



**NOAA**  
**FISHERIES**

# Gulf of Mexico Gag Grouper State Reef Fish Survey (SRFS) Run Council Request

SEFSC-SFD Gulf Branch Staff  
Gulf of Mexico Fishery Management Council  
Standing, Reef Fish, Socioeconomic, and Ecosystem SSC Meeting  
Tampa, FL • July 7-8, 2022

# GOM Gag Grouper SRFS Run

- Council Request
- Changes to Data Inputs
  - SRFS Time Series
  - Headboat corrections
- Model Results
- Diagnostics
- Projections, Benchmarks and Reference Points  
(in comparison to SEDAR 72)

# Council Request



**NOAA**  
FISHERIES

# Council Request

- SEDAR 72 (S72) Base Model (SSB Combined) approved in October 2021
- Council request to **substitute FL Private mode landings and discards** time series in **FES units** with FL Private mode landings and discards time series in **SRFS units**
- Detail methodology, results, diagnostics, stock status, and OFL, F0 and Frebuild projections in a report



## Gulf of Mexico Fishery Management Council

Managing Fishery Resources in the U.S. Federal Waters of the Gulf of Mexico

4107 W Spruce Street, Suite 200, Tampa, Florida 33607 USA  
Phone: 813.348.1630 • Toll free: 888.833.1844 • Fax: 813.348.1711  
www.gulfcouncil.org

### Gulf of Mexico Gag Grouper

#### Scope of Work

Original: May 11, 2022

1. Update the approved SEDAR 72 Gulf of Mexico gag grouper base model (sexes combined) through 2019:
  - Use the State of Florida's State Reef Fish Survey (SRFS) to inform private recreational landings data, once historical SRFS landings have been calibrated certified by the NOAA Office of Science and Technology.
  - Document any changes or corrections made to model and input datasets and provide updated input data tables.
2. Update model parameter estimates and their variances, model uncertainties, estimates of stock status and management benchmarks, and provide the probability of overfishing occurring at specified future harvest and exploitation levels. Provide commercial and recreational landings and discards in pounds and numbers.
  - Use the following status determination criteria (SDC):
    - $MSY$  or  $MSY$  proxy = yield at  $F_{MSY}$  or  $F_{Rebuild}$  (if overfished)
      - $F_{MSY} = F_{30\%SPR}$  and  $F_{MAX}$
    - $MSST = 0.5 * SSB_{MSY}$
    - $MFMT = F_{MSY}$  (or proxy) and  $F_{Rebuild}$  (if overfished)
    - $OY = 75\%$  of  $F_{MSY}$
    - If different SDC are recommended, provide outputs for both the current and recommended SDC.
  - Unless otherwise recommended, use the geometric mean of the previous three years' fishing mortality to determine  $F_{Current}$ . If an alternative approach is recommended, provide justification and outputs for the current and alternative approach.
  - Provide yield and spawning stock biomass streams for the overfishing limit and acceptable biological catch in pounds:
    - Annually for five years
    - Under a "constant catch" scenario for both three and five years
    - For the equilibrium yield at  $F_{MSY}$ , when estimable
    - For interim projection years, use finalized or preliminary data; for incomplete interim years, use the mean of the previous three years.
3. Develop a stock assessment report to address these TORS and fully document the input data and results of the stock assessment model.

#### Topical Working Group

No topical working groups are requested for this additional model run.



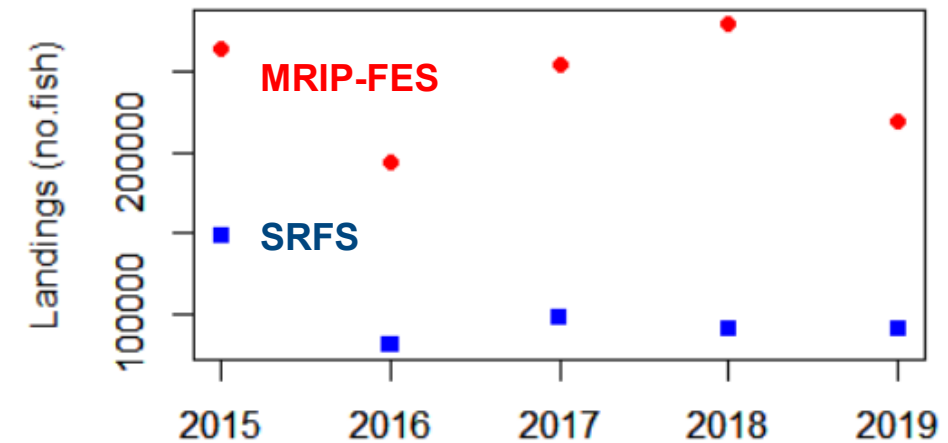
**NOAA**  
FISHERIES

# Changes to Data Inputs



**NOAA**  
FISHERIES

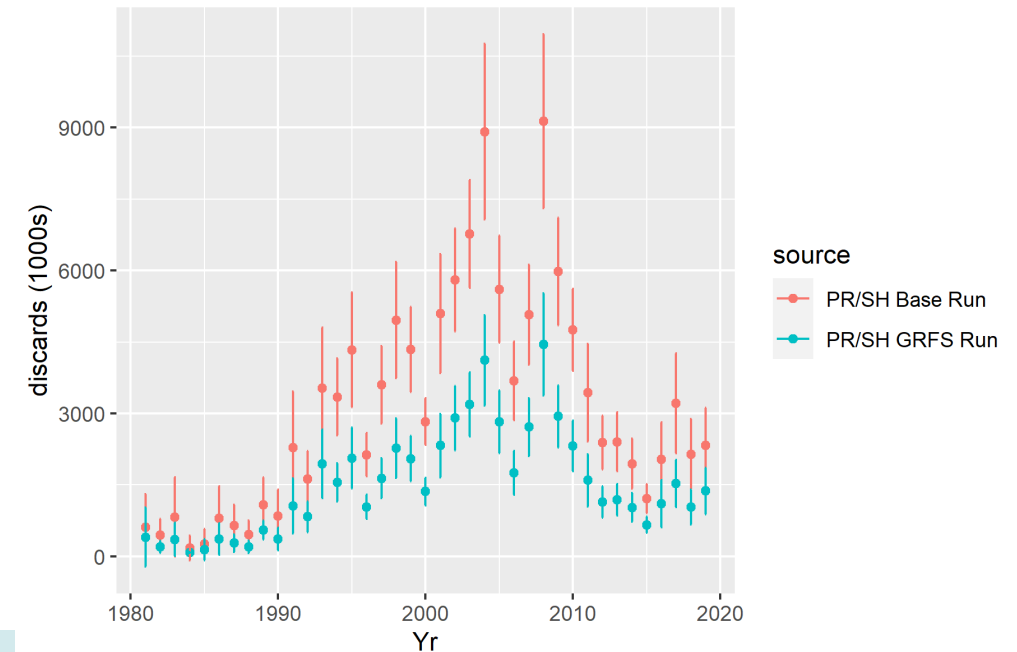
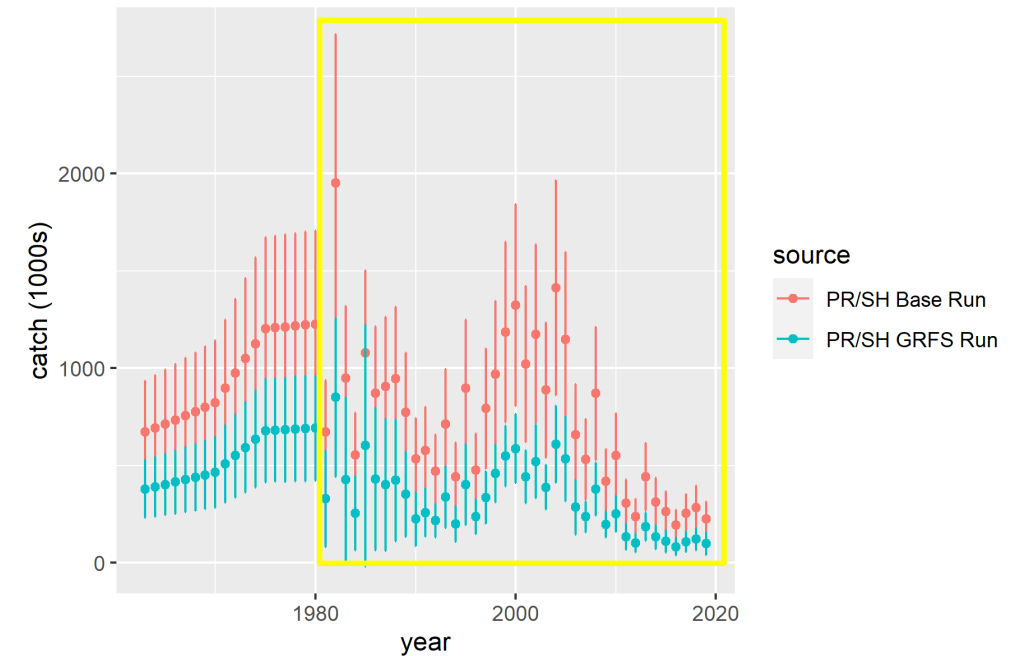
# Changes to Data Inputs



- The State Reef Fish Survey (SRFS) runs concurrent with the MRIP survey in FL since May 2015
- Using data from May 2015-Dec 2019, single **calibration factors** are produced to convert MRIP FES FL Private mode time series of landings and discards to SRFS units (SEDAR72-WP-04):
  - SRFS FL Private landings (no. fish) = **0.42** \* MRIP-FES FL Priv land
  - SRFS FL Private discards (no. fish) = **0.43** \* MRIP-FES FL Priv disc

# Changes to Data Inputs

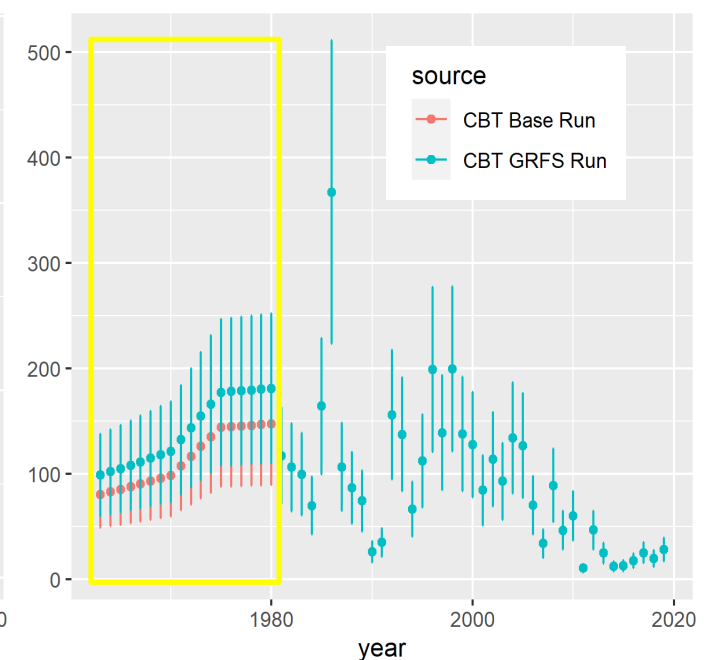
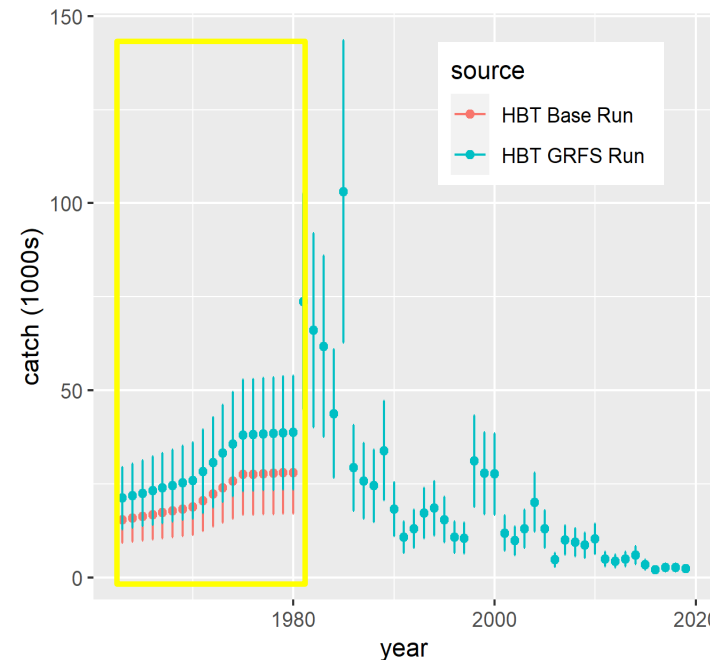
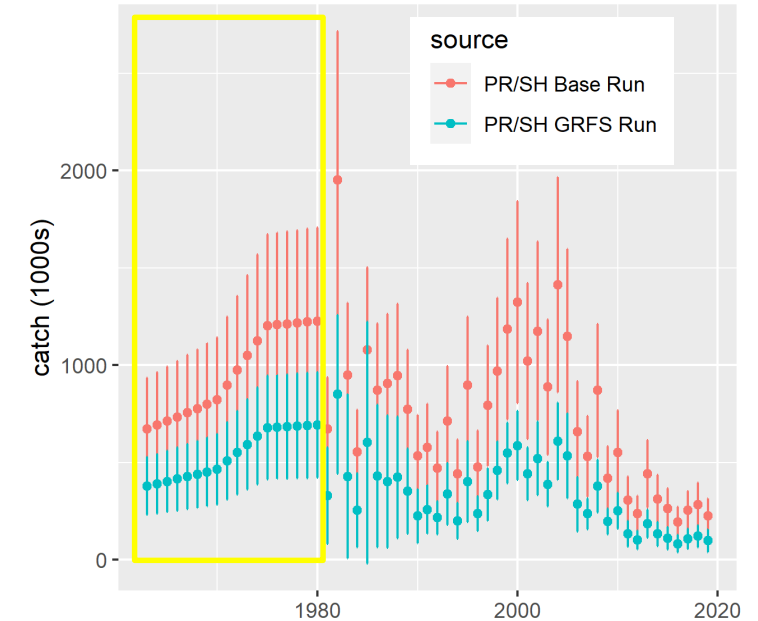
- In Stock Synthesis (SS), the Recreational Private + Shore fleet (Pr/Sh) includes Private and Shore modes from FL, AL, MS, LA, TX
- FL Private portion of that fleet replaced with SRFs time series → FL Private ~95% of the total catches/discards each year
  - 1983 peak in private landings replaced with geometric mean of 1981, 82, 84, 85 as in SEDAR 72
  - SRFs CVs for landings and discards used



# Changes to Data Inputs

- Historical time series of rec landings (63-80)

- FHWAR method uses mean recreational CPUE from 81-85 to multiply with historical effort estimates to estimate landings prior to 1980
- Mean rec CPUE recalculated using new Pr/Sh time series
  - No SRFS effort data for 81-85 so back-calculated assuming MRIP CPUE = SRFS CPUE (since both SRFS and MRIP calculate total catch using similar values for CPUE)
- Apportionment by mode re-calculated: based on average proportion of landings by fleet 1981-2019

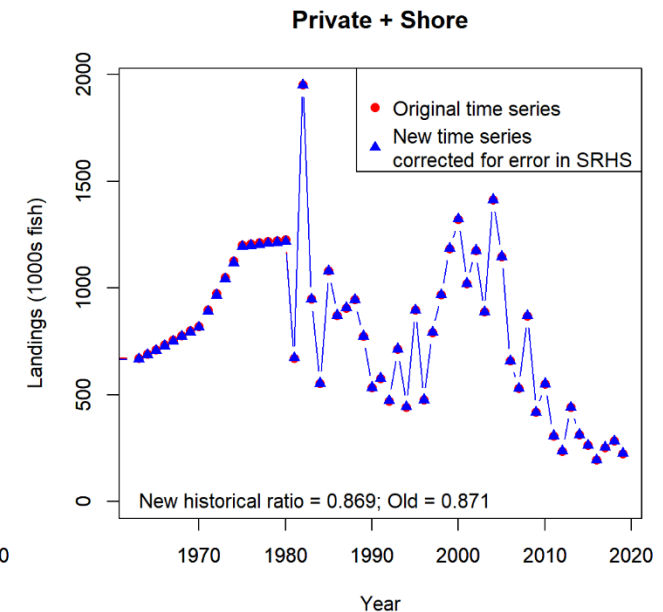
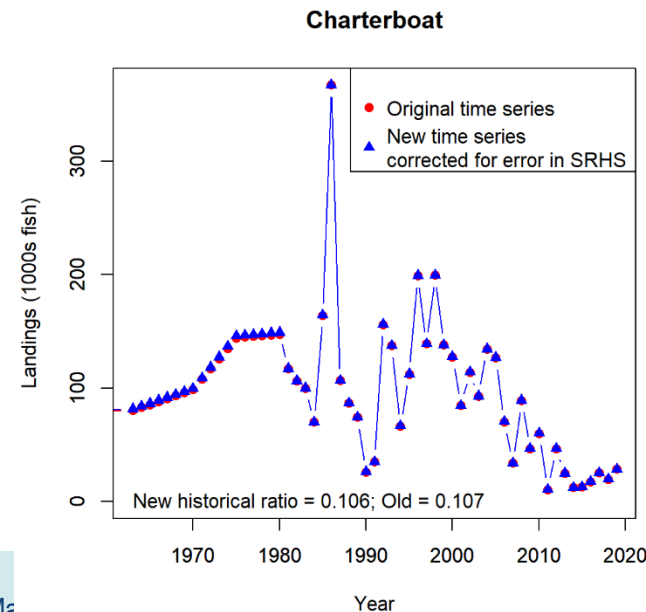
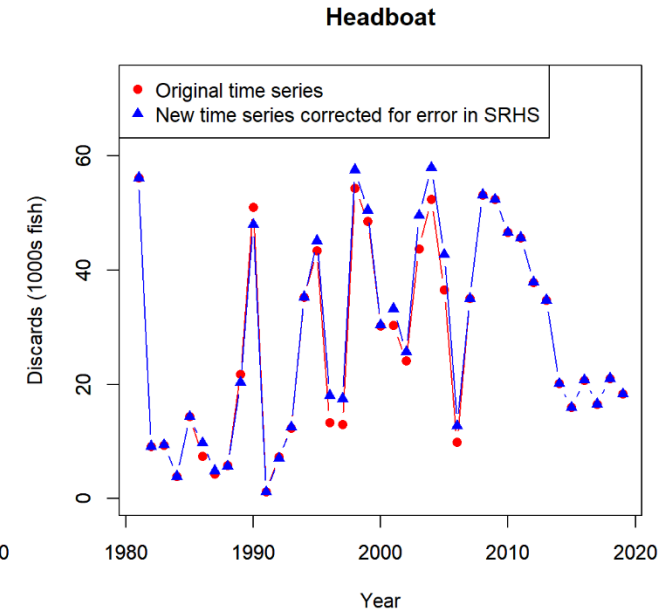
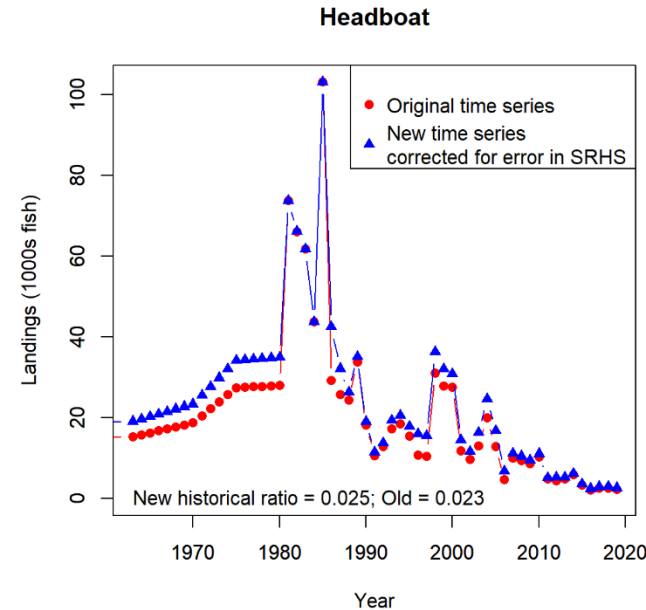




# Changes to Data Inputs:

## *Headboat Issue*

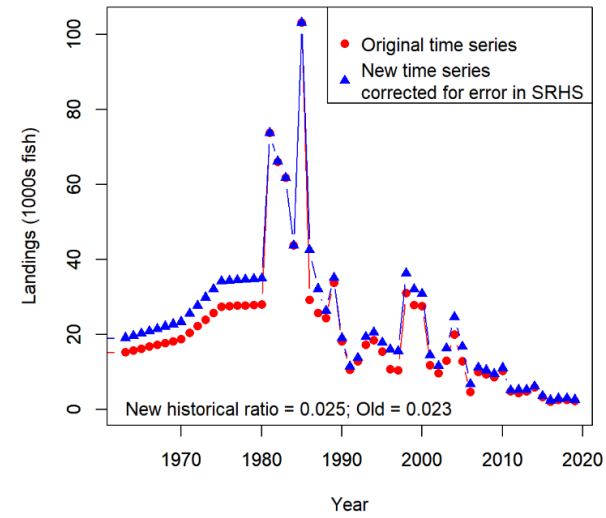
- Error detected in part of the Headboat time series of landings (1986-2019) and discards (1986-2007)
- S72 and SRFS run redone with corrected headboat datasets (and correction to historical ratios)



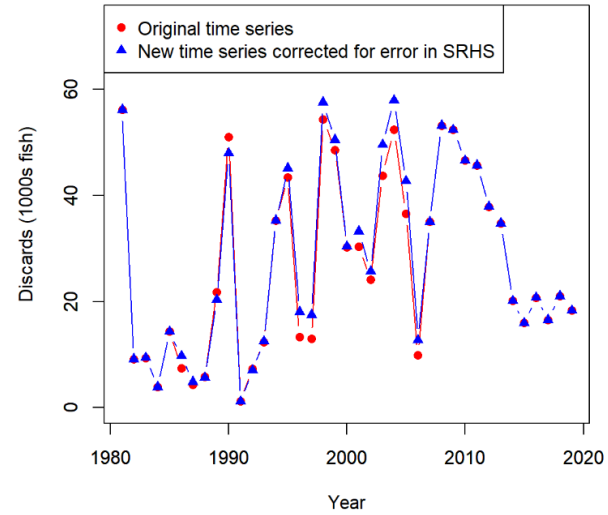
# S72

# SRFS RUN

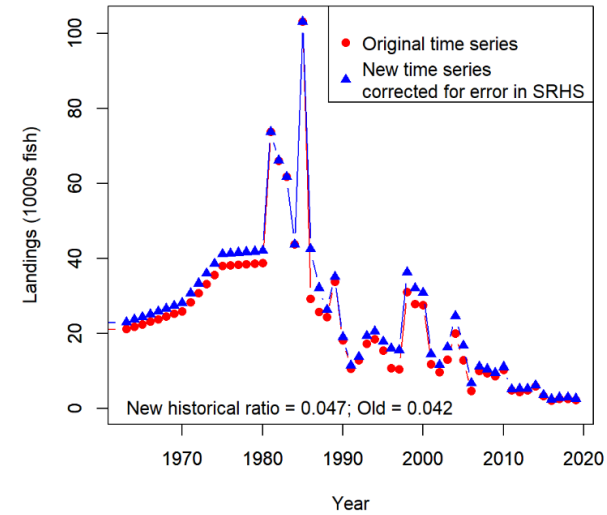
Headboat



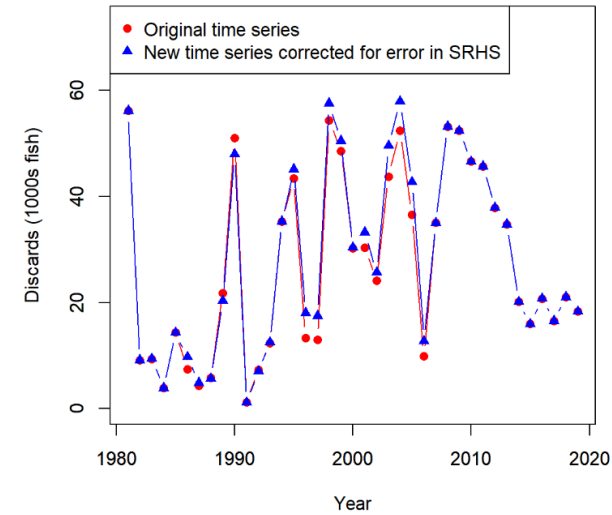
Headboat



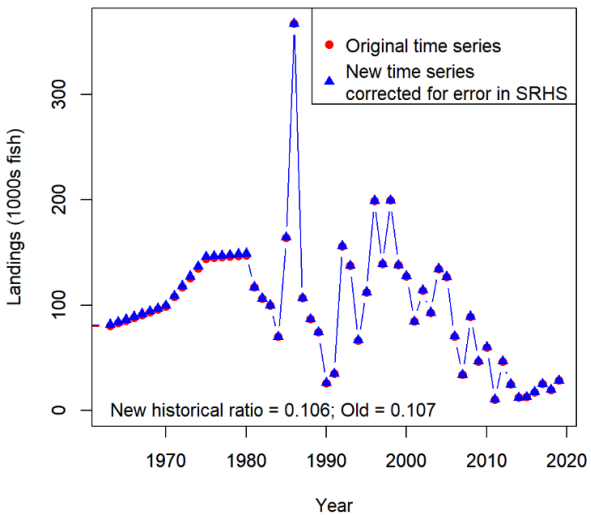
Headboat



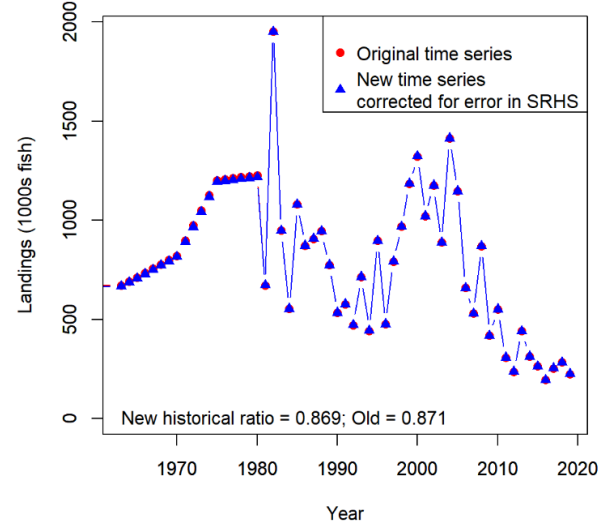
Headboat



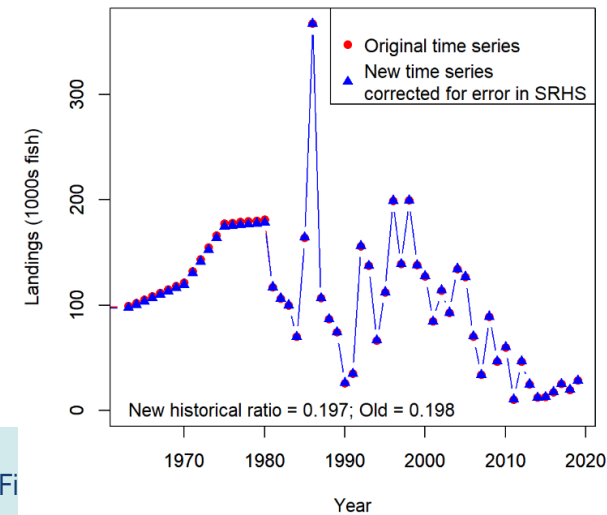
Charterboat



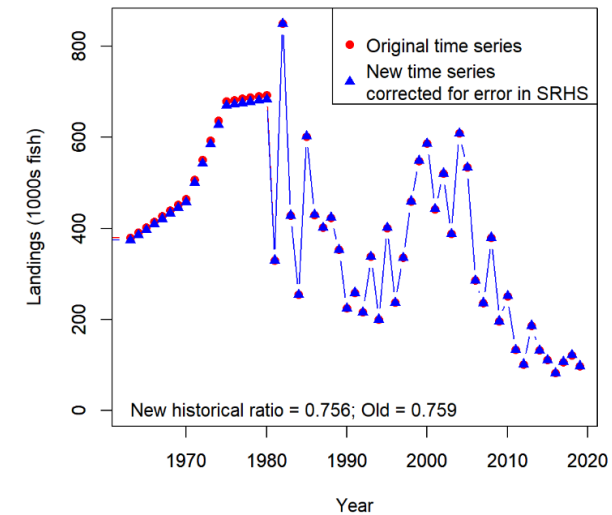
Private + Shore



Charterboat



Private + Shore



# S72

- Model
  - Fixed 2 private + shore fleet selectivity parameters at S72 values because of bounding issues:
    - Ascending limb
    - Descending limb
- Forecast
  - Hbt interim catches changed
    - From: 2.611, 3.47, 2.8156
    - To: 2.981, 3.637, 3.08933
  - 2021 red tide value recalculated (scaled to 2005 SS red tide estimate)
    - From : 0.1522
    - To : 0.1479

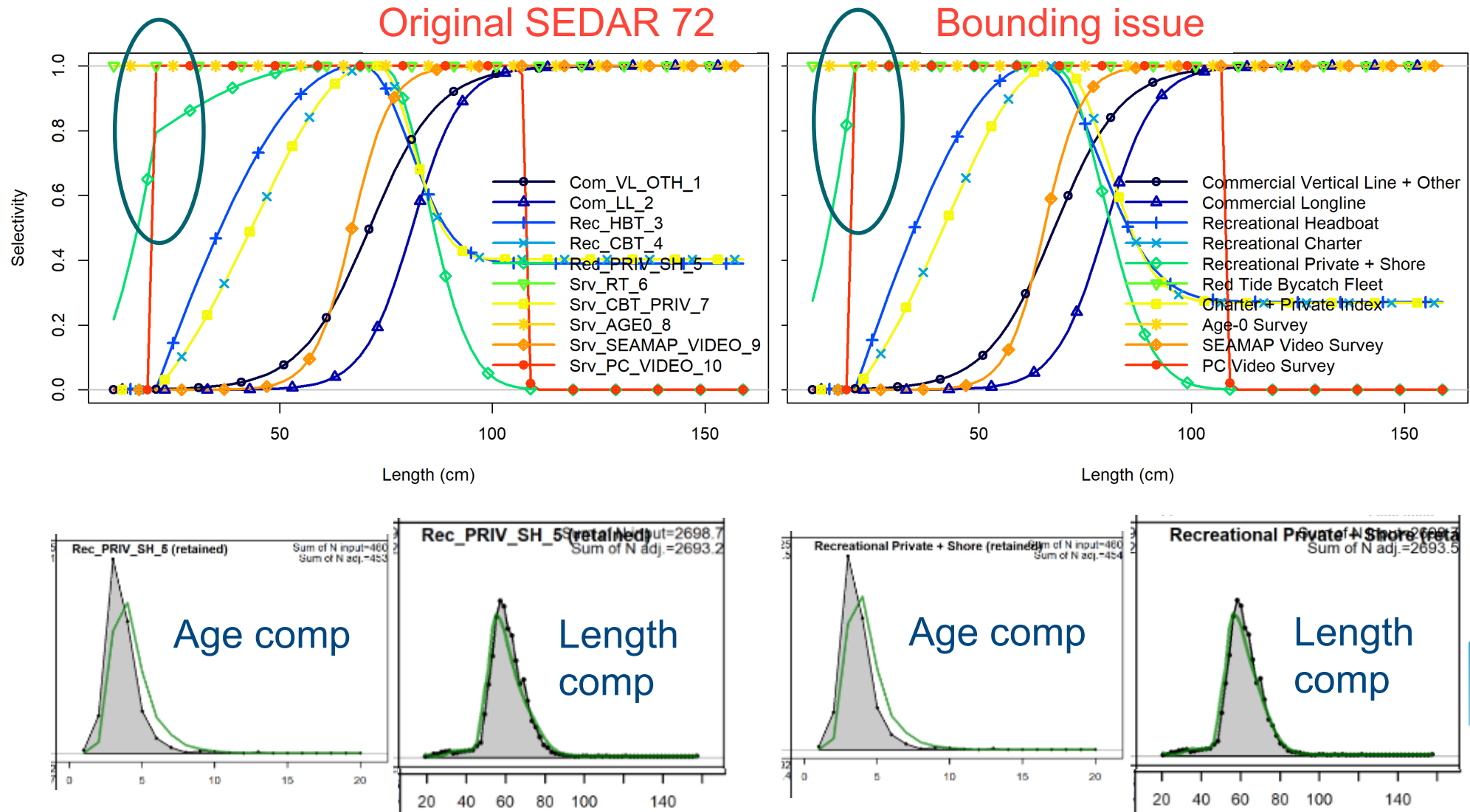
# SRFS RUN

- Model
  - Fixed 2 private + shore fleet selectivity parameters at S72 values because of bounding issues:
    - Ascending limb
    - Descending limb
- Forecast
  - Hbt interim catches changed
    - From: 2.611, 3.47, 2.8156
    - To: 2.981, 3.637, 3.08933
  - 2021 red tide value recalculated (scaled to 2005 SS red tide estimate)
    - From : 0.178516
    - To : 0.17856



# Private + Shore Fleet Selectivity

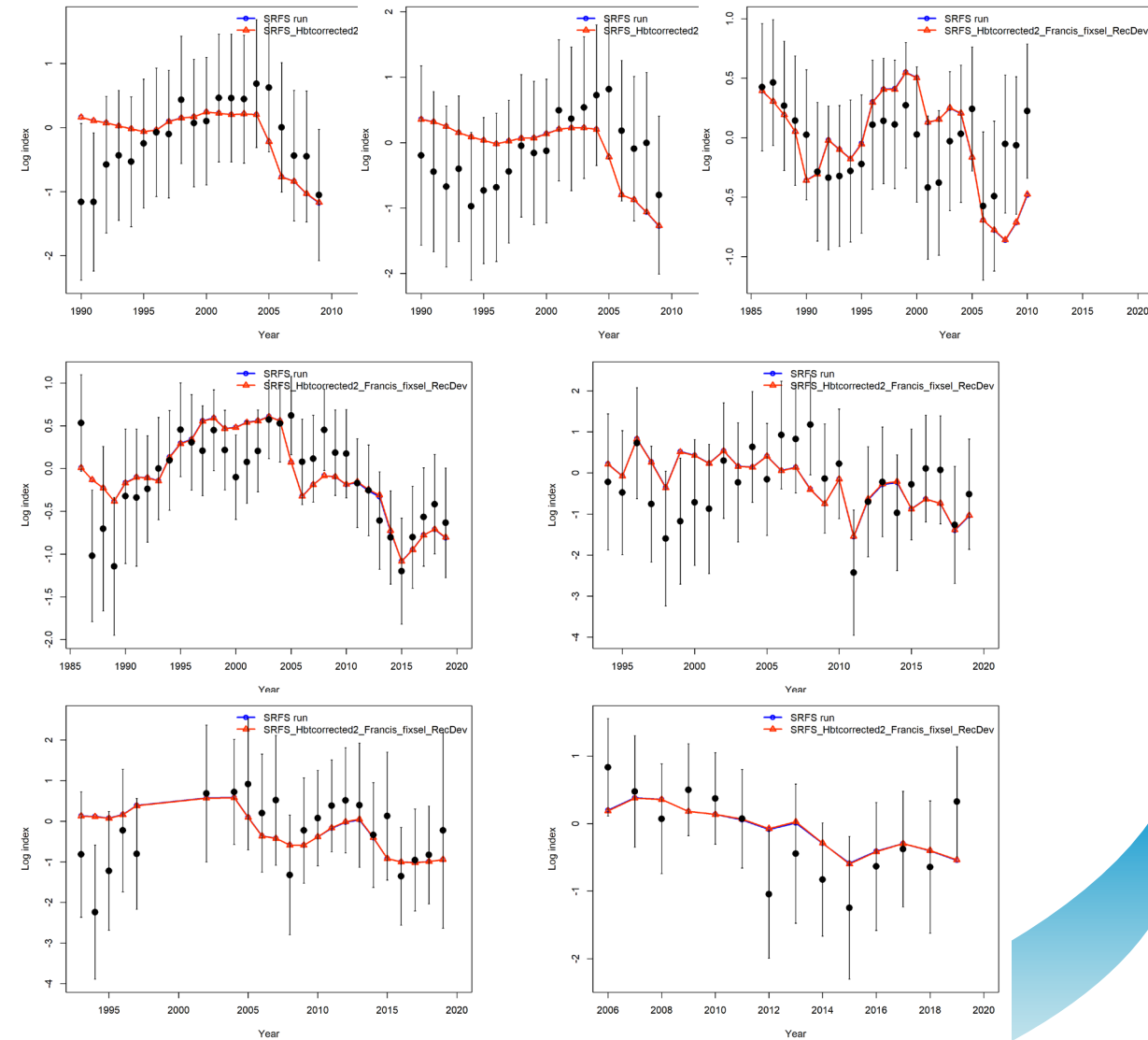
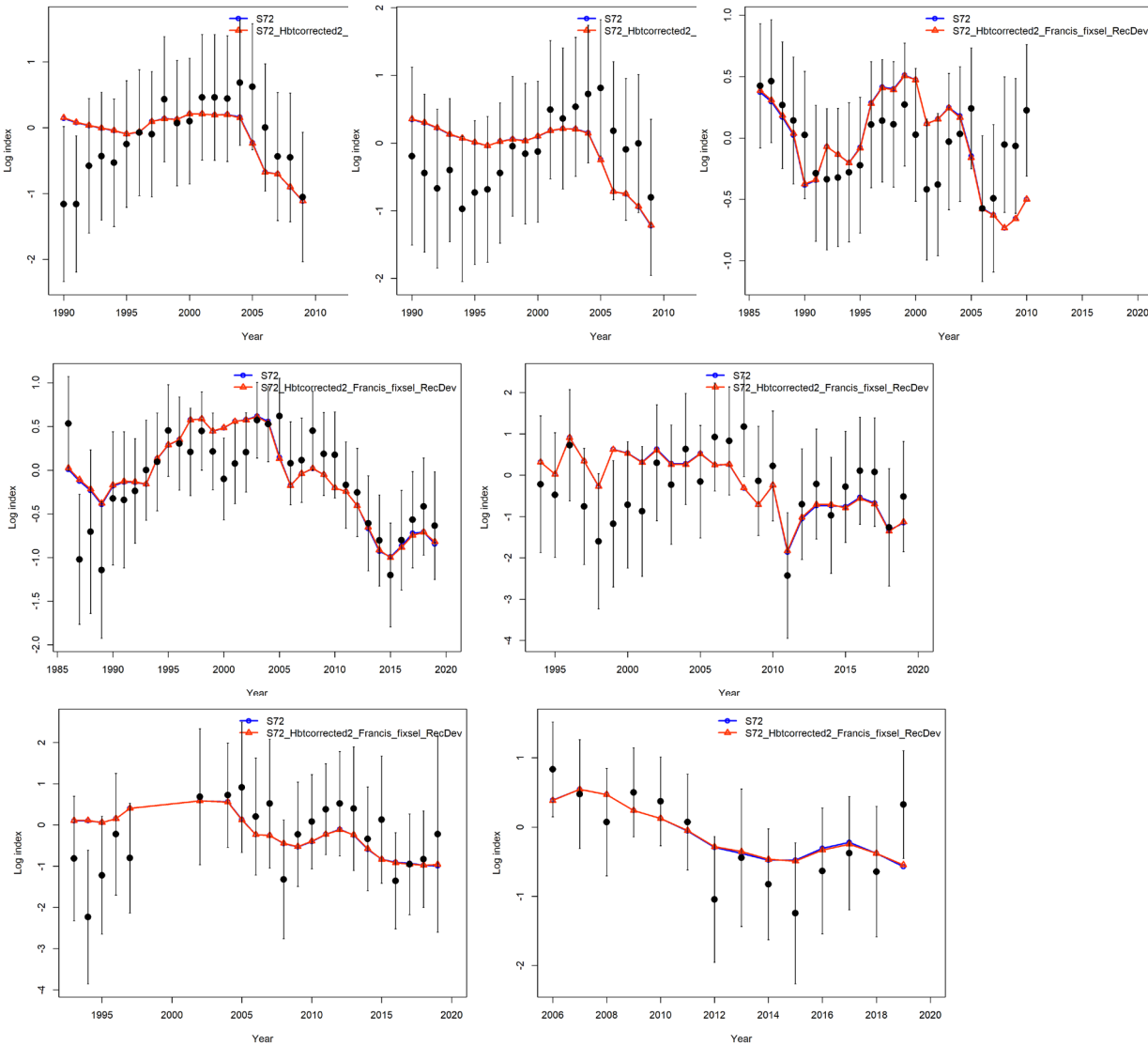
- Near-identical fits to the age/size composition data
- No size/age information on discards to inform it

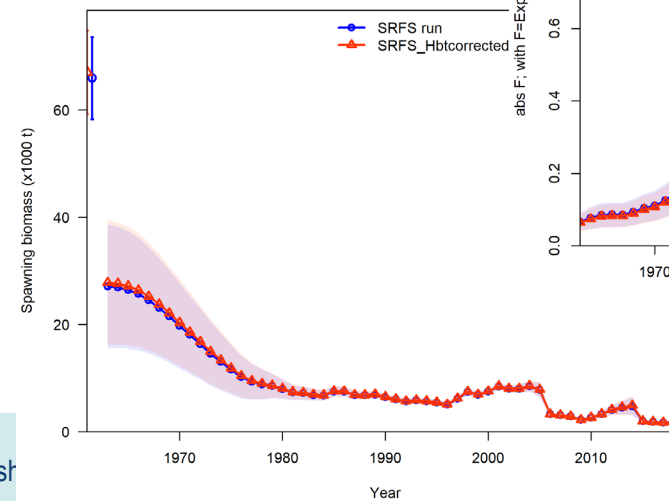
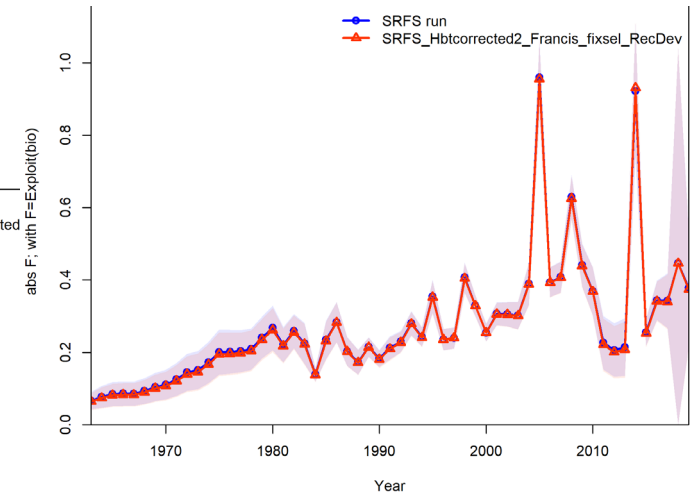
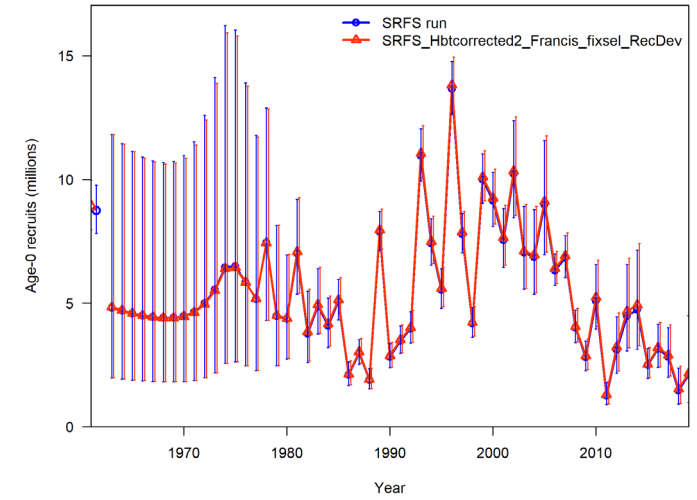
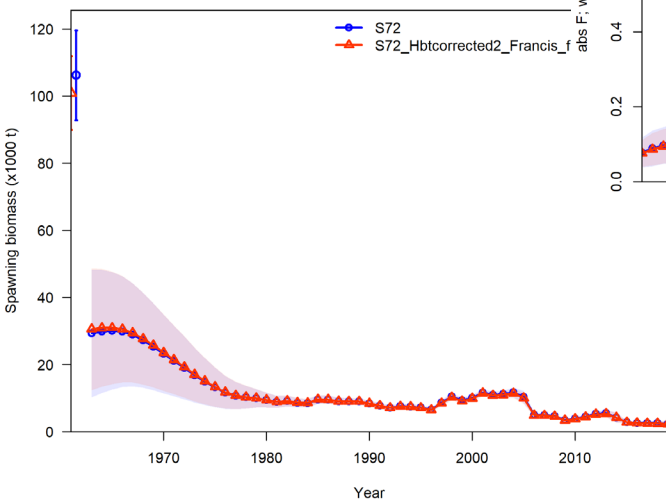
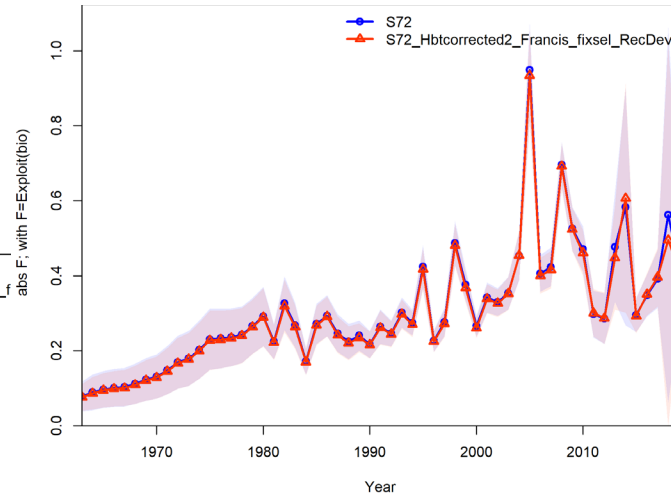
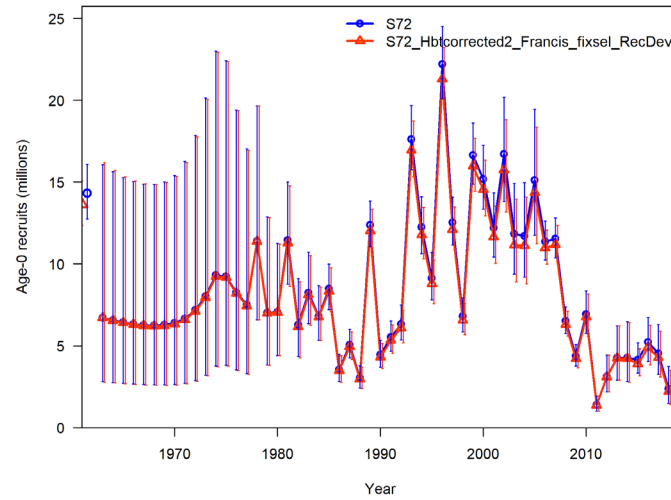


# S72

Minimal changes in fits to indices

# SRFS RUN





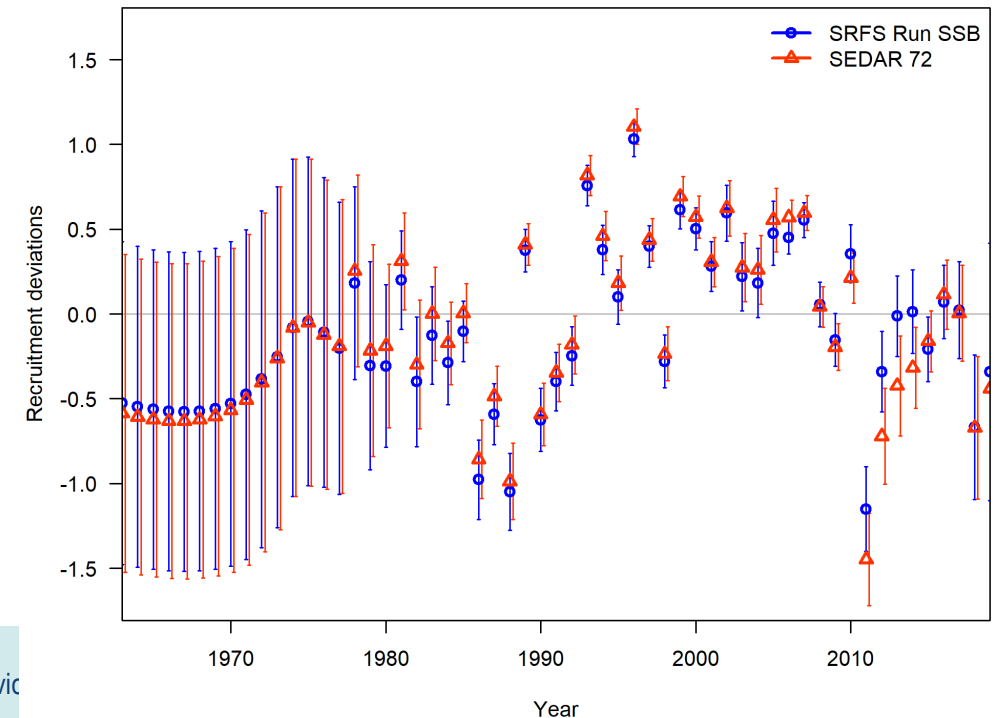
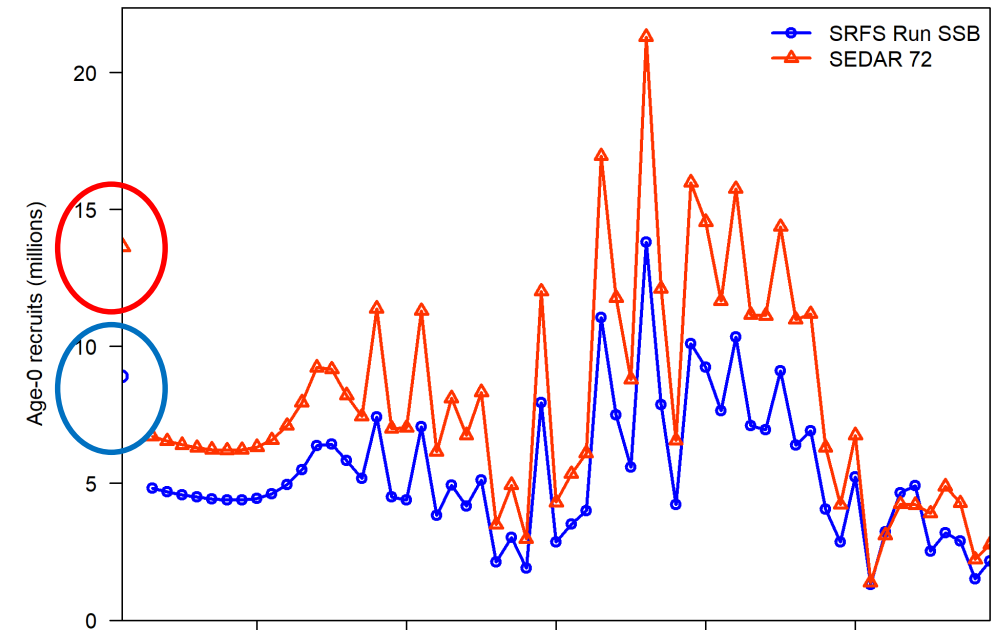
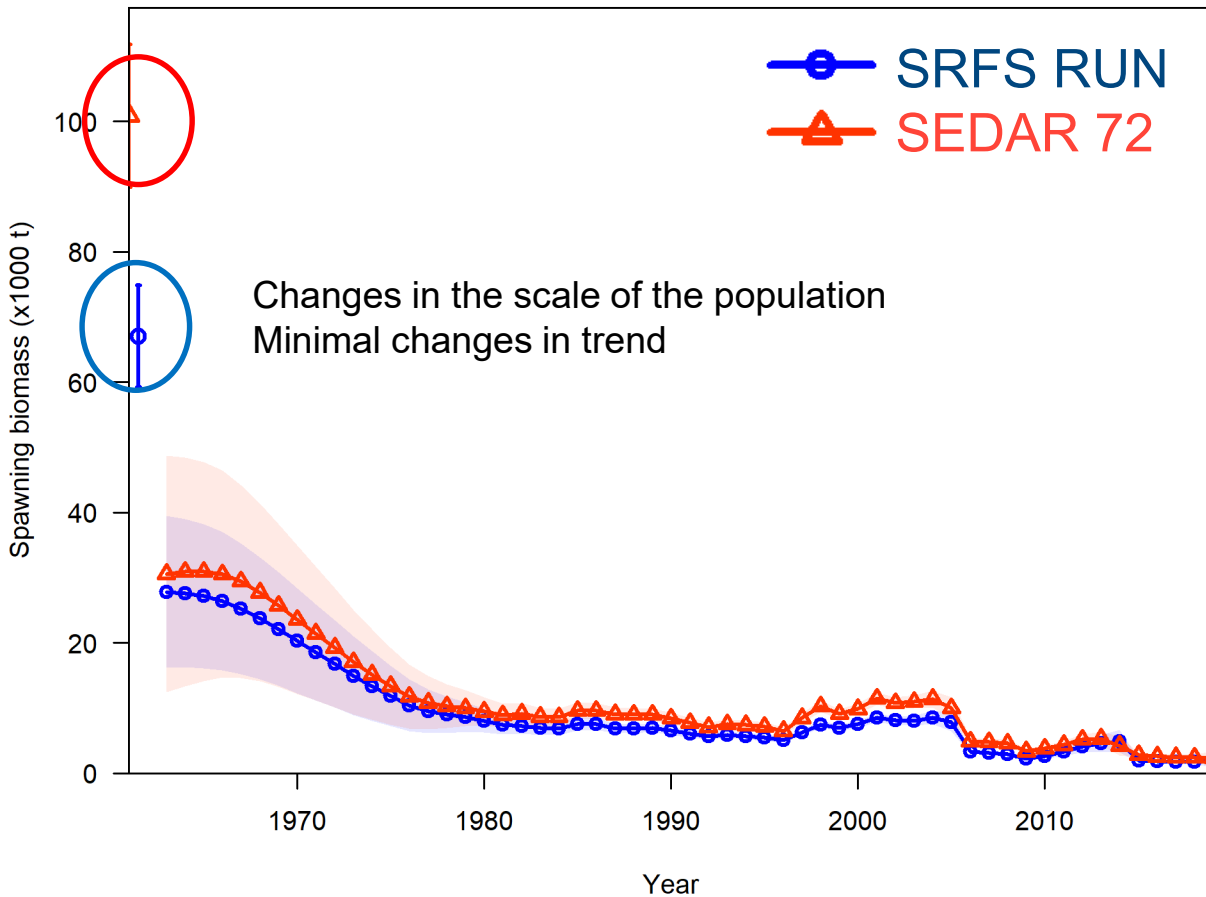
# Model Results

# Model Results

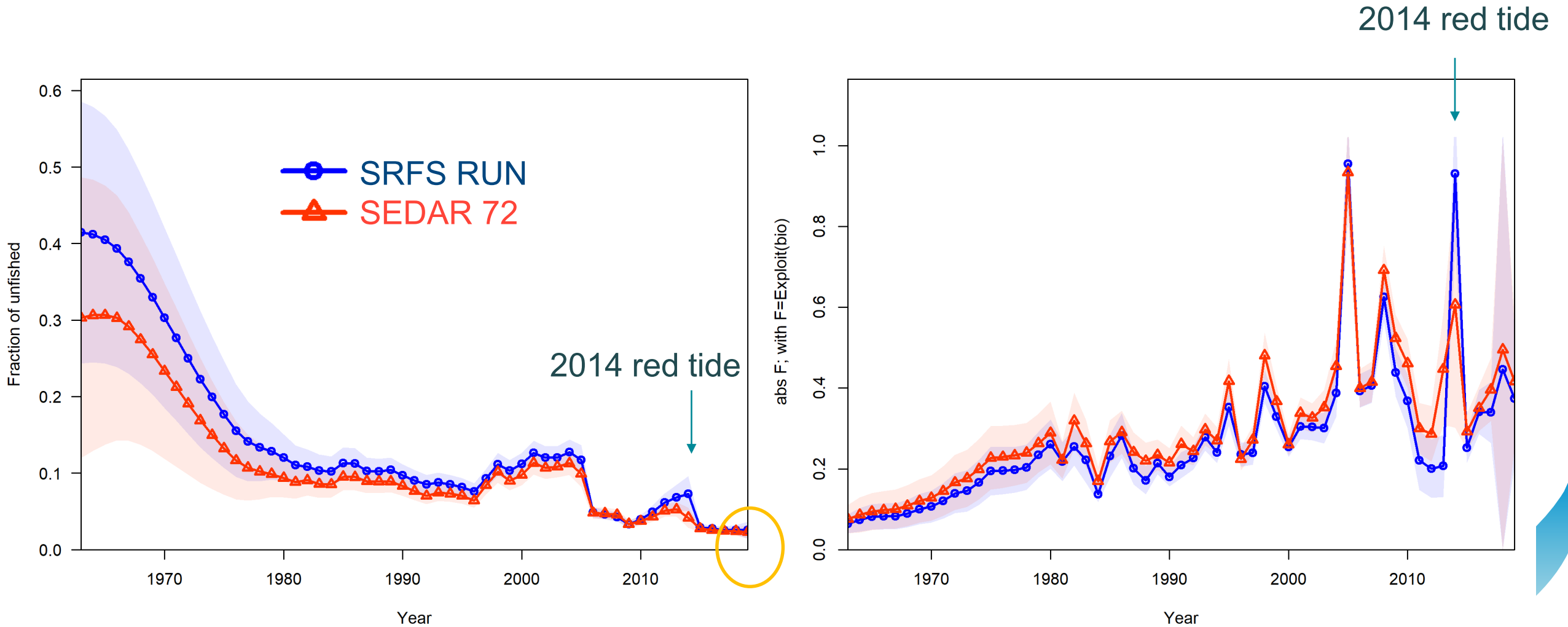
- Headboat corrections had a minimal effect on the model results
- The SRFS run had near identical fits to the data as in SEDAR 72 (details in report – will be updated with Headboat corrections)



# SRFS Run vs. SEDAR 72 Base Model



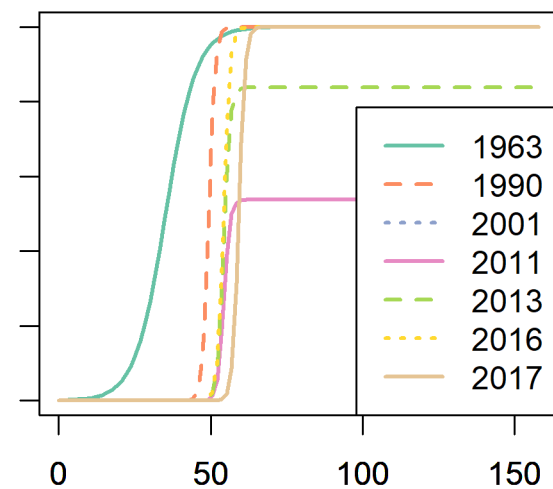
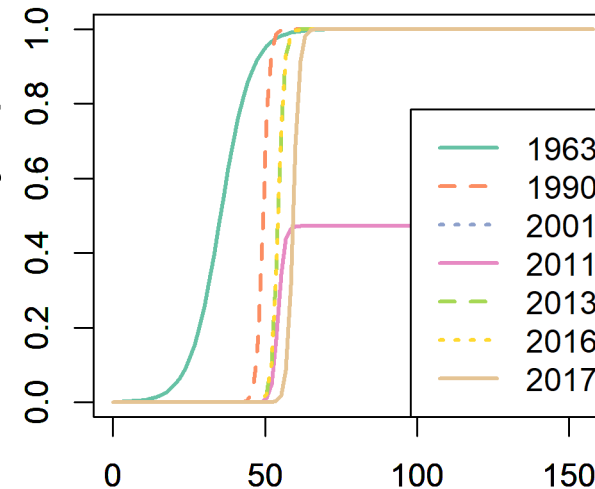
# SRFS Run vs. SEDAR 72 Base Model



# Private Shore Fleet

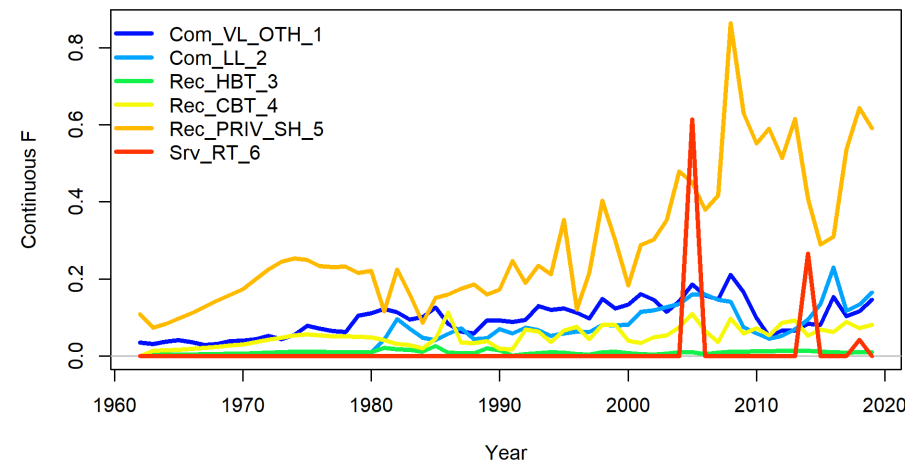
- SRFS Run : more severe 2014 red tide
- Trade-off between Pr/Sh fleet catches and 2014 red tide kill
- No length composition of private discards to inform asymptote – has to rely on landings:discards ratio (but high CV on landings)

Retention asymptote

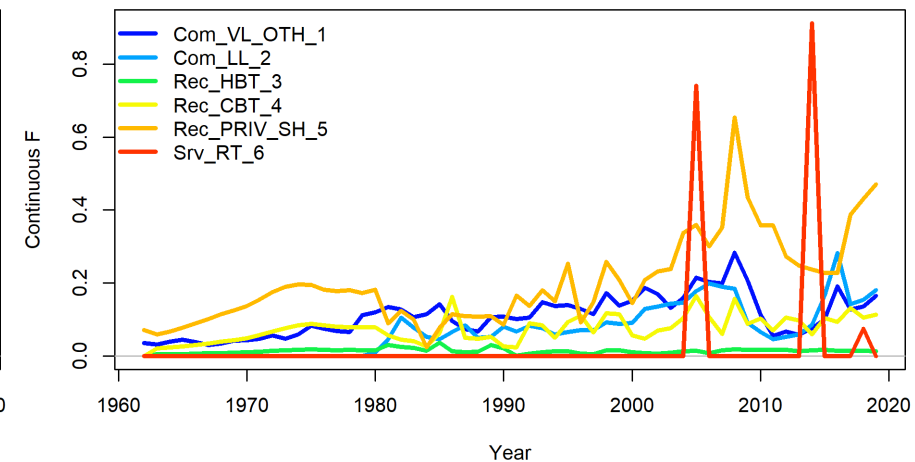


Time blocks

SEDAR 72



SRFS RUN

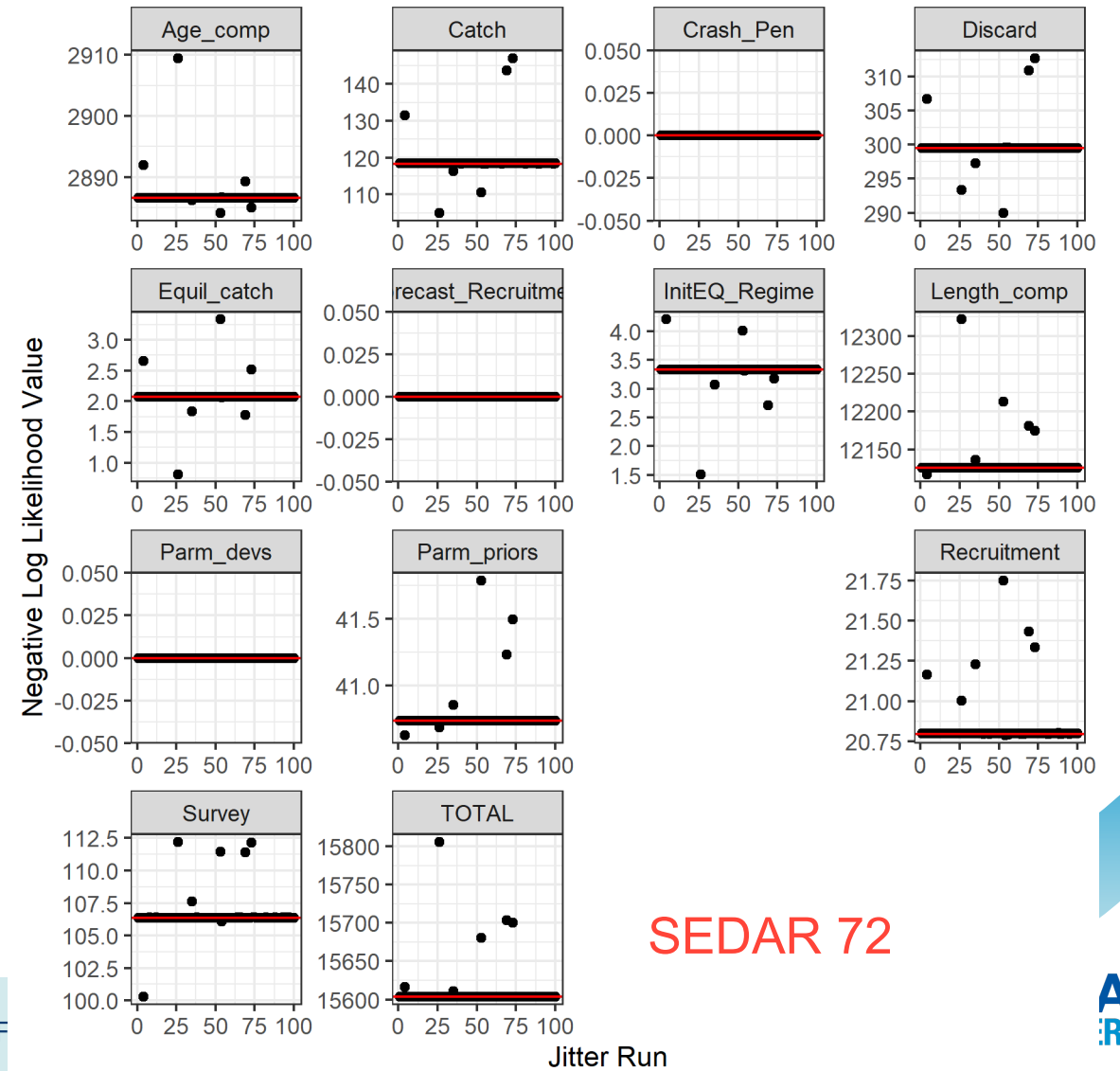
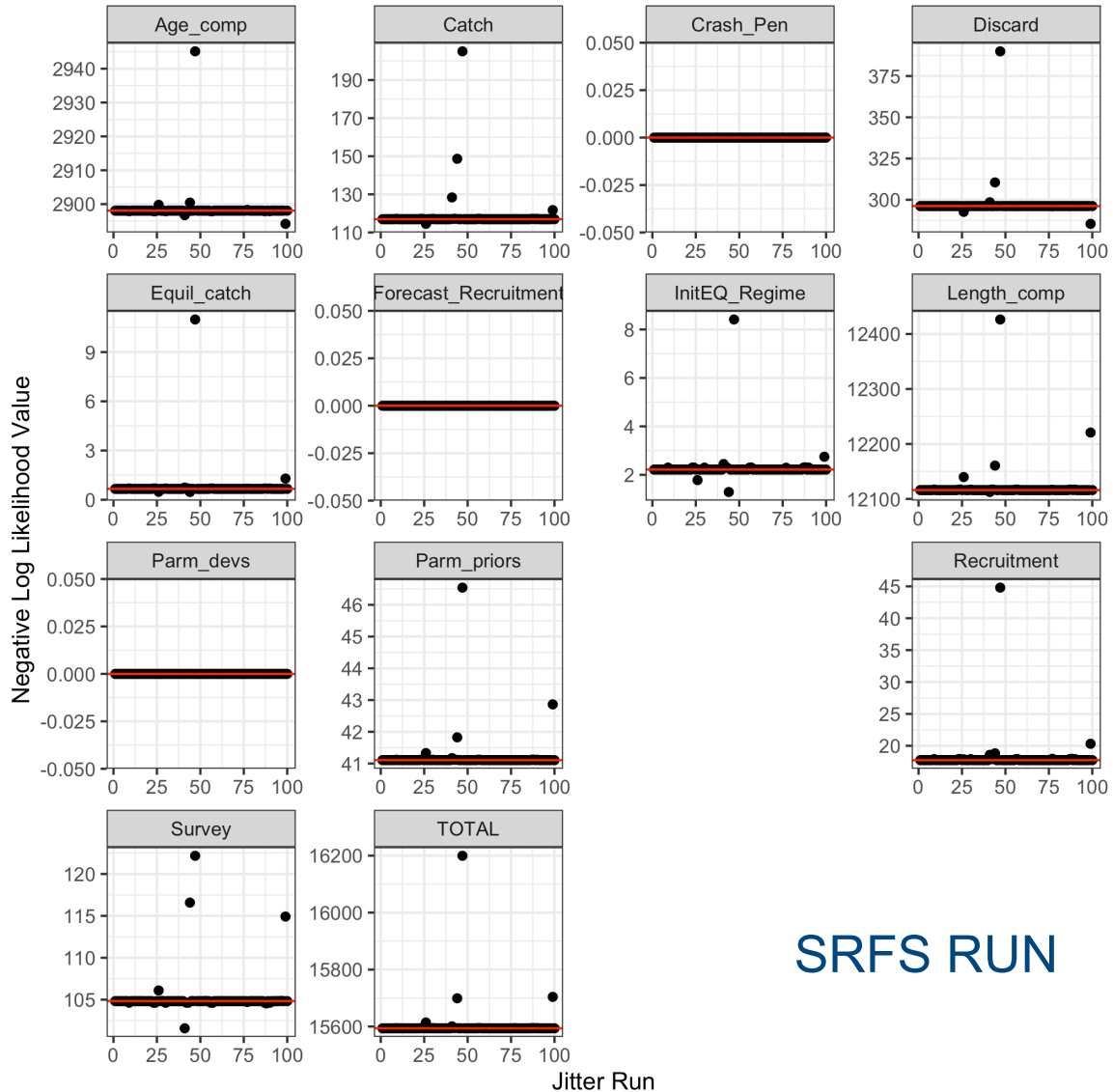


# Diagnostics



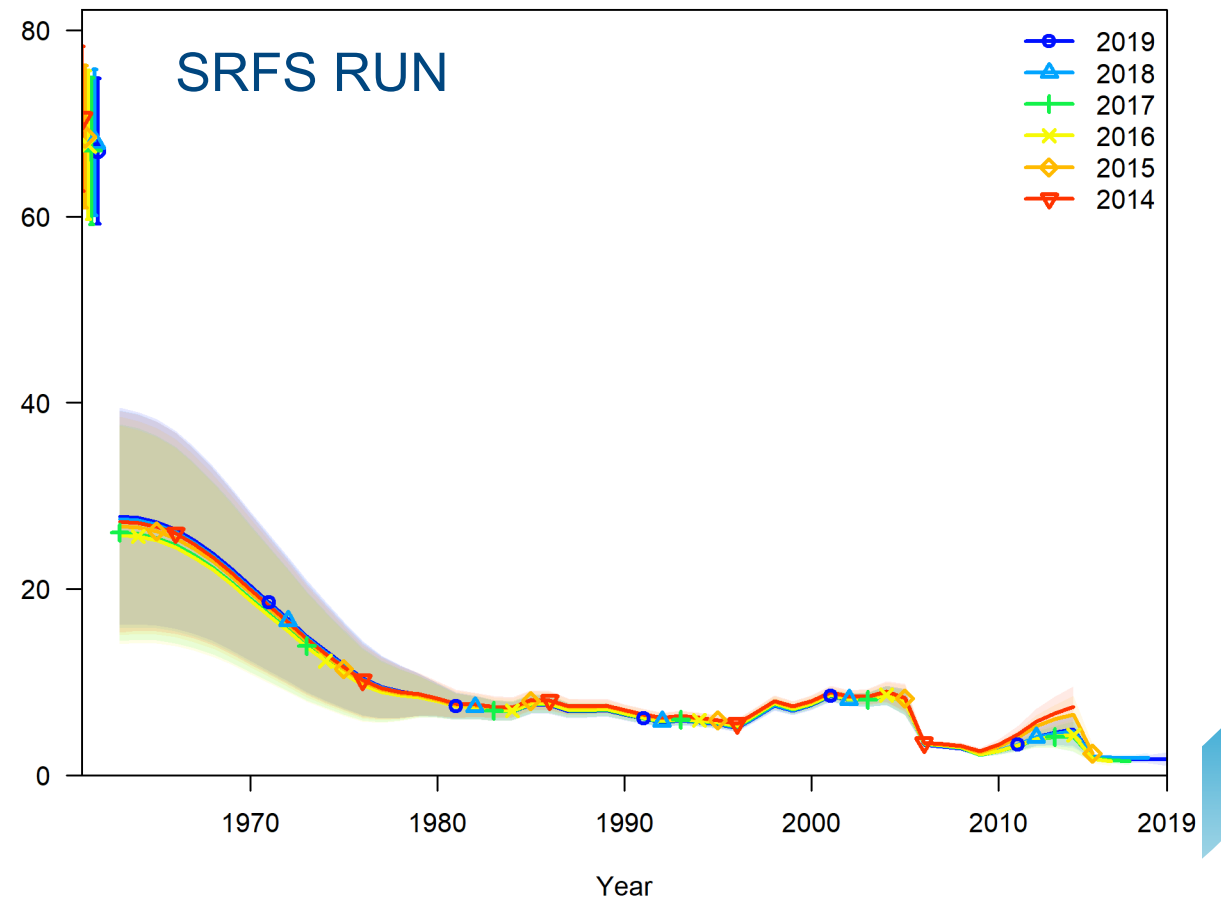
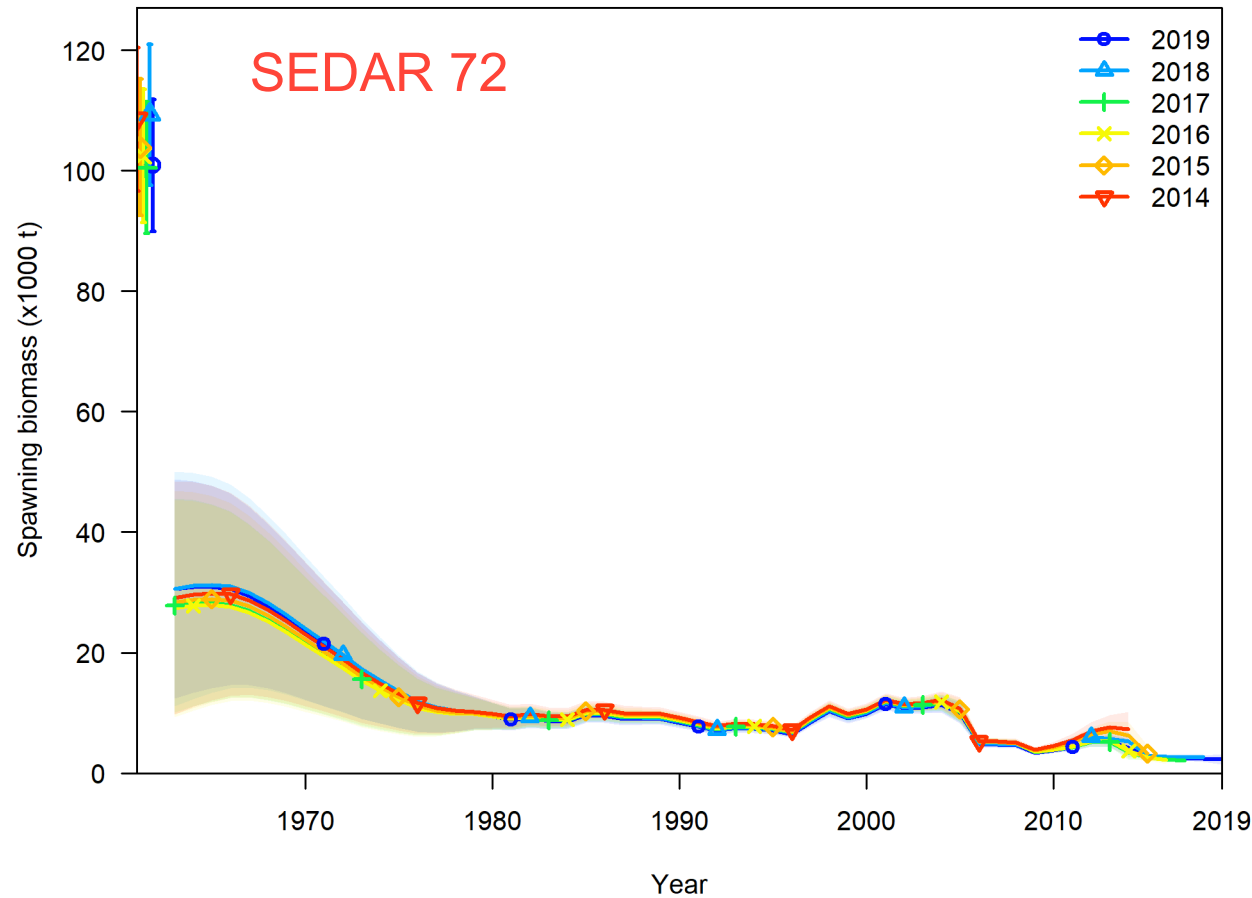
**NOAA**  
FISHERIES

# Diagnostics – Jitter Analysis



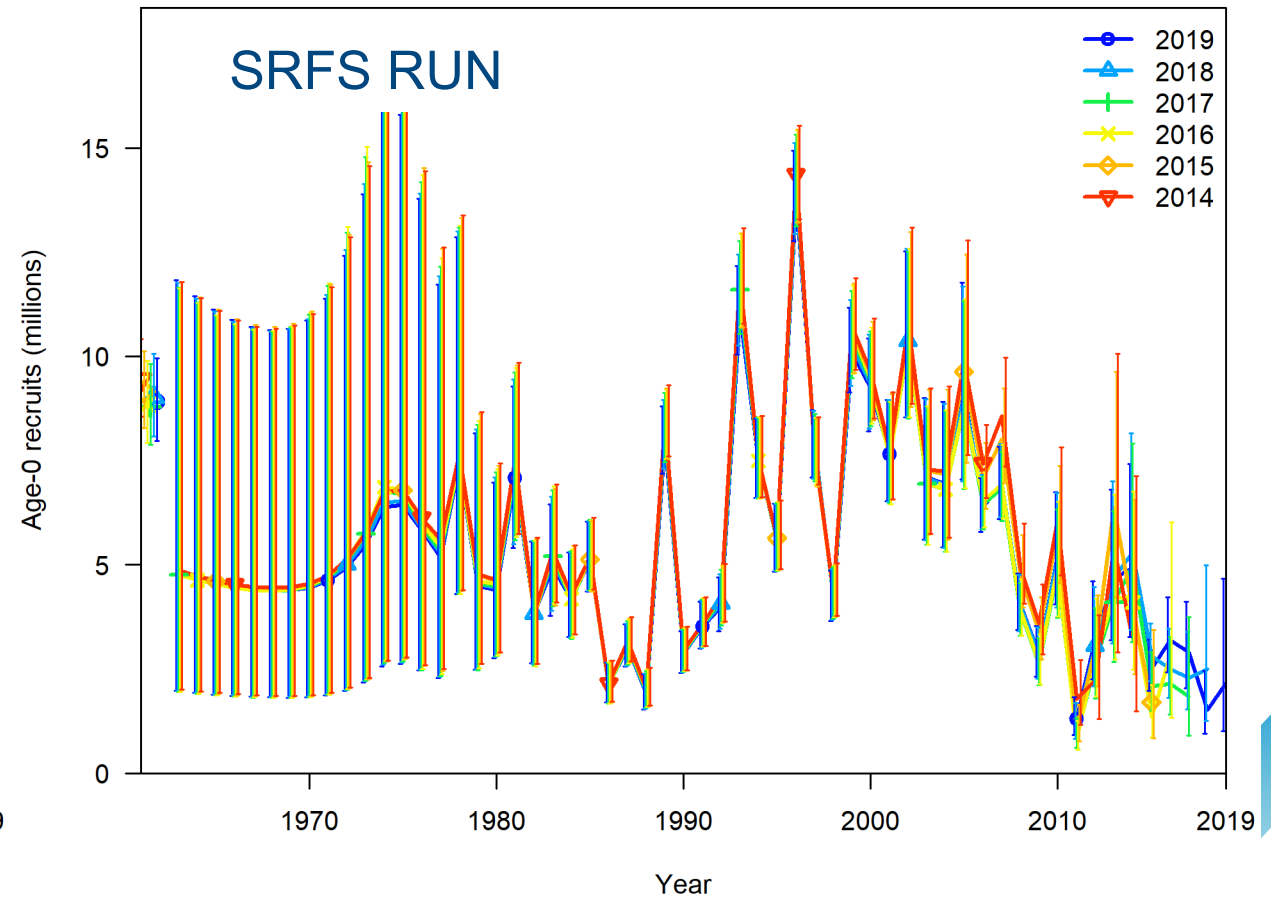
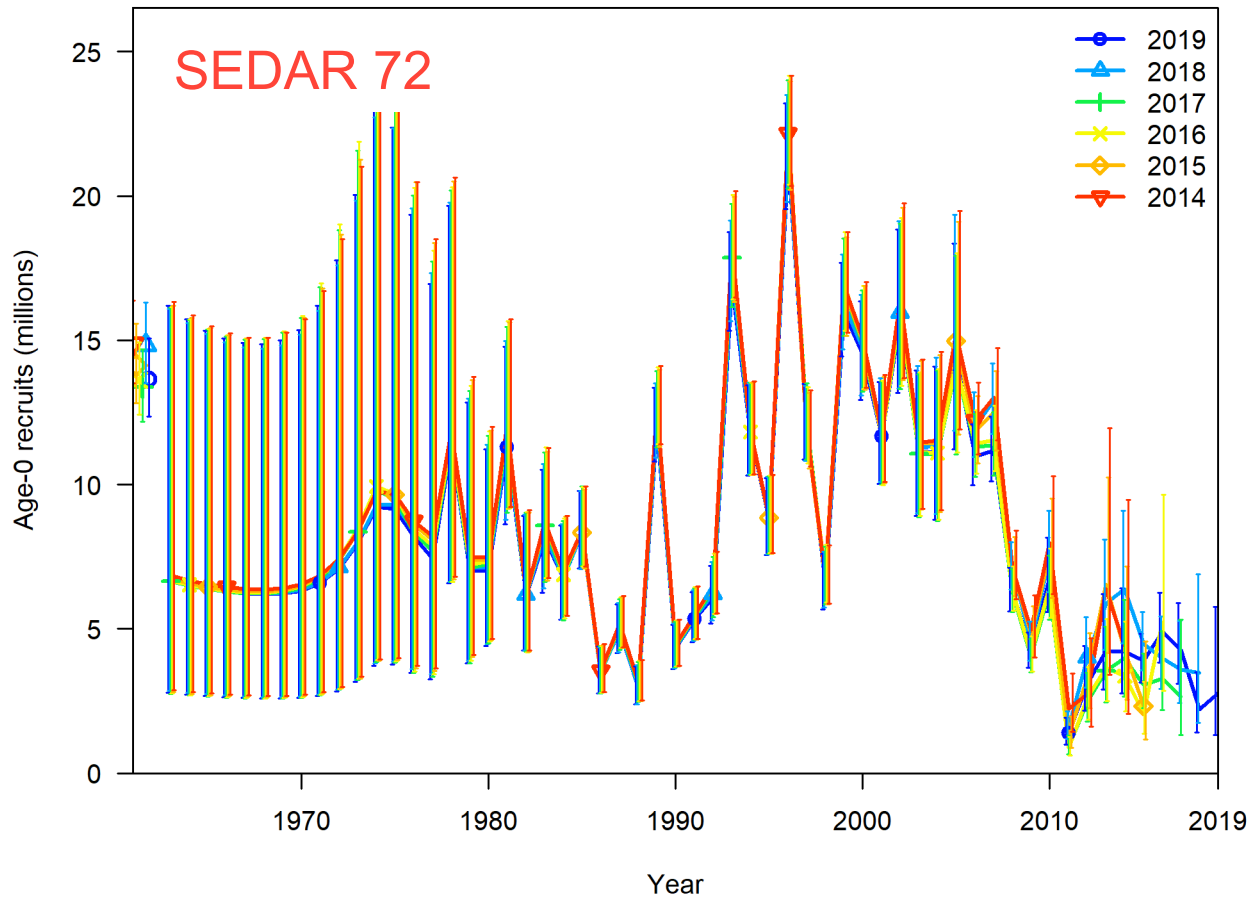
# Diagnostics – Retrospective Analysis

## SPAWNING STOCK BIOMASS



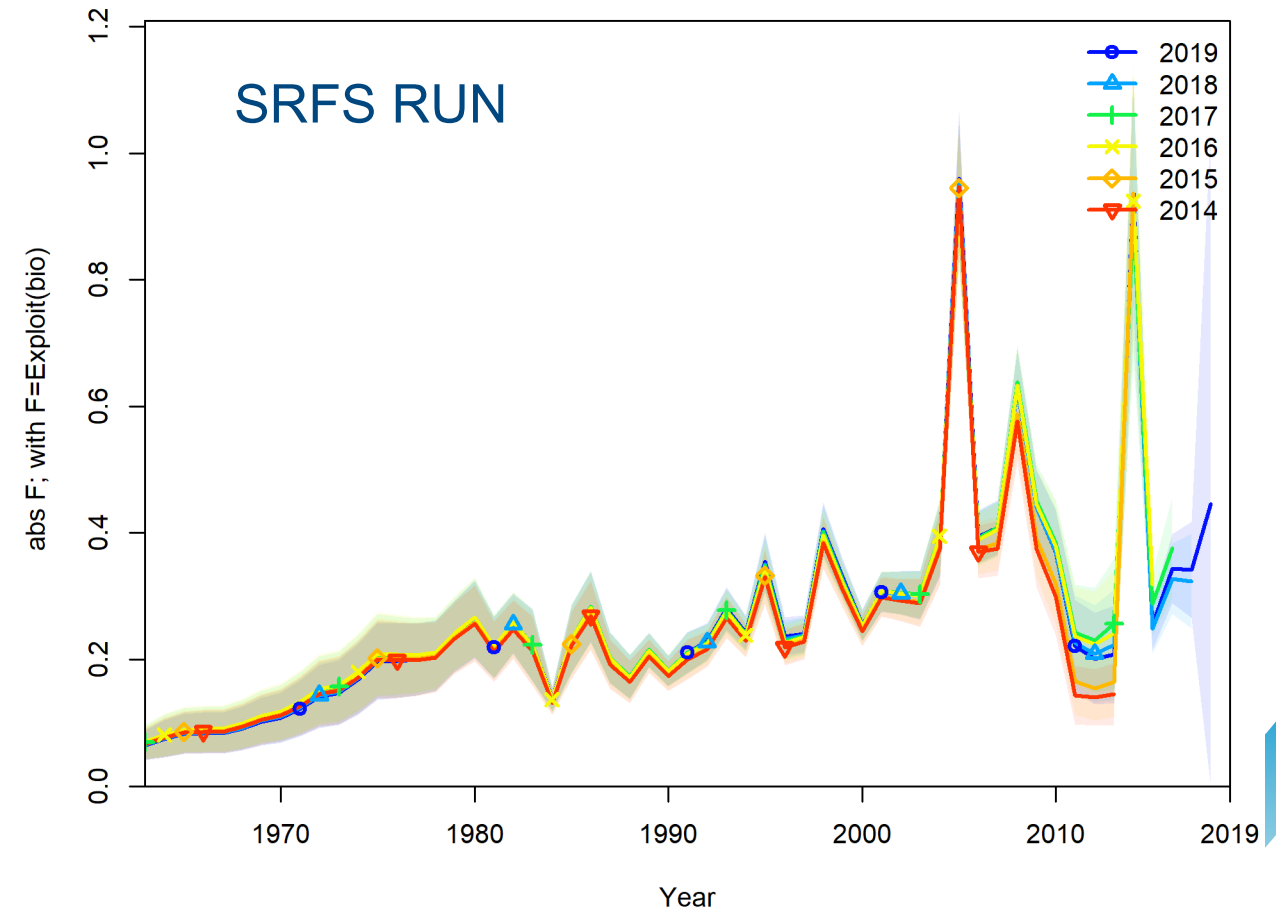
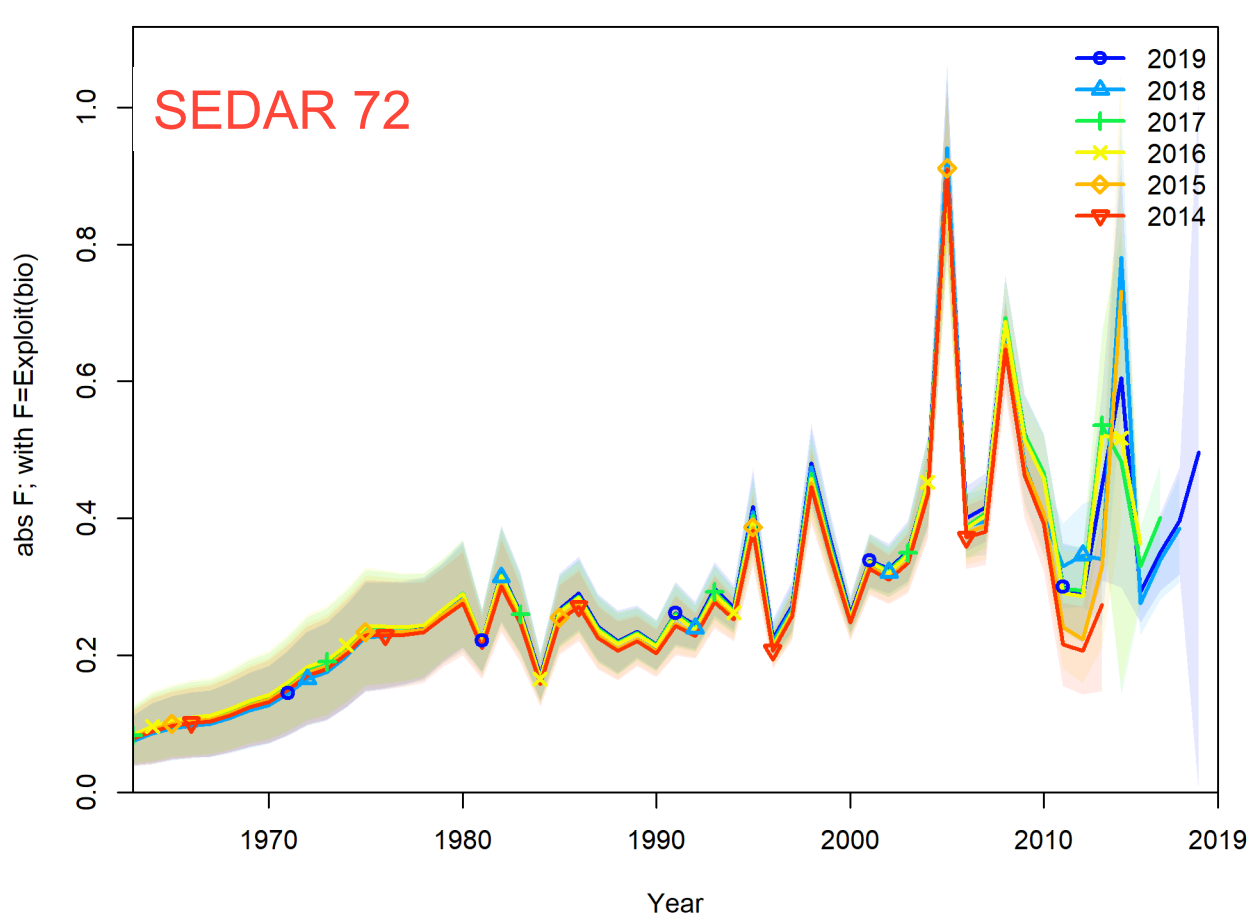
# Diagnostics – Retrospective Analysis

## RECRUITMENT



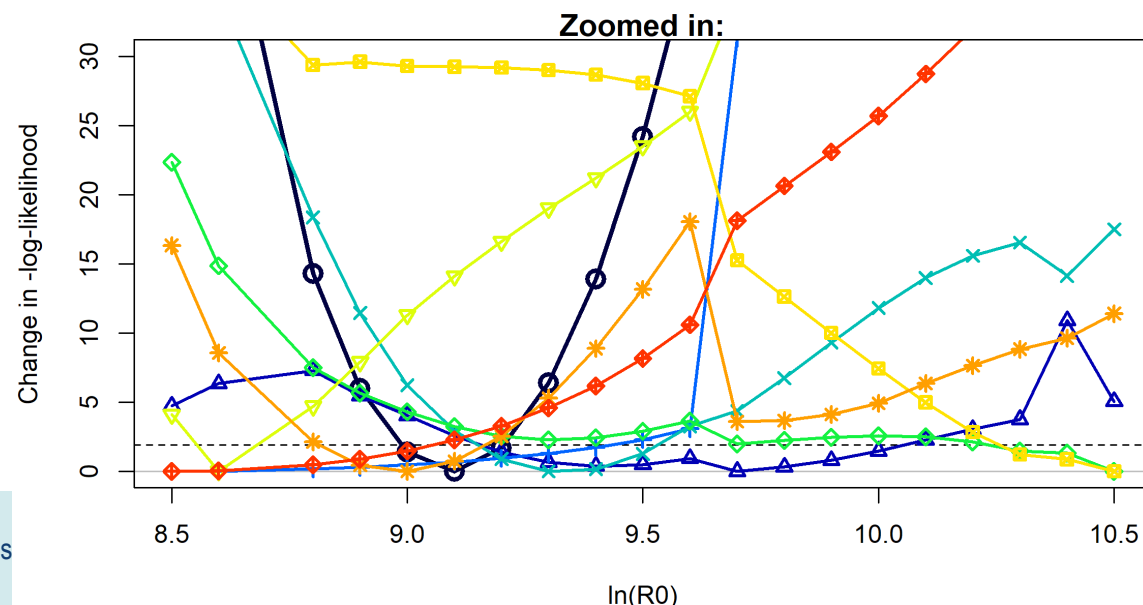
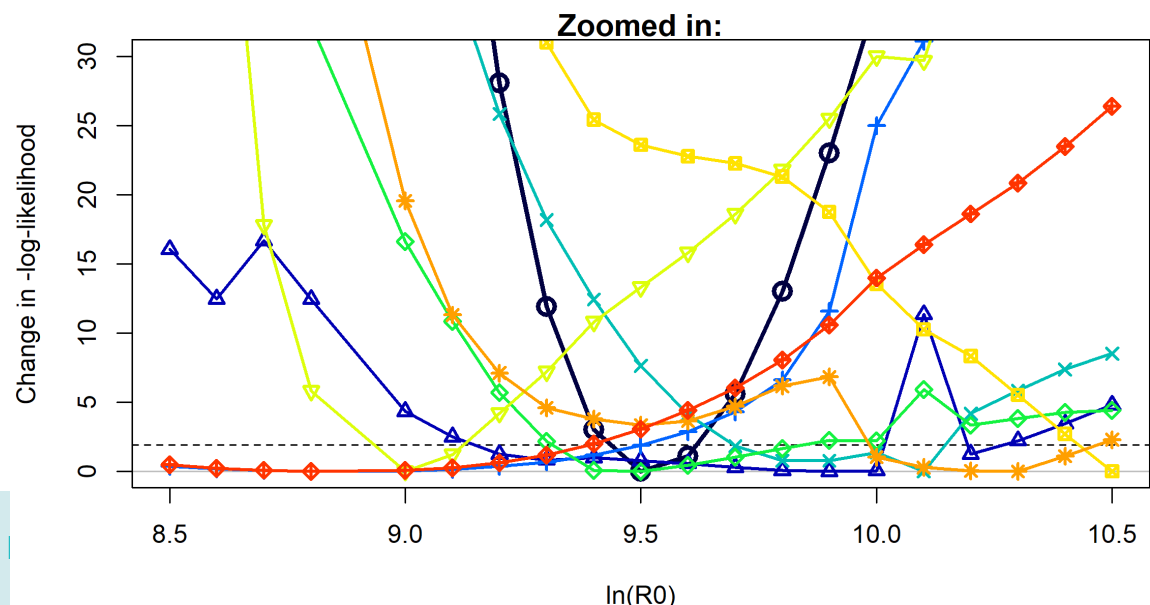
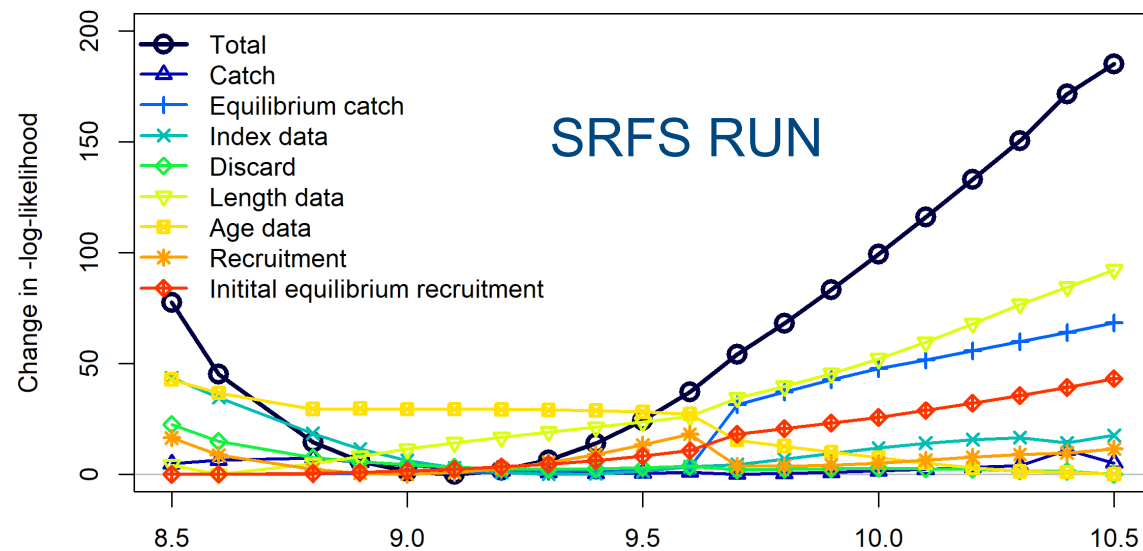
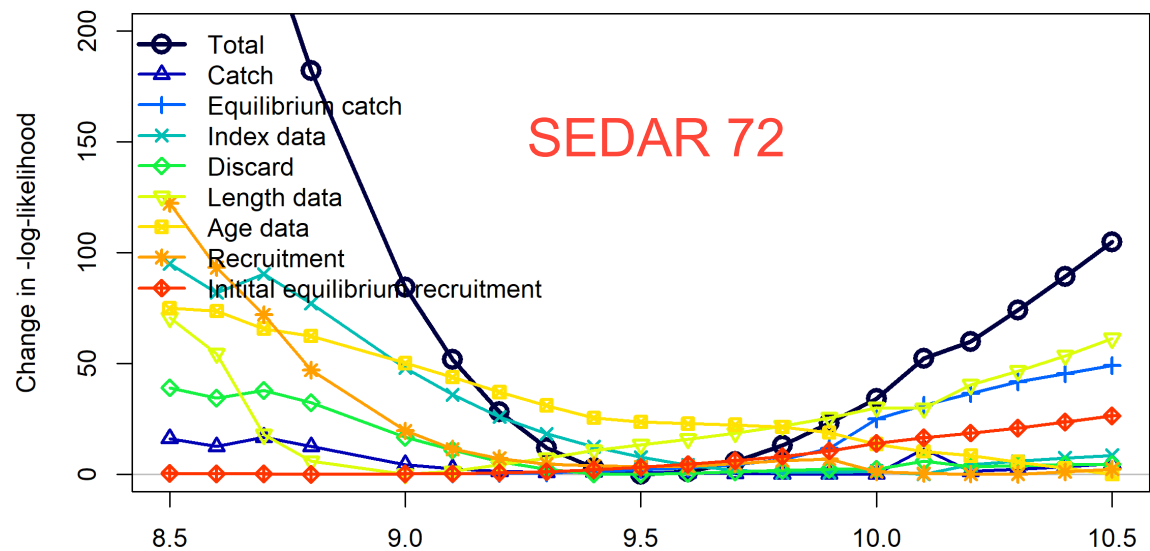
# Diagnostics – Retrospective Analysis

## EXPLOITATION RATE





# Diagnostics – R0 Likelihood Profiles



# Model Comparison Conclusions

- The use of the SRFS time series scales the stock's population size and recruitment estimates down by half but does not change the overall stock trajectory or terminal year SSB/SSB0 ratio
- The R0 likelihood profile from the SRFS run : increased levels of disagreement between the age (larger R0) and length (smaller R0) datasets



# Projections



**NOAA**  
FISHERIES

# Reference Points

- $F_{max}$  was listed in the Terms of Reference of the SRFS run (and consequently included in the report). However,  $F_{max}$  was not recommended by the SSC for use with SEDAR 72.
- Following a call with the SSC chair and vice chair, a request was made to also present  $F_{spr40\%}$
- Results from both  $F_{spr30\%}$  and  $F_{spr40\%}$  are therefore presented here.



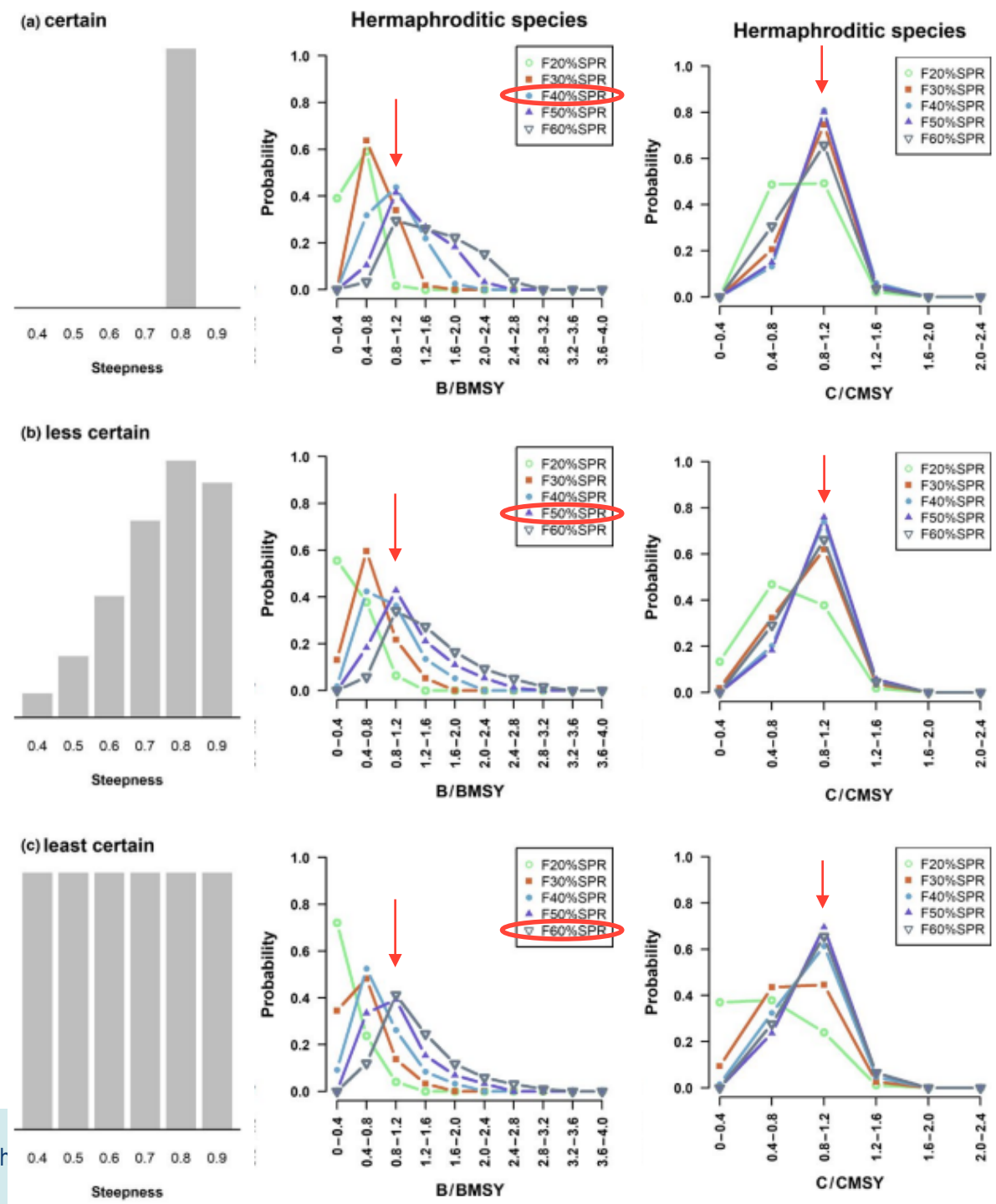
# Choice of SPR value

- $F_{sprX\%}$ 
  - Fraction by which  $F$  reduces a recruit's lifetime reproductive output
  - With protogynous hermaphrodites, if you are only measuring Female biomass, long term  $F$  may result in relatively low biomass levels of males, which in turn affects long term yield
  - Given our uncertainty surrounding the relative contribution of males to the reproductive output of the stock, using combined SSB (males + females) provides a buffer to avoid depleting males
  - Following a similar logic and adding in the complexity of uncertainty surrounding steepness, Harford et al. 2018 provides guidance on the level of SPR that would be highest probability of achieving long-term MSY in hermaphroditic stocks



# Harford et al. 2018

- Simulation: Given uncertainty in steepness, which proxy has the highest probability of achieving long-term MSY?
- Hermaphroditic stocks: **F50%SPR** greatest probability mass centered on long-term achievement of MSY while also maintaining biomass in proximity to Bmsy (60%SPR with more weight given to lower  $h$  values, 40% if  $h=0.8$  is known exactly)
- Simulation uses SSB female



# Projections settings

Parameter		Value	Comment
Relative F		Not used	Average relative fishing mortality (apical F) over terminal three years of model (Red Tide F excluded)
Selectivity		2019	Fleet specific selectivity estimated in the terminal year of the model
Retention		2019	Fleet specific retention estimated in the terminal year of the model
Recruitment	Beverton-Holt stock-recruitment relationship		Derived from the model estimated Beverton-Holt stock-recruitment relationship
Interim Landings (2020-2022)	77/91/109 mt (Comm. Vertical Line) 139.04/164.5/128.26 mt (Comm. Longline) 2.98/3.64/3.09 thousands of fish (Headboat) 37.61/80.38/48.84 thousands of fish (Charter) 130.81/90.33/106.41 thousands of fish (Private) <b>SEDAR 72: 305.4/208.66/246.52 thousands of fish (Private)</b>		Landings provided for 2020-2021; For 2022, used 3-year average of landings (2019-2021)
Allocation Ratio	39:61		Commercial:Recreational
Red Tide in Interim Years		0.1786 <b>SEDAR 72: 0.148</b>	Red Tide F for 2021 obtained from the Ecosim model (medium red tide scenario)

# MSRA Table

		SEDAR 72		SRFS RUN	
Criteria	Definition				
Base M	Target M for fully selected ages in the Lorenzen (2005) scaling	0.159	0.159	0.159	0.159
Steepness	Steepness of the Beverton-Holt stock-recruit relationship (fixed)	0.855	0.855	0.855	0.855
R0	Virgin Recruitment (1000s)	13641	13641	8902.1	8903.2
Generation Time	Fecundity-weighted mean age	7.88	7.88	7.88	7.88
SSB0	Virgin spawning stock biomass (mt)	100891	100891	67045	67052
<b>Mortality Rate Criteria</b>					
Proxy	Fmsy proxy used	<b>Fspr30</b>	<b>Fspr40</b>	<b>Fspr30</b>	<b>Fspr40</b>
Fmsy proxy	Fmsy proxy	0.148	0.101	0.144	0.098
MFMT	Fmsy proxy	0.148	0.101	0.144	0.098
%SPR equivalent of Fmsy proxy	%SPR equivalent	30	40	30	40
Fcurrent	Geometric mean of the last 3 years of the assessment (F2017-2019), excluding red tide mortality	0.416	0.416	0.353	0.352
Fcurrent/MFMT	Current stock status based on MFMT	<b>2.805</b>	<b>4.109</b>	<b>2.455</b>	<b>3.578</b>
<b>Biomass Criteria</b>					
SSBmsy proxy	Equilibrium SSB at Fmsy proxy	27140	37675	18035	25039
MSST	0.5*SSBFmsy_proxy	13570	18838	9017.6	12520
SSBcurrent	SSB2019	2304.3	2304.3	1709.1	1706.4
SSBcurrent/SSBFmsy_proxy	Current stock status based on SSBFmsy	0.085	0.061	0.095	0.068
SSBcurrent/MSST	Current stock status based on MSST	<b>0.17</b>	<b>0.122</b>	<b>0.19</b>	<b>0.136</b>
First year mgmt		2023	2023	2023	2023
Yr rebuilt at F=0		<b>2033</b>	<b>2036</b>	<b>2033</b>	<b>2035</b>
SSBcurrent/SSB0	SSB ratio in 2019	0.023	0.023	0.025	0.025
SSByrrebuilt/SSB0	SSB ratio in first year rebuilt	0.131	0.225	0.149	0.227



# Frebuild scenarios

- Obtain  $T_{min}$  (minimum time required to rebuild) from  $F=0$  projections
  - $F=0$  starting in 2023 (first year management)
  - Using beginning of year (Jan 1) SSB estimates to determine if stock is rebuilt that year ( $SSB/SSB_{Fmsy\_proxy} \geq 1$ )

# OFL Projections

## SEDAR 72 – Fspr30

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	4,275	0.396	2.67	2,463	0.09	0.18	-	0.02
2018	2,216	0.495	3.34	2,427	0.09	0.18	-	0.02
2019	2,774	0.417	2.81	2,304	0.08	0.17	-	0.02
2020	5,056	0.427	2.88	2,458	0.09	0.18	3.34	0.02
2021	5,087	0.458	3.09	2,481	0.09	0.18	3.09	0.02
2022	4,148	0.660	4.46	1,835	0.07	0.14	3.14	0.02
2023	3,238	0.148	1.00	1,314	0.05	0.10	0.71	0.01
2024	4,610	0.148	1.00	2,138	0.08	0.16	1.1	0.02
2025	5,974	0.148	1.00	3,226	0.12	0.24	1.48	0.03
2026	6,956	0.148	1.00	4,263	0.16	0.31	1.74	0.04
2027	7,608	0.148	1.00	5,121	0.19	0.38	2.07	0.05

## SRFS RUN – Fspr30

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	2,898	0.342	2.37	1,694	0.09	0.19	-	0.03
2018	1,517	0.446	3.10	1,726	0.10	0.19	-	0.03
2019	2,159	0.375	2.60	1,709	0.09	0.19	-	0.03
2020	3,557	0.331	2.30	1,840	0.10	0.20	1.88	0.03
2021	3,764	0.388	2.69	2,019	0.11	0.22	2.07	0.03
2022	3,146	0.481	3.34	1,519	0.08	0.17	1.91	0.02
2023	2,843	0.144	1.00	1,307	0.07	0.14	0.61	0.02
2024	3,655	0.144	1.00	1,923	0.11	0.21	0.89	0.03
2025	4,452	0.144	1.00	2,728	0.15	0.30	1.17	0.04
2026	5,048	0.144	1.00	3,527	0.20	0.39	1.39	0.05
2027	5,468	0.144	1.00	4,240	0.24	0.47	1.65	0.06



# F=0 Projections

## SEDAR 72 – Fspr30 – 10 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	4,275	0.396	2.67	2,463	0.09	0.18	-	0.02
2018	2,216	0.495	3.34	2,427	0.09	0.18	-	0.02
2019	2,774	0.417	2.81	2,304	0.08	0.17	-	0.02
2020	5,056	0.427	2.88	2,458	0.09	0.18	3.34	0.02
2021	5,087	0.458	3.09	2,481	0.09	0.18	3.09	0.02
2022	4,148	0.660	4.46	1,835	0.07	0.14	3.14	0.02
2023	3,238	0.000	0.00	1,314	0.05	0.10	0	0.01
2024	5,013	0.000	0.00	2,425	0.09	0.18	0	0.02
2025	6,742	0.000	0.00	4,014	0.15	0.30	0	0.04
2026	8,023	0.000	0.00	5,761	0.21	0.42	0	0.06
2027	8,918	0.000	0.00	7,479	0.28	0.55	0	0.07
2028	9,674	0.000	0.00	9,455	0.35	0.70	0	0.09
2029	10,394	0.000	0.00	12,058	0.44	0.89	0	0.12
2030	11,021	0.000	0.00	15,269	0.56	1.13	0	0.15
2031	11,526	0.000	0.00	18,935	0.70	1.40	0	0.19
2032	11,922	0.000	0.00	22,923	0.84	1.69	0	0.23
2033	12,232	0.000	0.00	27,151	1.00	2.00	0	0.27

## SRFS RUN – Fspr30 – 10 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	2,898	0.342	2.37	1,694	0.09	0.19	-	0.03
2018	1,517	0.446	3.10	1,726	0.10	0.19	-	0.03
2019	2,159	0.375	2.60	1,709	0.09	0.19	-	0.03
2020	3,557	0.331	2.30	1,840	0.10	0.20	1.88	0.03
2021	3,764	0.388	2.69	2,019	0.11	0.22	2.07	0.03
2022	3,146	0.481	3.34	1,519	0.08	0.17	1.91	0.02
2023	2,843	0.000	0.00	1,307	0.07	0.14	0	0.02
2024	3,939	0.000	0.00	2,182	0.12	0.24	0	0.03
2025	4,966	0.000	0.00	3,404	0.19	0.38	0	0.05
2026	5,734	0.000	0.00	4,779	0.26	0.53	0	0.07
2027	6,286	0.000	0.00	6,198	0.34	0.69	0	0.09
2028	6,737	0.000	0.00	7,814	0.43	0.87	0	0.12
2029	7,138	0.000	0.00	9,816	0.54	1.09	0	0.15
2030	7,474	0.000	0.00	12,179	0.68	1.35	0	0.18
2031	7,744	0.000	0.00	14,806	0.82	1.64	0	0.22
2032	7,955	0.000	0.00	17,611	0.98	1.95	0	0.26
2033	8,122	0.000	0.00	20,532	1.14	2.28	0	0.31



# OFL Projections

## SEDAR 72 – Fspr40

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	4,275	0.396	3.92	2,463	0.07	0.13	-	0.02
2018	2,216	0.495	4.90	2,427	0.06	0.13	-	0.02
2019	2,774	0.417	4.12	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	3,238	0.101	1.00	1,314	0.03	0.07	0.48	0.01
2024	4,740	0.101	1.00	2,228	0.06	0.12	0.77	0.02
2025	6,222	0.101	1.00	3,464	0.09	0.18	1.07	0.03
2026	7,304	0.101	1.00	4,700	0.12	0.25	1.29	0.05
2027	8,039	0.101	1.00	5,786	0.15	0.31	1.57	0.06

## SRFS RUN – Fspr40

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB <sub>0</sub>
2017	2,898	0.342	3.48	1,694	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,726	0.07	0.14	-	0.03
2019	2,159	0.375	3.82	1,709	0.07	0.14	-	0.03
2020	3,557	0.331	3.36	1,840	0.07	0.15	1.88	0.03
2021	3,764	0.388	3.95	2,019	0.08	0.16	2.07	0.03
2022	3,146	0.481	4.89	1,519	0.06	0.12	1.91	0.02
2023	2,843	0.098	1.00	1,307	0.05	0.10	0.42	0.02
2024	3,748	0.098	1.00	2,005	0.08	0.16	0.63	0.03
2025	4,620	0.098	1.00	2,933	0.12	0.23	0.85	0.04
2026	5,274	0.098	1.00	3,892	0.16	0.31	1.03	0.06
2027	5,740	0.098	1.00	4,792	0.19	0.38	1.25	0.07

# F=0 Projections

## SEDAR 72 – Fspr40 – 13 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.396	3.92	2,463	0.07	0.13	-	0.02
2018	2,216	0.495	4.90	2,427	0.06	0.13	-	0.02
2019	2,774	0.417	4.12	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	3,238	0.000	0.00	1,314	0.03	0.07	0	0.01
2024	5,013	0.000	0.00	2,425	0.06	0.13	0	0.02
2025	6,742	0.000	0.00	4,014	0.11	0.21	0	0.04
2026	8,023	0.000	0.00	5,761	0.15	0.31	0	0.06
2027	8,918	0.000	0.00	7,479	0.20	0.40	0	0.07
2028	9,674	0.000	0.00	9,455	0.25	0.50	0	0.09
2029	10,394	0.000	0.00	12,058	0.32	0.64	0	0.12
2030	11,021	0.000	0.00	15,269	0.41	0.81	0	0.15
2031	11,526	0.000	0.00	18,935	0.50	1.01	0	0.19
2032	11,922	0.000	0.00	22,923	0.61	1.22	0	0.23
2033	12,232	0.000	0.00	27,151	0.72	1.44	0	0.27
2034	12,478	0.000	0.00	31,547	0.84	1.67	0	0.31
2035	12,674	0.000	0.00	36,032	0.96	1.91	0	0.36
2036	12,830	0.000	0.00	40,524	1.08	2.15	0	0.40

## SRFS RUN – Fspr40 – 12 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,898	0.342	3.48	1,694	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,726	0.07	0.14	-	0.03
2019	2,159	0.375	3.82	1,709	0.07	0.14	-	0.03
2020	3,557	0.331	3.36	1,840	0.07	0.15	1.88	0.03
2021	3,764	0.388	3.95	2,019	0.08	0.16	2.07	0.03
2022	3,146	0.481	4.89	1,519	0.06	0.12	1.91	0.02
2023	2,843	0.000	0.00	1,307	0.05	0.10	0	0.02
2024	3,939	0.000	0.00	2,182	0.09	0.17	0	0.03
2025	4,966	0.000	0.00	3,404	0.14	0.27	0	0.05
2026	5,734	0.000	0.00	4,779	0.19	0.38	0	0.07
2027	6,286	0.000	0.00	6,198	0.25	0.50	0	0.09
2028	6,737	0.000	0.00	7,814	0.31	0.62	0	0.12
2029	7,138	0.000	0.00	9,816	0.39	0.78	0	0.15
2030	7,474	0.000	0.00	12,179	0.49	0.97	0	0.18
2031	7,744	0.000	0.00	14,806	0.59	1.18	0	0.22
2032	7,955	0.000	0.00	17,611	0.70	1.41	0	0.26
2033	8,122	0.000	0.00	20,532	0.82	1.64	0	0.31
2034	8,254	0.000	0.00	23,517	0.94	1.88	0	0.35
2035	8,360	0.000	0.00	26,514	1.06	2.12	0	0.40



# Frebuild : Tmin \* 2

SEDAR 72 – Fspr40 – Tmin=13 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.396	3.92	2,463	0.07	0.13	-	0.02
2018	2,216	0.495	4.90	2,427	0.06	0.13	-	0.02
2019	2,774	0.417	4.12	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	3,238	0.095	0.94	1,314	0.03	0.07	0.45	0.01
2024	4,758	0.095	0.94	2,240	0.06	0.12	0.73	0.02
2025	6,255	0.095	0.94	3,497	0.09	0.19	1.01	0.03
2026	7,350	0.095	0.94	4,762	0.13	0.25	1.22	0.05
2027	8,096	0.095	0.94	5,881	0.16	0.31	1.5	0.06
2028	8,736	0.095	0.94	7,084	0.19	0.38	1.85	0.07
2029	9,400	0.095	0.94	8,667	0.23	0.46	2.27	0.09
2030	10,018	0.095	0.94	10,586	0.28	0.56	2.73	0.10
2031	10,537	0.095	0.94	12,694	0.34	0.67	3.22	0.13
2032	10,956	0.095	0.94	14,879	0.39	0.79	3.71	0.15
2033	11,293	0.095	0.94	17,091	0.45	0.91	4.21	0.17
2034	11,568	0.095	0.94	19,300	0.51	1.02	4.71	0.19
2035	11,791	0.095	0.94	21,467	0.57	1.14	5.18	0.21
2036	11,973	0.095	0.94	23,547	0.62	1.25	5.63	0.23
2037	12,122	0.095	0.94	25,505	0.68	1.35	6.05	0.25

SRFS RUN – Fspr40 – Tmin=12 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	3.46	1,695	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,727	0.07	0.14	-	0.03
2019	2,158	0.374	3.81	1,706	0.07	0.14	-	0.03
2020	3,553	0.331	3.37	1,836	0.07	0.15	1.88	0.03
2021	3,758	0.389	3.96	2,014	0.08	0.16	2.07	0.03
2022	3,139	0.482	4.91	1,513	0.06	0.12	1.91	0.02
2023	2,833	0.091	0.93	1,301	0.05	0.10	0.39	0.02
2024	3,754	0.091	0.93	2,010	0.08	0.16	0.58	0.03
2025	4,640	0.091	0.93	2,957	0.12	0.24	0.79	0.04
2026	5,304	0.091	0.93	3,942	0.16	0.31	0.97	0.06
2027	5,777	0.091	0.93	4,873	0.19	0.39	1.18	0.07
2028	6,173	0.091	0.93	5,866	0.23	0.47	1.43	0.09
2029	6,549	0.091	0.93	7,073	0.28	0.56	1.72	0.11
2030	6,882	0.091	0.93	8,459	0.34	0.68	2.03	0.13
2031	7,159	0.091	0.93	9,941	0.40	0.79	2.35	0.15
2032	7,383	0.091	0.93	11,448	0.46	0.91	2.67	0.17
2033	7,563	0.091	0.93	12,946	0.52	1.03	2.98	0.19
2034	7,709	0.091	0.93	14,408	0.58	1.15	3.28	0.21
2035	7,828	0.091	0.93	15,810	0.63	1.26	3.57	0.24
2036	7,924	0.091	0.93	17,131	0.68	1.37	3.84	0.26
2037	8,003	0.091	0.93	18,353	0.73	1.47	4.08	0.27

# Frebuild : Tmin \* 2 continued

SEDAR 72 – Fspr40 – Tmin=13 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB0
2038	12,243	0.095	0.94	27,317	0.73	1.45	6.43	0.27
2039	12,342	0.095	0.94	28,970	0.77	1.54	6.78	0.29
2040	12,423	0.095	0.94	30,458	0.81	1.62	7.09	0.30
2041	12,489	0.095	0.94	31,782	0.84	1.69	7.37	0.32
2042	12,544	0.095	0.94	32,950	0.87	1.75	7.61	0.33
2043	12,589	0.095	0.94	33,970	0.90	1.80	7.82	0.34
2044	12,626	0.095	0.94	34,854	0.93	1.85	8	0.35
2045	12,657	0.095	0.94	35,614	0.95	1.89	8.16	0.35
2046	12,682	0.095	0.94	36,264	0.96	1.93	8.29	0.36
2047	12,703	0.095	0.94	36,816	0.98	1.95	8.4	0.36
2048	12,721	0.095	0.94	37,282	0.99	1.98	8.5	0.37
2049	12,735	0.095	0.94	37,675	1.00	2.00	8.58	0.37
2050	12,746	0.101	1.00	38,003	1.01	2.02	9.22	0.38

SRFS RUN – Fspr40 – Tmin=12 years

Year	R	F	F/ MFMT	SSB	SSB/ SSBF <sub>msy</sub>	SSB/ MSST	Yield	SSB/ SSB0
2038	8,067	0.091	0.93	19,466	0.78	1.55	4.31	0.29
2039	8,120	0.091	0.93	20,468	0.82	1.63	4.5	0.31
2040	8,163	0.091	0.93	21,360	0.85	1.71	4.68	0.32
2041	8,198	0.091	0.93	22,144	0.88	1.77	4.83	0.33
2042	8,227	0.091	0.93	22,829	0.91	1.82	4.96	0.34
2043	8,251	0.091	0.93	23,421	0.94	1.87	5.08	0.35
2044	8,271	0.091	0.93	23,929	0.96	1.91	5.18	0.36
2045	8,287	0.091	0.93	24,363	0.97	1.95	5.26	0.36
2046	8,301	0.091	0.93	24,730	0.99	1.98	5.33	0.37
2047	8,312	0.091	0.93	25,040	1.00	2.00	5.39	0.37

# Extra Slides



**NOAA**  
**FISHERIES**



# Fmax – earlier discussion recap

- Origins of  $F_{max}$  (refresher)
  - Original intent: In 2001, SSB female only models were being used for Gag. Since SPR does not include males but  $F_{max}$  does (the maximum yield per recruit depends on the average weight of all landed animals (male & female)),  $F_{max}$  was used as a way to ensure male biomass is also preserved so that the yield could be maximized over the entire population, not just the females (if you are only measuring Female biomass, long term F may result in the relatively low biomass levels of males, which in turn affects long term yield)
- $F_{max}$  vs.  $F_{\%SPR}$ 
  - 2001 assessment (VPA):  $F_{max}^{SSB\ female} \sim F_{45-60\%SPR}$
  - SEDAR 10:  $F_{max}^{SSB\ female} \sim F_{31-33\%SPR}$
  - SEDAR 33:  $F_{max}^{SSB\ female} \sim F_{40\%SPR}$ ;  $F_{max}^{SSB\ combined} \sim F_{30\%SPR}$
  - SEDAR 33 update:  $F_{max}^{SSB\ female} \sim F_{29\%SPR}$
  - SEDAR 72:  $F_{max}^{SSB\ female} \sim F_{30\%SPR}$ ;  $F_{max}^{SSB\ combined} \sim F_{13\%SPR}$
  - SRFS RUN:  $F_{max}^{SSB\ combined} \sim F_{13\%SPR}$
- In SEDAR 72/SRFS run  $F_{max}$  not any more conservative than  $F_{spr30}$ .  
Alternative to preserving more males is to model SSB as male + female combined and/or use a higher  $F_{spr}$  (Harford et al. 2018)



# OFL Projections

## SEDAR 72 – Fspr30

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.396	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.495	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.417	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	0.148	39:61	62:38	0.28	-45	0.09	24	0.43	-62	-81	1.05	71	93
2024	0.148	39:61	63:37	0.43	-15	0.12	21	0.67	-40	-71	1.08	62	90
2025	0.148	39:61	62:38	0.58	14	0.13	18	0.9	-20	-62	1.1	55	89
2026	0.148	39:61	59:41	0.68	34	0.13	16	1.06	-5	-58	1.21	53	89
2027	0.148	39:61	55:45	0.81	60	0.16	16	1.26	13	-52	1.55	55	90

## SRFS RUN – Fspr30

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.342	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.375	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.388	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.481	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	0.144	39:61	52:48	0.24	-53	0.07	22	0.37	-67	-67	0.85	69	93
2024	0.144	39:61	53:47	0.35	-31	0.09	21	0.54	-52	-51	0.91	63	90
2025	0.144	39:61	53:47	0.46	-10	0.1	18	0.71	-36	-38	0.96	57	89
2026	0.144	39:61	50:50	0.54	8	0.11	17	0.85	-24	-28	1.08	56	89
2027	0.144	39:61	47:53	0.64	27	0.13	17	1.01	-10	-17	1.33	57	90

Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

# OFL Projections

## SEDAR 72 – Fspr40

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.396	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.495	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.417	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	0.101	39:61	62:38	0.19	-63	0.06	24	0.3	-74	-87	0.71	71	93
2024	0.101	39:61	63:37	0.3	-40	0.08	21	0.47	-58	-80	0.73	61	90
2025	0.101	39:61	61:39	0.42	-18	0.09	18	0.65	-42	-73	0.75	54	89
2026	0.101	39:61	58:42	0.5	0	0.1	16	0.79	-30	-69	0.85	52	89
2027	0.101	39:61	54:46	0.61	21	0.12	16	0.96	-15	-64	1.1	53	90

## SRFS RUN – Fspr40

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.342	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.375	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.388	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.481	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	0.098	39:61	52:48	0.16	-68	0.05	22	0.26	-77	-77	0.57	69	93
2024	0.098	39:61	53:47	0.25	-51	0.06	20	0.38	-66	-66	0.62	62	90
2025	0.098	39:61	52:48	0.33	-35	0.07	18	0.52	-54	-55	0.66	56	89
2026	0.098	39:61	49:51	0.4	-20	0.08	16	0.63	-44	-48	0.76	55	89
2027	0.098	39:61	46:54	0.49	-3	0.09	16	0.76	-32	-38	0.96	56	89

# Frebuild : Tmin \* 2

SEDAR 72 – Fspr40 – Tmin=13 years

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.396	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.495	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.417	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	0.095	39:61	61:39	0.18	-65	0.06	24	0.28	-75	-88	0.66	71	93
2024	0.095	39:61	63:37	0.28	-44	0.07	21	0.44	-60	-81	0.69	61	90
2025	0.095	39:61	61:39	0.39	-22	0.08	18	0.62	-45	-75	0.71	54	89
2026	0.095	39:61	58:42	0.48	-6	0.09	16	0.75	-33	-71	0.8	52	89
2027	0.095	39:61	54:46	0.58	15	0.11	16	0.91	-19	-66	1.04	53	90
2028	0.095	39:61	52:48	0.72	42	0.14	16	1.13	0	-58	1.32	54	89
2029	0.095	39:61	51:49	0.88	75	0.17	16	1.38	23	-47	1.54	53	88
2030	0.095	39:61	50:50	1.07	111	0.2	16	1.67	48	-37	1.71	51	87
2031	0.095	39:61	49:51	1.25	148	0.22	15	1.96	75	-26	1.86	49	86
2032	0.095	39:61	48:52	1.45	186	0.25	15	2.27	102	-16	2.01	47	85
2033	0.095	39:61	47:53	1.64	225	0.28	15	2.57	129	-5	2.16	46	85
2034	0.095	39:61	46:54	1.84	263	0.31	14	2.87	156	5	2.31	45	84
2035	0.095	39:61	45:55	2.02	300	0.34	14	3.16	181	14	2.45	44	83
2036	0.095	39:61	43:57	2.2	334	0.36	14	3.44	206	23	2.57	43	83
2037	0.095	39:61	42:58	2.36	367	0.39	14	3.69	229	31	2.69	42	82

SRFS RUN – Fspr40 – Tmin=12 years

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	0.091	39:61	52:48	0.15	-70	0.04	22	0.24	-79	-79	0.53	69	93
2024	0.091	39:61	53:47	0.23	-55	0.06	20	0.36	-68	-68	0.57	62	90
2025	0.091	39:61	52:48	0.31	-39	0.07	18	0.48	-57	-58	0.61	56	89
2026	0.091	39:61	49:51	0.38	-25	0.07	16	0.59	-47	-51	0.71	54	89
2027	0.091	39:61	45:55	0.46	-9	0.09	16	0.72	-36	-42	0.89	55	89
2028	0.091	39:61	43:57	0.56	10	0.11	16	0.87	-22	-29	1.09	56	89
2029	0.091	39:61	42:58	0.67	32	0.13	16	1.05	-7	-15	1.25	54	88
2030	0.091	39:61	42:58	0.79	56	0.15	16	1.24	10	0	1.38	53	87
2031	0.091	39:61	41:59	0.92	81	0.16	15	1.43	28	15	1.5	51	86
2032	0.091	39:61	39:61	1.04	106	0.18	15	1.63	45	29	1.62	50	85
2033	0.091	39:61	38:62	1.16	130	0.2	15	1.82	62	43	1.74	49	85
2034	0.091	39:61	37:63	1.28	153	0.22	15	2	78	57	1.86	48	84
2035	0.091	39:61	36:64	1.39	175	0.24	14	2.18	94	69	1.97	47	84
2036	0.091	39:61	35:65	1.5	196	0.25	14	2.34	109	81	2.07	47	84
2037	0.091	39:61	34:66	1.59	215	0.26	14	2.49	122	91	2.17	47	83

# Frebuild : Tmin \* 2 continued

SEDAR 72 – Fspr40 – Tmin=13 years

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.095	39:61	41:59	2.51	396	0.41	14	3.93	250	39	2.79	42	82
2039	0.095	39:61	40:60	2.65	423	0.43	14	4.14	268	46	2.89	41	82
2040	0.095	39:61	40:60	2.77	447	0.45	14	4.33	285	52	2.98	41	82
2041	0.095	39:61	39:61	2.87	468	0.46	14	4.49	300	57	3.07	41	81
2042	0.095	39:61	38:62	2.97	487	0.48	14	4.64	313	61	3.14	40	81
2043	0.095	39:61	37:63	3.05	503	0.49	14	4.77	325	65	3.21	40	81
2044	0.095	39:61	37:63	3.12	517	0.5	14	4.88	335	69	3.27	40	81
2045	0.095	39:61	37:63	3.18	529	0.51	14	4.98	343	72	3.32	40	81
2046	0.095	39:61	36:64	3.23	539	0.51	14	5.06	350	74	3.37	40	81
2047	0.095	39:61	36:64	3.28	548	0.52	14	5.12	356	77	3.41	40	81
2048	0.095	39:61	35:65	3.31	555	0.53	14	5.18	362	78	3.44	40	81
2049	0.095	39:61	35:65	3.34	561	0.53	14	5.23	366	80	3.47	40	81
2050	0.101	39:61	35:65	3.6	611	0.57	14	5.62	401	93	3.74	40	81

SRFS RUN – Fspr40 – Tmin=12 years

Year	F	Allocation (com:rec)	Relative F (com:rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.091	39:61	33:67	1.68	232	0.28	14	2.63	134	101	2.25	46	83
2039	0.091	39:61	32:68	1.76	247	0.29	14	2.75	145	109	2.33	46	83
2040	0.091	39:61	31:69	1.82	261	0.3	14	2.85	154	116	2.4	46	83
2041	0.091	39:61	31:69	1.88	273	0.31	14	2.95	162	123	2.47	46	83
2042	0.091	39:61	30:70	1.94	283	0.31	14	3.03	170	128	2.53	45	83
2043	0.091	39:61	30:70	1.98	292	0.32	14	3.1	176	133	2.58	45	83
2044	0.091	39:61	29:71	2.02	299	0.33	14	3.16	181	137	2.62	45	83
2045	0.091	39:61	29:71	2.05	306	0.33	14	3.21	186	141	2.66	45	83
2046	0.091	39:61	29:71	2.08	311	0.34	14	3.25	190	144	2.69	45	83
2047	0.091	39:61	29:71	2.1	316	0.34	14	3.29	193	146	2.72	45	83