

# Atlantic Smooth Dogfish (*Mustelus canis*) Stock Assessment

**NOAA**  
**FISHERIES**

SEFSC

SEDAR 39

March 11, 2015



---

# Outline

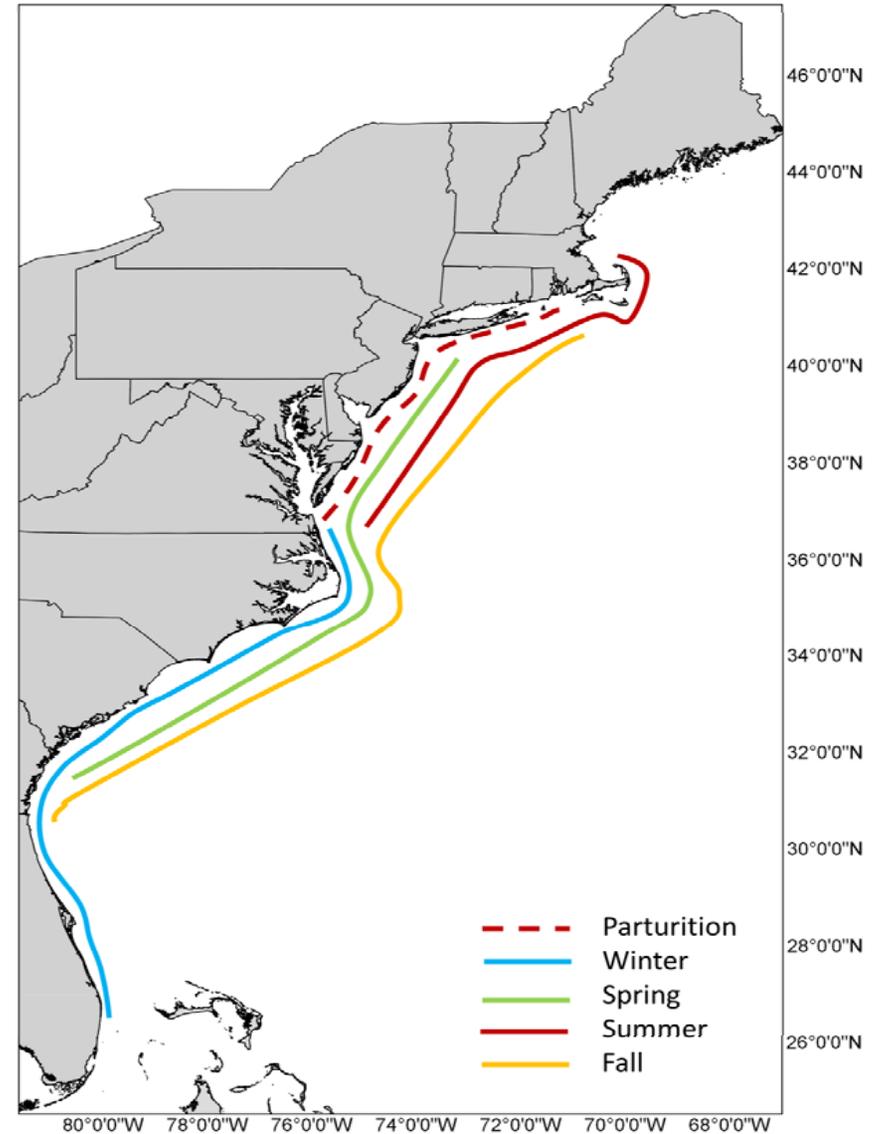
- Data inputs
- Stock assessment model and results
- Model sensitivity results
- Projection model results
- Conclusions

# Data Inputs

- Distribution
- Catch
- Indices of relative abundance
- Length composition
- Life history

# Distribution

- Approximate seasonal distribution pattern of smooth dogfish along the east coast of the United States
  - SEDAR 39 Data Workshop report (SEDAR39-DW28)

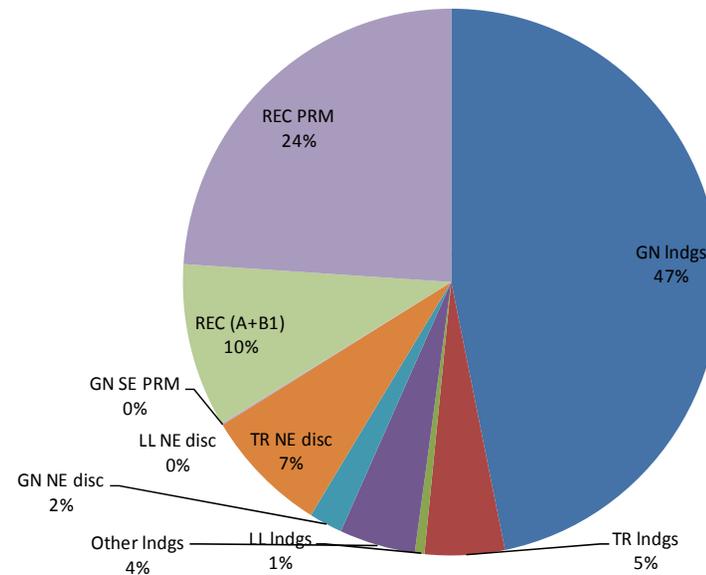


# Catch

- Catches of smooth dogfish in the Atlantic as a proportion for all years combined

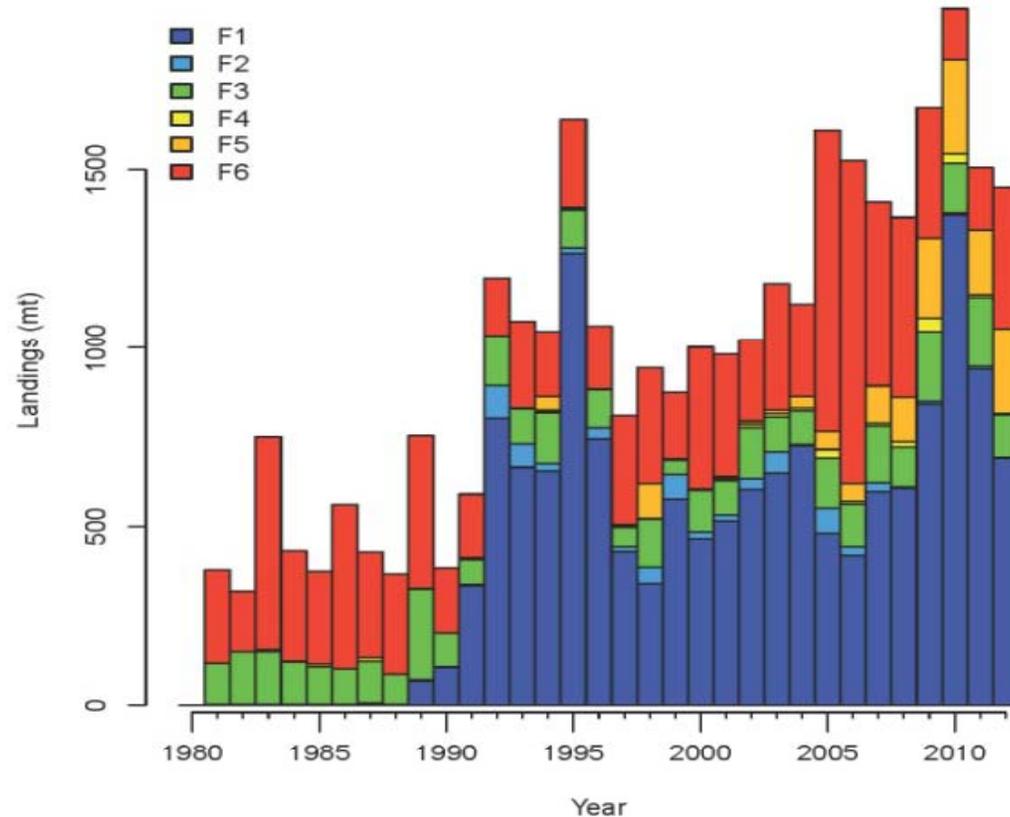
- SEDAR 39 Data Workshop report

Smooth dogfish catches, 1981-2012 combined (Atlantic)



# Catch

- Catch data were aggregated into six “fleets” for input in the stock assessment model (in mt whole weight)
- F1 (Com-GN Kept) = Com-GN Landings;
- F2 (Com-GN Discard) = Com-GN-NE (PRM) + Com-GN-SE (PRM);
- F3 (Com-TR) = Com-TR Landings + Com-TR-NE (PRM);
- F4 (Com-LL) = Com-LL Landings + updated Com-LL-NE (PRM);
- F5 (Com-Other) = Com-Other Landings; and
- F6 (Recreational) = Recreational (A+B1) + Recreational (PRM).



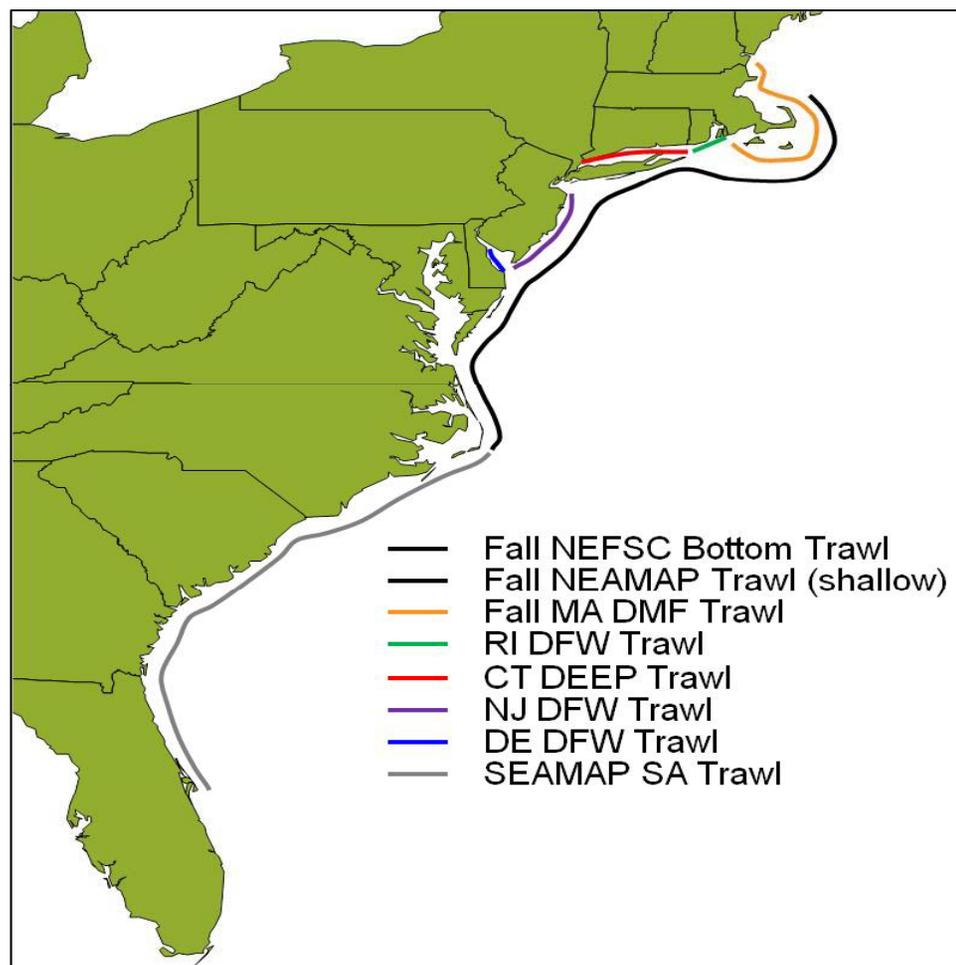
# Indices of Relative Abundance

- Eight Indices of relative abundance were recommended by the Index Working Group of the SEDAR 39 Data Workshop for the Atlantic stock of smooth dogfish

SS3	Index Name	SEDAR Document Number	Rank
S1	NEFSC Fall Trawl-N	SEDAR39-DW-24	1
S2	NEAMAP Fall Trawl	SEDAR39-DW-30	2
S3	MA DMF Fall Trawl	SEDAR39-DW-24	3
S4	RI DEM Seas. Trawl	SEDAR39-DW-10	3
S5	CT DEEP Trawl	SEDAR39-DW-12	3
S6	DE DFW Trawl	SEDAR39-DW-15	3
S7	NJ DFW Trawl	SEDAR39-DW-14	3
S8	SEAMAP-SA Trawl	SEDAR39-DW-02	4

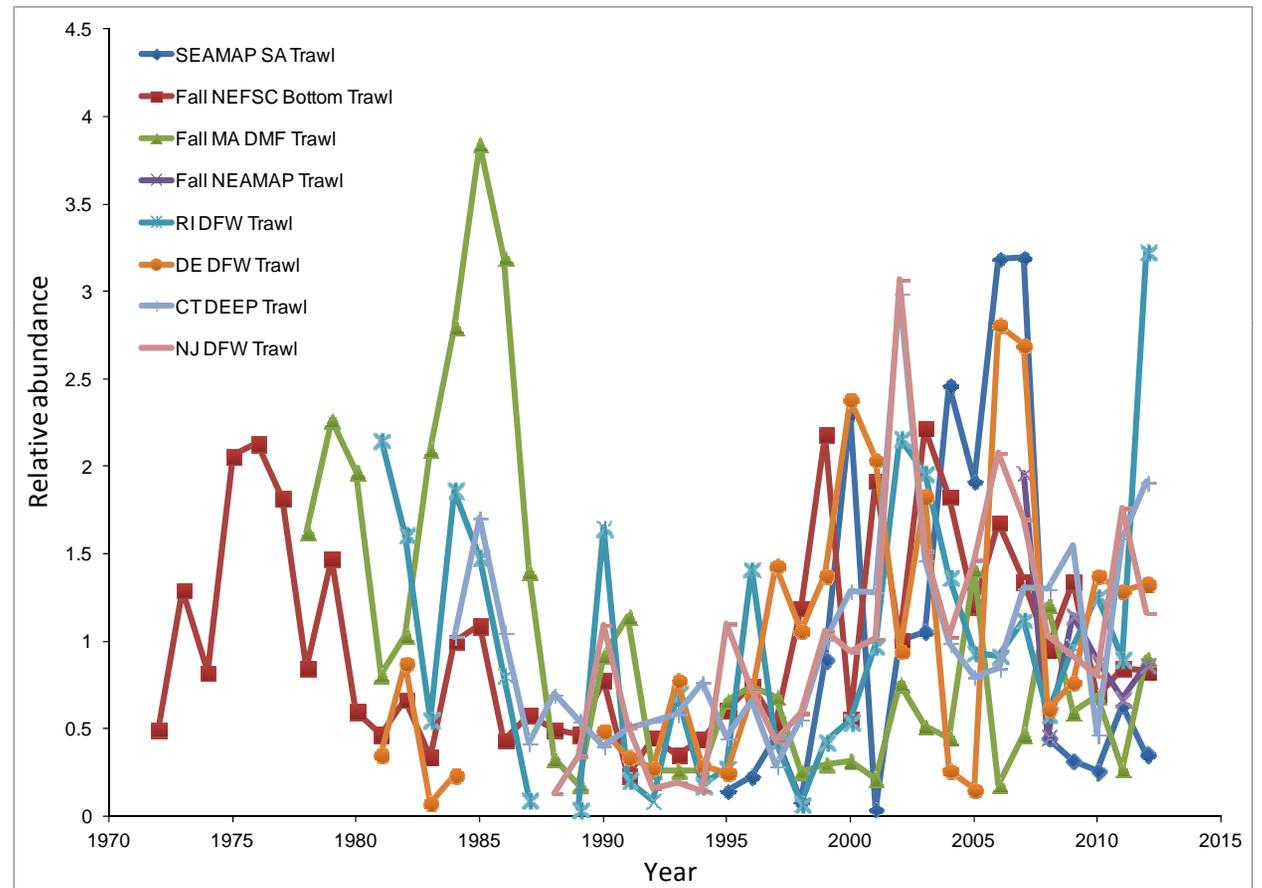
# Linear Coverage of Abundance Indices

- Approximate linear coverage of abundance indices recommended for the Atlantic stock of smooth dogfish by the Index Working Group of the SEDAR 39 Data Workshop



# Annual Relative Abundance Indices

- Annual indices of relative abundance for each time series recommended for the Atlantic stock of smooth dogfish



# Length Composition Data

- Fishery-independent and fishery-dependent length composition data submitted for the Atlantic stock of smooth dogfish during the SEDAR 39 Data Workshop were reviewed for use in the stock assessment model during the SEDAR 39 Assessment Webinars
- Length composition data recommended for use in the stock assessment model were associated with each aggregated catch time series (fleets F1 – F6) and each index of abundance (surveys S1 – S8)

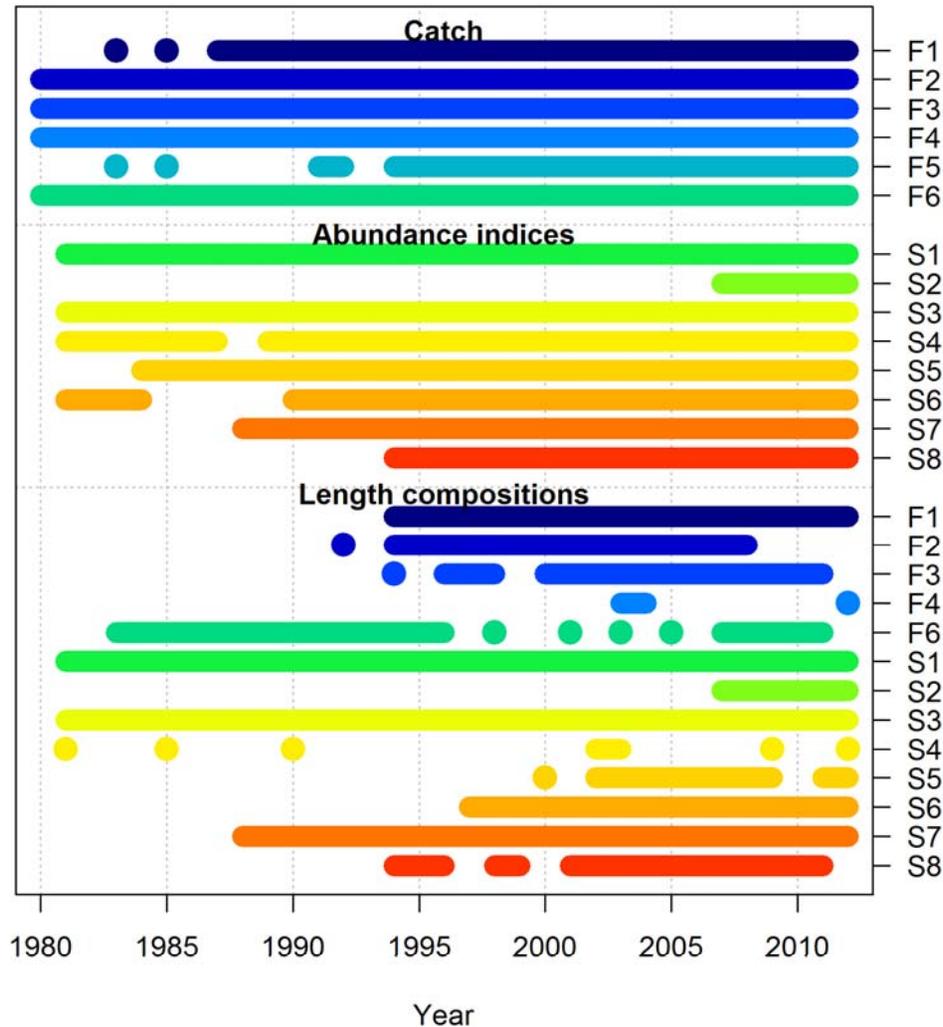
---

# Life History

- Growth in length and weight at age
- Fecundity
- Stock-recruitment steepness

# Stock Synthesis (SS3) Assessment Model

Data by type and year



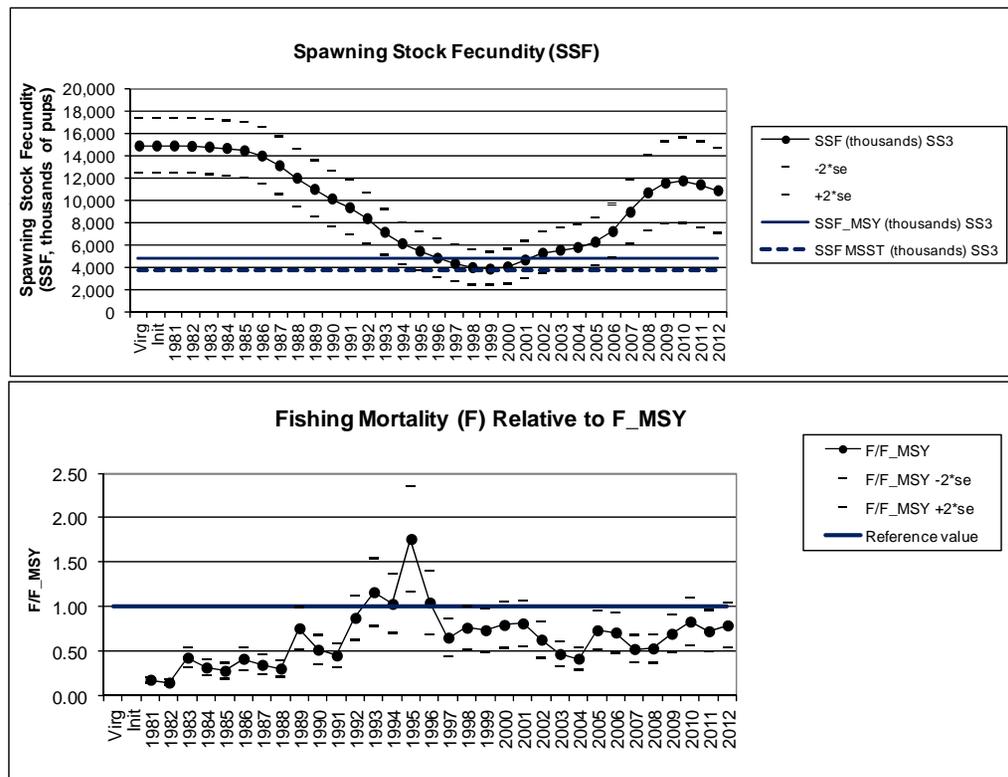
- Catch
  - 6 Fleets (F1 – F6)
- Abundance
  - 8 Surveys (S1 – S8)
- Length composition
  - 5 Fleets (F1 – F6, excluding F5)
  - 8 Surveys (S1 – S8)

# SS3 Assessment Base Model

- The SEDAR 39 Assessment Panel recommended a dome-shaped functional form (Sel-2) for the main targeted fishery (fleet F1 – NE Gillnet Kept) as the base model for the stock assessment

# SS3 Assessment Base Model Results (Sel-2)

- The base model configuration Sel-2 predicted that the stock was not overfished and that there was an almost negligible chance of overfishing occurring (ATL Assessment Report Figure 4.17)

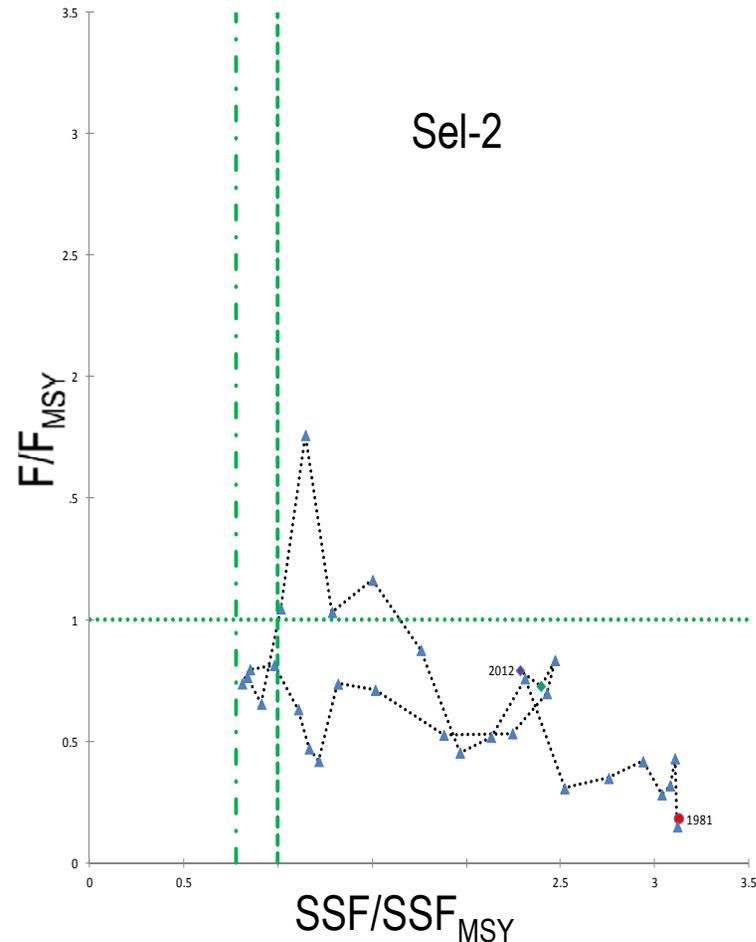


Approximate 95% intervals based on  $\pm 2^*$ (asymptotic SE)

The SSF minimum stock size threshold MSST (stippled line top panel) is calculated as  $(1 - \text{average } M) * \text{SSF}_{\text{MSY}}$ .

# SS3 Assessment Base Model Results (Sel-2)

- The base model configuration (Sel-2) predicted that the stock was not overfished and that overfishing was not occurring (ATL Assessment Report Figure 4.23b)



The dotted horizontal line indicates  $F_{MSY}$ , the dashed vertical line indicates  $SSF_{MSY}$   
The dot-dashed vertical line indicates MSST ( $(1-M)*SSF_{MSY}$ )  
 $M$  is calculated as the average natural mortality at age used in the assessment model configuration).

# SS3 Assessment Base Model Results (Sel-2)

ATL Assessment Report Table 4.13

- Stock is not overfished  $SSF_{2012} > SSF_{MSY}$
- Overfishing is not occurring  $F_{2012} < F_{MSY}$

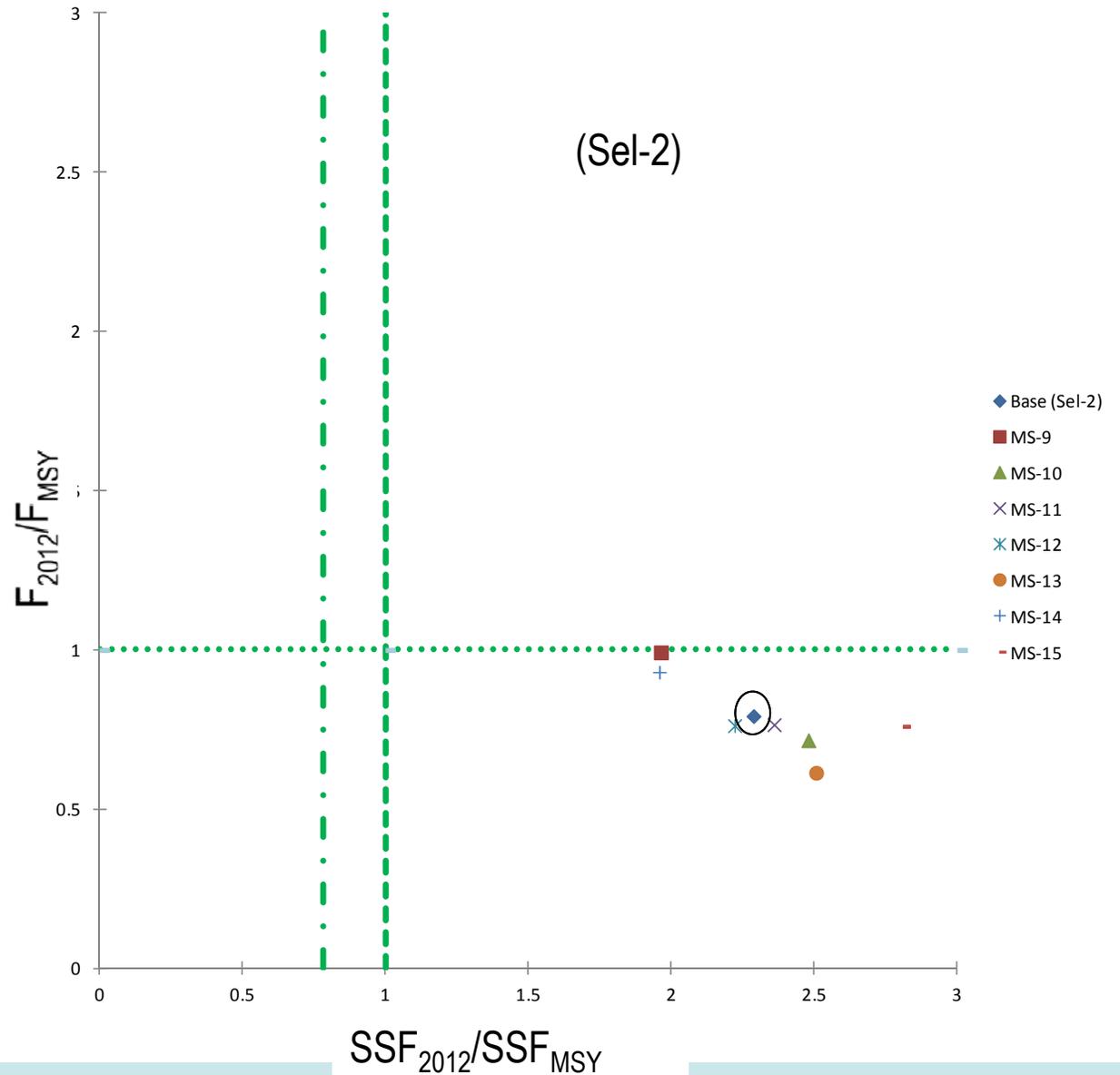
	Base Model (Sel-2)	
AIC	5633.5	
Parameters	52	
Objective function	2764.7	
Gradient	8.91E-05	
(1-avgM )	0.78	
Steepness	0.54	
	Est	CV
$SSF_{2012}$	10,847	18%
$F_{2012}$	0.102	---
$R_{2012}$	2,213	11%
$SSF_0$	14,849	8%
$R_0$	2,385	8%
MSY	1,125	8%
$SSF_{MSY}$	4,746	8%
$F_{MSY}$	0.129	2%
$SSF_{2012}/SSF_{MSY}$	<b>2.286</b>	---
$F_{2012}/F_{MSY}$	<b>0.792</b>	16%
Stock status	$SSF_{2012} > SSF_{MSY}$	
Fishery status	$F_{2012} < F_{MSY}$	

# Assessment Model Sensitivity Results

- All of the sensitivity scenarios conducted under the base model configuration (Sel-2) estimated that the stock was not in an overfishing condition, although one scenario was estimated close to an overfishing condition ( $F_{2012} \approx F_{MSY}$ ; ATL Assessment Report Table 4.13 and Figure 4.24.b)

# Assessment Model Sensitivity Results

- Base (Sel-2)
- MS-9 Start Year 1972 (Sel-2)
- MS-10 Ranked CPUE (Sel-2)
- MS-11 Low Catch (Sel-2)
- MS-12 High Catch (Sel-2)
- MS-13 Low Productivity (Sel-2)
- MS-14 High Productivity (Sel-2)
- MS-15 Hierarchical (Sel-2)



# Projections

- Projections were conducted in R statistical software at alternative fixed levels of total annual removals due to fishing (1000s of sharks) ranging from zero to 1,000 in increments of 50
- Projection results for the base model indicated that levels of fixed removals less than or equal to 550 (1000s of sharks) resulted in at least a 70% probability of maintaining  $SSF_t$  above  $SSF_{MSY}$  during the years 2013 – 2022 (SEDAR39-RW-01 Table 2)

Alternative	Fixed level of total annual removals due to fishing (1000s of sharks)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	150	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	350	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
9	400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96
10	450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.91
11	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.90	0.84
12	550	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.83	0.74
13	600	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.88	0.75	0.63
14	650	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.81	0.65	0.51
15	700	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.72	0.54	0.38
16	750	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.64	0.43	0.28
17	800	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.54	0.34	0.18
18	850	1.00	1.00	1.00	1.00	1.00	1.00	0.77	0.46	0.24	0.10
19	900	1.00	1.00	1.00	1.00	1.00	0.99	0.70	0.37	0.17	0.05
20	950	1.00	1.00	1.00	1.00	1.00	0.98	0.62	0.29	0.10	0.02
21	1000	1.00	1.00	1.00	1.00	1.00	0.96	0.53	0.21	0.06	0.01

# Projection Results

- Projection results obtained from the base model (Sel-2) were within the range of those obtained from sensitivity runs conducted for the base model

Projection scenario	Model configuration	Example of fixed removals (1000s)
1	Base model configuration (Sel-2)	550*
2	MS-9 Start Year 1972 (Sel-2)	350
3	MS-10 Ranked CPUE (Sel-2)	650
4	MS-11 Low Catch (Sel-2)	450
5	MS-12 High Catch (Sel-2)	650
6	MS-13 Low Productivity (Sel-2)	850
7	MS-14 High Productivity (Sel-2)	350
8	MS-15 Hierarchical (Sel-2)	500

# Conclusions

- The base model predicted that the stock was not overfished and that overfishing was not occurring
- All sensitivity runs conducted with the base model configuration also predicted that the stock was not overfished and that overfishing was not occurring
- Projection results obtained from the base model were within the range of those obtained from sensitivity runs conducted for the base model