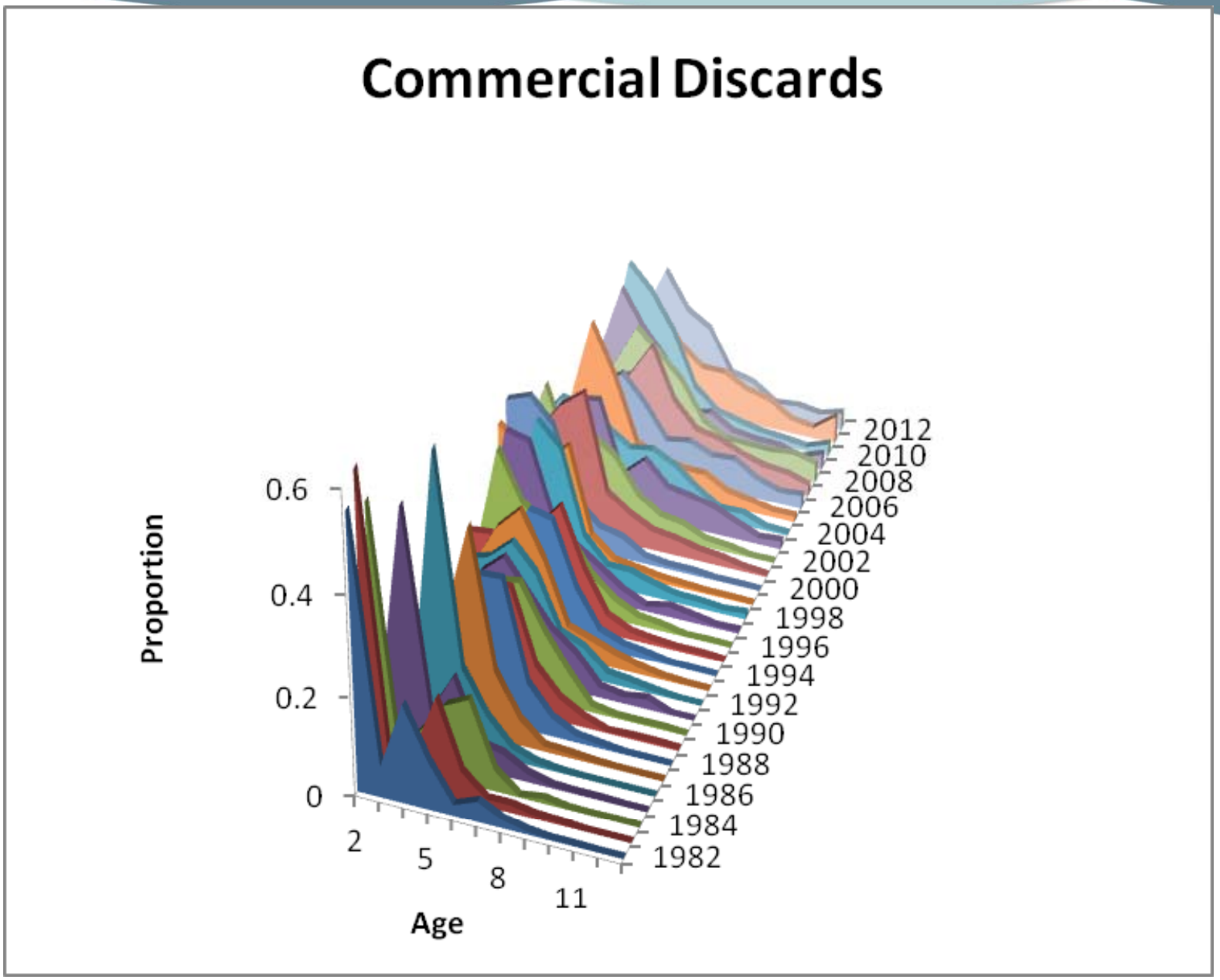
Catch Composition (cont.)



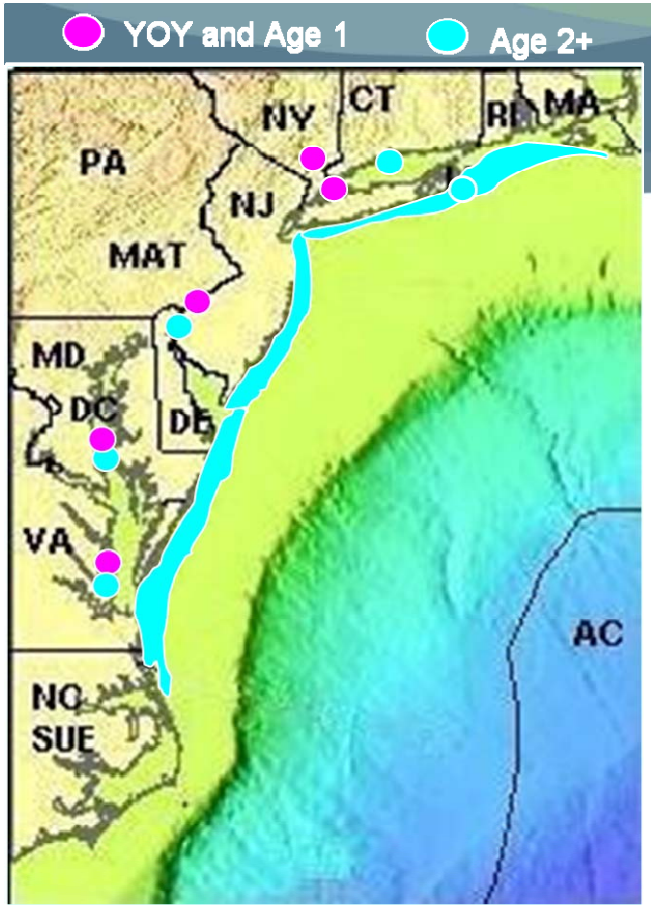
Catch Composition (cont.)



Catch Composition (cont.)



YOY, AGE-1, AGGREGATE AND AGE COMPOSITION SURVEYS

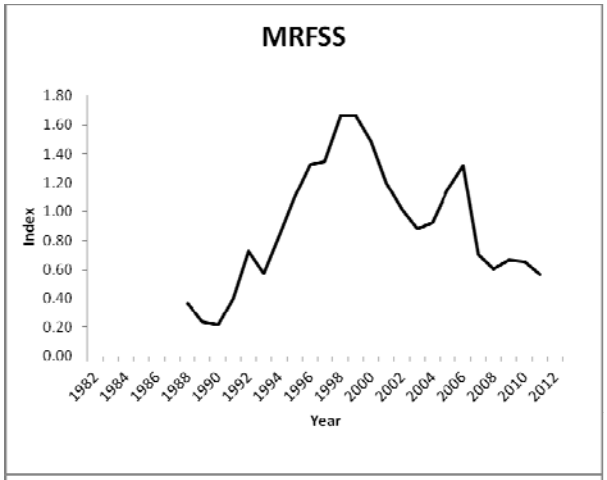


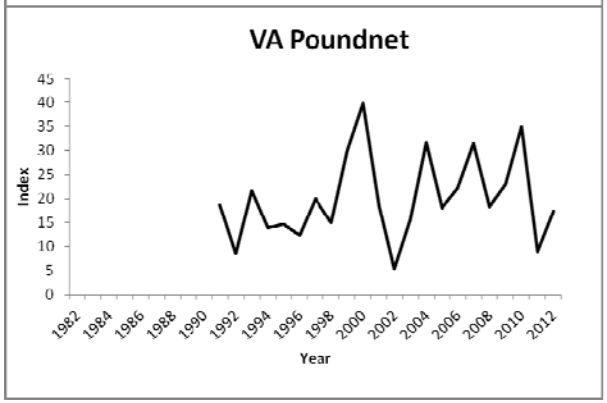
Distribution of Indices

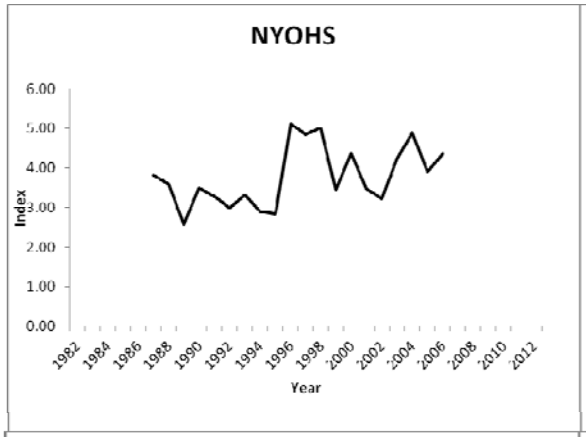
- Massachusetts Commercial CPUE – dropped; not reflective of abundance
- CT Recreational CPUE – dropped; irreproducible & double counting with MRFSS/MRIP
- VA Pound Net – re-instituted

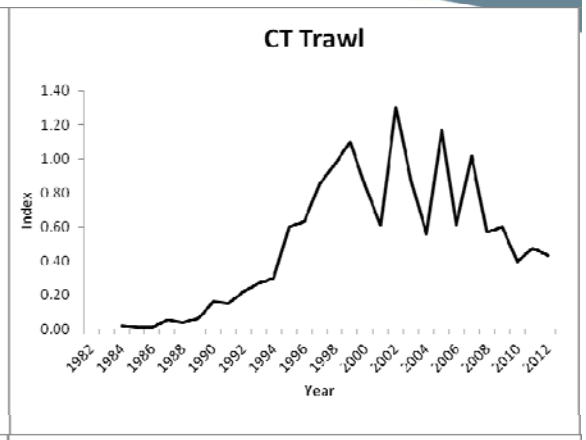
State	Index	Design	Time of Year	What Stock?	Ages
Marine Recreational Fisheries Survey	Total Catch Rate Index	Stratified Random	May-Dec	Mixed	Aggregate (3-13+)
Connecticut Trawl Survey	Mean number per tow	Stratified Random	April-June	Mixed	Aggregate (4-6)
NEFSC Trawl Survey	Mean number per tow	Stratified Random	March-May	Mixed	Aggregate (2-9)
New Jersey Trawl Survey	Mean number per tow	Stratified Random	April	Mixed	2-13+
New York Ocean Haul Seine Survey	Mean number per haul	Random	Sept-Nov	Mixed	2-13+
Delaware Electrofishing Survey	Mean number per hour	Lattice	April-May	Delaware	2-13+
New York YOY Seine Survey	Mean number per haul	Fixed	July-Nov	Hudson	0
New York W. Long Island Seine Survey	Mean number per haul	Fixed	May-Oct	Hudson	1
New Jersey YOY Seine Survey	Mean number per haul	Fixed/Random	Aug-Oct	Delaware	0
Virginia YOY Seine Survey	Mean number per haul	Fixed	July-Sept	Chesapeake	0
Maryland YOY and Age 1 Seine Survey	Mean number per haul	Fixed	July-Sept	Chesapeake	0-1
Maryland Gillnet Survey	Mean number per set	Stratified Random	April-May	Chesapeake	2-13+
Virginia Pound Net Survey	Mean number per set	Fixed	March-May	Chesapeake	1-13+

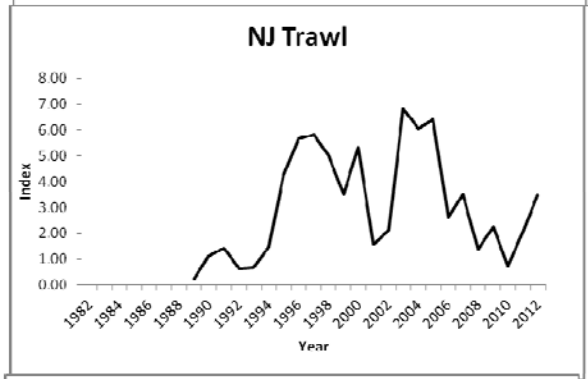
Fisheries-Dependent

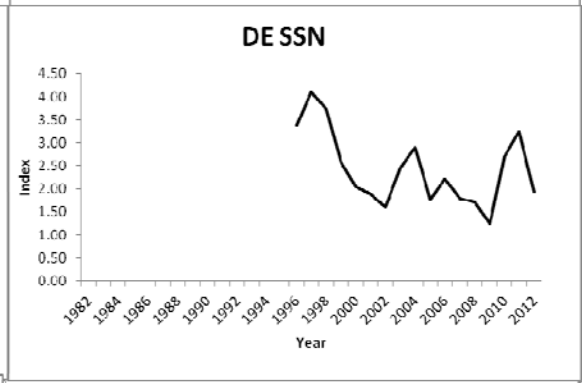


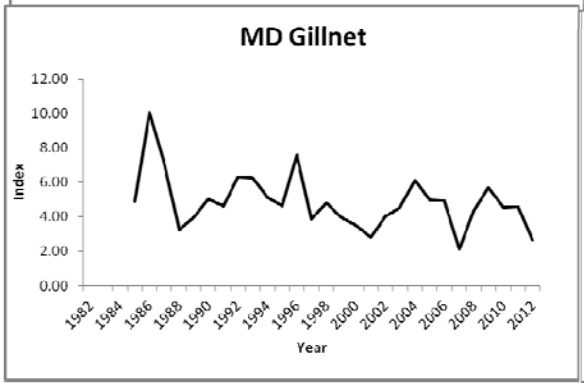


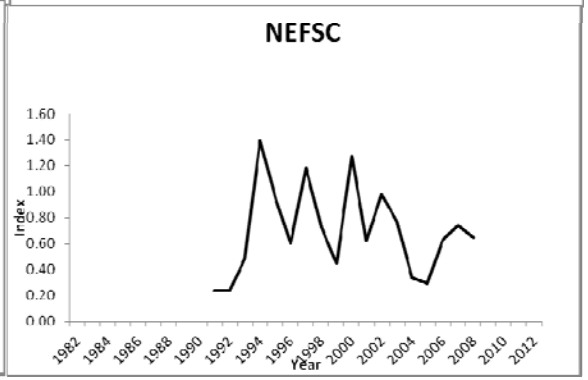




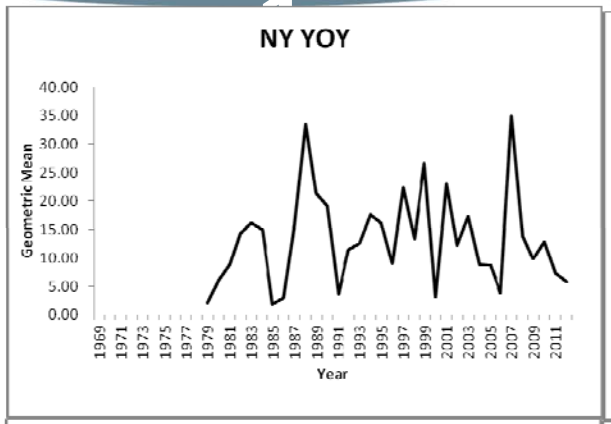


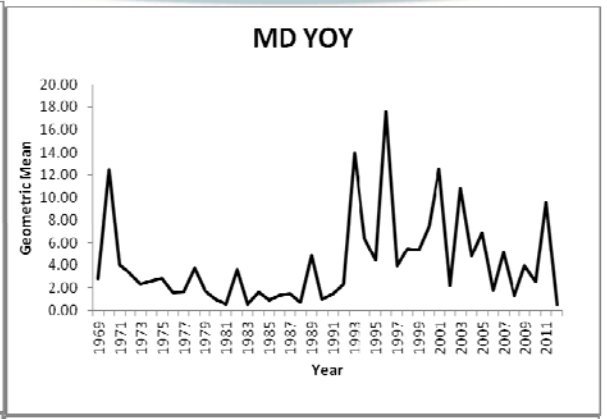


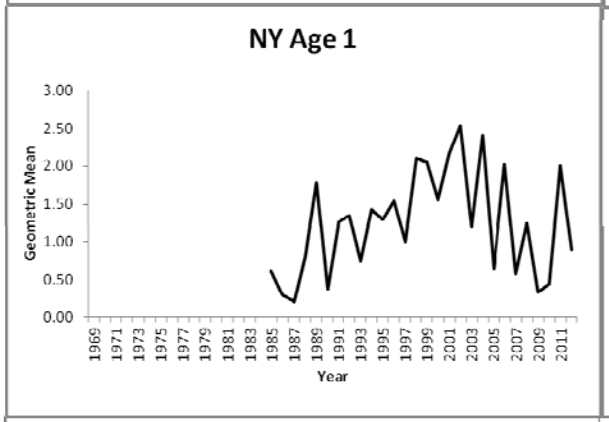


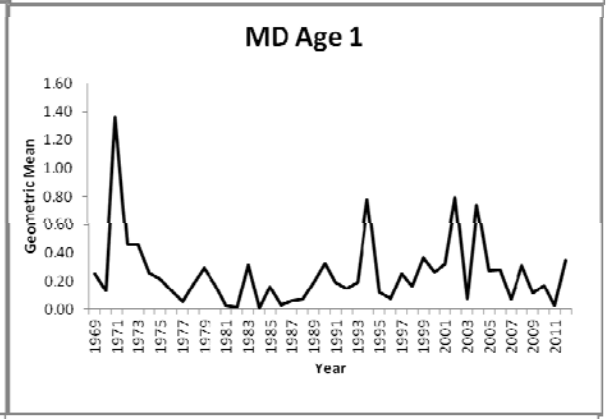


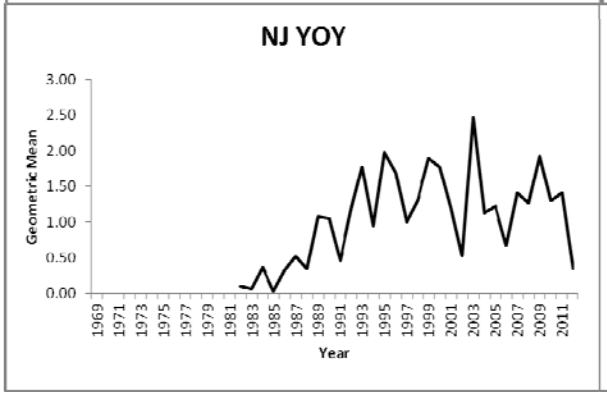
YOY and Age

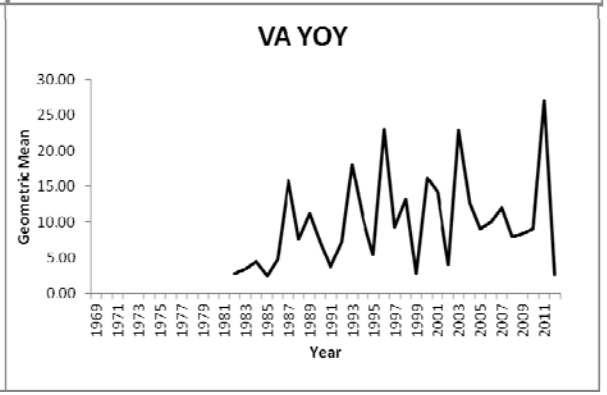

NY YOY
Geometric Mean
Year


MD YOY
Geometric Mean
Year


NY Age 1
Geometric Mean
Year


MD Age 1
Geometric Mean
Year


NJ YOY
Geometric Mean
Year


VA YOY
Geometric Mean
Year

STATISTICAL CATCH-AT-AGE MODELING

Statistical Catch-At-Age Model

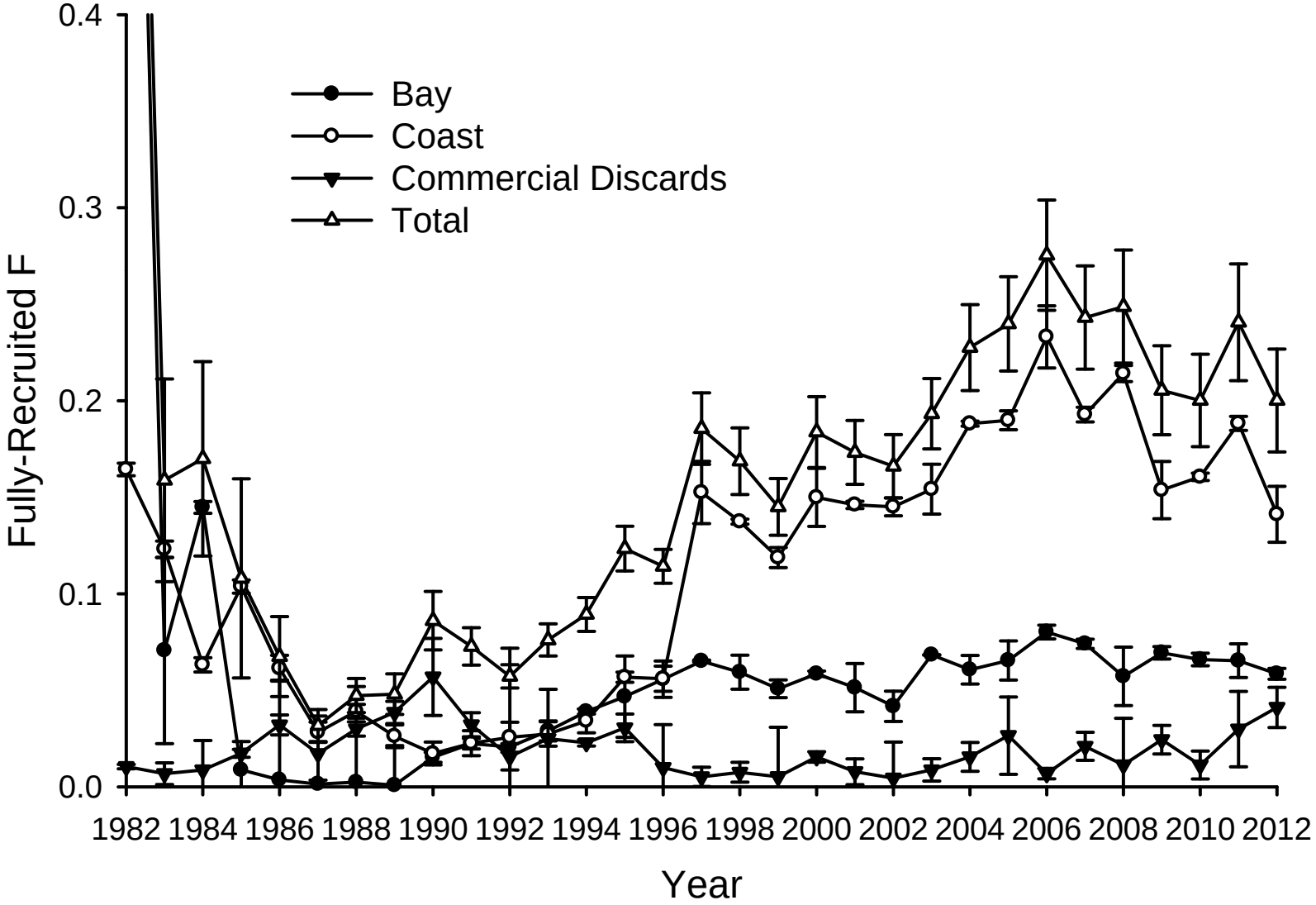
- Forward projecting statistical catch-at-age model
  - Age-1 abundance (recruitment) in each year
  - Fully-recruited F in each year
  - Catch selectivity in 4 regulatory periods
  - Catchability coefficients for all indices
  - Selectivity for each survey with age composition data

- Data are split into three “Fleets” based on regions
  - Chesapeake Bay, Coast and Commercials Discards
  - Improved selectivity fits
  - Provided partial F for each fleet

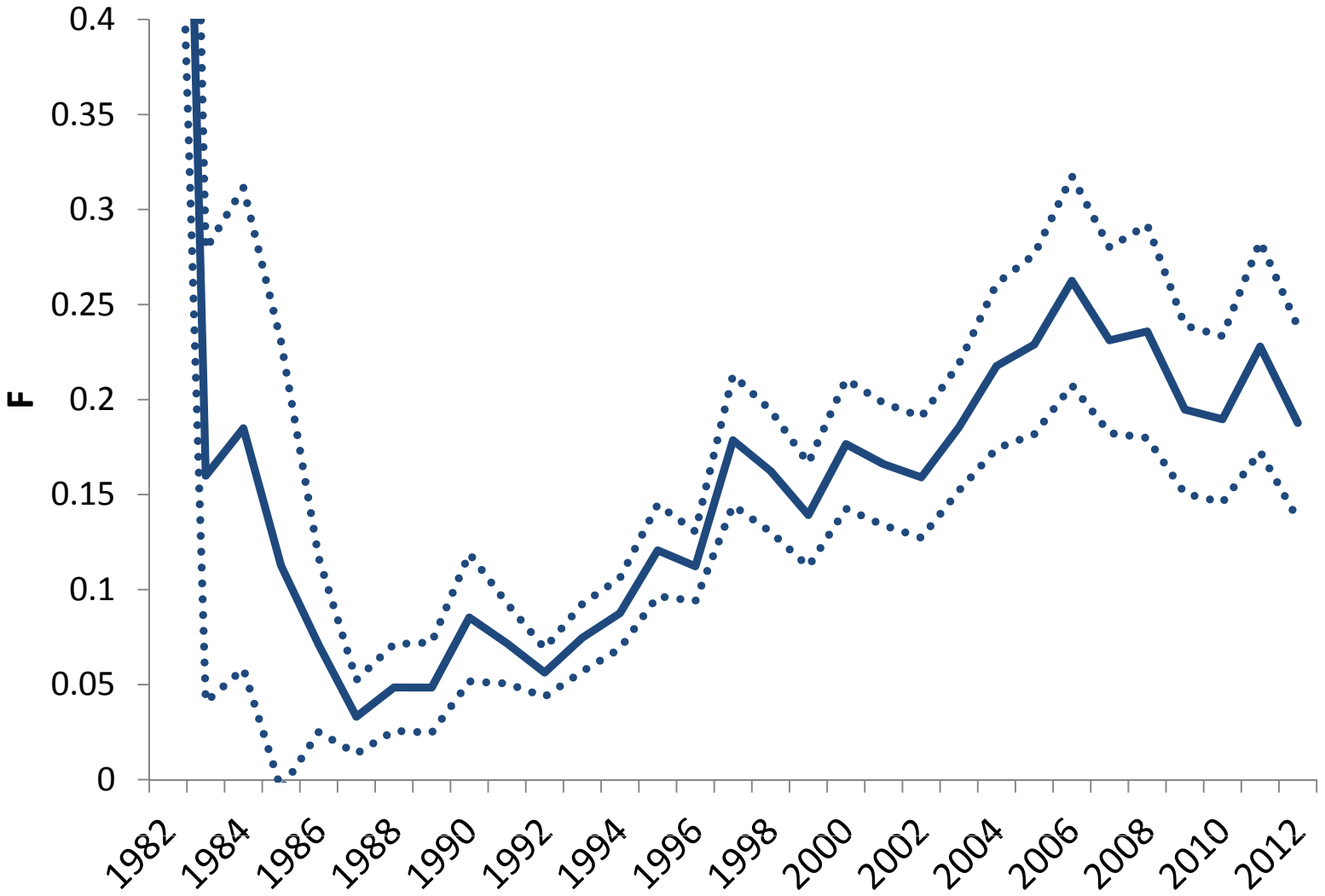
- Age-specific M were used (1.13: age 1 to 0.15: age 7+)

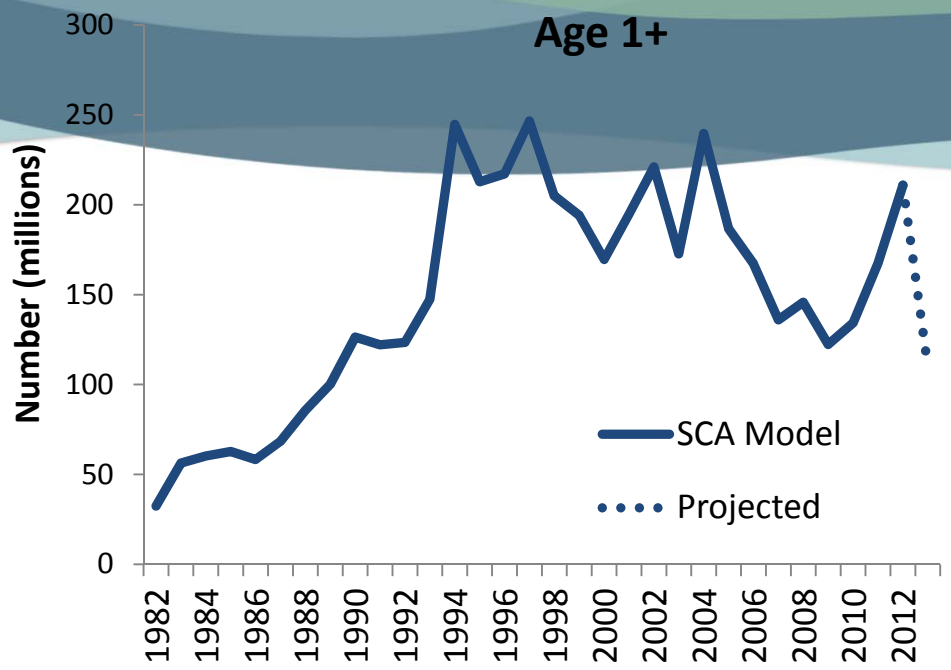
- F is now fully-recruited F (fleets combined), not average F of ages 8-11

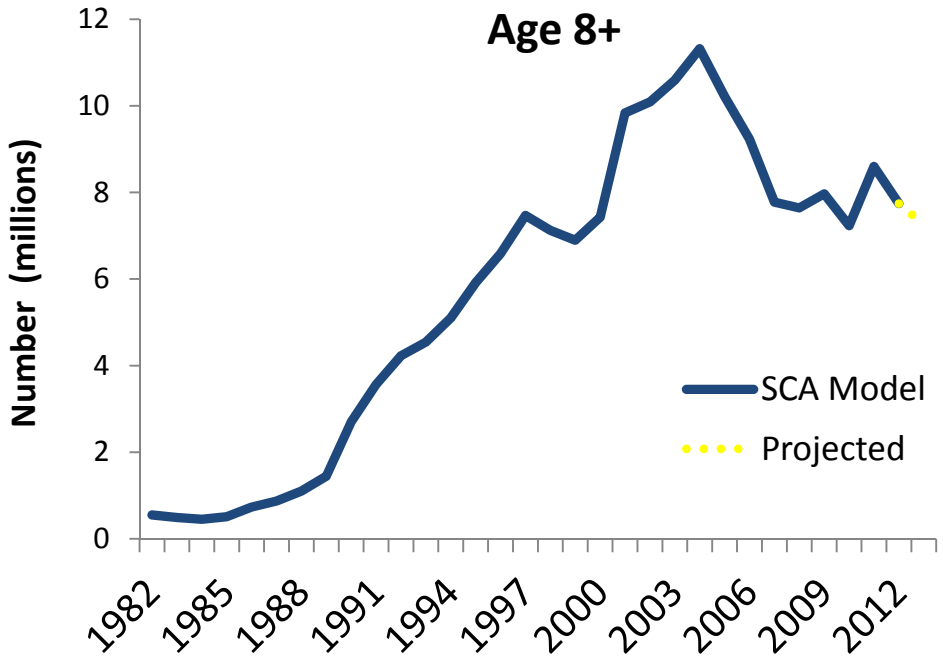
Fully-Recruited F (±1 SD) By "Fleet"



Fully-Recruited F (±95%CI)

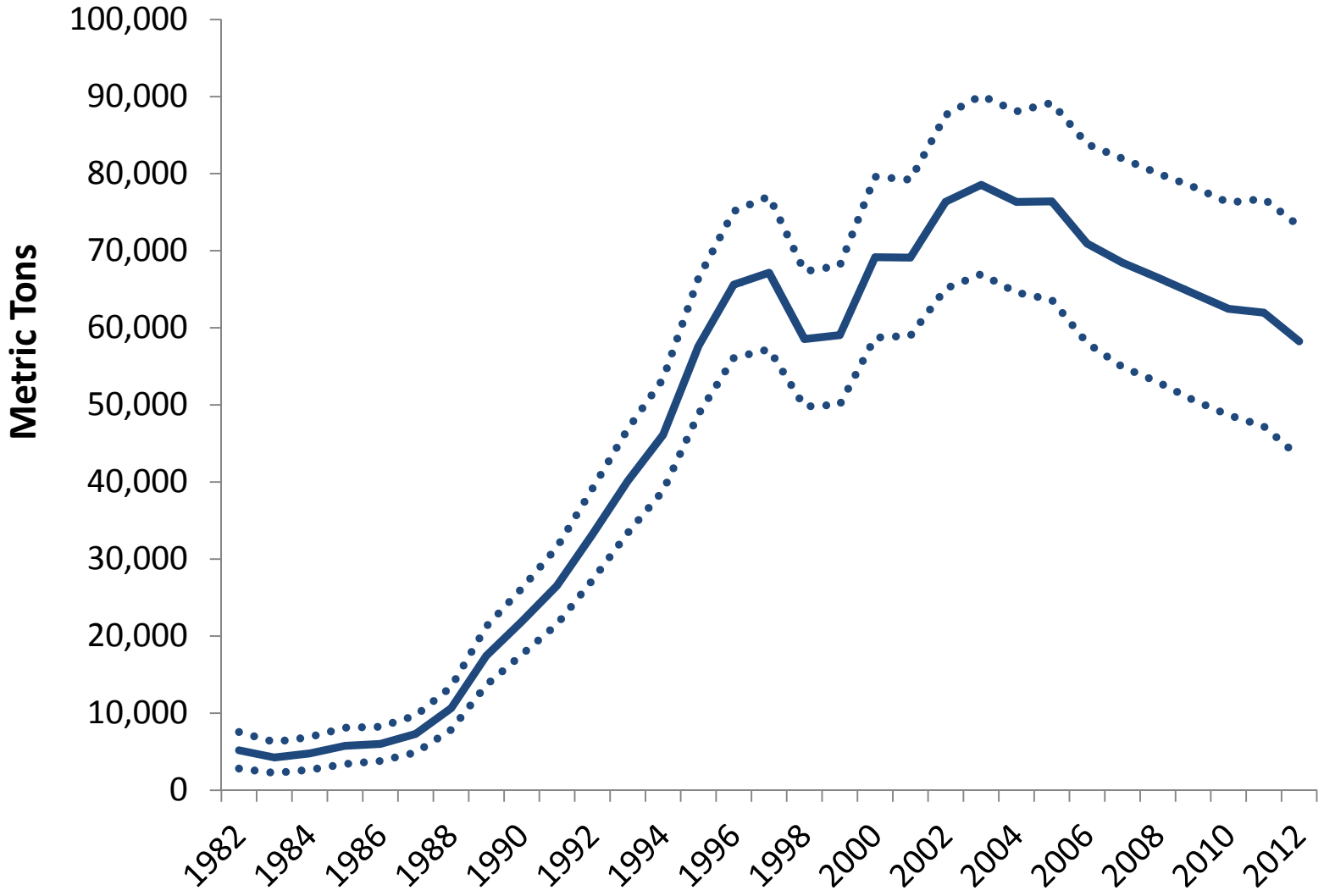



Age 1+
Number (millions)
300
250
200
150
100
50
0
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
SCA Model
Projected

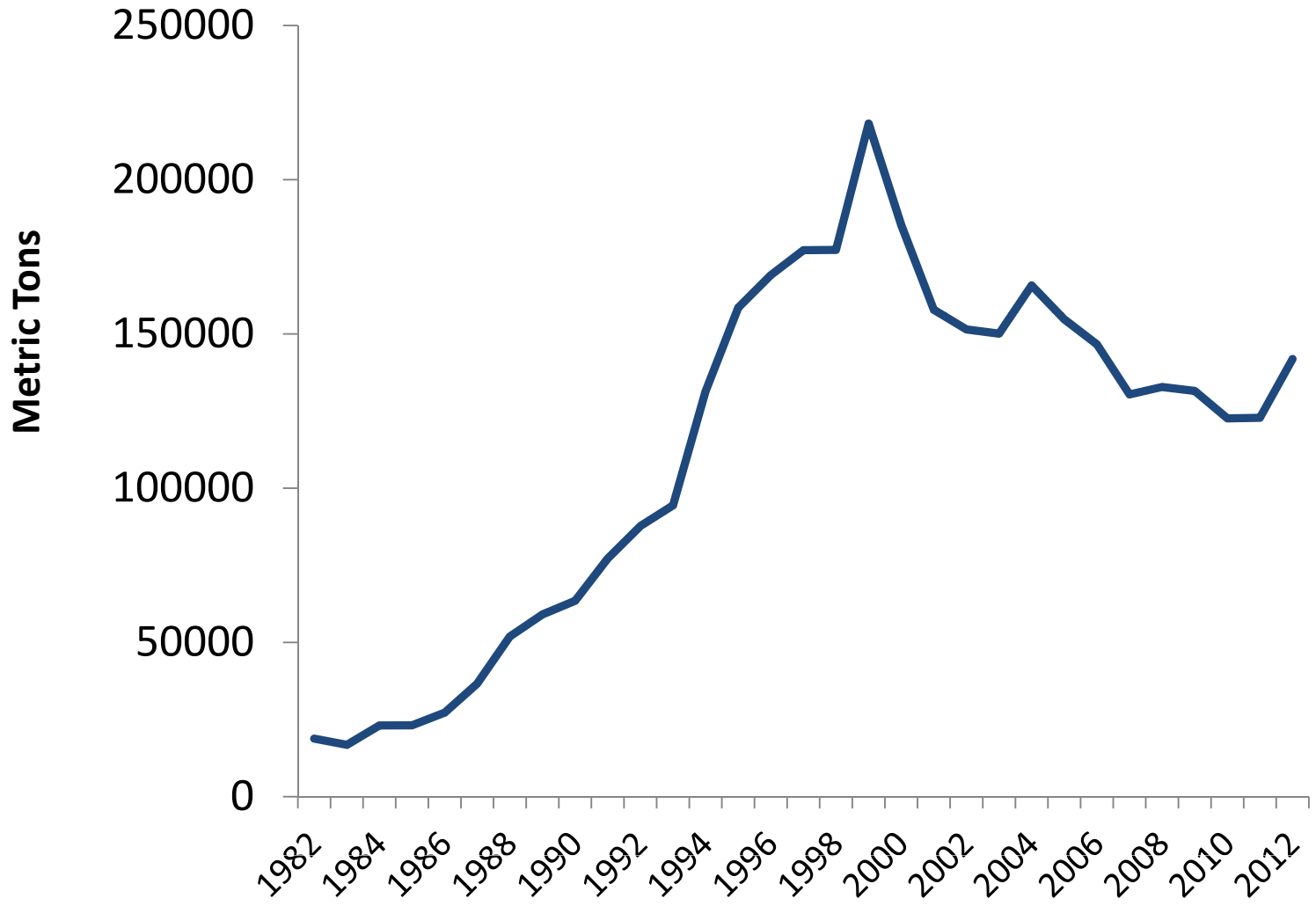

Age 8+
Number (millions)
12
10
8
6
4
2
0
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
SCA Model
Projected

Abundance

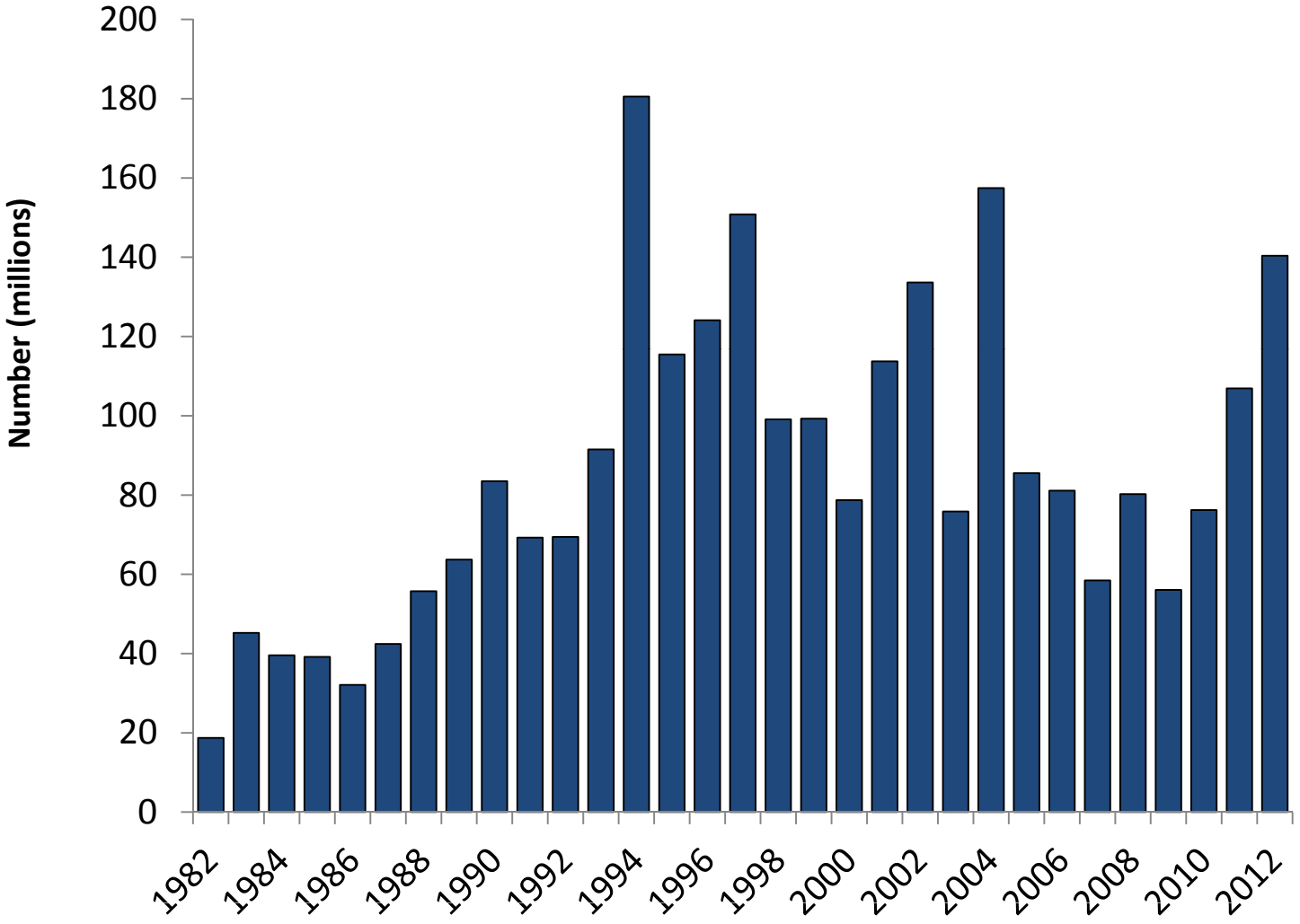
Female Spawning Stock Biomass (±95%CI)



Total Biomass

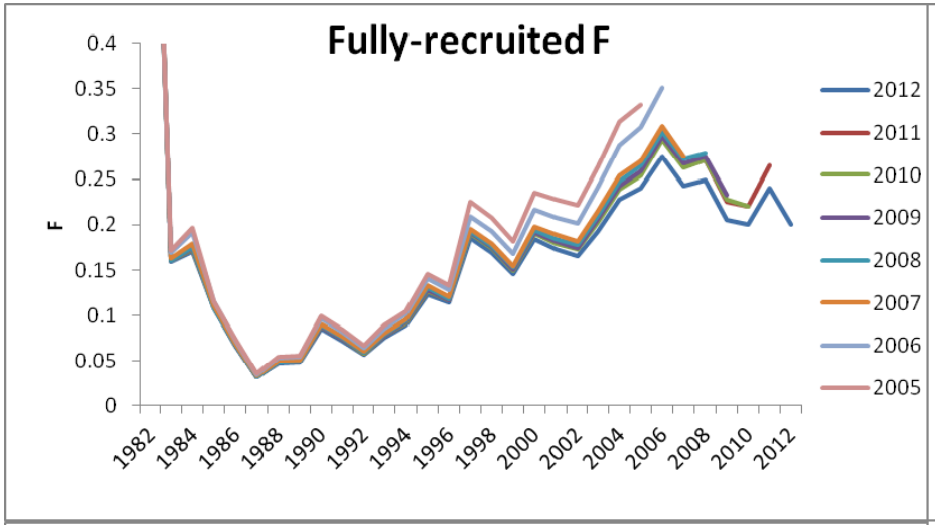


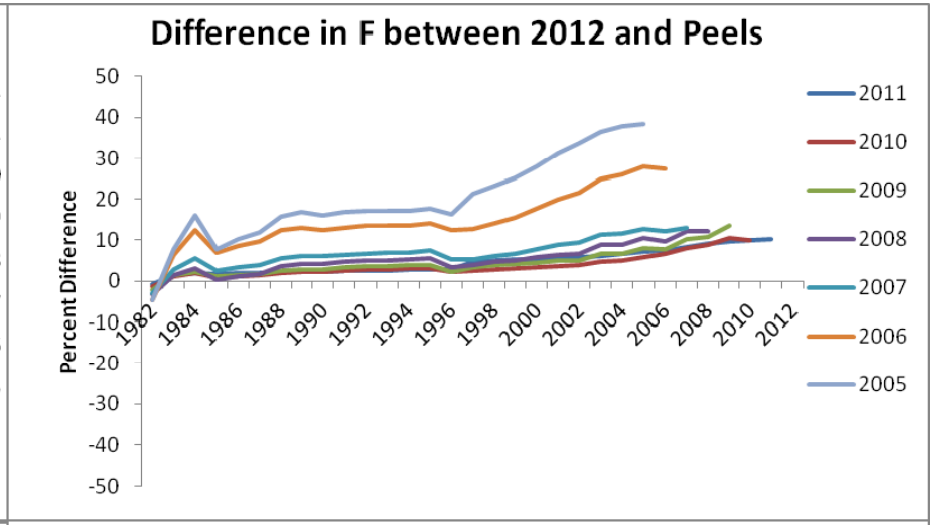
Recruitment

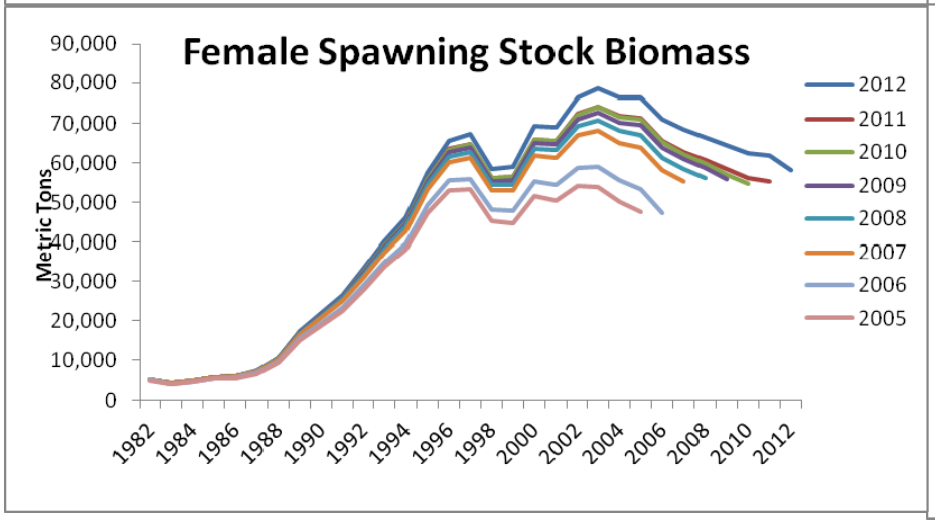


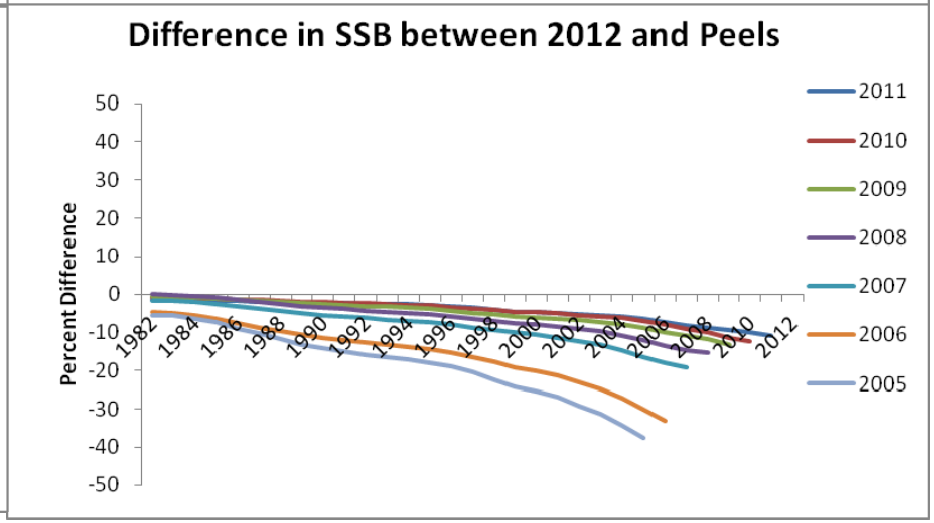
RETROSPECTIVE

Retrospective Analysis









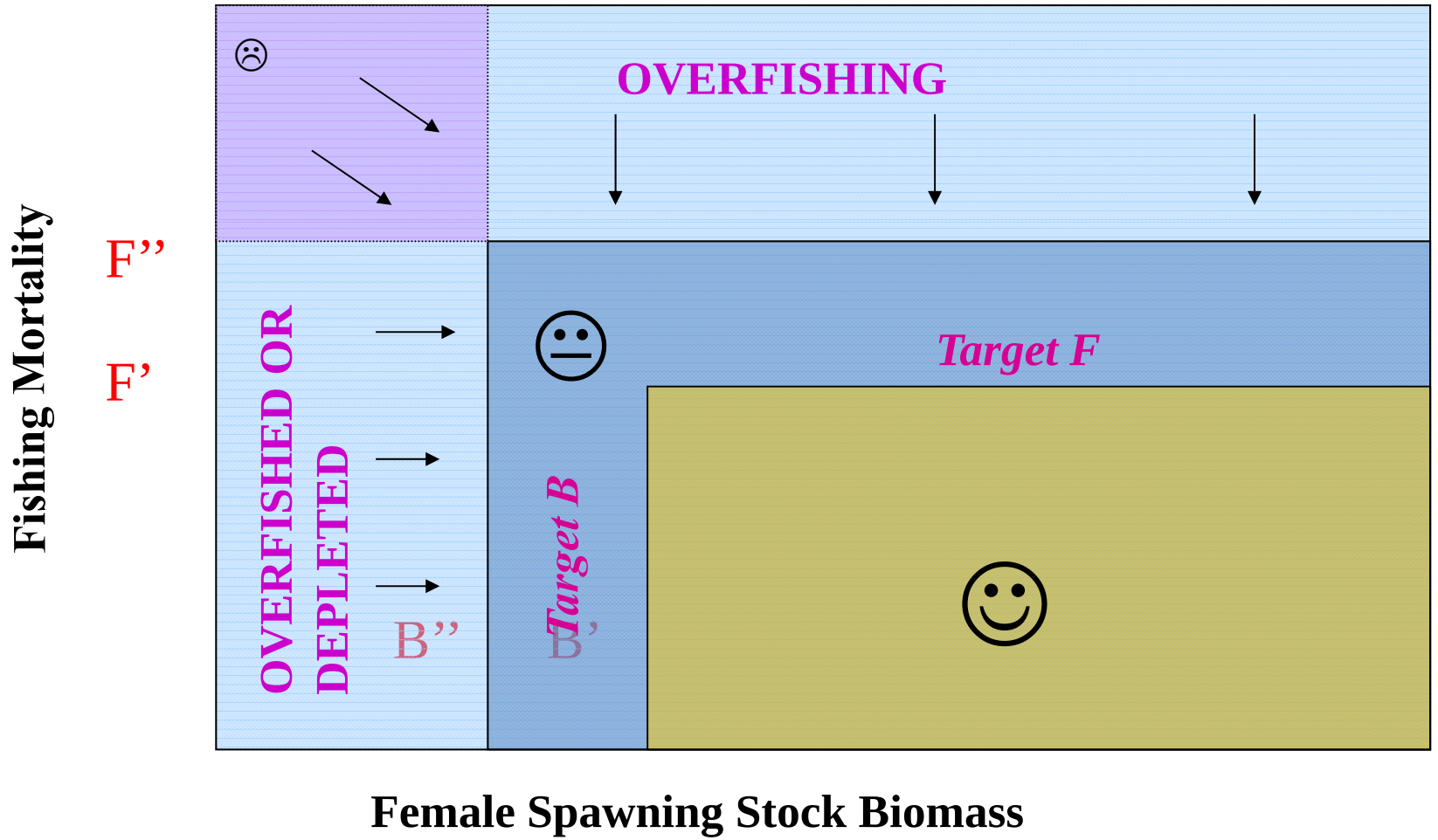
REFERENCE POINTS

Current Reference Points

- Use female spawning stock biomass (SSB) and fishing mortality (F) to gauge the status of the stock and the fishery

- Include target and threshold for SSB and F

Current control rule

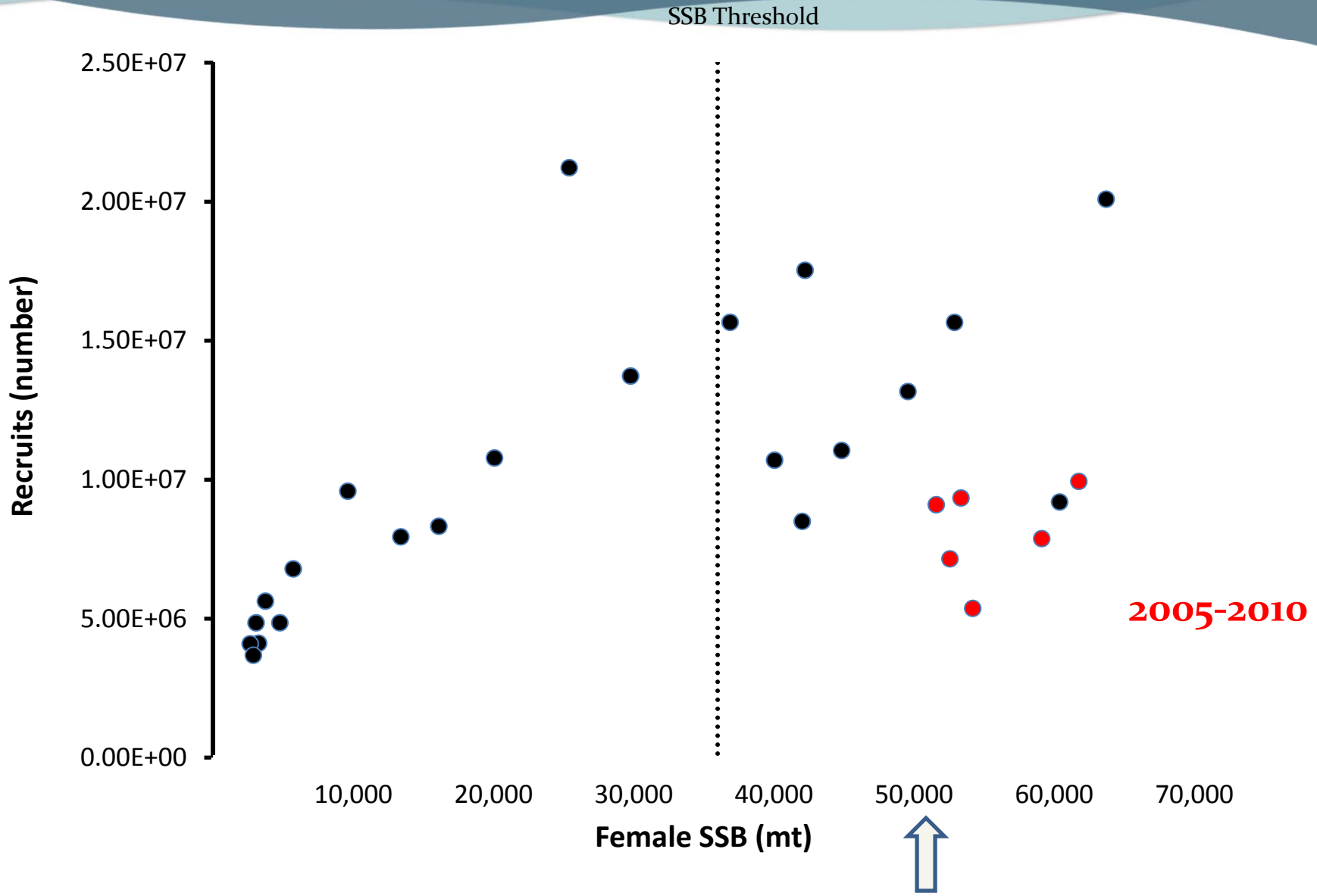


Current Reference Points

- Target and limit SSB values were defined in Amendment VI as
- $SSB_{threshold} = SSB_{1995}$
- SSB_{target} =125% of $SSB_{threshold}$

- Last time reviewed at SAW 46 (2007)
- SSB threshold = 36,000 mt
- SSBtarget =46,101 mt

Current reference points



Current Reference Points

Fishing mortality

Threshold F = F_{msy}

Target F < F_{msy}

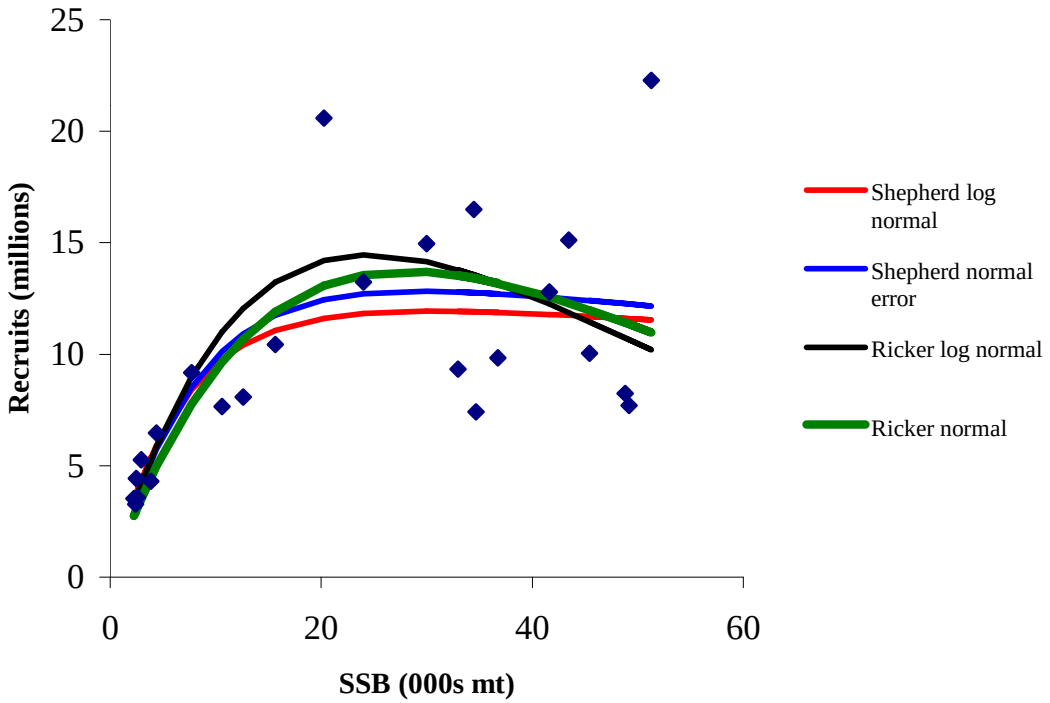
(corresponds to the annual exploitation rate of 24%).

SAW 46 update:

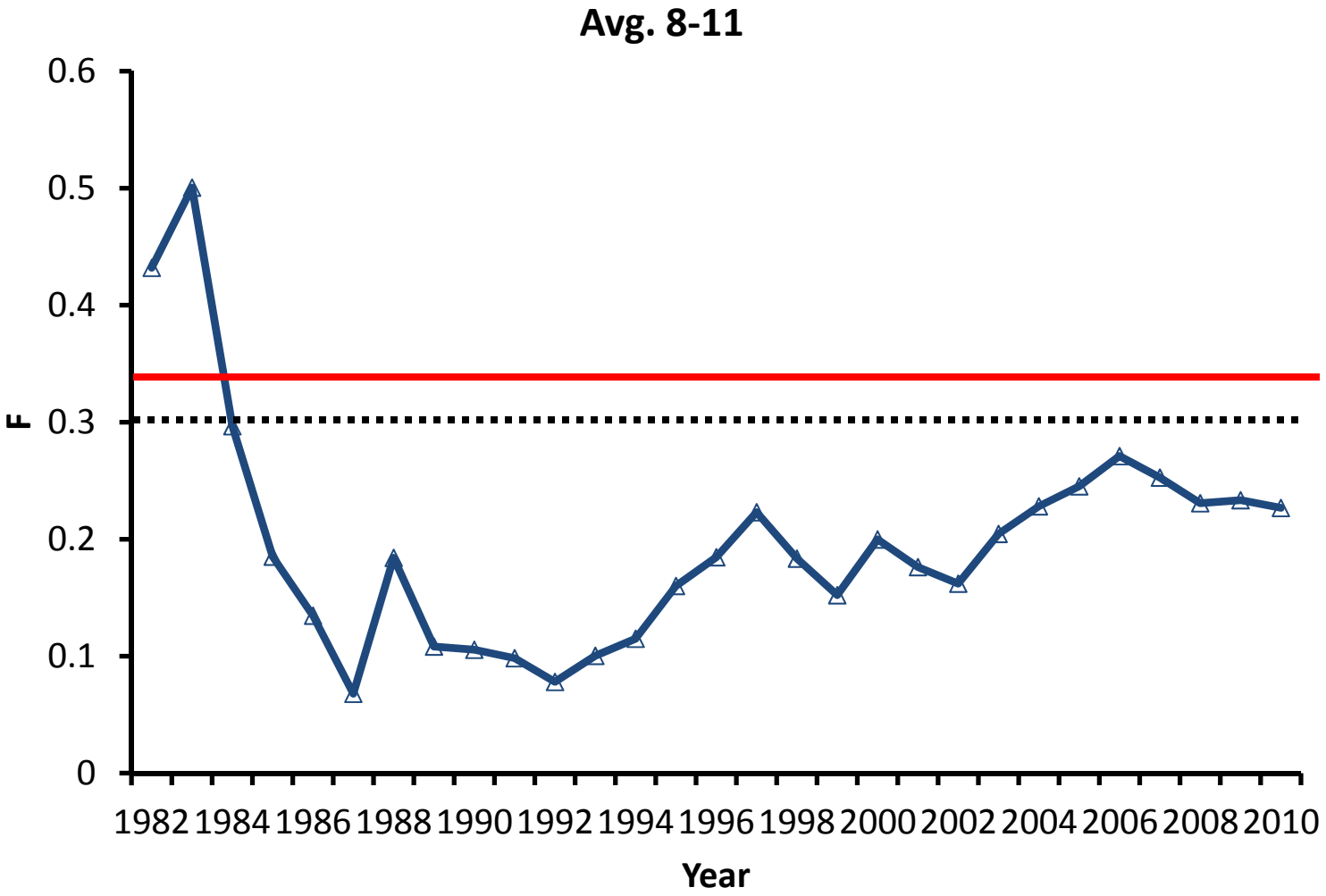
$F_{threshold}$ =F_{msy} =0.34

Based on four Stock recruitment models average

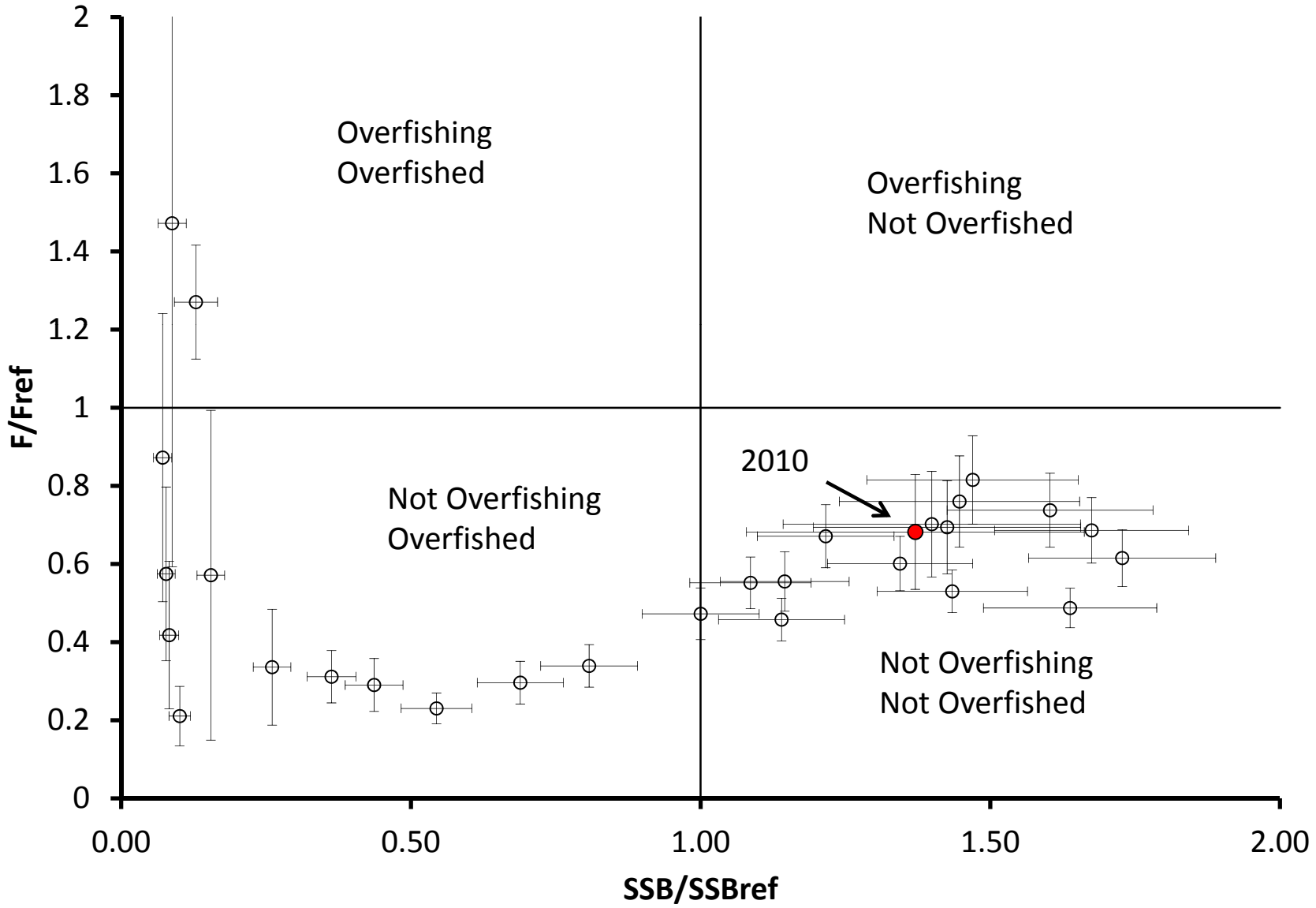
F_{target} =0.3



Fishing Mortality (2012 update)



2012 stock status update



Striped bass reference points proposed in new SAW/SARC 57 2013 assessment

- No change to definition of SSB reference points, but numbers changed

- Revised F_{target} and $F_{threshold}$ such that

- F_{target} – fishing mortlatiy that in reusults in SSB = SSB_{target} in longterm

- $F_{threshold}$ – fishing mortlatiy that in reusults in SSB = $SSB_{threshold}$ in longterm

Major reasons for reference points revision

- Current estimates are sensitive to S/R model assumptions
- Calculations imply that F_{MSY} ~ F20% SPR
- SSB_{MSY} > 1995_{SSB} threshold
- Disconnect between F_{MSY} and long term projection if SSB (< SSB_{MSY})

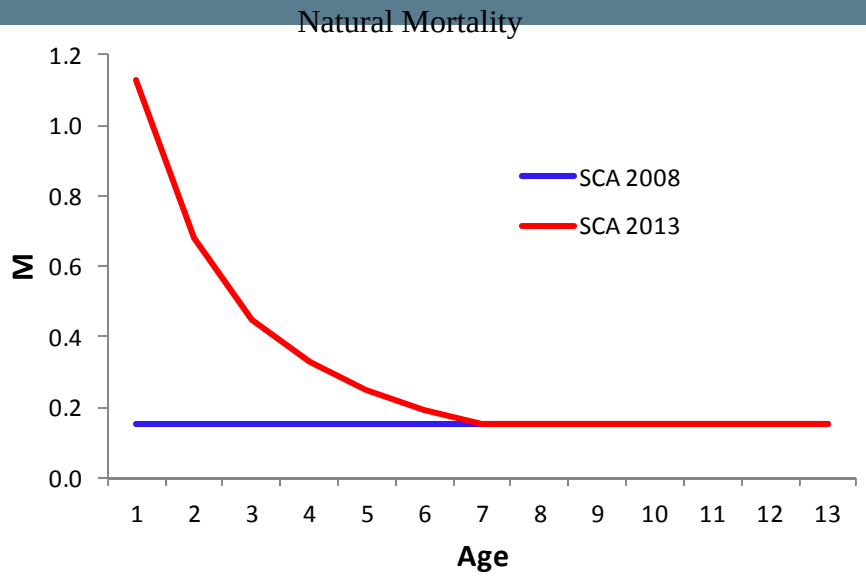
- Alternative approach:
  - Use long term projection drawing from empirical recruitment since 1990 and average selectivity (5 year avg.) and calculate F which produces SSBtarget and SSBthreshold

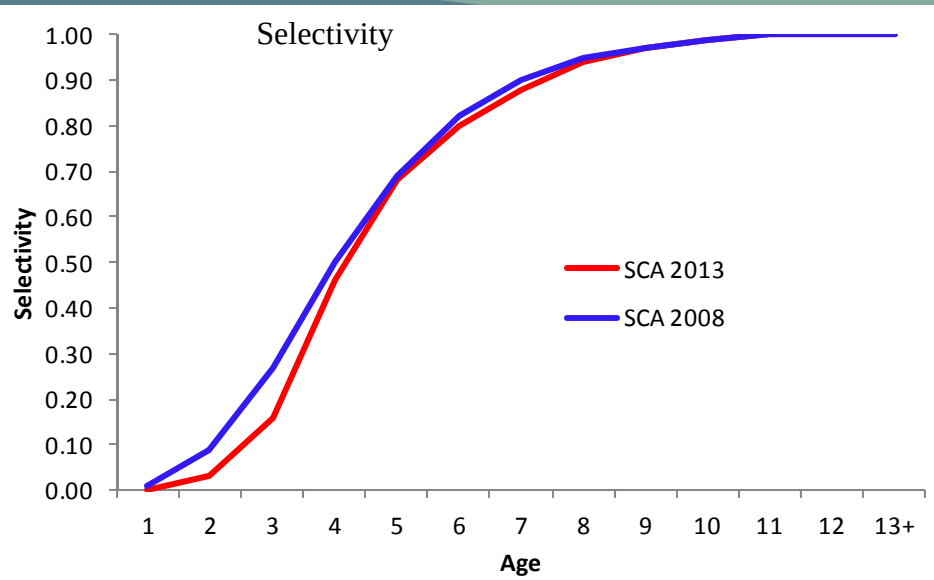
- Advantages:
- 1995 SSB robust to model S/R assumptions
- Avoids management to optimal yield for recreational species
- Aligns SSB reference points with fishing mortality target and threshold

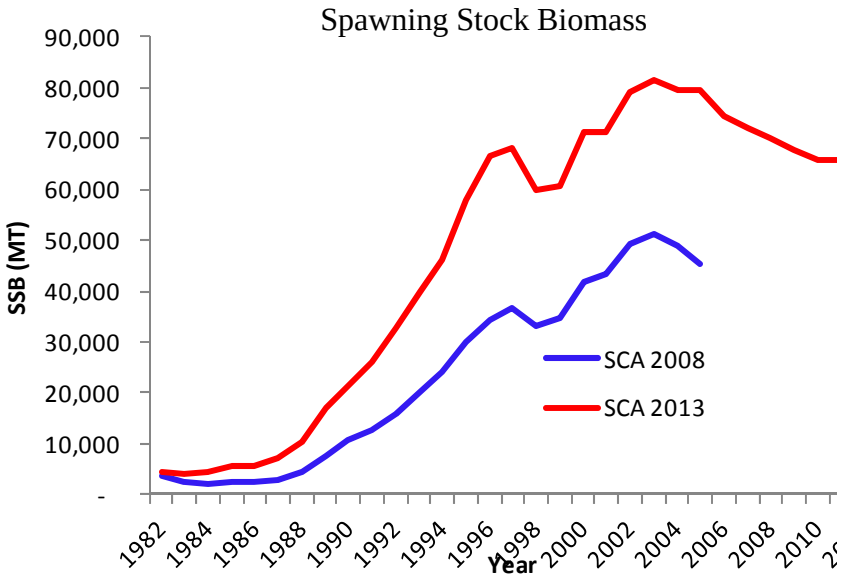
Striped Bass reference points proposed in new SAW/SARC 57 2013 assessment

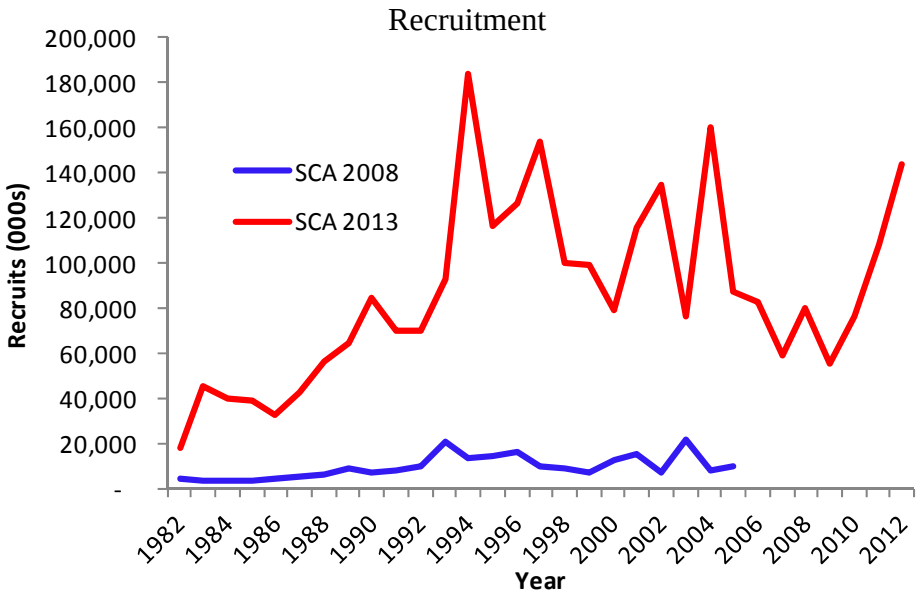
•Inputs affecting reference points calculations:

- Sex ratio information remains the same
- Maturity information remains the same
- Revised natural mortality (age specific)
- New SCA model results
- Beverton- Holt stock recruitment model
- Updated mean weights at age


Natural Mortality
M
Age
SCA 2008
SCA 2013


Selectivity
Selectivity
Age
SCA 2013
SCA 2008

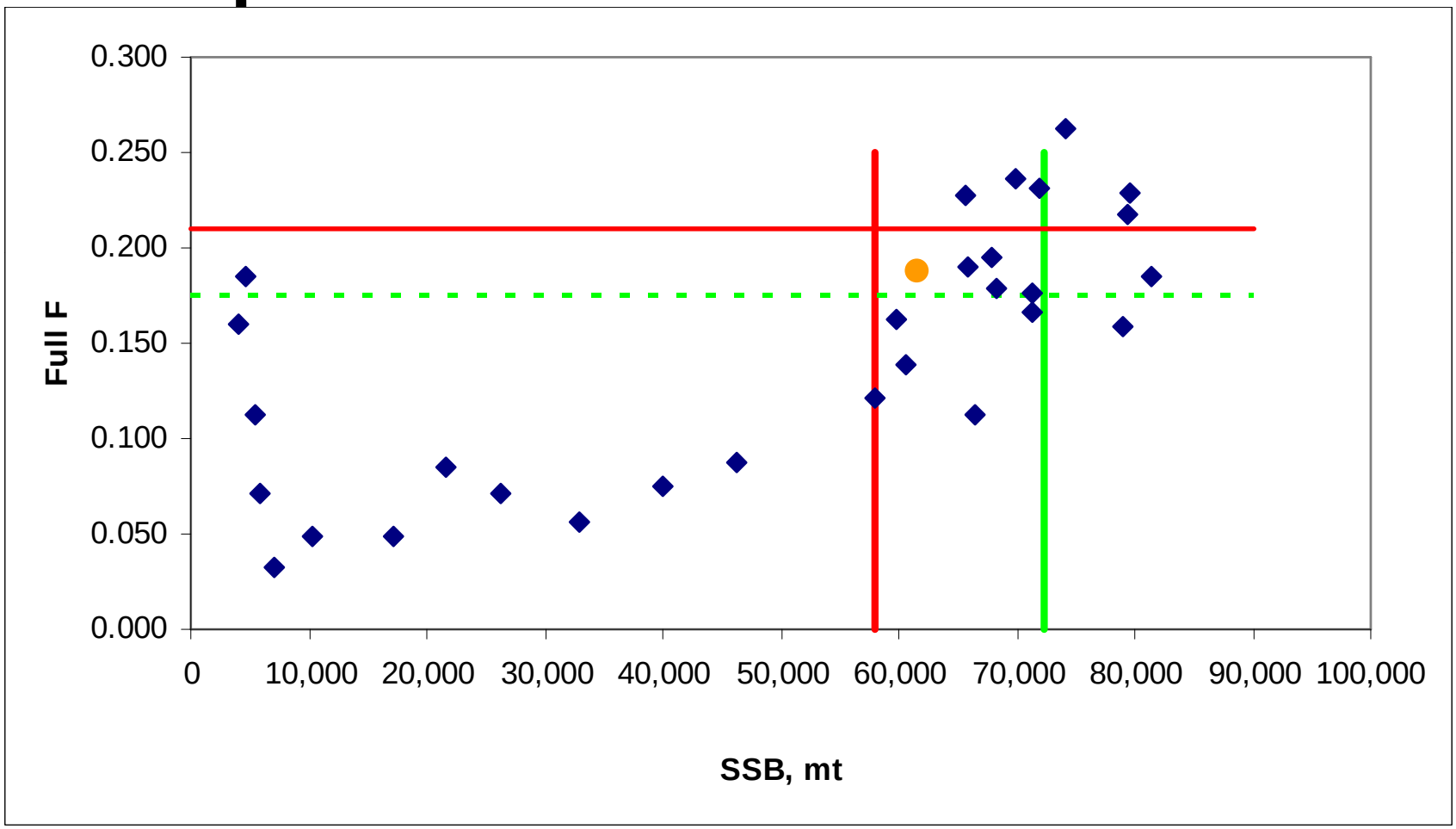

Spawning Stock Biomass
SSB (MT)
Year
SCA 2008
SCA 2013


Recruitment
Recruits (000s)
Year
SCA 2008
SCA 2013

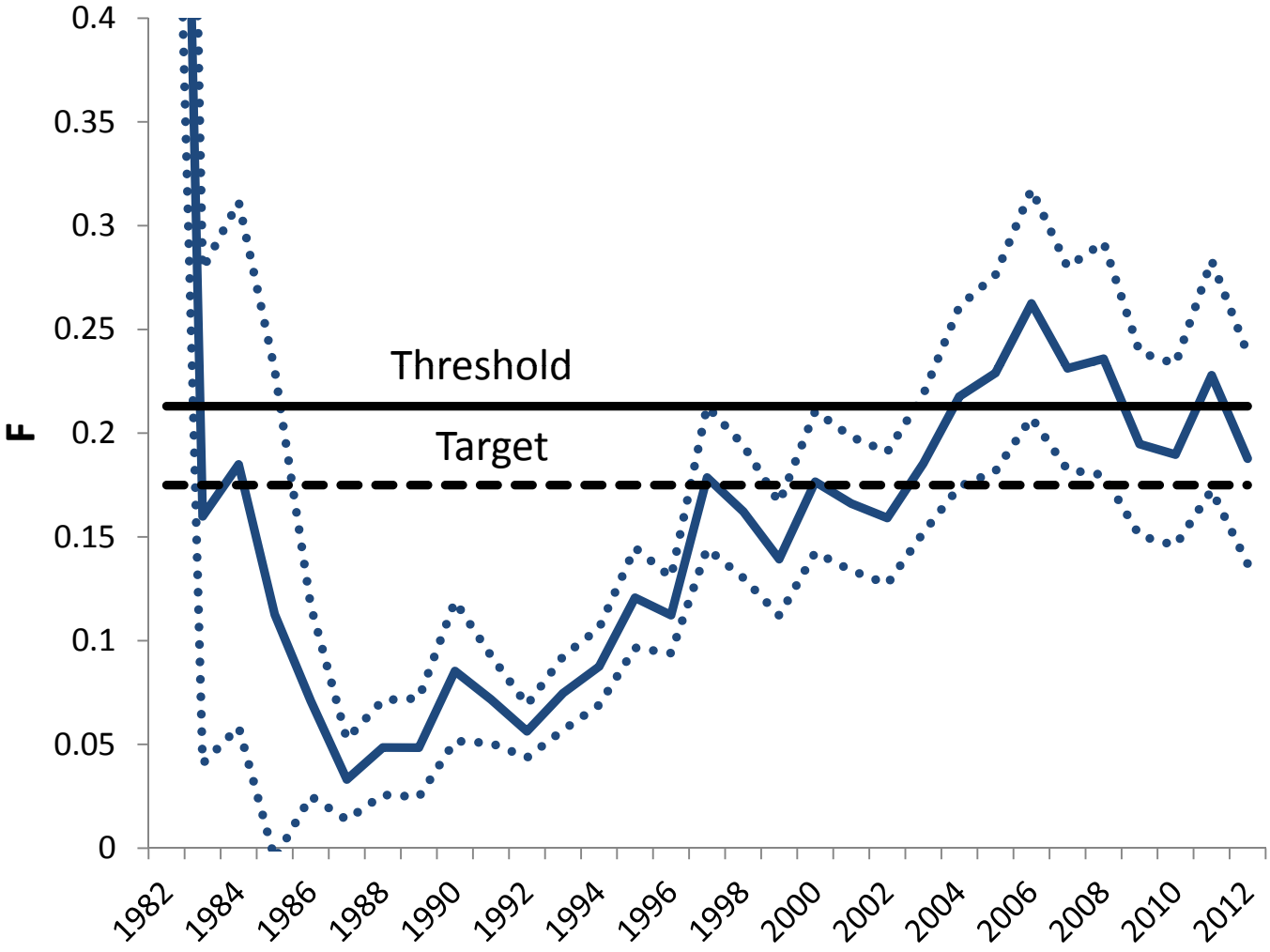
SAW/SARC 57 Updated Striped Bass biological reference points

BRP	Mean	-2se	+2se
SSB_{lim}	57,904	48,721	67,087
F_{lim}	0.213	0.236	0.18
SSB_{target}	72,380	60,901	83,858
F_{target}	0.175	0.145	0.196
SSB_{2012}	58,238	45,338	77,678
F_{2012}	0.200	0.136	0.239

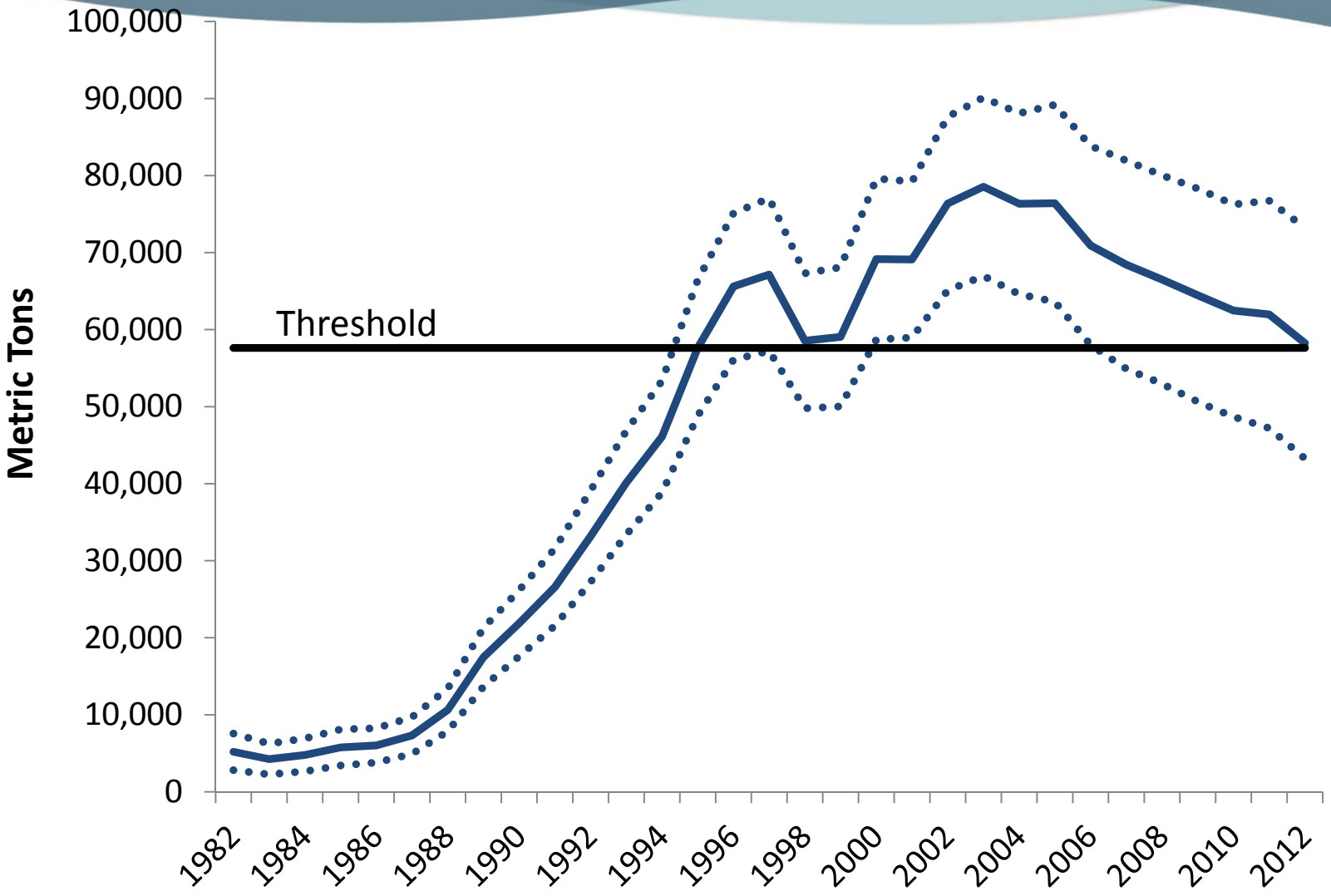
Striped bass stock status relative to new



Fishing Mortality (±95% CI)



Female Spawning Stock Biomass (±95%CI)

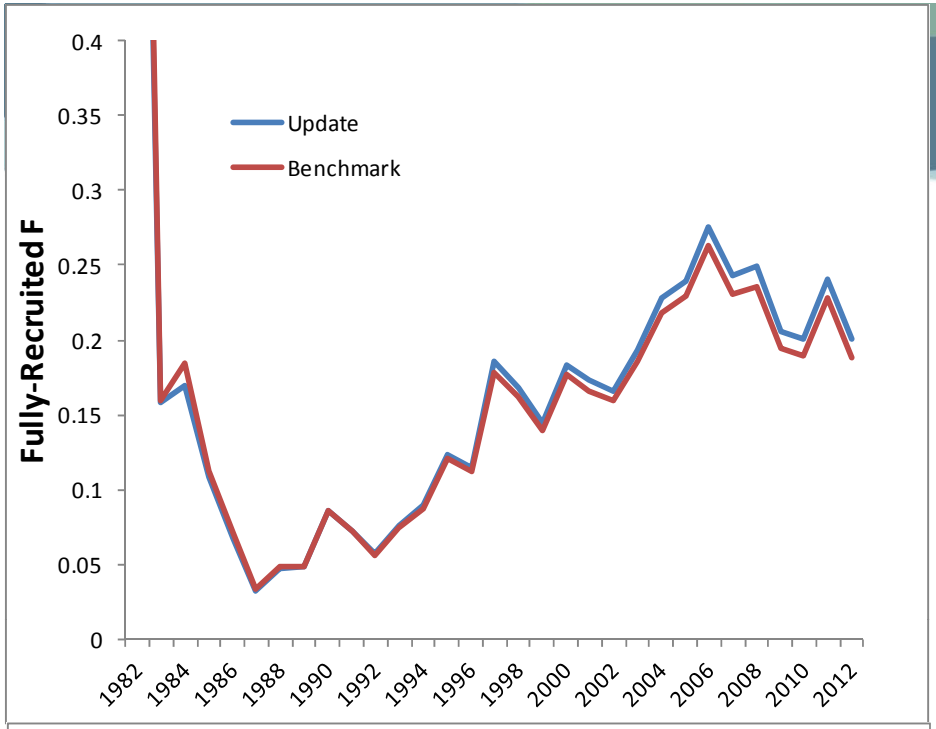


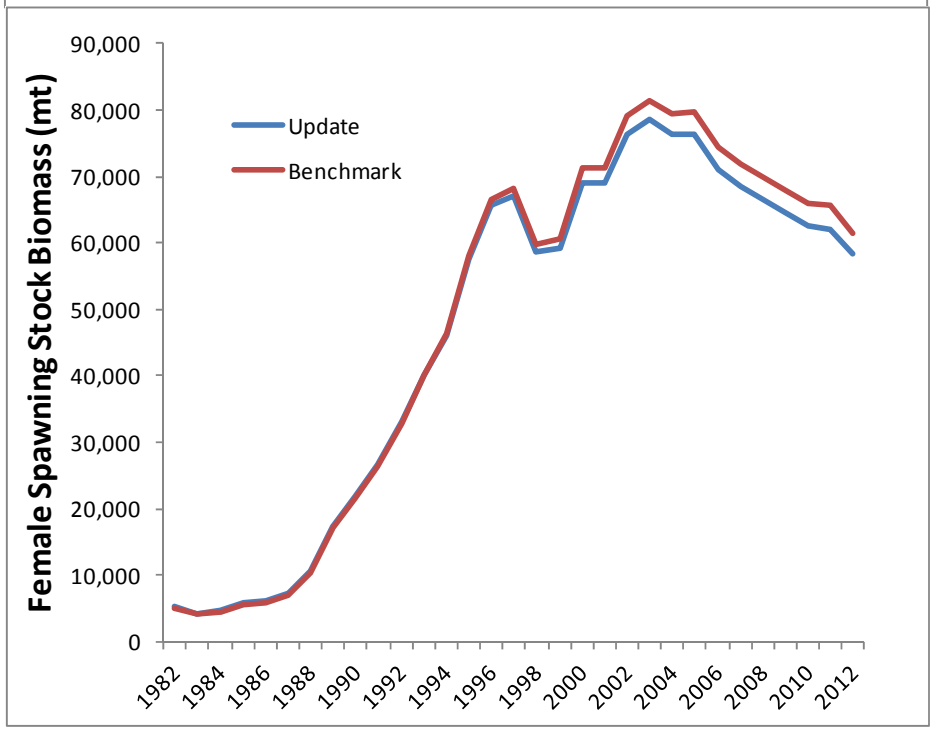
Probabilities

y		Uncorrected	Retro Corrected
SSBref (SD)	SSB2012 (SD)	$Pr(SSB_{2012}<=SSB_{ref})$	$Pr(SSB_{2012}<=SSB_{ref})$
57626 (4500)	58237 (7646)	0.46	0.12

		Uncorrected	Retro Corrected
Fref	F2012 (SD)	$Pr(F_{2012}>=F_{ref})$	$Pr(F_{2012}>=F_{ref})$
0.219	0.200 (0.027)	0.24 (w/o Fref error)	0.04
		0.31 (w/Fref error)	0.13

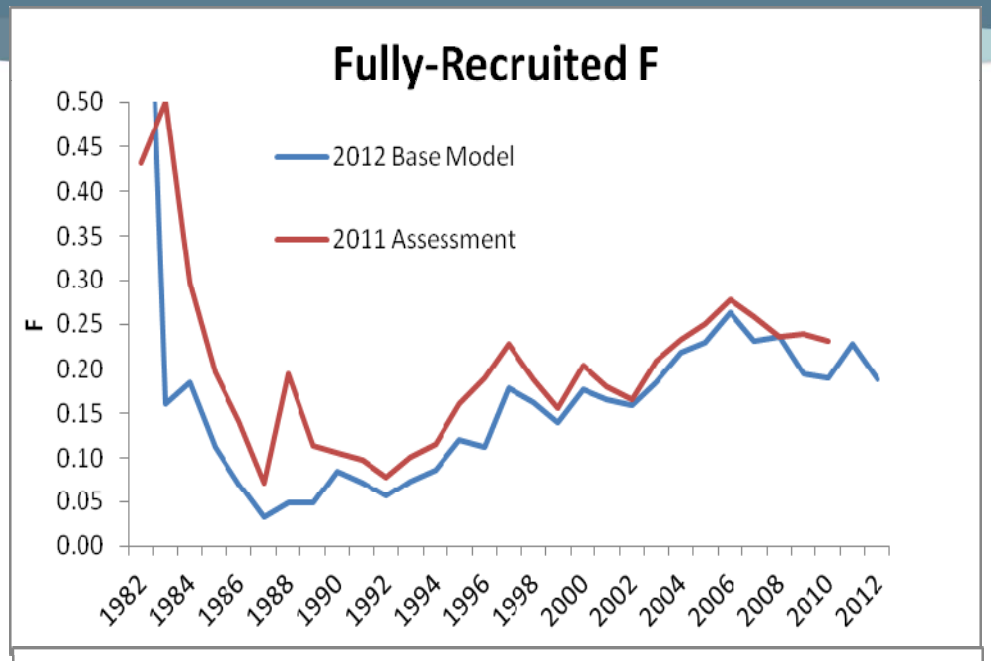
SENSITIVITY RUNS

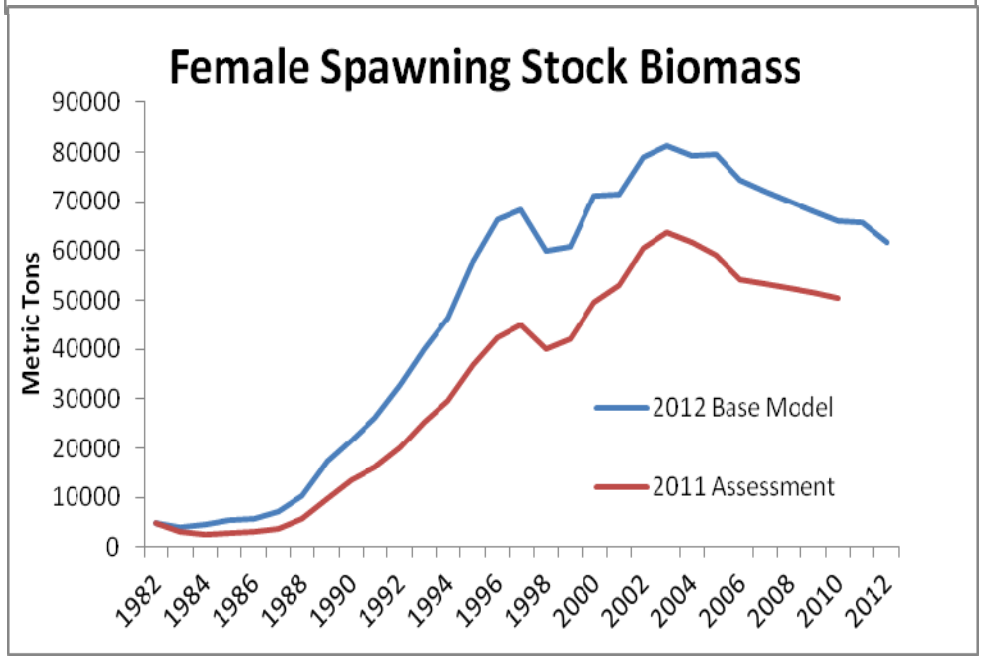


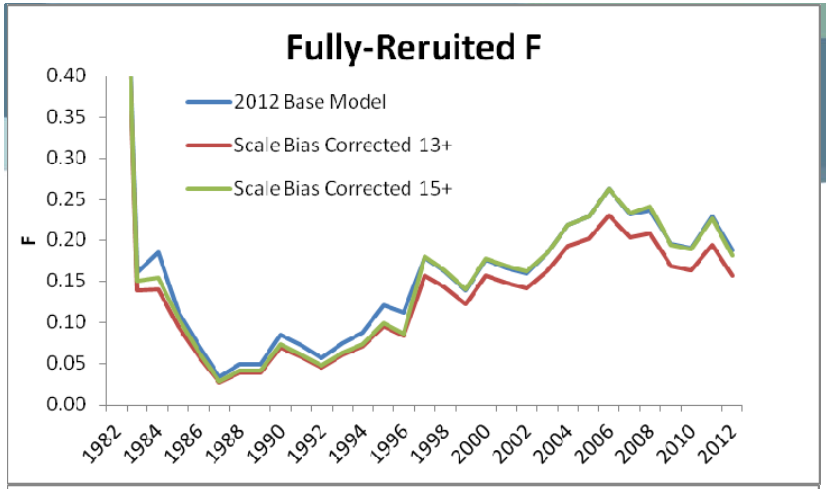


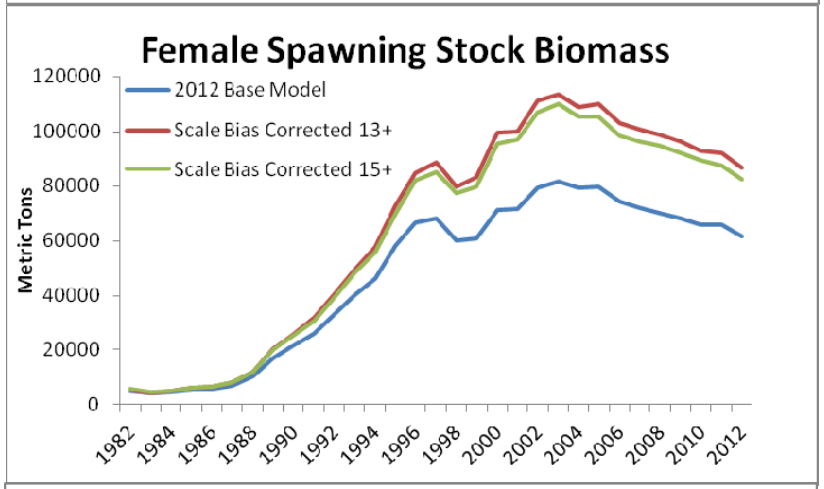
Comparison of Benchmark and Update

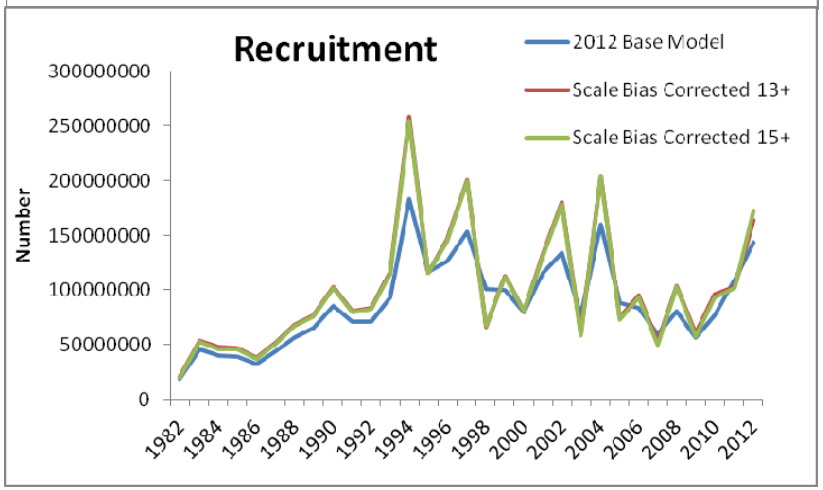
Comparison of Benchmark and 2011 Assessment





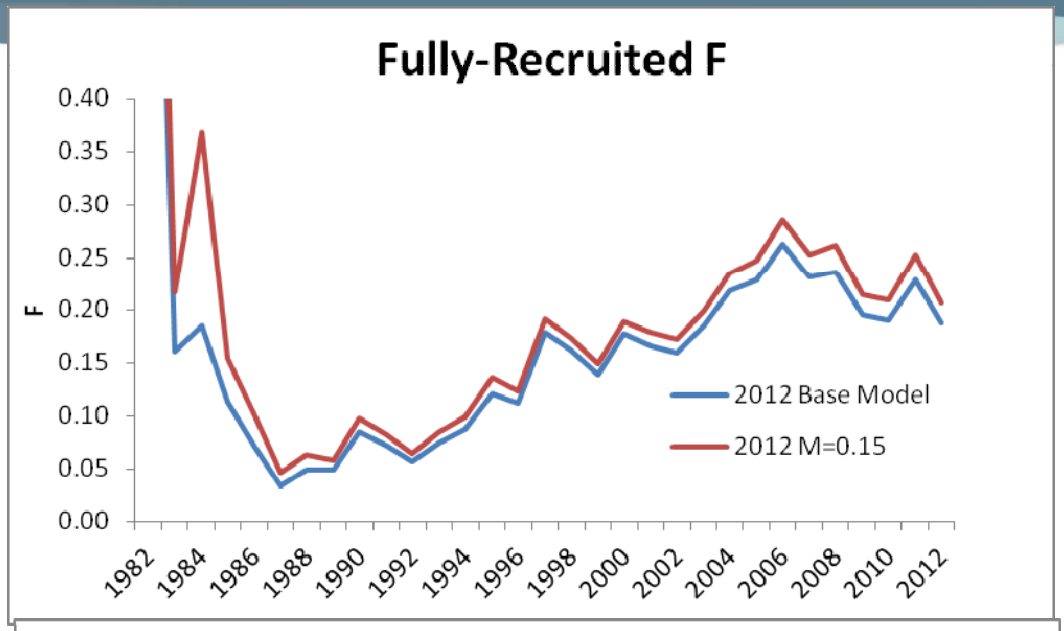


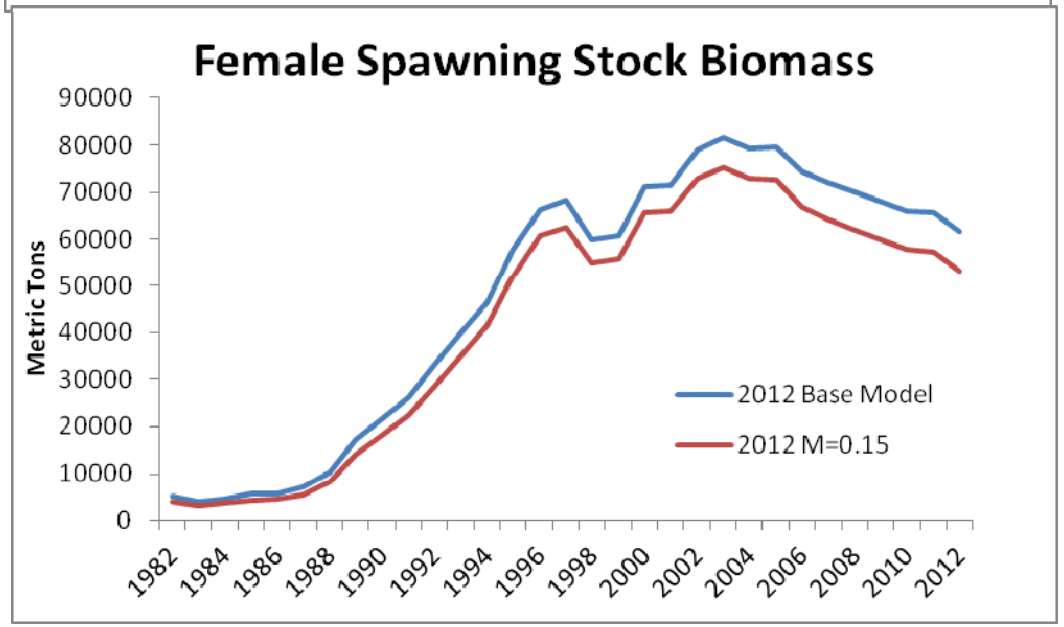




Comparison of Benchmark and Otolith Adjusted Ages

Comparison of Benchmark and Constant M=0.15





PROJECTIONS

Projections

- Projected 2012 abundance-at-age forward through 2017

- Calculated SSB and probability of going below SSB reference point

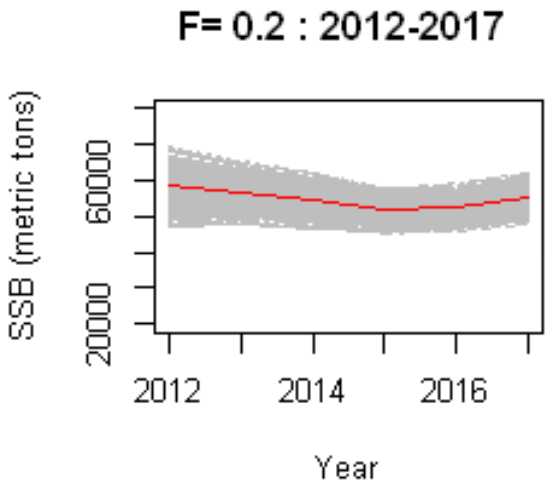
- Used 2012 selectivity pattern for 2012; average 2008-2012 for 2013-2017

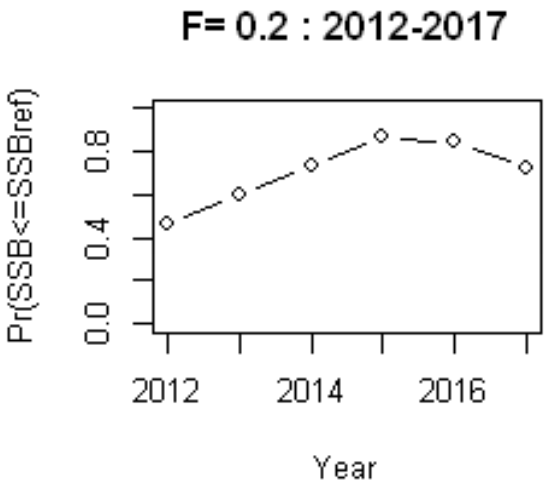
- Resampled from empirical recruitment values from 1990-2012

- Starting abundance-at age in 2012 resampled 1000 times

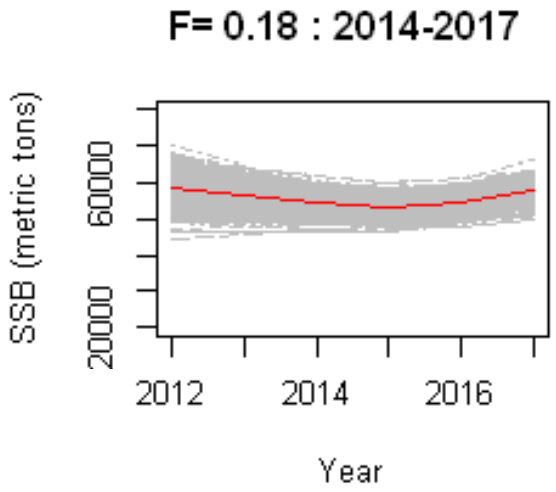
- Used F_{2012}=0.200, F=0.219 (Fref), F=0.180 (target), F=0.34 (old Fref), F=0.15, F=0.10

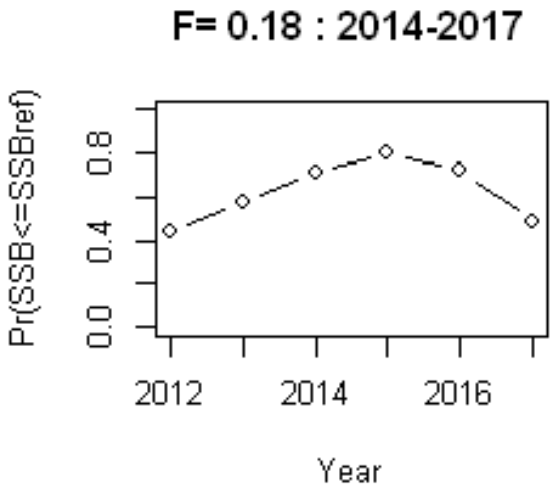
Constant Fishing Mortality

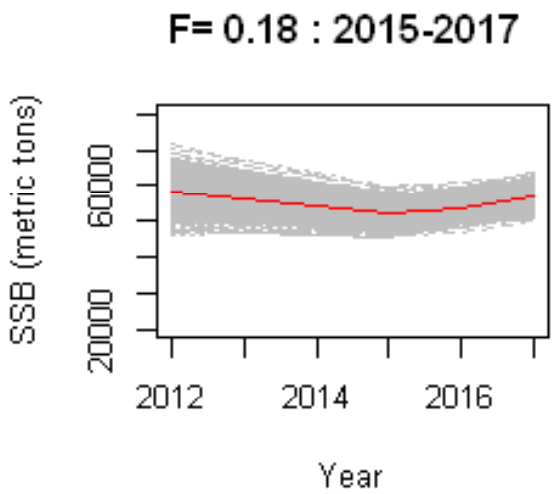


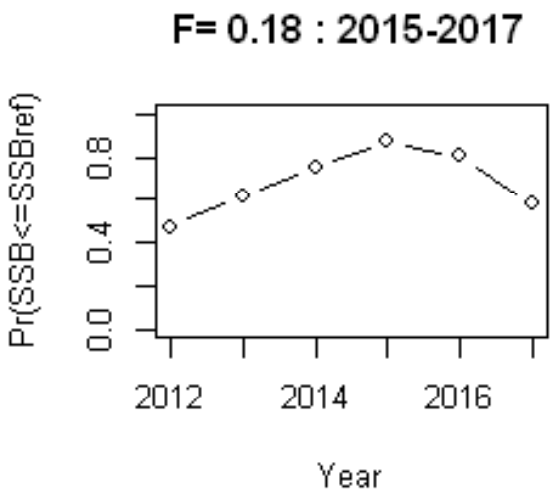


Constant Fishing Mortality (cont.)

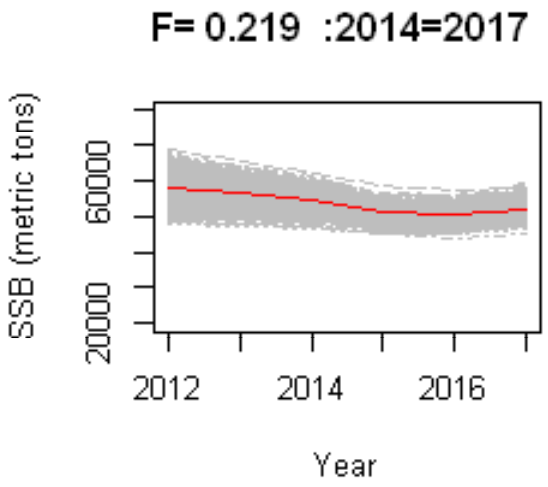


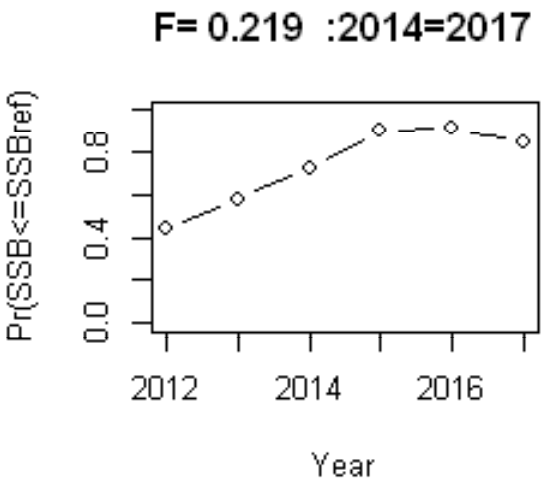


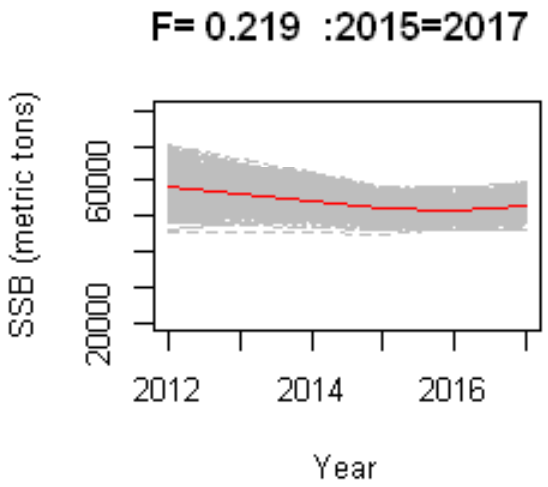


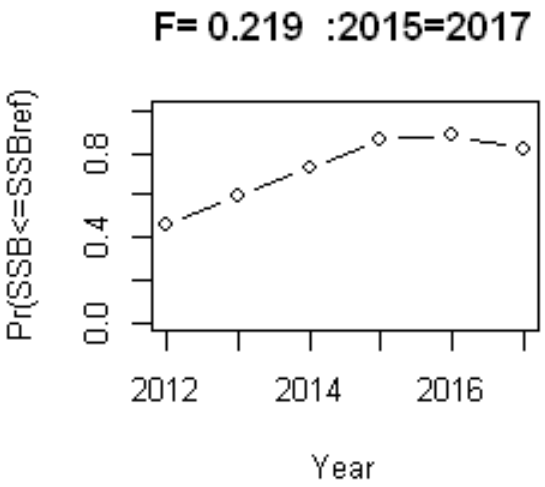


Constant Fishing Mortality (cont.)

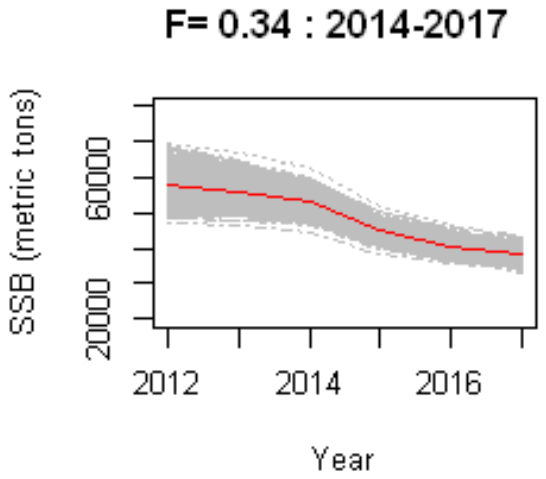


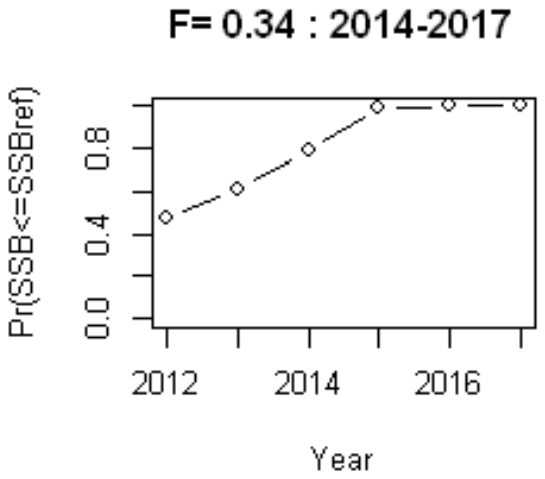


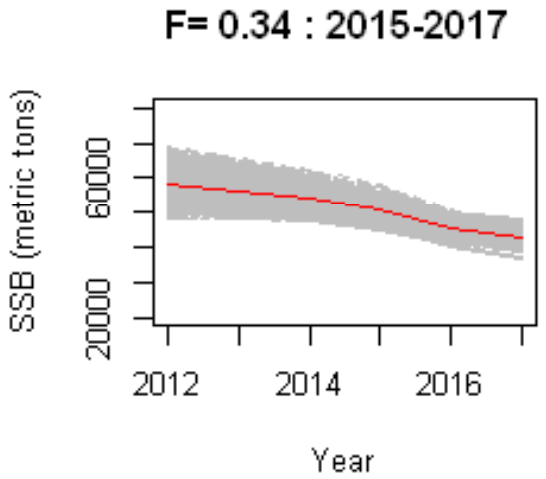


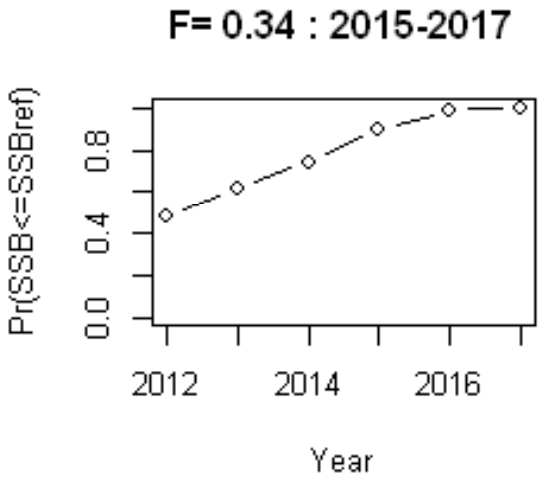


Constant Fishing Mortality (cont.)

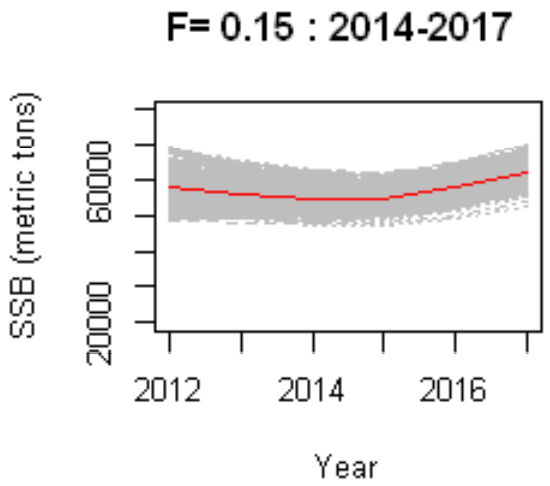


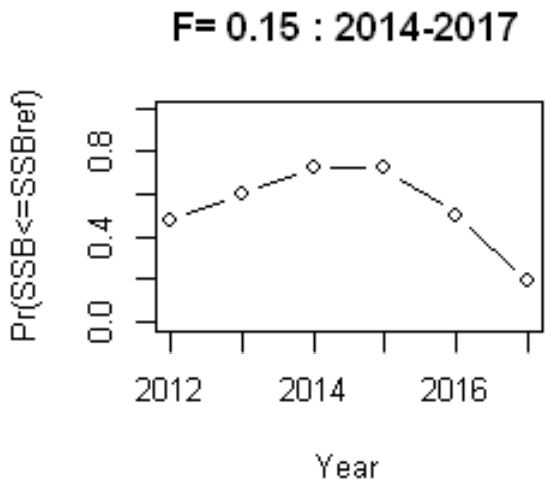


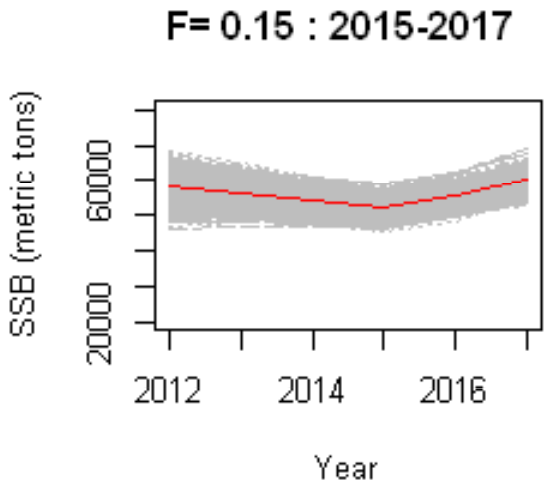


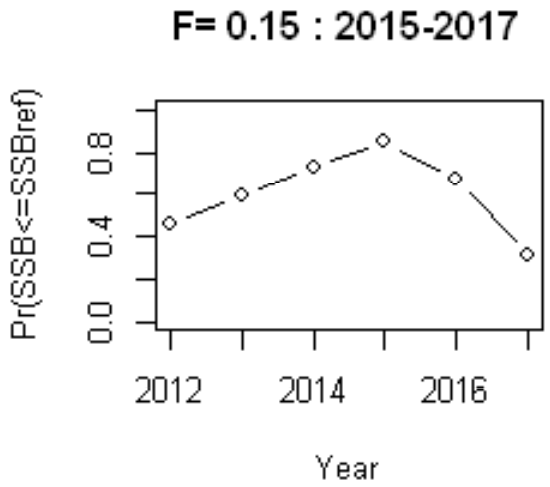


Constant Fishing Mortality (cont.)









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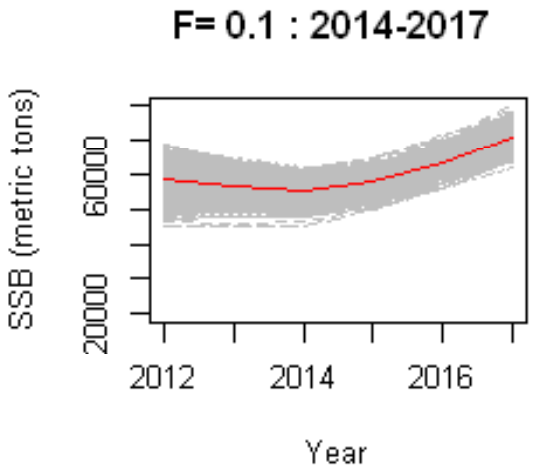
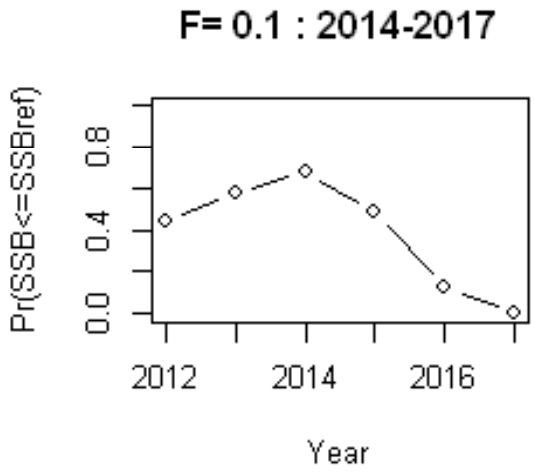
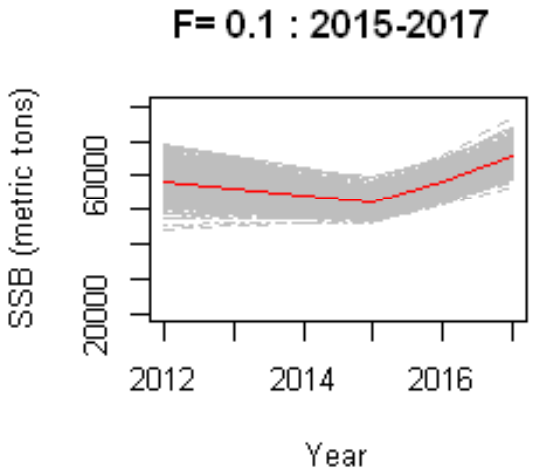
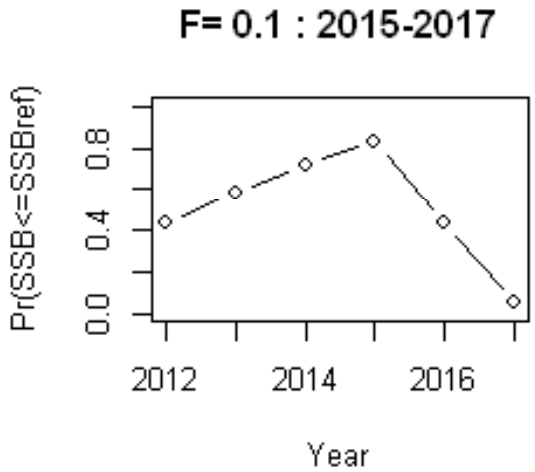


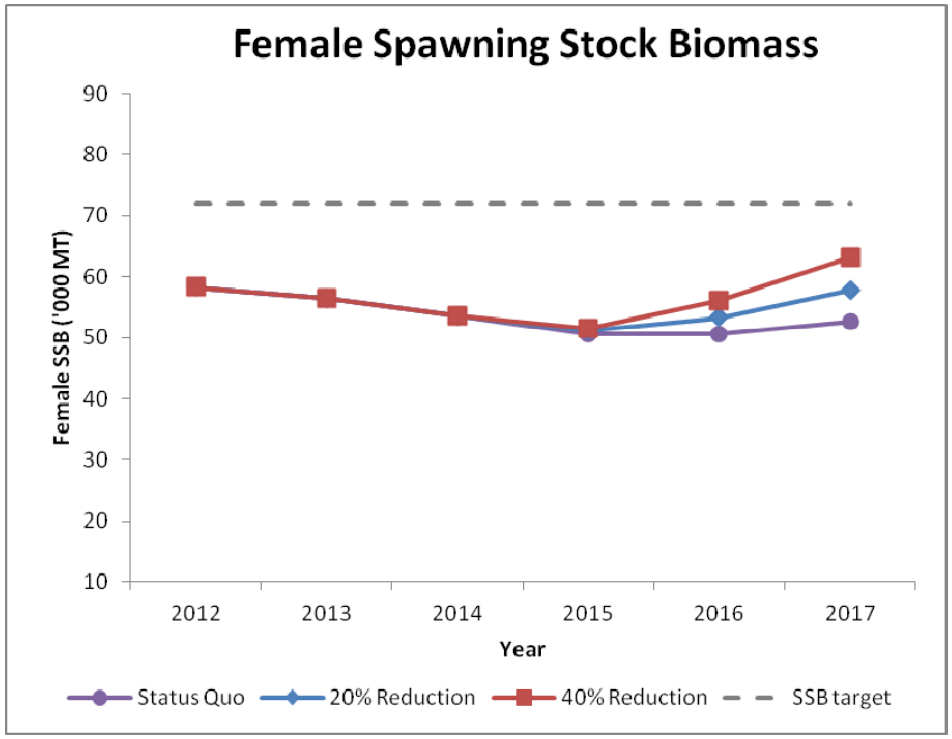


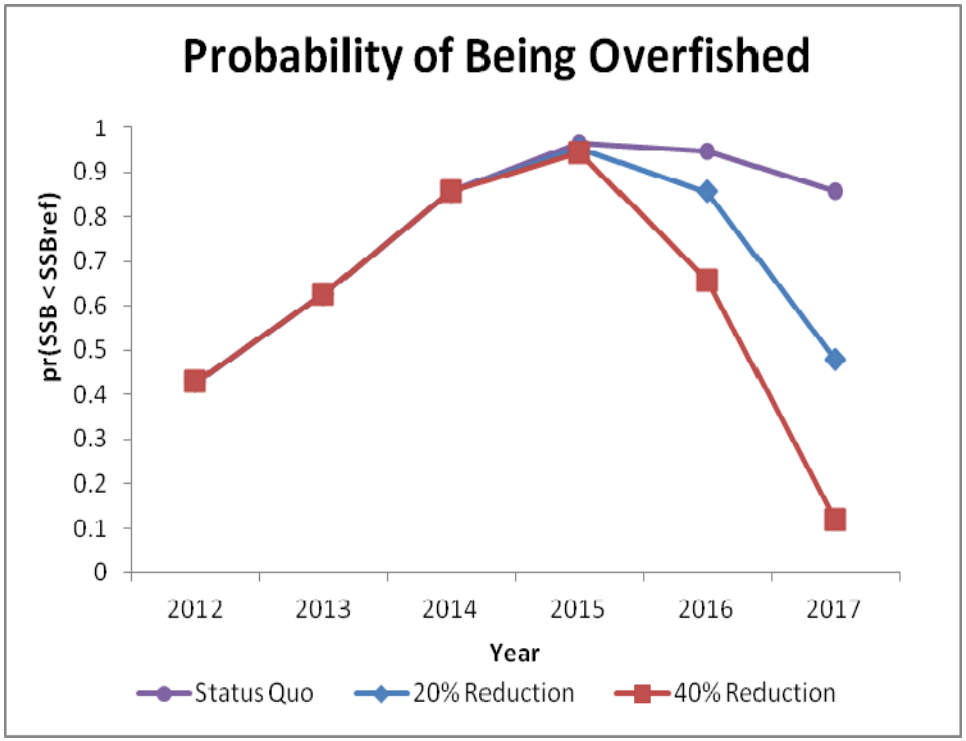




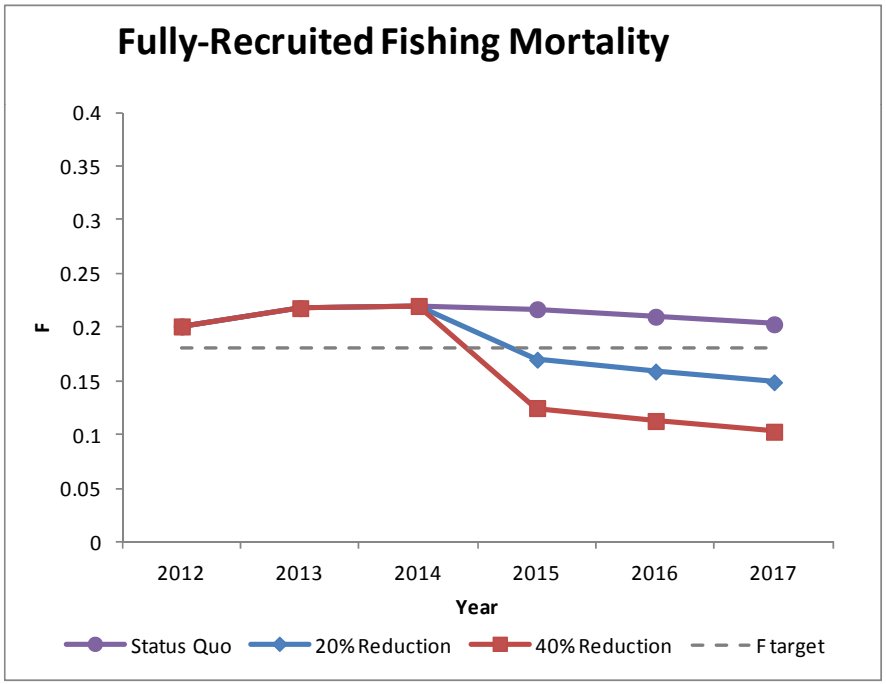
CONSTANT HARVEST SCENARIOS

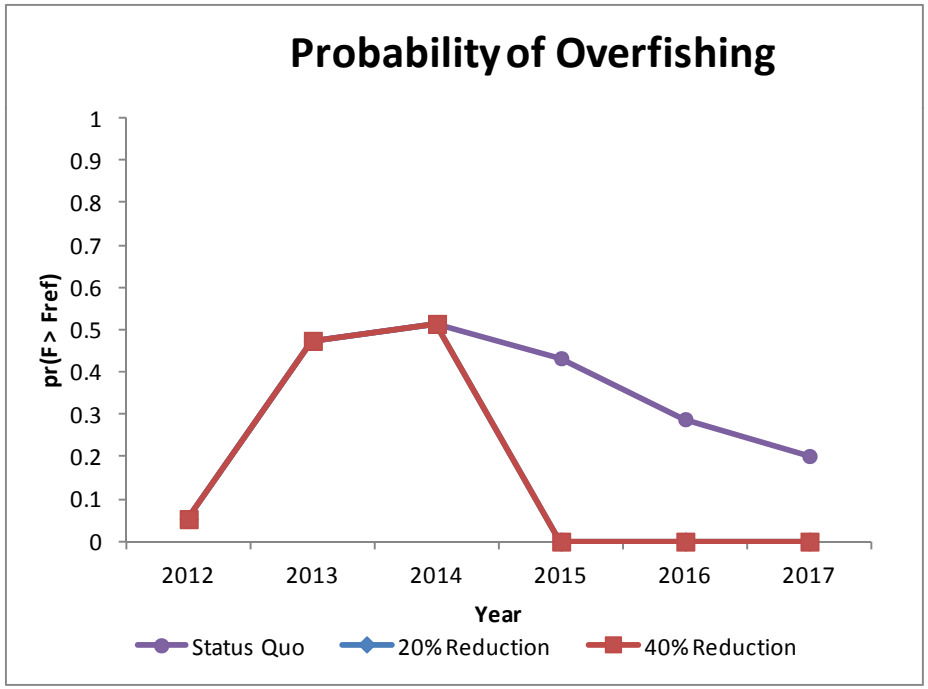
Constant Harvest Scenarios



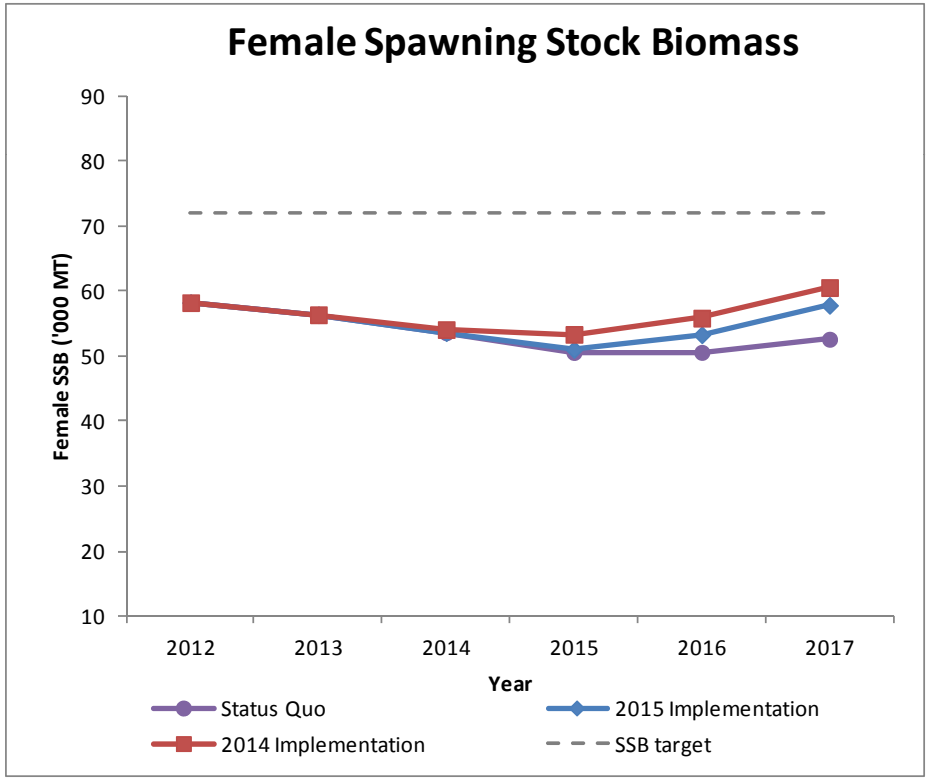


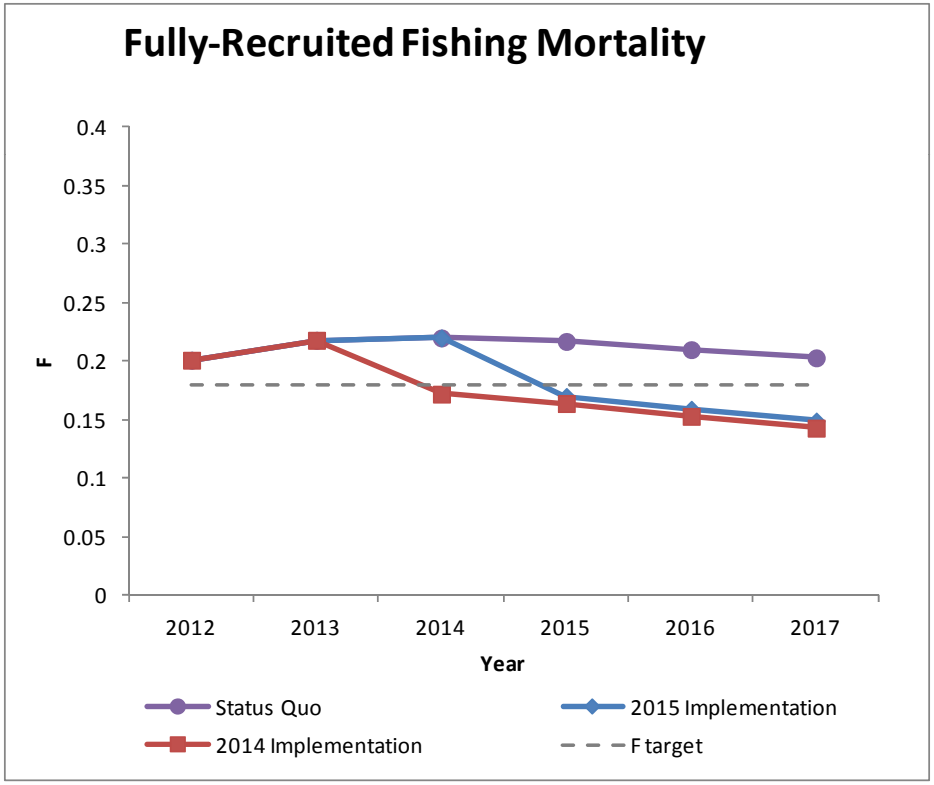
Constant Harvest Scenarios





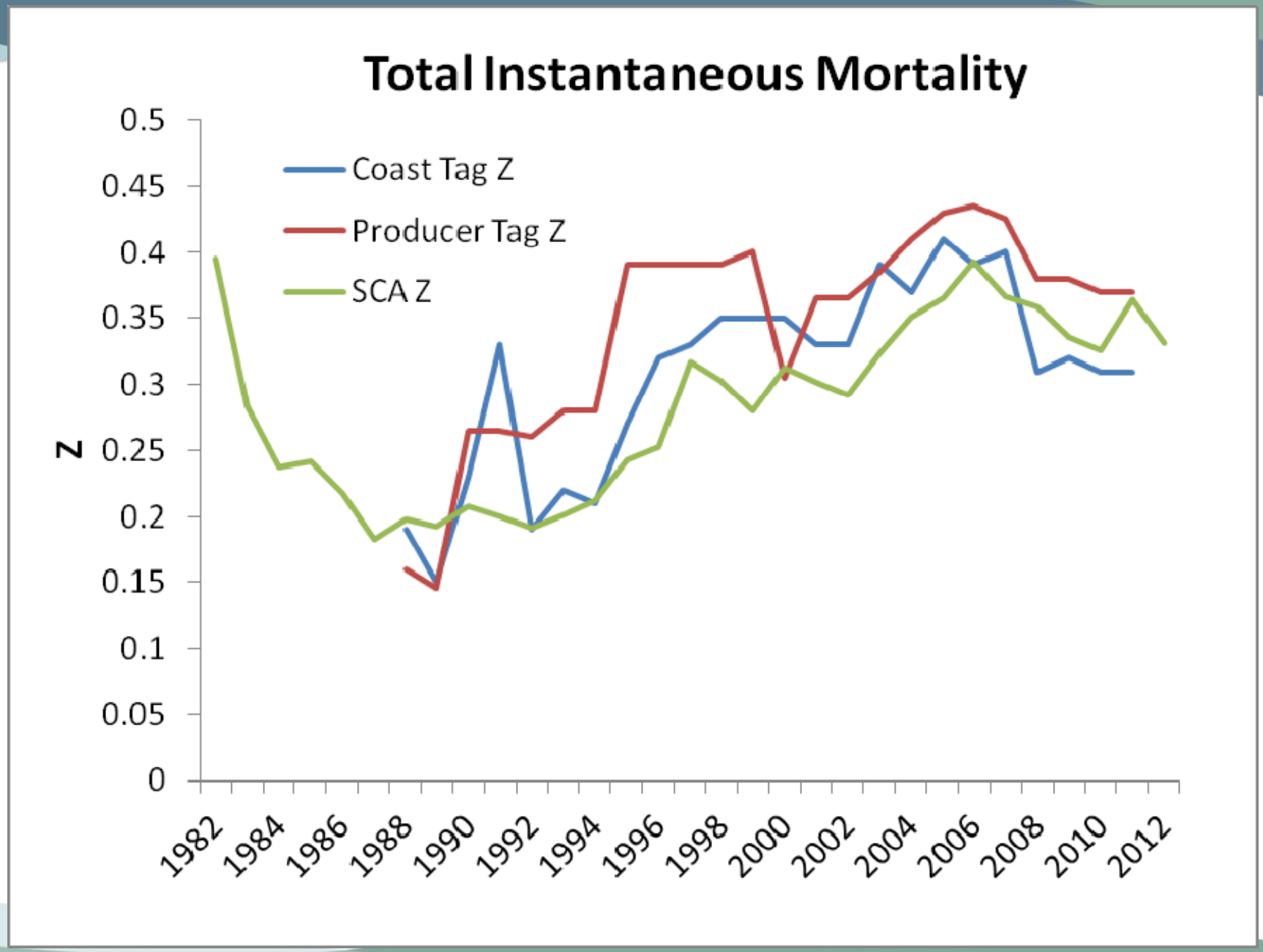
Constant Harvest Scenario





20% Reduction in Harvest

SCA VS TAG COMPARISON OF TOTAL MORTALITY


Total Instantaneous Mortality
Coast Tag Z
Producer Tag Z
SCA Z
Z
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012

Striped Bass
Assessment Peer Review Report

Presented to ASMFC Striped Bass
Management Board

October 29, 2013

NEFSC Stock Assessment Review Committee (SARC) Process

1. Striped Bass Stock Assessment Subcommittee, Tagging Subcommittee, and Technical Committee developed assessment

2. External Peer Review Panel: Chair + Center of Independent Experts (CIE)

   - Emphasis on reviewing only the science/assessment

3. SARC Products: 3 Individual Reviewer Reports, Review Panel Consensus Report, and Summary Report

   http://www.nefsc.noaa.gov/nefsc/saw/ (see SAW/SARC 57)

   http://www.nefsc.noaa.gov/publications/ (see Ref. Docs.)

The 57th Northeast Regional
Stock Assessment Review Committee (SARC 57)
Northeast Fisheries Science Center, Woods Hole, Massachusetts
July 23-26, 2013

SARC Chair:

Dr. Cynthia Jones, Old Dominion University, MAFMC SSC

SARC Panelists from the Center for Independent Experts:

Dr. Robin Cook, University of Strathclyde, Glasgow, Scotland

Dr. John Simmonds, National Fisheries Laboratory, Scotland

Dr. Henrik Sparholt, ICES, Copenhagen, Denmark

Review Panel Overall Findings

- Stock assessment was accepted; stock is not overfished and overfishing is not occurring in 2012

- Panel finds stock assessment acceptable for management use

Assessment Terms of Reference

- **ToR 1:** Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources. Evaluate evidence for changes in natural mortality in recent years.
- Panel Recommendation: re-examine the age aggregated MRFSS/MRIP index using different models, or by truncating the age range

ToR 2: Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.

<u>Panel Recommendations:</u>

- organize fishery dependent data in the model to represent actual fishing fleets
  - current 'fishing fleets' are Chesapeake landings, coastal landings, and commercial dead discards
- split the assessment into female and male components to account for sexual dimorphism

ToR 3: Use the statistical catch-at-age model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component, where possible, and for total stock complex.

The review concludes this ToR was completed, the current assessment is acceptable and suitable for estimating the status of the stock.

ToR 3

Panel Recommendations:

- Re-evaluate model sensitivity to the MD Spawning Stock Survey Index and MRFSS/MRIP aggregate index because of their influence on results
- Assessment model is based on three 'fleets' that do not correspond to real fisheries
  - reformulating assessment into two or more fleets, each with landings and discard components, may add value to assessment results, allowing commercial and recreational fisheries to be considered separately
- Splitting the assessment by females and males should be considered in the future, given the implications on mortality and the estimation of reference points
- Explore potential bias caused by the use of scales to age individuals (vs. otoliths)

ToR 4: Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.

Panel Recommendations:

- Inclusion of tag estimated mortality in the assessment may be helpful, possibly to estimate a new rate, or confirm the current discard survival rates used for estimating catch are accurate
- Explore data on re-releases of tagged fish that may be more typical of fishery releases than those released by tagging program

ToR 5: Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs.

Panel Findings:

- Internally consistent F and SSB thresholds and targets were defined based on a non-parametric assumption that future recruitment will be similar to past recruitment (1990 to present)
- Overall the approach does not estimate F_{MSY} or SSB_{MSY} explicitly but provides management reference points that promote high and stable long term yield

ToR 6: Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

Panel Recommendations:

- Projections need to be run with the same recruitment model that is used for calculation of the biological reference points
- Current three fleet approach makes it difficult to estimate mortality separately for the two main fisheries
  - Suggest reformulating model into recreational and commercial fleets

ToR 7: Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

Panel Recommendations:

- Developing an aggregate index from state surveys is a high priority
- Examine issues related to sexually differentiated migrations
- Consider differences in exploitation of males and females regarding migratory behavior and its consequential influence on BRPs
- Suggest evaluation of a two area spatial assessment model to account for the diverse Chesapeake Bay and coastal fisheries.

Review Panel Overall Findings

- Stock assessment was accepted; stock is not overfished and overfishing is not occurring in 2012
- Aggregating commercial and recreational catches makes results less clear
- Management of striped bass has a history with ad hoc reference points (SSB_{1995}); internally consistent F and SSB threshold and targets were computed that are consistent with estimated SSB_{1995}
- Available data were assembled well and suitable for the assessment; assessment robust to different model formulations; the modeling approach is stable
- Reviewers agreed with assessment team that natural mortality (M) is higher at younger ages, as used in the assessment
- Estimates of both recreational and commercial dead discards are sensitive to assumed values of post-release mortality

Review Panel Future Recommendations

- Improve coordination of fishery-independent surveys to better match the temporal and spatial use of habitats
- Standardize state/coastal surveys to better address temporal and spatial availability of stock and to provide more meaningful combined stock index
- Explore development of a model with male and female components
- Given the non-uniform spatial distribution of the stock by age, obtain a better model of selection for the MRIP index, or truncate the age range of index
- Examine whether modeling inconsistency exists between projections and models used to define BRPs
- Management targets based on female SSB may need to be reconsidered if exploitation of males is significant

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

Striped Bass Management Action Timelines

Atlantic Striped Bass Management Board
August 6, 2013

Potential Addendum Contents

- Change to the F reference points
  - Consider stock specific reference points (CB/AS)
- Constant harvest projections to achieve new F target
- Management measures to achieve desired reduction
- Recreational : bag limits, size limits, season
- Commercial : size limits, commercial quota, season

Action Timelines Moving Forward

1. Initiate draft addendum at this meeting
   - Draft for public comment for February 2014 meeting
   - Conduct public hearings during spring
   - Final Action taken at the May 2014 meeting
2. Initiate draft addendum at February 2014 meeting
   - Draft for public comment for May 2014 meeting
   - Public hearings conducted in summer 2014
   - Final Action taken at the August 2014 meeting