California Scorpionfish 2017 Stock Assessment

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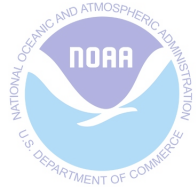
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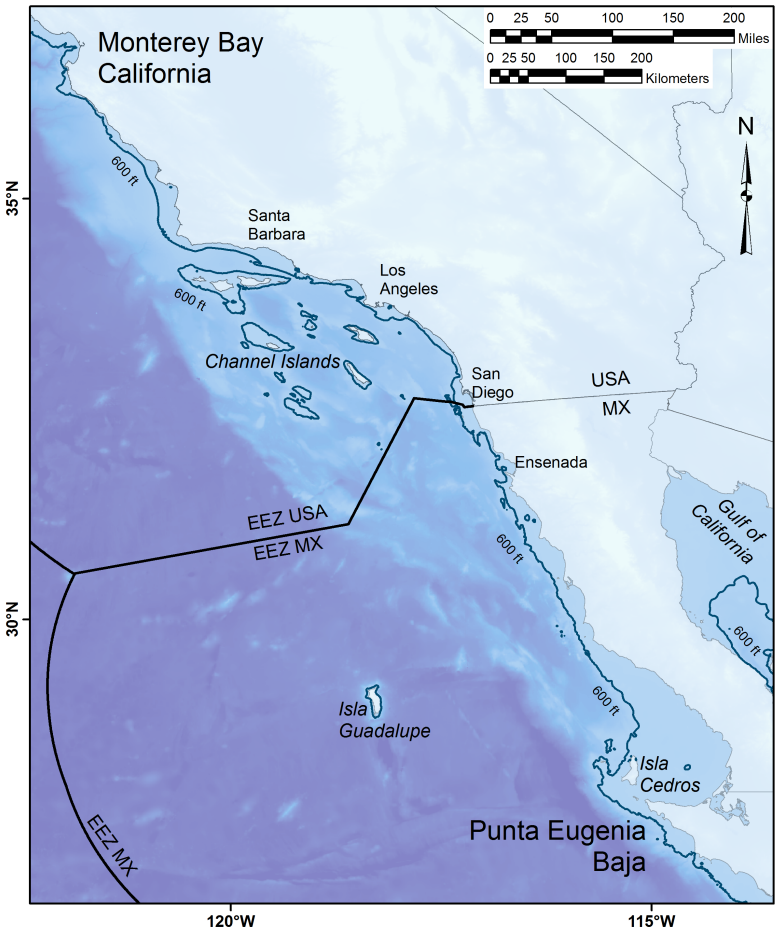
U.S. DEPARTMENT OF COMMERCE

California scorpionfish (*Scorpaena guttata*)

- Most common species of *Scorpaena* on the U.S. West Coast, more species in Mexico
- Venomous dorsal, anal and pelvic spines
- Demersal, found over both hard and soft bottom (anectodtal evidence sugggests they prefer *new* structure)
- Exhibit aggregating behavior (spawning and non-spawning aggregations)

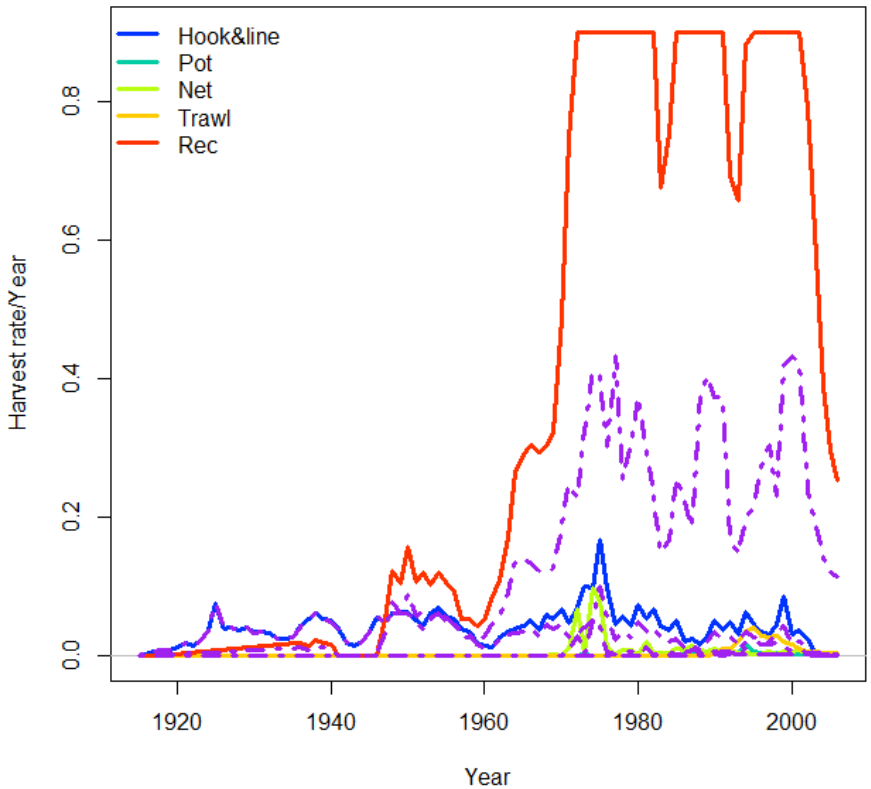
Distribution and Stock Assessment Boundary

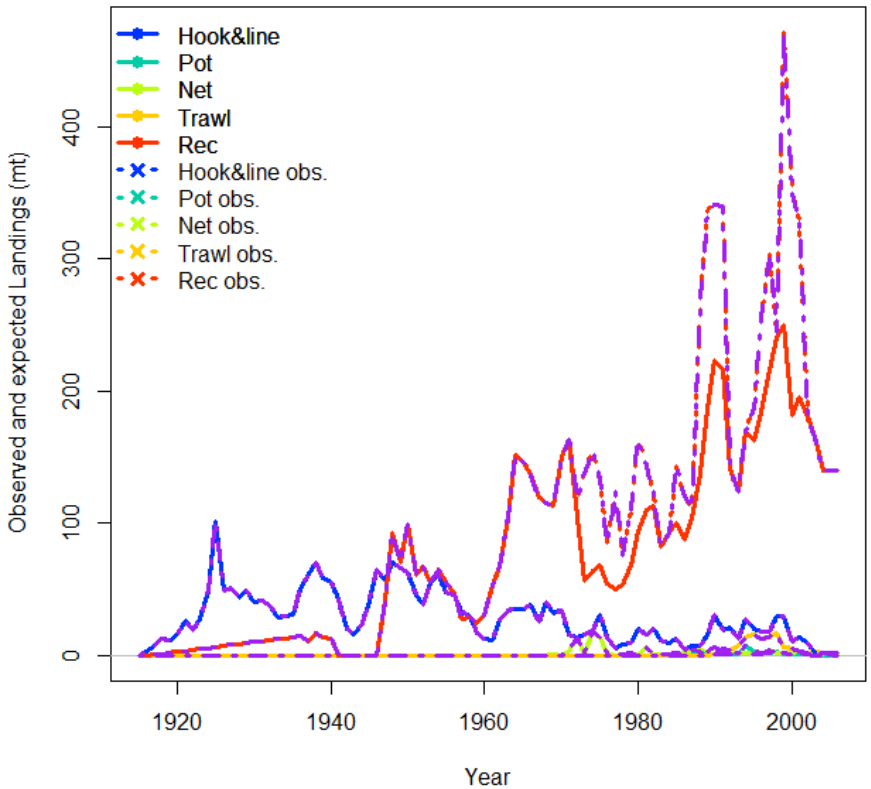


- Distributed from central California to Punta Eugenia, Baja California Sur, Mexico
- Assessment south of Pt. Conception to U.S/Mexico border
- Observed from the intertidal to 600 ft, prefer depths of 20-450 ft
- Proportion of the stock in Mexican waters unknown

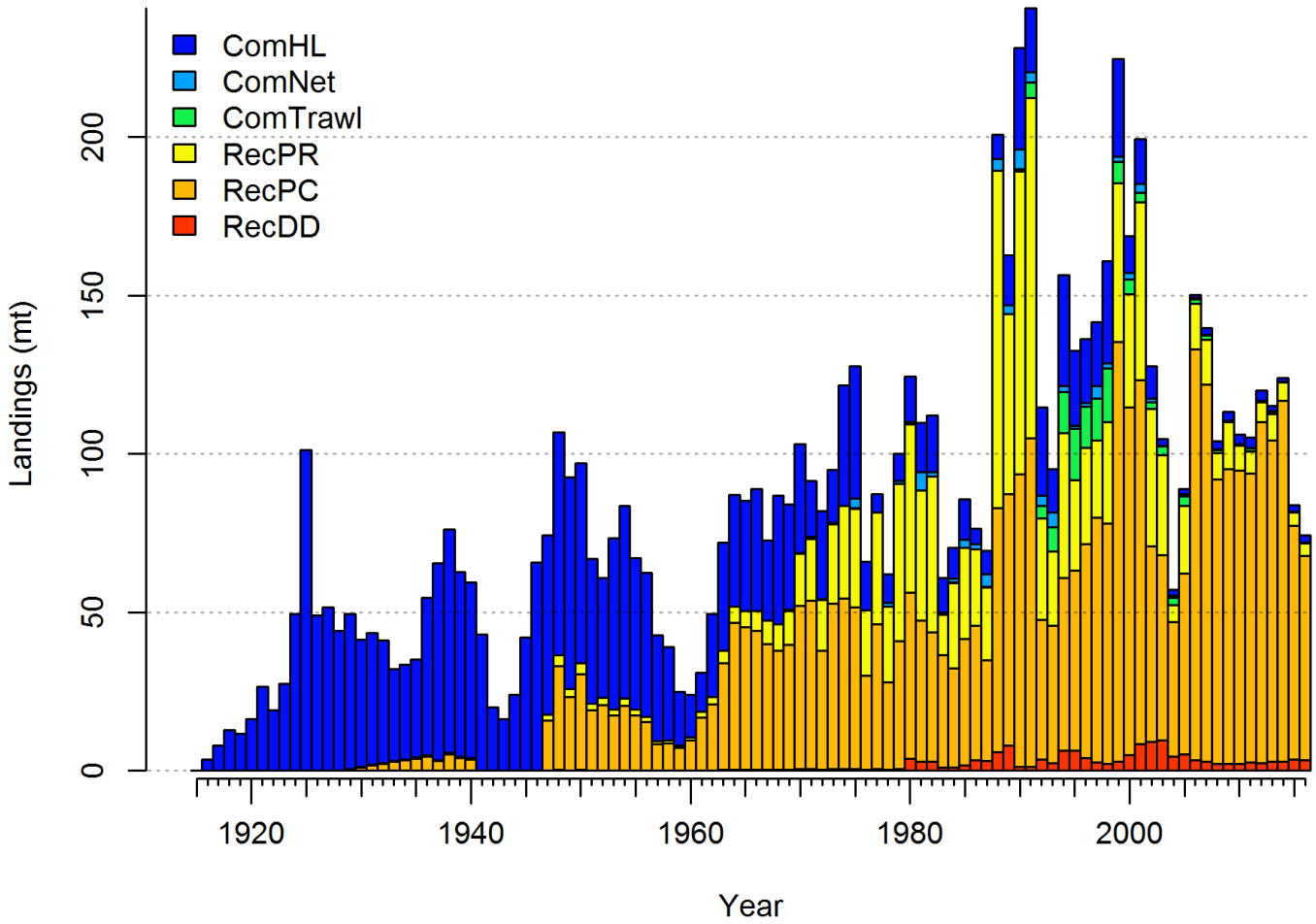
Assessment History

- Firt full assessment in 2005, catch-only update in 2014
- Not all of the recreational catch was removed in the 2005 model
- Input vs. estimated catch was not standard output in SS v.1.8
- Catch-only update also used SS v.1.8

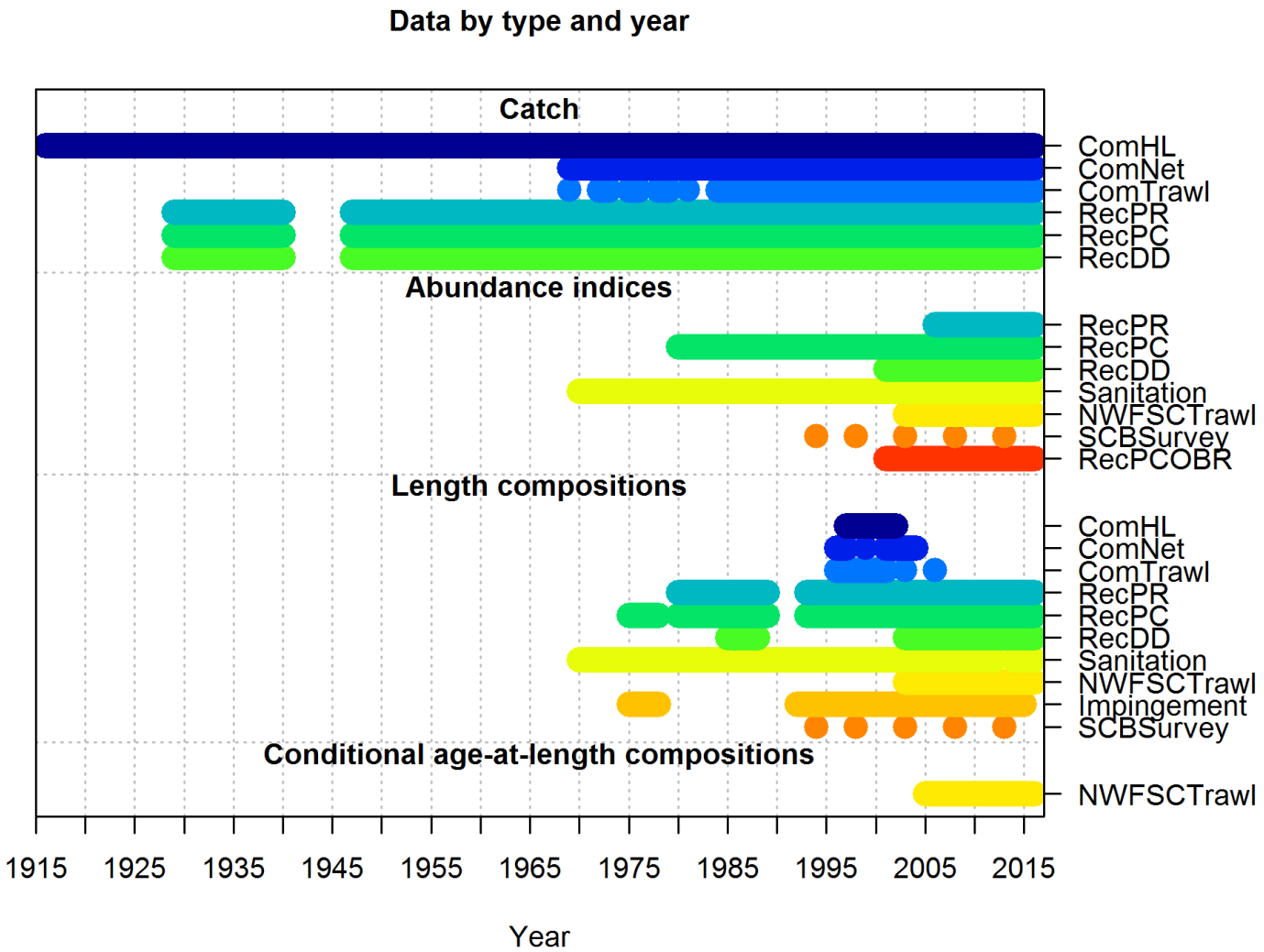




2017 Assessment: Catches by Fleet



Indices of Abundance



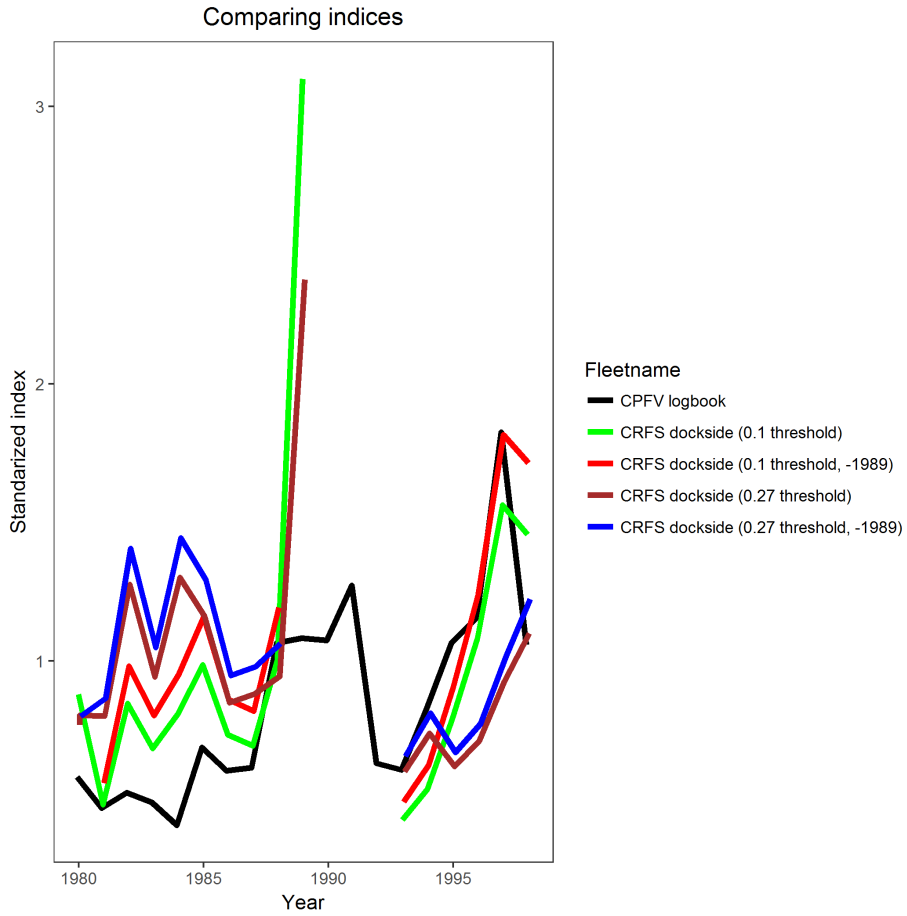
Indices of Abundance

All of the methods used to standardize indices have been endorsed by the SSC

Name	Years	Fishery ind.	Method
Recreational PR dockside CPUE	2004-2016	No	delta-GLM (bin-lognormal)
CPFV logbook CPUE	1980-2016	No	negative binomial
Onboard observer discard catch CPUE	2002-2016	No	delta-GLM (bin-lognormal)
Sanitation district CPUE	1970-2016	Yes	delta-GLM (bin-lognormal)
NWFSC trawl survey CPUE	2003-2016	Yes	VAST
CSUN/VRG Gillnet survey CPUE	1995-2008	Yes	delta-GLM (bin-lognormal)
Southern California Bight trawl survey CPUE	'94, '98, '03, '08, '13	Yes	delta-GLM (bin-lognormal)
Onboard observer retained catch CPUE	2002-2016	No	delta-GLM (bin-lognormal)

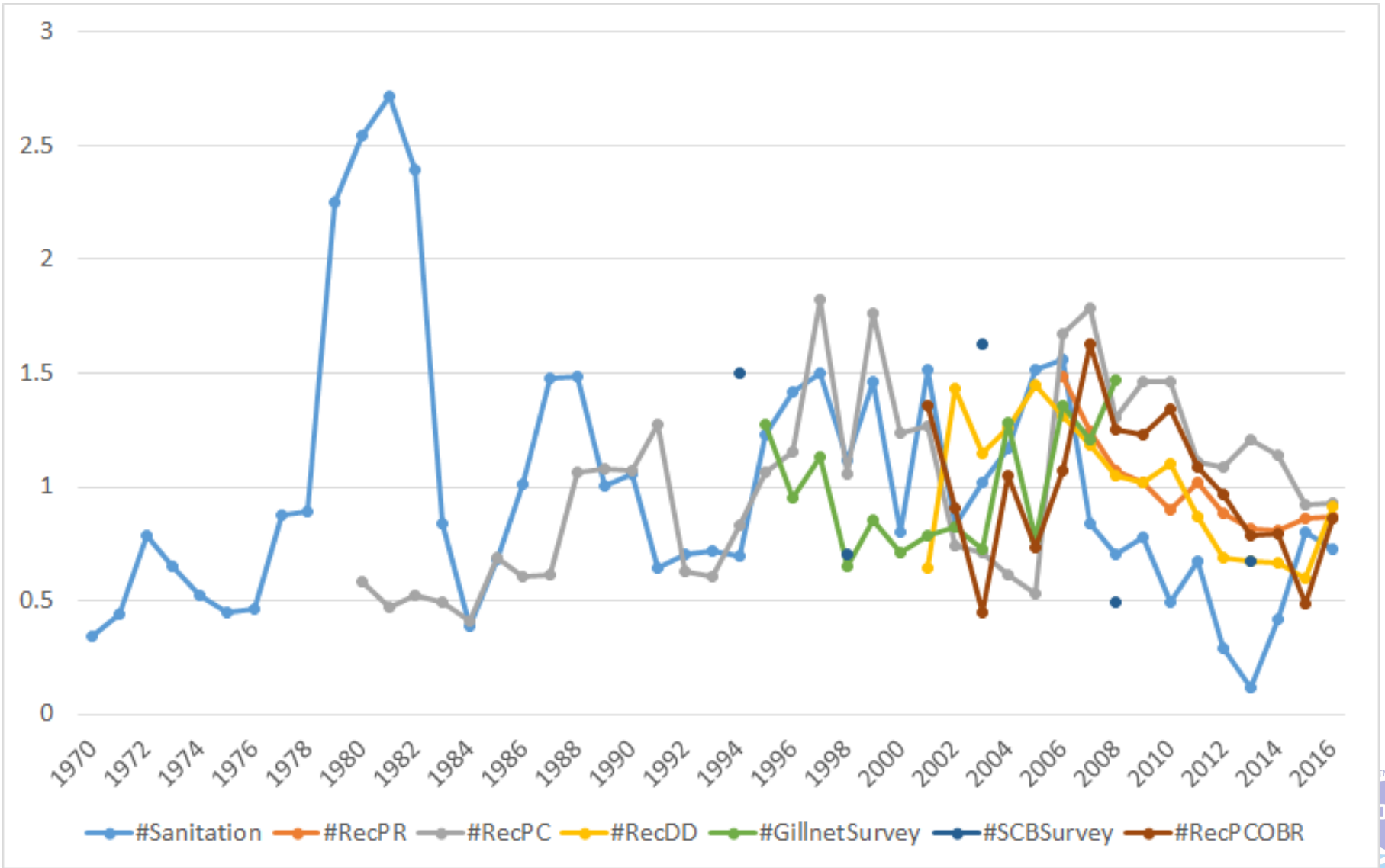
Indices of Abundance

- Stephens-MacCall threshold exploration for the dockside recreational charter boat index
- Index not used in the assessment, charter boat logbook used

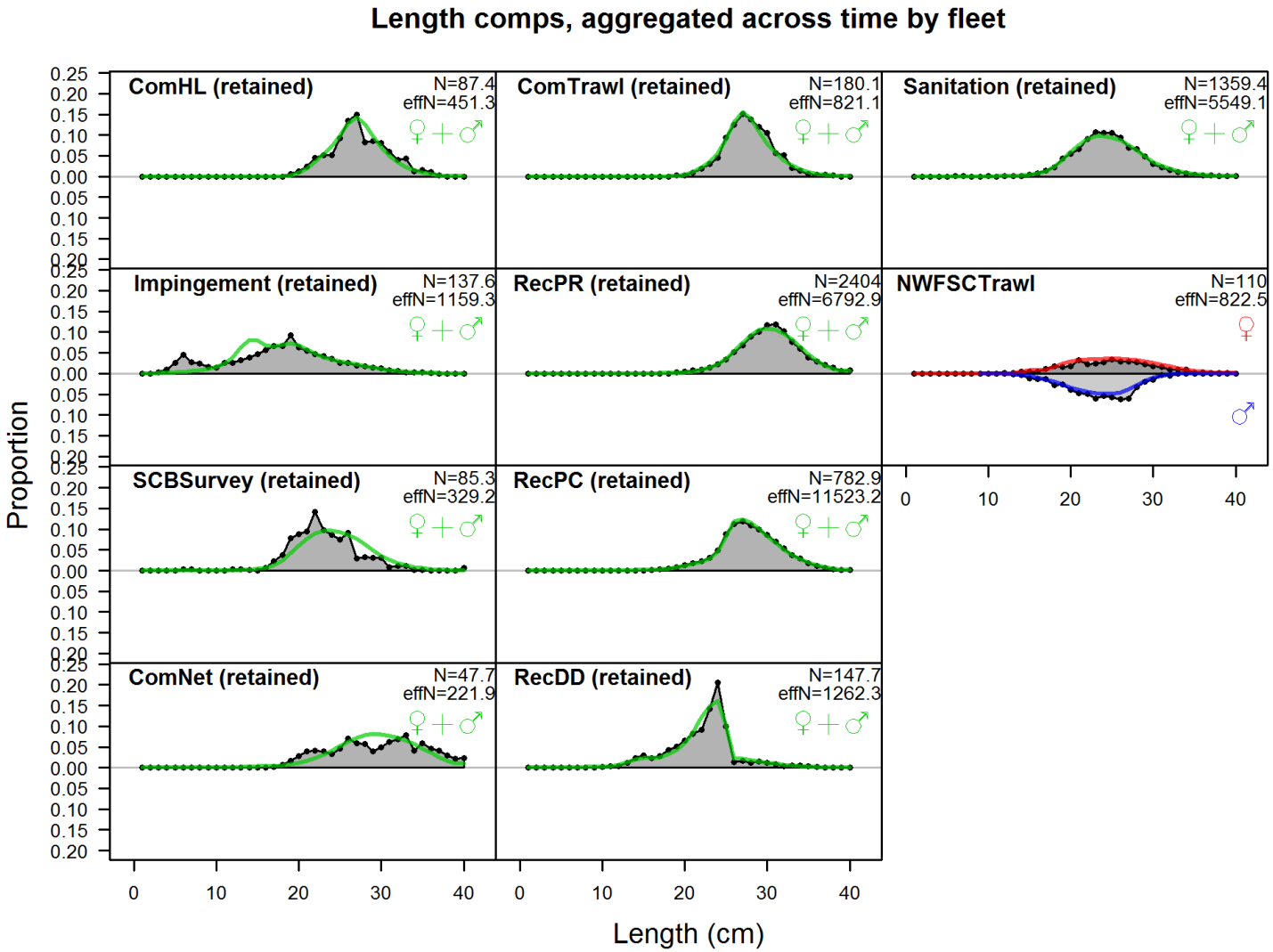


All Indices of Abundance

The gillnet survey removed from the final model

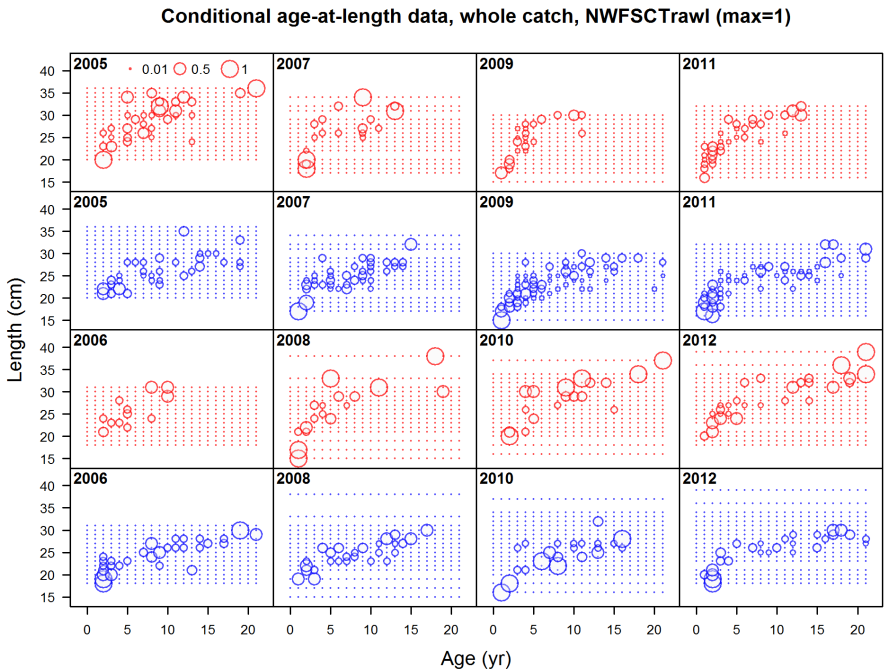


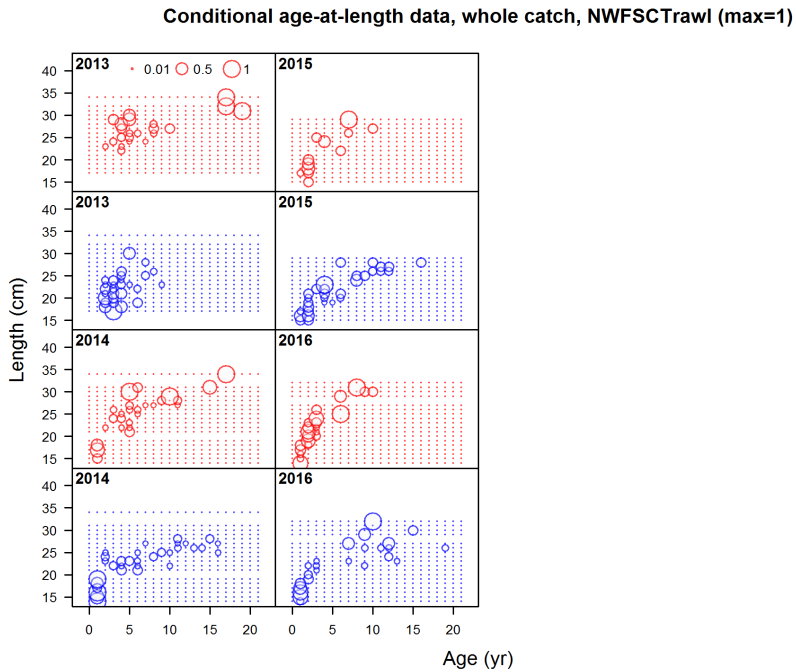
Aggregate length composition



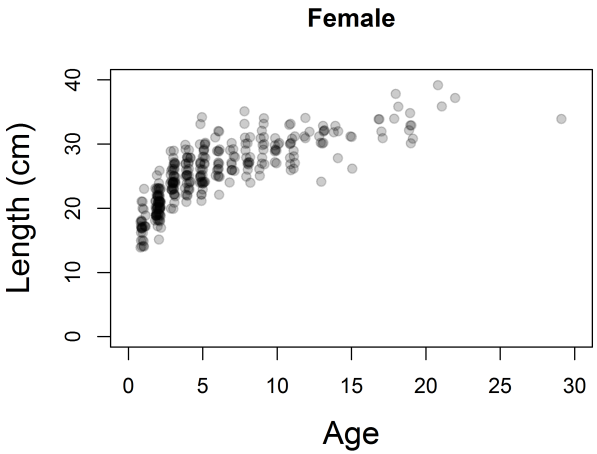
NWFSC Length and Age Composition

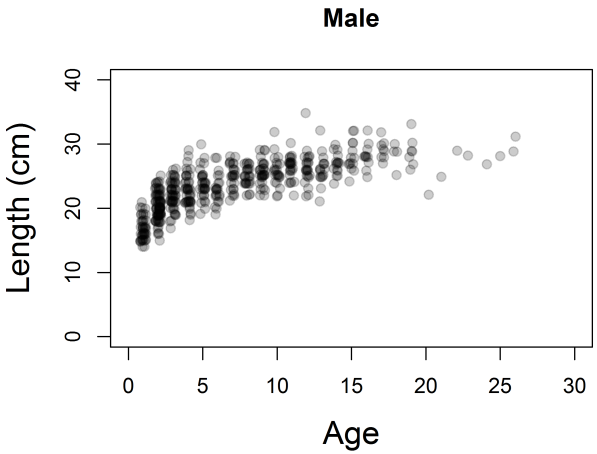
Note: females in red and males in blue

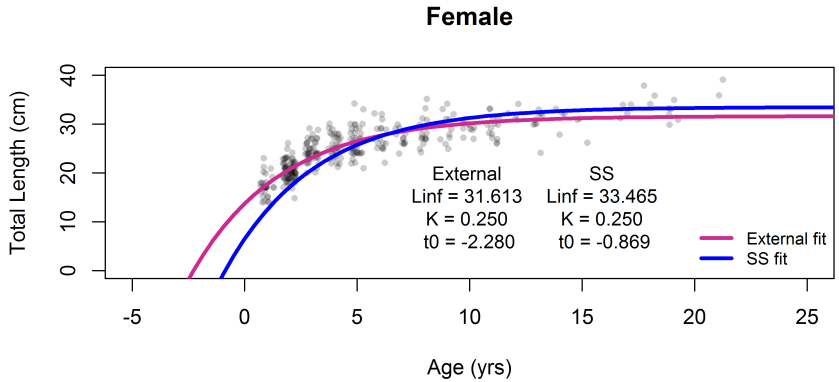


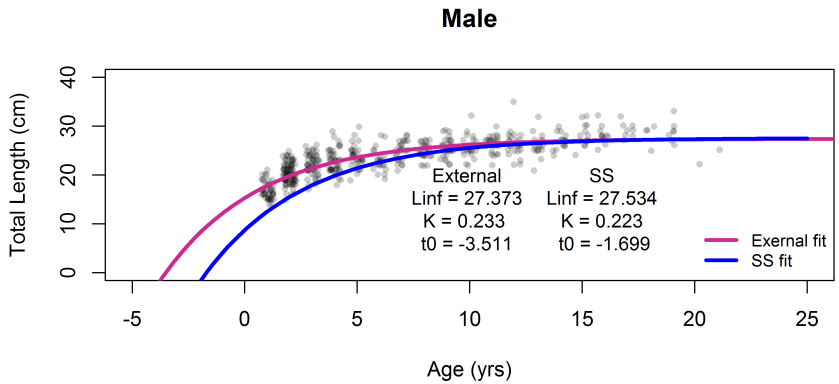


Length-at-Age









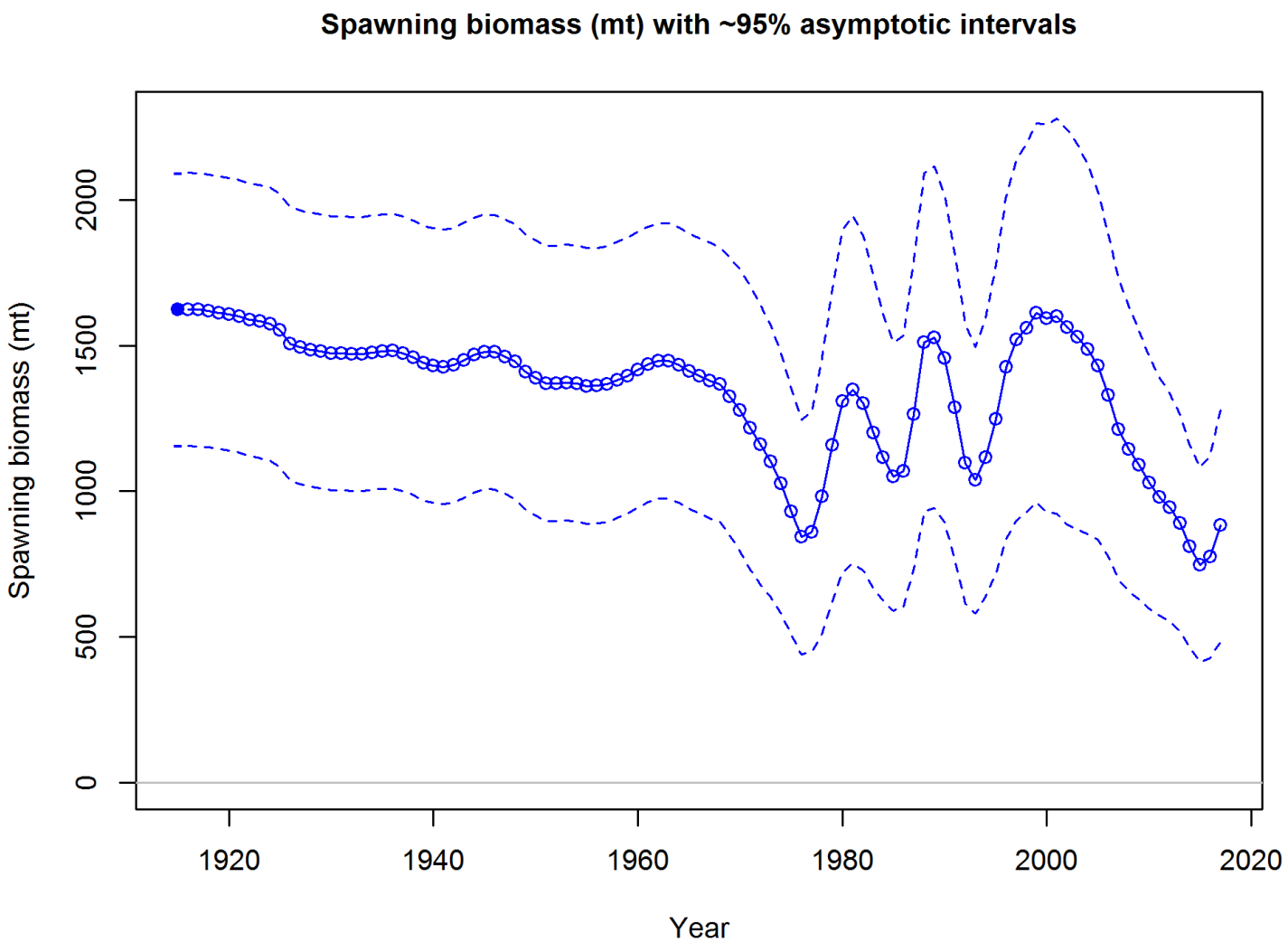
Model Specifications

- Stock Synthesis version 3.30.05.04
- Model starts in 1916, unfished equilibrium catch prior to that
- M fixed at 0.235 for both sexes
  - Pre-STAR model fixed female M at prior with max. age of 21 (0.25714), male M offset estimated
  - M fixed at 0.25 for both sexes in 2005 assessment
- Steepness fixed at 0.718 (from meta-analysis)
  - h fixed at 0.7 in 2005 assessment
- One cm length bins
- Recruitment deviations estimated

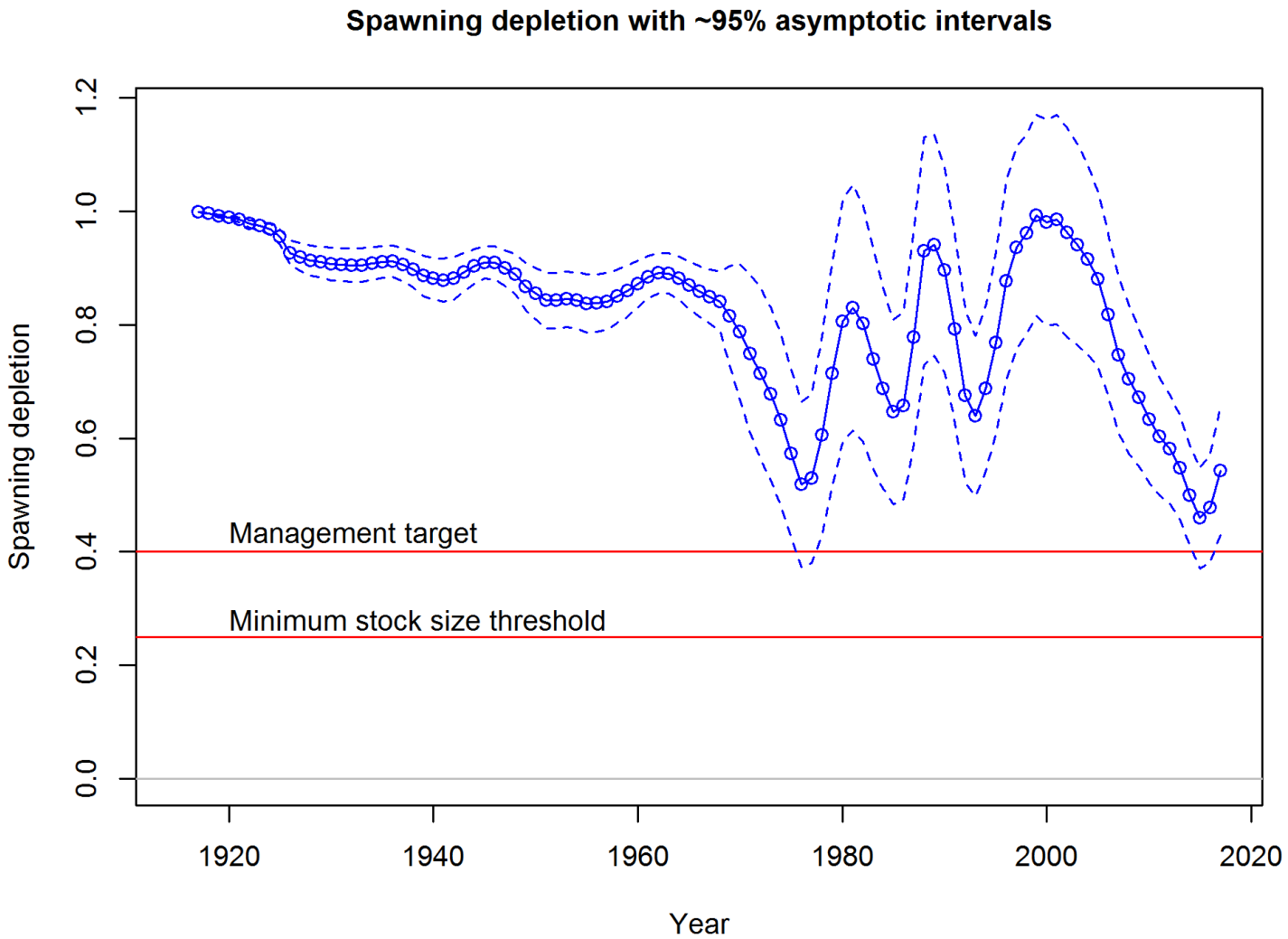
Selectivity

- Time blocks
  - Commercial fleet: 1916-1999 and 2000-2016 (10-in. minimum size limit as of 2000)
  - Recreational fleets: 1916-2000 (few regulations), 2001-2005 (fishery closures), 2006-2016 (consistent regulations)
- Double normal selectivity patterns

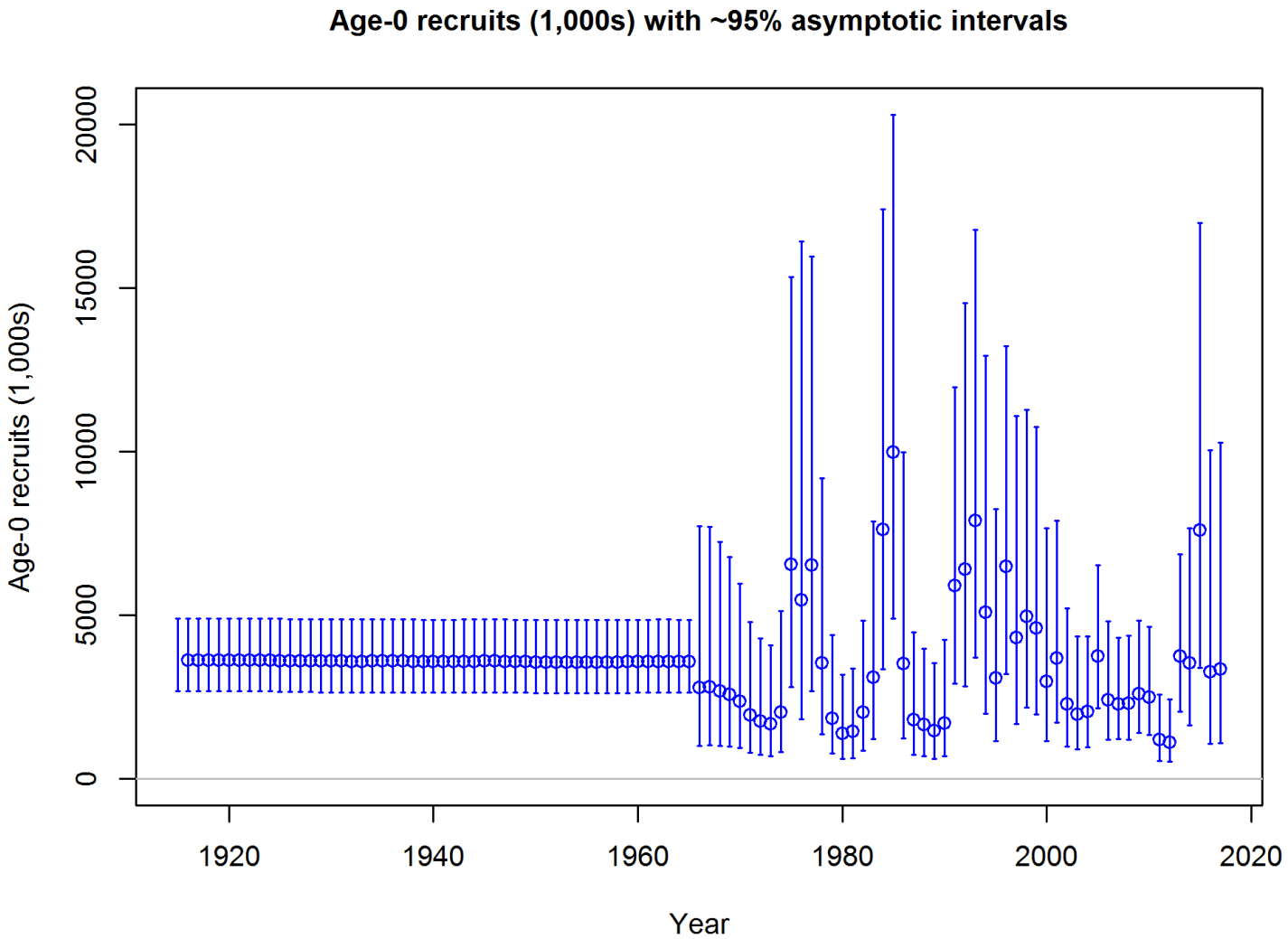
Stock Status - Biomass



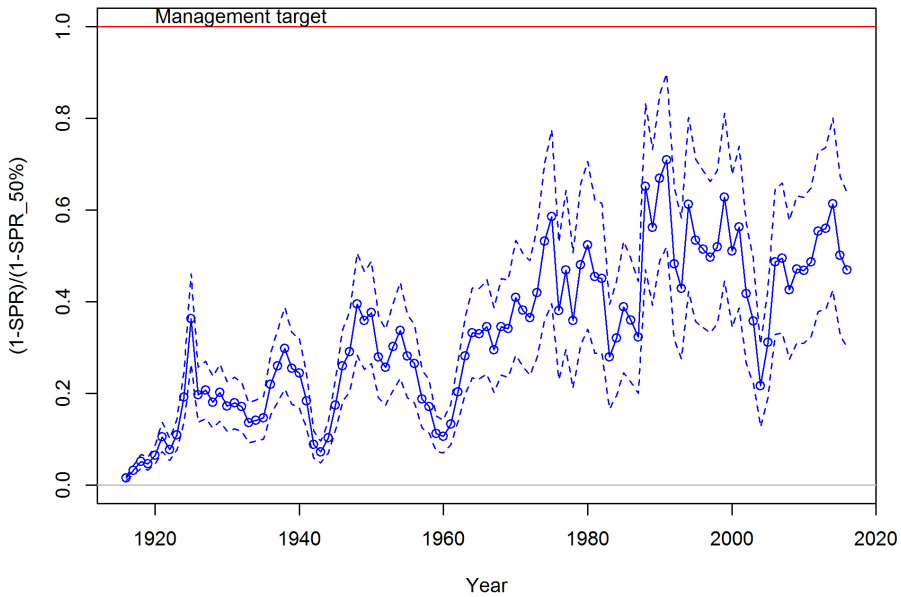
Stock Status - Depletion

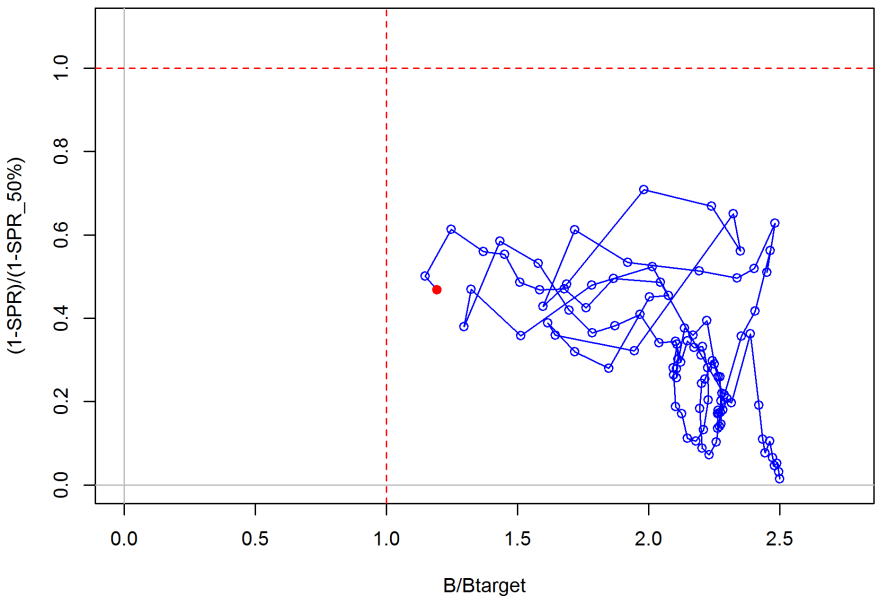


Stock Status - Recruitment

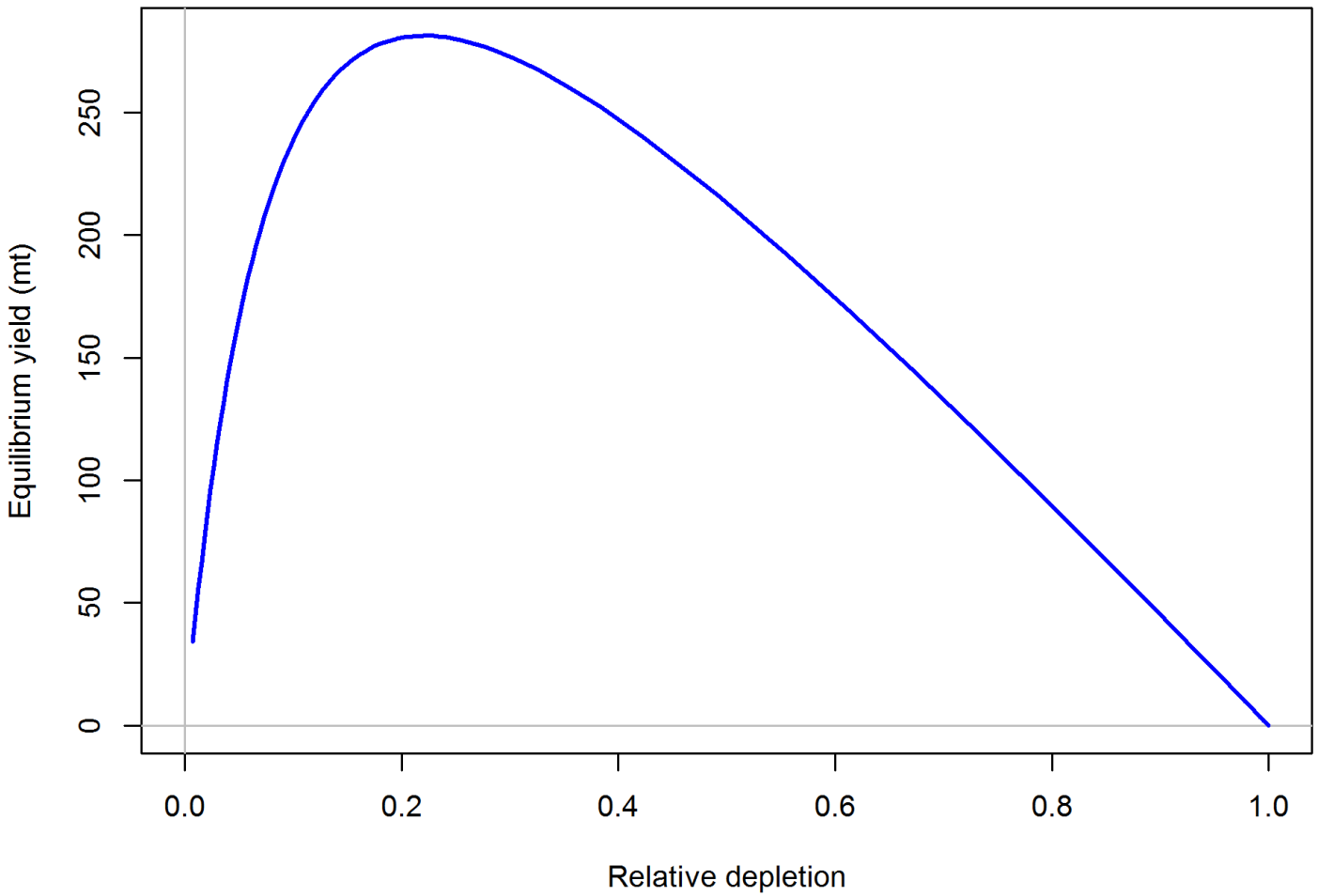


Stock Status - Exploitation





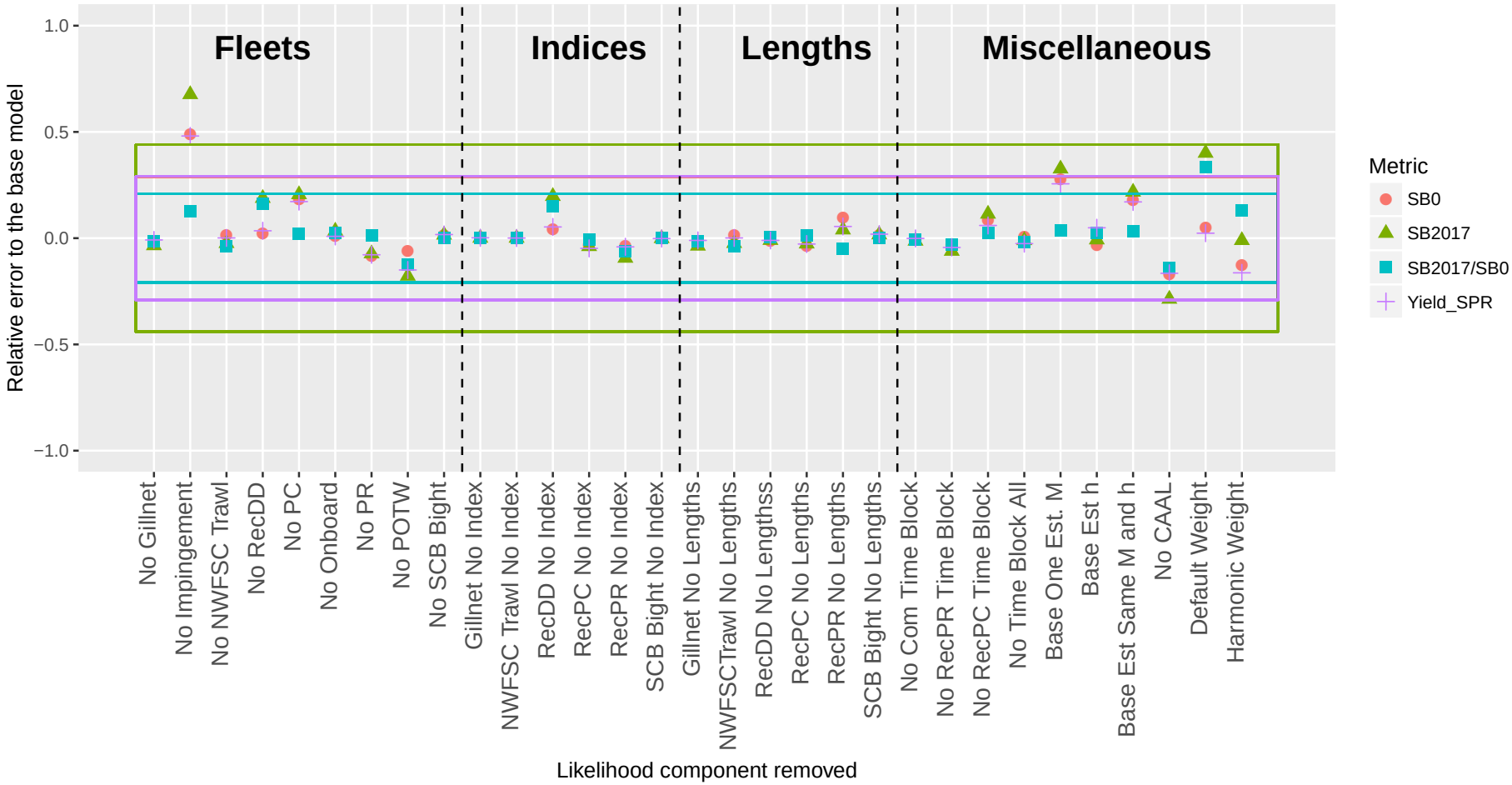
Stock Status - Eq. Yield



Reference Points

Quantity	Estimate	95% Confidence Interval
Unfished spawning biomass (mt)	1624.4	(1156.4-2092.5)
Unfished age 1+ biomass (mt)	2921.9	(2052.8-3791.1)
Unfished recruitment (R_0)	3619.8	(2518.6-4721)
Spawning biomass (2017, mt)	882.5	(484.2-1280.7)
Depletion (2017)	0.5432	(0.4299-0.6565)
Reference points based on $SB_{40\%}$		
Proxy spawning biomass ($B_{40\%}$)	649.8	(462.5-837)
SPR resulting in $B_{40\%}$ ($SPR_{B40\%}$)	0.4589	(0.4589-0.4589)
Exploitation rate resulting in $B_{40\%}$	0.1741	(0.1601-0.1882)
Yield with $SPR_{B40\%}$ at $B_{40\%}$ (mt)	247.2	(168.6-325.9)
Reference points based on SPR proxy for MSY		
Spawning biomass	723.8	(515.2-932.3)
SPR_{proxy}	0.5	
Exploitation rate corresponding to SPR_{proxy}	0.1502	(0.1383-0.1621)
Yield with SPR_{proxy} at SB_{SPR} (mt)	232.4	(158.5-306.4)
Reference points based on estimated MSY values		
Spawning biomass at MSY (SB_{MSY})	358.8	(250.6-467)
SPR_{MSY}	0.2974	(0.2857-0.3091)
Exploitation rate at MSY	0.3236	(0.2917-0.3554)
MSY (mt)	281.3	(192.2-370.4)

Sensitivities - All



Decision Table

			States of nature					
			Low M 0.164		Base M 0.235		High M 0.2745	
	Year	Catch	Spawning biomass	Depletion	Spawning biomass	Depletion	Spawning biomass	Depletion
Constant Catch	2019	150.00	587.05	0.47	1154.73	0.71	2252.89	0.84
	2020	150.00	584.87	0.47	1174.89	0.72	2312.02	0.86
	2021	150.00	574.64	0.46	1176.29	0.72	2331.33	0.87
	2022	150.00	561.72	0.45	1169.09	0.72	2330.83	0.87
	2023	150.00	548.66	0.44	1158.79	0.71	2321.64	0.86
	2024	150.00	536.43	0.43	1148.13	0.71	2309.70	0.86
	2025	150.00	525.20	0.42	1138.24	0.70	2297.82	0.86
	2026	150.00	514.89	0.41	1129.45	0.70	2287.10	0.85
	2027	150.00	505.35	0.40	1121.77	0.69	2277.85	0.85
	2028	150.00	496.46	0.40	1115.12	0.69	2270.05	0.85
Estimated MSY	2019	232.40	573.15	0.46	984.92	0.61	1779.53	0.66
	2020	232.40	588.87	0.47	955.43	0.59	1673.88	0.62
	2021	232.40	592.42	0.47	912.16	0.56	1560.33	0.58
	2022	232.40	588.94	0.47	869.23	0.54	1462.95	0.54
	2023	232.40	584.63	0.47	837.51	0.52	1400.62	0.52
	2024	232.40	579.50	0.46	812.51	0.50	1353.76	0.50
	2025	232.40	575.83	0.46	796.20	0.49	1327.05	0.49
	2026	232.40	572.04	0.46	782.22	0.48	1302.32	0.48
	2027	232.40	569.72	0.45	773.77	0.48	1290.11	0.48
	2028	232.40	567.04	0.45	765.22	0.47	1275.09	0.47
ACL = ABC	2019	346.30	587.05	0.47	1154.73	0.71	2252.89	0.84
	2020	333.89	479.44	0.38	1068.32	0.66	2206.66	0.82
	2021	313.01	383.32	0.31	983.88	0.61	2142.68	0.80
	2022	293.00	311.34	0.25	917.22	0.56	2085.85	0.78
	2023	277.18	260.27	0.21	869.36	0.54	2042.74	0.76
	2024	265.38	221.15	0.18	835.93	0.51	2012.49	0.75
	2025	256.64	187.64	0.15	812.37	0.50	1992.23	0.74
	2026	250.12	157.42	0.13	795.36	0.49	1979.19	0.74
	2027	245.19	129.79	0.10	782.82	0.48	1971.20	0.73
	2028	241.44	104.22	0.08	773.46	0.48	1966.69	0.73

Research and Data Needs

- **Natural mortality and steepness**: Both natural mortality and steepness were fixed in the base model. The natural mortality estimate used the assessment was based on maximum age and steepness based on rockfish species meta-analysis.
- **Stock south of the U.S. border**: No available information on the status of California scorpionfish in Mexico could be found.
- **Sex ratio**: The sex ratio in the only published work by Love et al. (1987) and samples from the NWFSC trawl survey were skewed towards males.
- **Aggregating behavior**: Aggregative behavior in both spawning and non-spawning seasons of California scorpionfish is not well understood.

Research and Data Needs

- **Fecundity/maturity**: A reproductive biology study of California scorpionfish is needed.There are currently no estimates of fecundity for California scorpionfish and no studies have been done of the relationship between weight and reproductive output.
- **Discard mortality**: Many scorpionfish are discarded at sea. The assessment used estimates of discard mortality of a distantly related species (lingcod) in a different ecological setting (Karpov 1996).
- **Environmental covariates**: The relationship between environmental conditions and recruitment for scorpionfish should be further explored. Preliminary exploration using CalCOFI temperature data suggested that a relationship existed, but other time series may correlate more strongly given that scorpionfish are a near-shore species.

Research and Data Needs

- **Discard fleet modeling**: Modeling discard as a separate fleet, as was done for California scorpionfish, is a simple and intuitive approach, but the strengths and weaknesses of this approach are unclear.
- **POTW trawl surveys**: Additional biological information (sex, otoliths, depth distribution) should be collected for California scorpionfish during the Publicly Owned Treatment Works (POTWs) trawl survey and the Southern California Bight Regional Monitoring Project (SCCWRP) trawl survey.
- **Age validation**: An age validation study is needed for California scorpionfish.

Questions??

Uncertainties Identified by the STAR panel

- The stock likely extends south of southern boundary of the assessment at the US/Mexico border.
- Maturity estimates used are dated and cannot be reproduced. No studies have been done of the relationship between fish weight and reproductive output.
- Ageing samples come only from the NWFSC shelf-slope survey NW slope shelf survey ($\geq 55m$) and thus does not cover the depth distribution of the stock. The maximum age from this data set could be biased.
- Estimates of discard mortality based of a distantly related species (lingcod) in a different ecological setting.
- Steepness in the assessment was based on the Thorson prior, which is only strictly appropriate for West Coast rockfish (*Sebastes* spp.).