

# Review of Status and Biomass Reference Points for Spiny Dogfish

New England Fishery Management Council  
Portland, ME  
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# Objectives

- Recent Assessment History for Spiny Dogfish
- Background on biomass reference points
- Updated biomass and fishing mortality reference points
- Will NOT discuss pending decisions on revised catch limits for 2010

<http://www.nefsc.noaa.gov/publications/crd/crd1006/index.html>

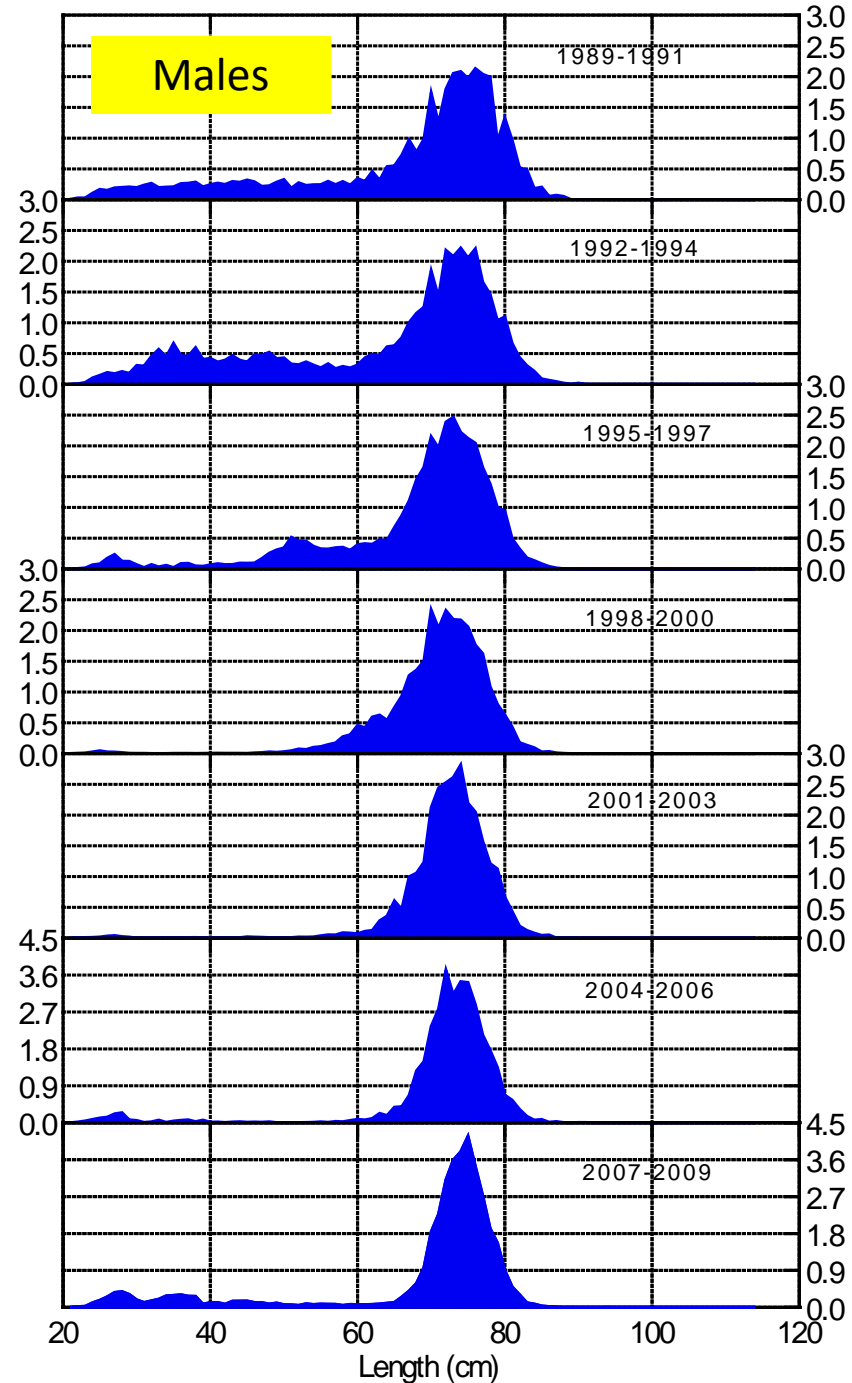
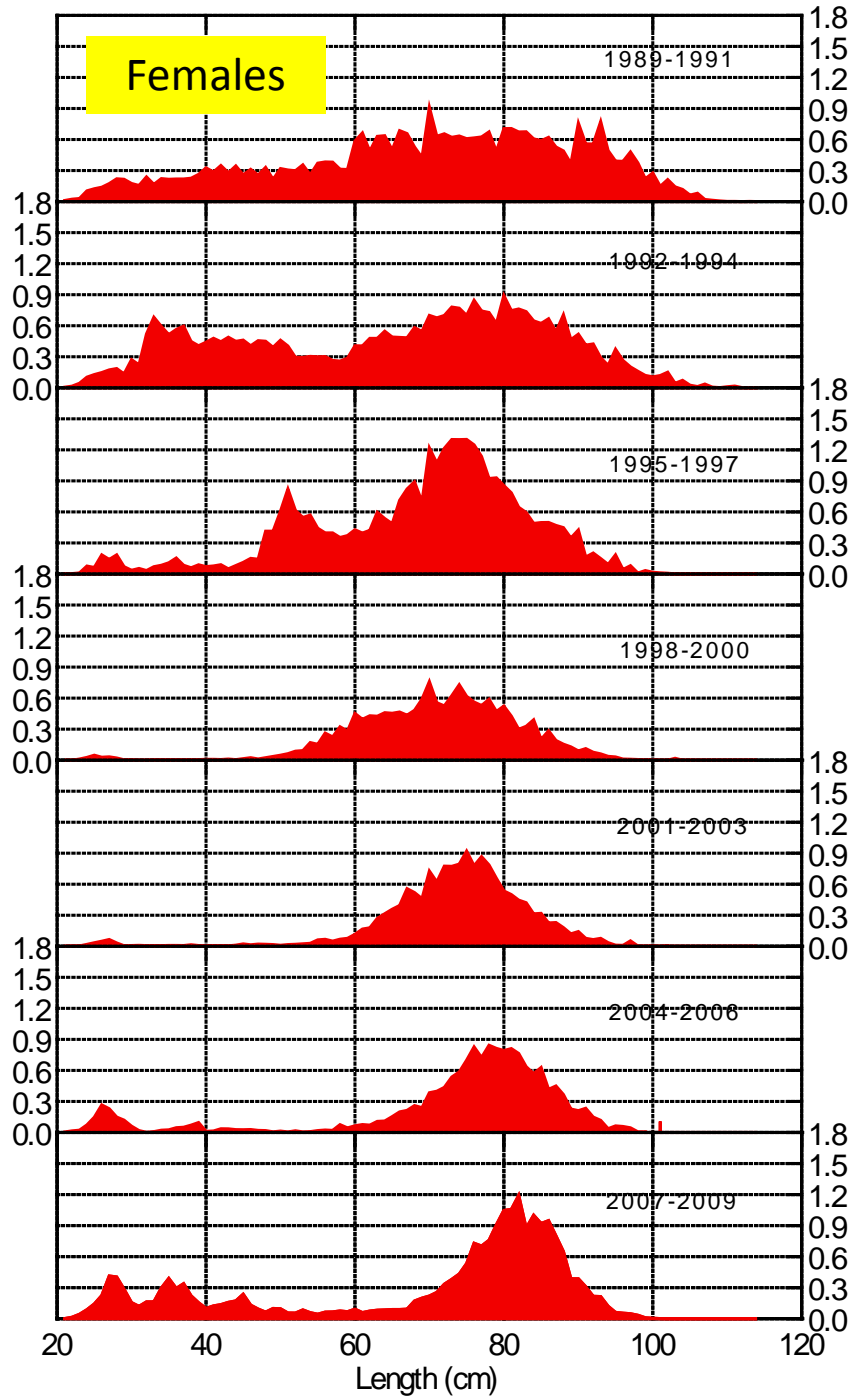
Rago PJ and KA Sosebee. 2010. Biological Reference Points for Spiny Dogfish . Northeast Fish Sci Cent Ref Doc. 10-06; 52 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026

# *Background*

- No currently approved biomass reference points for spiny dogfish (Last considered at SARC 43, 2006)
- No agreement at TRAC on model or assessment, Jan 25-29
- Absence of assessment and reference points caused problems for US management.
- TRAC reviewers agreed to review biological reference points (BRP)
- WebEx Meeting was held Apr 9 to address BRPs
- TRAC Reviewers included Drs. Vince Gallucci (U. WA), Robert Mohn (DFO), Thomas Miller (U. MD). Robert O'Boyle, a member of the NEFMC SSC also participated.
- NEFSC, MAFMC, Industry and others

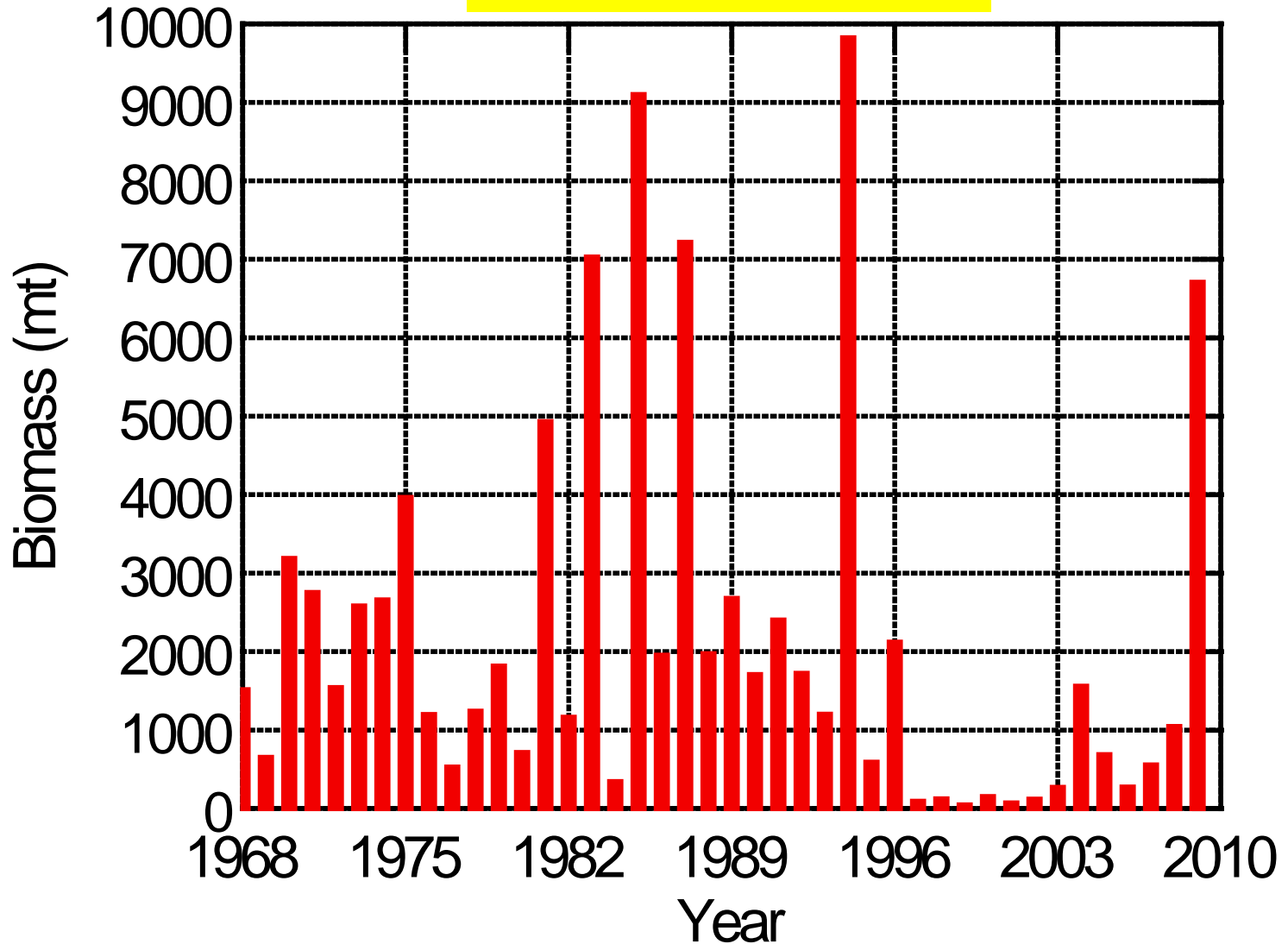
# *What was done?*

- Focus on US management needs
- Description of current biological reference points
  - Scaling Issues
  - Identify SSBmax only
- Ricker Stock Recruitment
  - Temporal Changes  $\leq 1996$ ,  $> 1996$
  - Inclusion of Covariates
    - Maternal Wt,
    - Ave Pup Wt,
    - Mature Male:Female Ratio
- Updated Selectivity estimates
- Updated Stochastic Biomass and F
  - Incorporates measurement uncertainty in survey, trawl footprint, discards, recreational landings.
- Comparisons with Reference Points

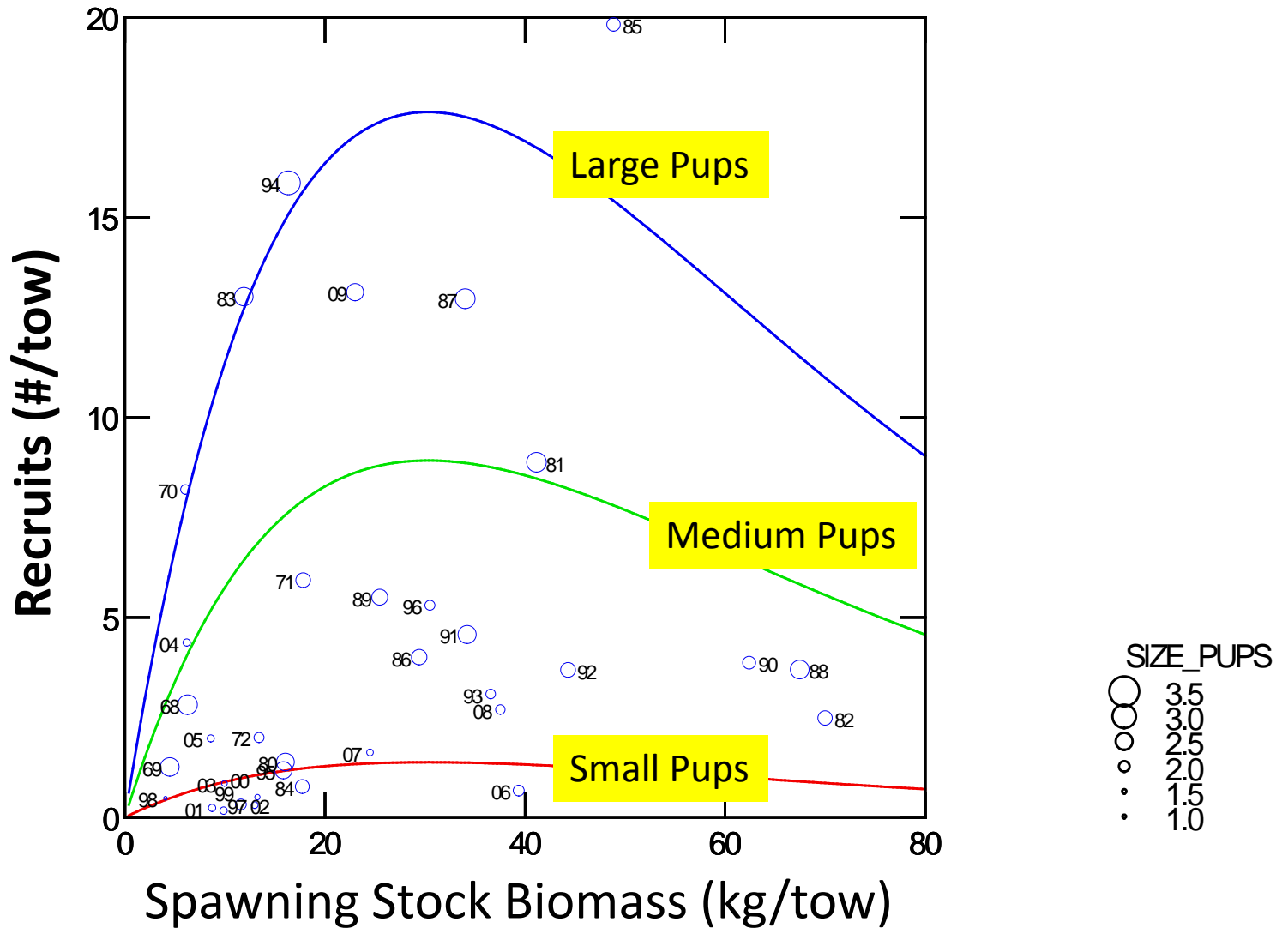


# Swept Area Biom., Pups, Nom. Footprint

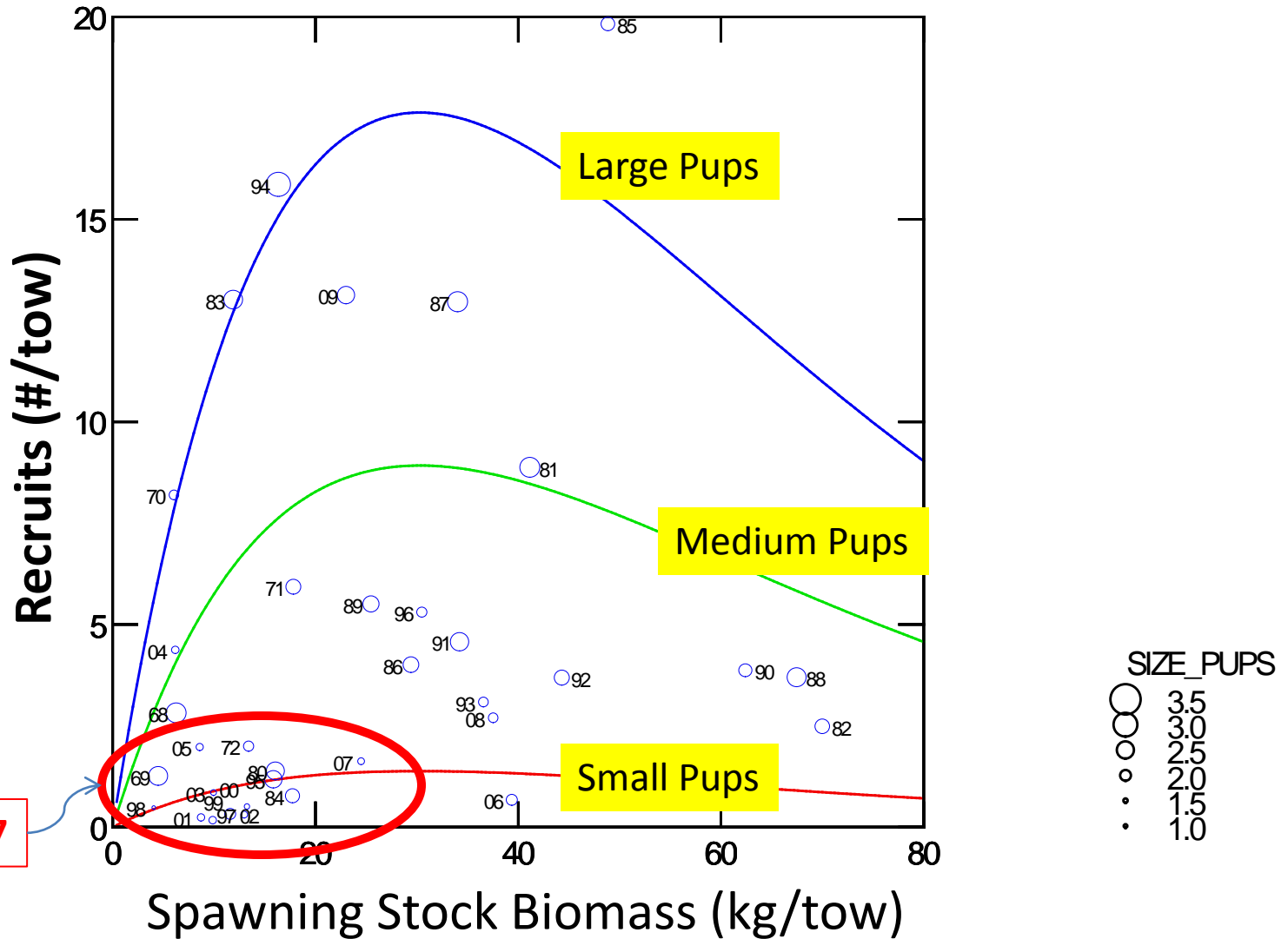
## Recruitment



Predicted R vs SSB for 10th (red), 90th (green) %ile and maximum (black) ave pup wt



Predicted R vs SSB for 10th (red), 90th (green) %ile and maximum (black) ave pup wt



1996-2007



# Candidate Model {#} Evaluation

## • MLE Method

- Base Model {1-3}
  - '68-72, '80-1996
  - '68-72, '80-2003
  - '68-72, '80-2009
- Full Model {4} (Maternal Wt, Pup Wt, Sex Ratio)
- Two Factor Models {5-7}
- Single Factor {8-10}
- 

## • Robust Method

- Base Model {11-13}
  - '68-72, '80-1996
  - '68-72, '80-2003
  - '68-72, '80-2009
- Full Model {14} (Maternal Wt, Pup Wt, Sex Ratio)
- Two Factor Models {15-17}
- Single Factor {18-20}
- Sensitivity (t=20, 10, 5) {21-23}

Used AIC methods to identify best candidate model

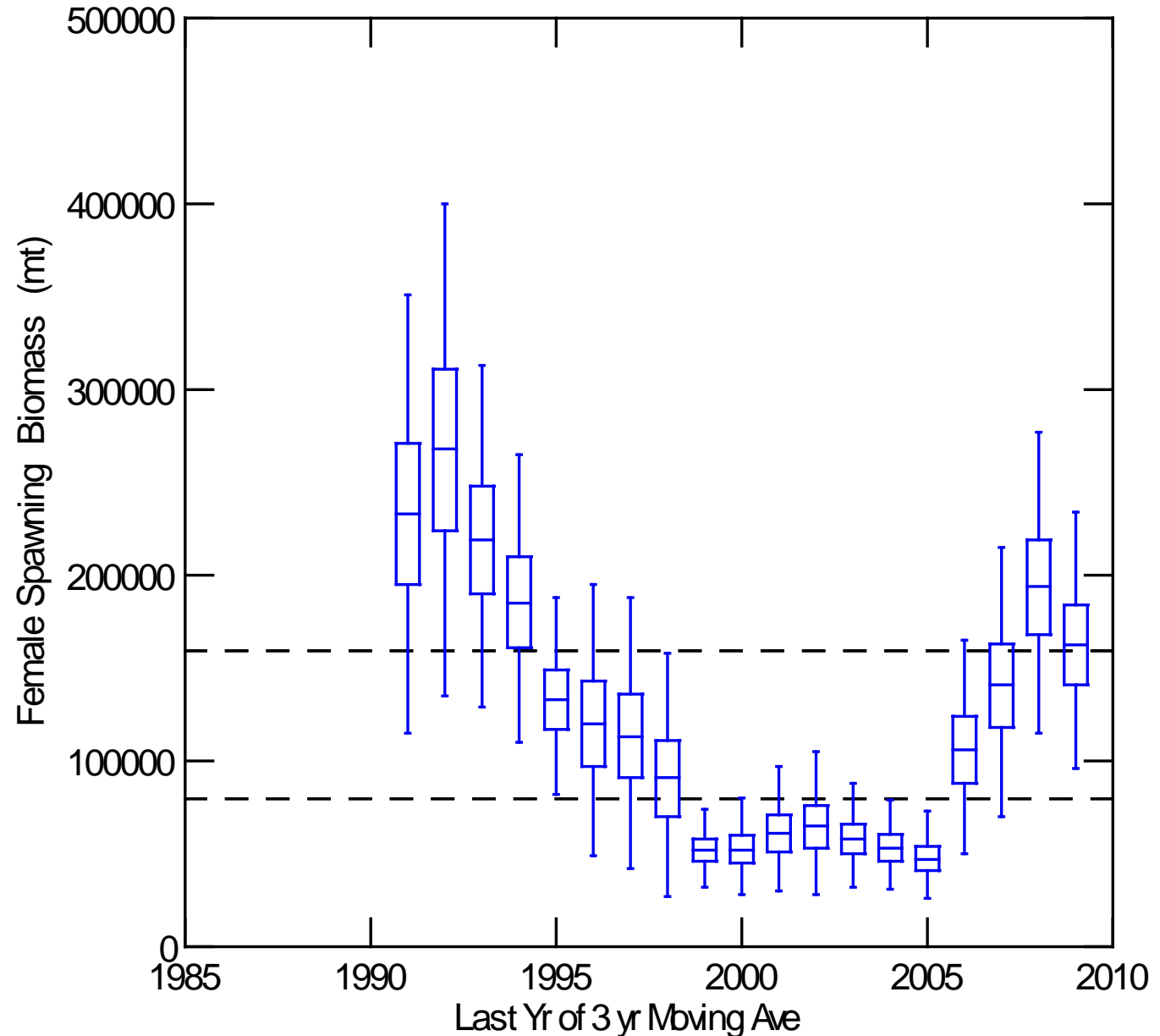
## *Some Bottom Line Results*

- Reviewers accepted the revised biomass reference points, but with some caveats and recommendations
- Revised reference points include an important covariate—average weight of pups. (Explains additional variance in observed recruitment).
- Based on the revised reference points and updated information on selectivity, spiny dogfish are considered rebuilt.

# *Revised Reference Points (Biomass)*

- Based on revised model, the female SSB target is **30.3 kg/tow** for females  $\geq 80$  cm in the NEFSC spring bottom trawl survey.
- Using the nominal footprint of  $0.01 \text{ nm}^2$  the revised target is **189,553 mt**.
- Using the best estimate of the survey footprint ( $=0.0119 \text{ nm}^2$ ) is **159,288 mt**.
- All of these measures of abundance can be directly estimated by the FSV Bigelow. Can be expressed in terms of "Albatross" units.

# Stochastic Estimates of Female Spawning Stock Biomass



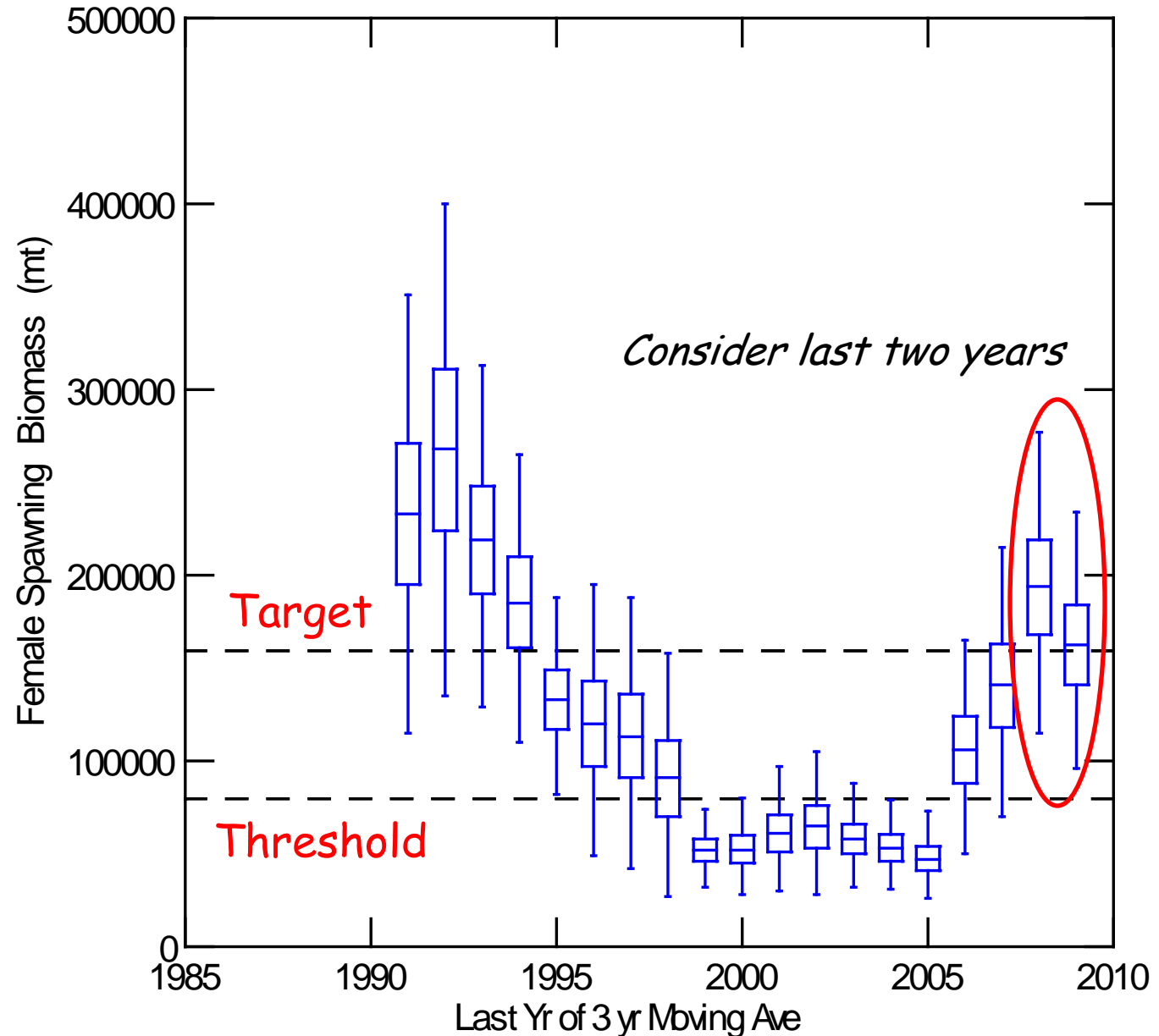
Horizontal dashed lines represent female SSB target of 159,288 mt based on Ricker Stock-Recruitment model (Model 19, Table 4).

Threshold biomass target is assumed to be  $\frac{1}{2}$  target biomass.

Center line of box represents median; upper and lower bounds represent interquartile range.

Year on X-axis identifies the last year of a 3-year moving average, e.g., 2009 is last year of 2007-2009.

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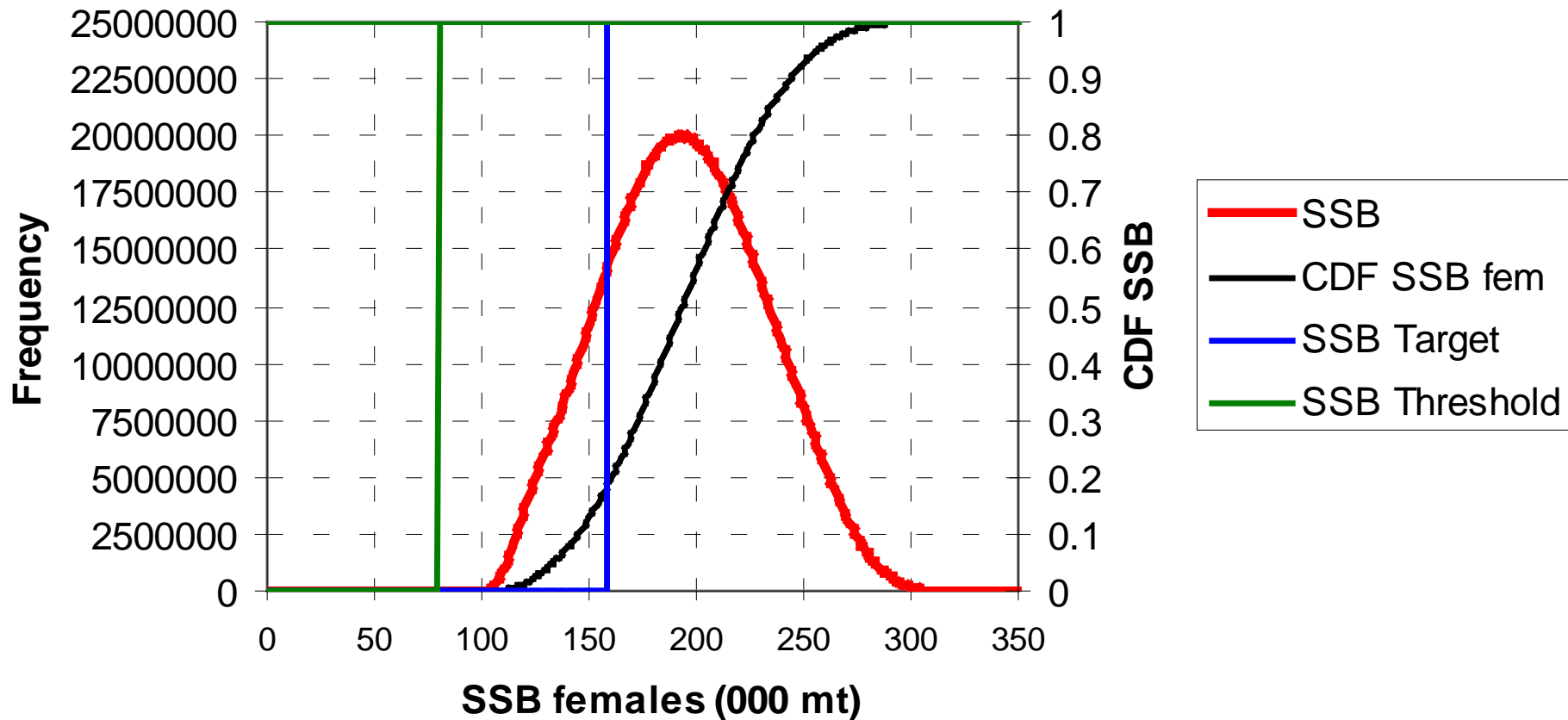
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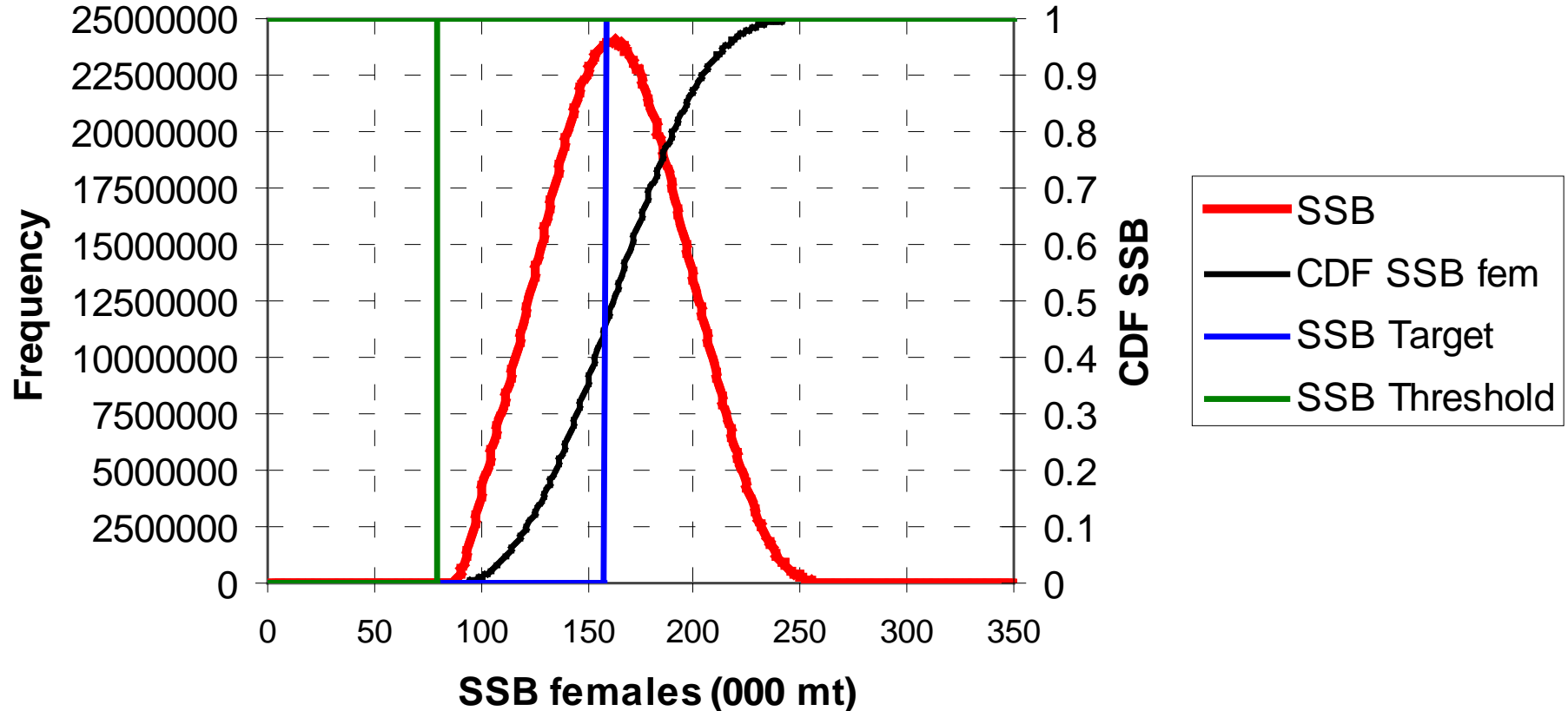
2008—Female stock exceeds rebuilding target.  
Probability of exceeding biomass target is about 80%

### Stochastic Estimate of Spawning Stock Biomass with nominal target and threshold biomasses, 2008



2009—Female stock exceeds rebuilding target.  
Probability of exceeding biomass target is about 55%

### Stochastic Estimate of Spawning Stock Biomass with nominal target and threshold biomasses, 2009



# *Revised Reference Points (Fishing Mortality)*

- 2006 to 2008 fishery selectivity patterns were re-estimated
- Revised selectivity patterns alter the force of mortality over the size range of the population.
- Basic principle—Higher  $F$ s are possible when the mortality occurs on older and larger fish.
- Reference Point for  $F$  is based on life history of spiny dogfish.
  - Threshold is based on Replacement of females (each female pup replaces itself over its lifetime).
  - Target is based on a rate that incorporates a buffer for growth ( $F$  is set to allow 1.5 female pups per female over its lifetime).
- Updated  $F$  threshold is **0.325**
- Updated  $F$  target is **0.207**
- Previous values (SARC 43) were 0.39 and 0.284 respectively.

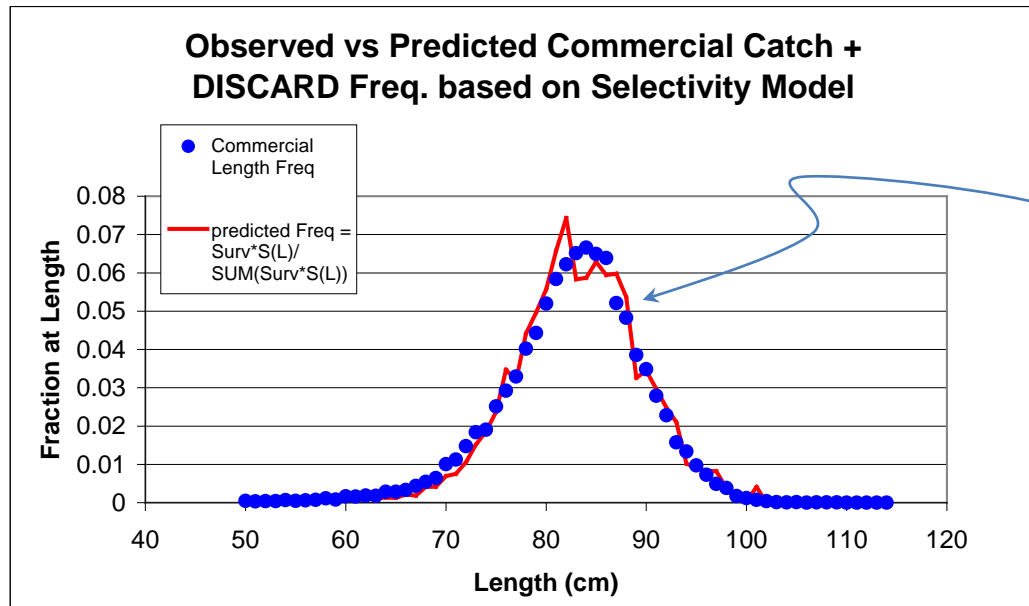
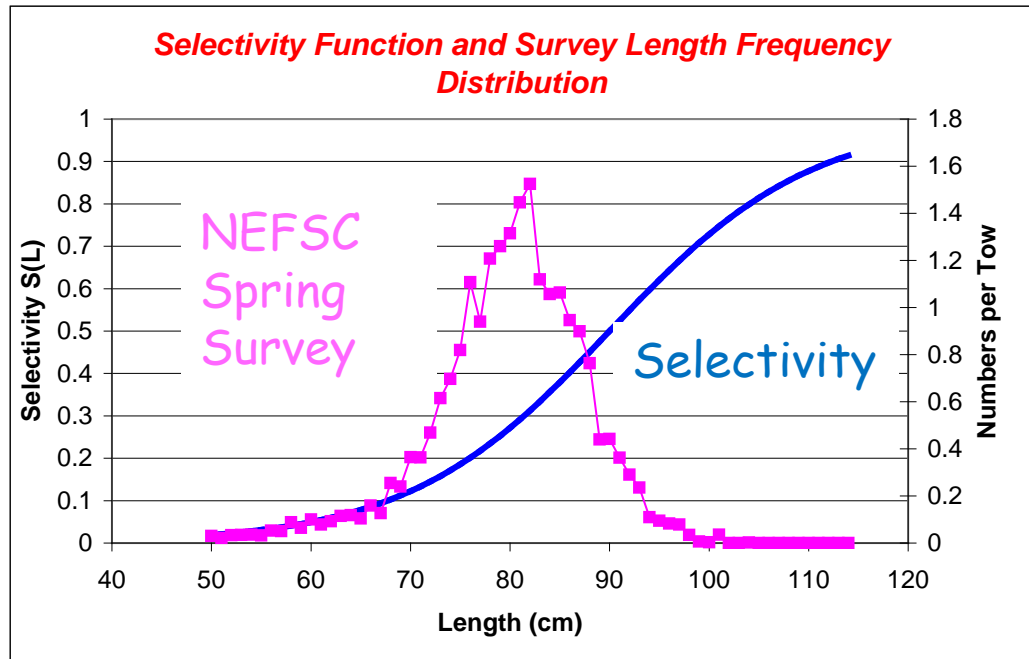


FEMALES, 3-yr Average, w/Discard 2008

alpha	beta	L50%ile
8.867	-0.099	90

model:  $S(L) = 1/(1+\exp(\alpha+\beta * L))$

# Updated selectivity pattern for 2008 fishery



Observed vs Predicted size frequency for catch (i.e., landings + discards)

# *Current Status*

- Using the best estimate of the survey footprint (=0.0119 nm<sup>2</sup>) is 159,288 mt.
- Female SSB in 2008 = 194,616 mt
- Female SSB in 2009 = 163,356 mt
- Stock is not overfished and above the Bmsy proxy
  
- Current fishing mortality rate on female exploitable stock is 0.11
- This value is below the target (0.325) and threshold (0.207) values
- Overfishing is not occurring

# *Rebuilt. Some Comments*

- Successful fisheries management
- Rebuilding is consistent with the original plan. (Exit fishery, 5 yr closure)
- Some unexpected factors
  - Change in fishery selectivity and extension of exit fishery.
  - Low recruitment period 1997-2003
  - Changes in dogfish distribution
  - Interference in other fisheries
- Uncertainty in status and targets
- This is a manageable resource.

# *Rebuilt. Some Concerns*

- Revised reference point depends on stock biomass and average weight of pups. When pup weight is lower, productivity is expected to be lower.
- Population will oscillate as the weak year classes enter the spawning stock (~2013-2020).
- Discards are a problem.
  - 81% of fishing mortality by weight on males is via discards
  - 42% of F on females via discards
- Male population is large but mostly offshore
- Cooperative Research efforts are underway
- Ecosystem implications