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SEDAR 57
Spiny Lobster

169th CFMC
Regular Virtual Meeting

June 23-24, 2020

General Goals

Stock assessments use models and data to…

- determine if fishing yield is sustainable

- determine if stock size is above or below the level that can provide Maximum Sustainable Yield

- quantify the uncertainty in the status of the stock

- provide management advice for optimizing resource utilization
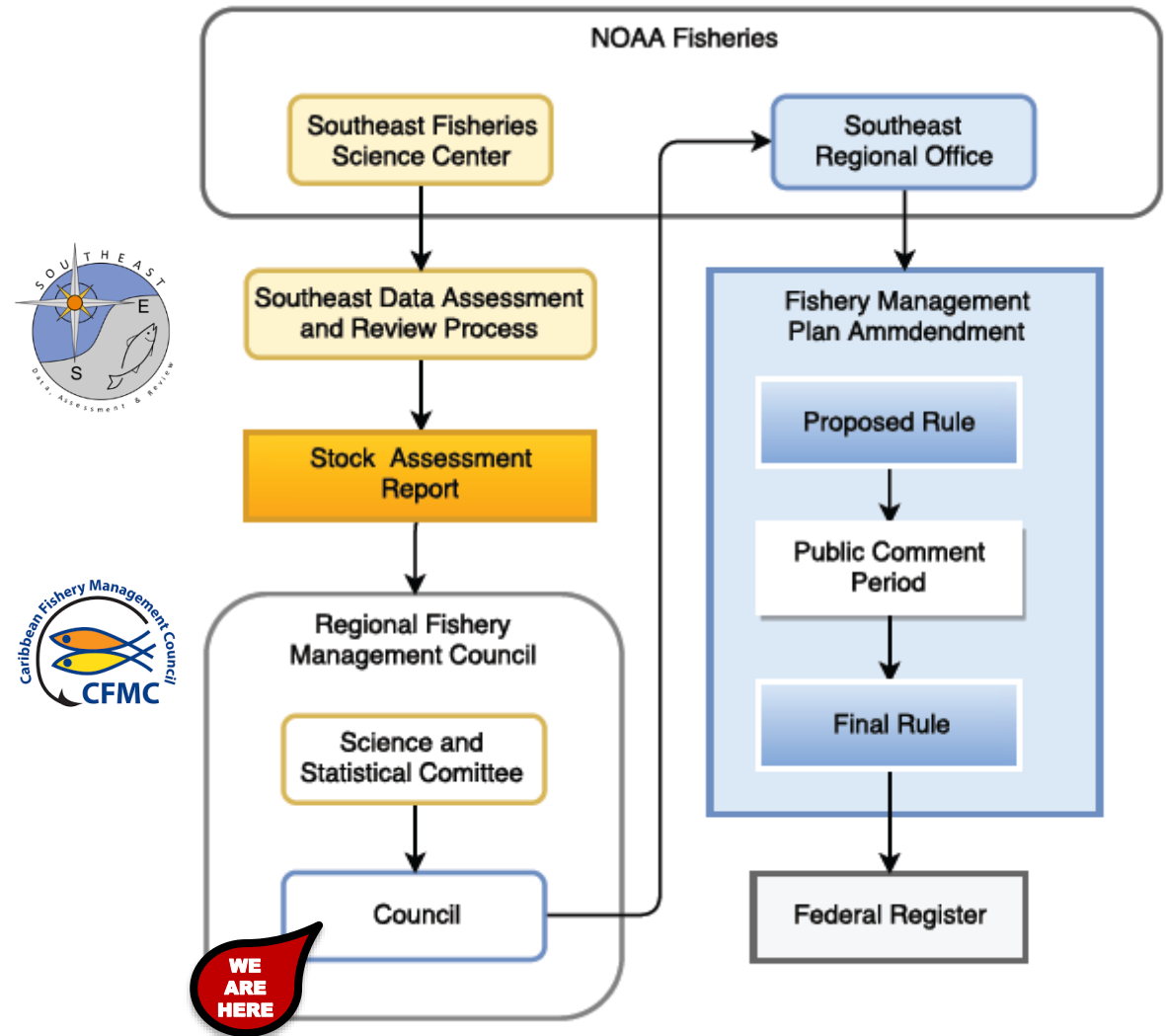
Stock Synthesis (SS) Version 3.30

- Integrated catch-at-age model (Methot and Wetzel 2013)
- The model simulates the dynamics of the stock (mortality, maturity, growth, etc.) and dynamics of the fishery (selectivity, effort, etc.)
- Flexible in ability to use diversity of age, size, and aggregate data from fisheries and surveys
- Globally used modeling framework

Inputs to Models for Each of the Three Island Platforms

Data

- Annual removals by Gear

- Annual length composition by Gear

Estimated Parameters

- Unfished recruitment (R0)

- Selectivity and Retention

Fixed Parameters

- Growth

- Natural Mortality

- Maturity

- Little relationship between spawner and recruits (recruitment comes largely from upstream sources)

- 50/50 sex ratio

- Time block to represent change in retention due to size limit
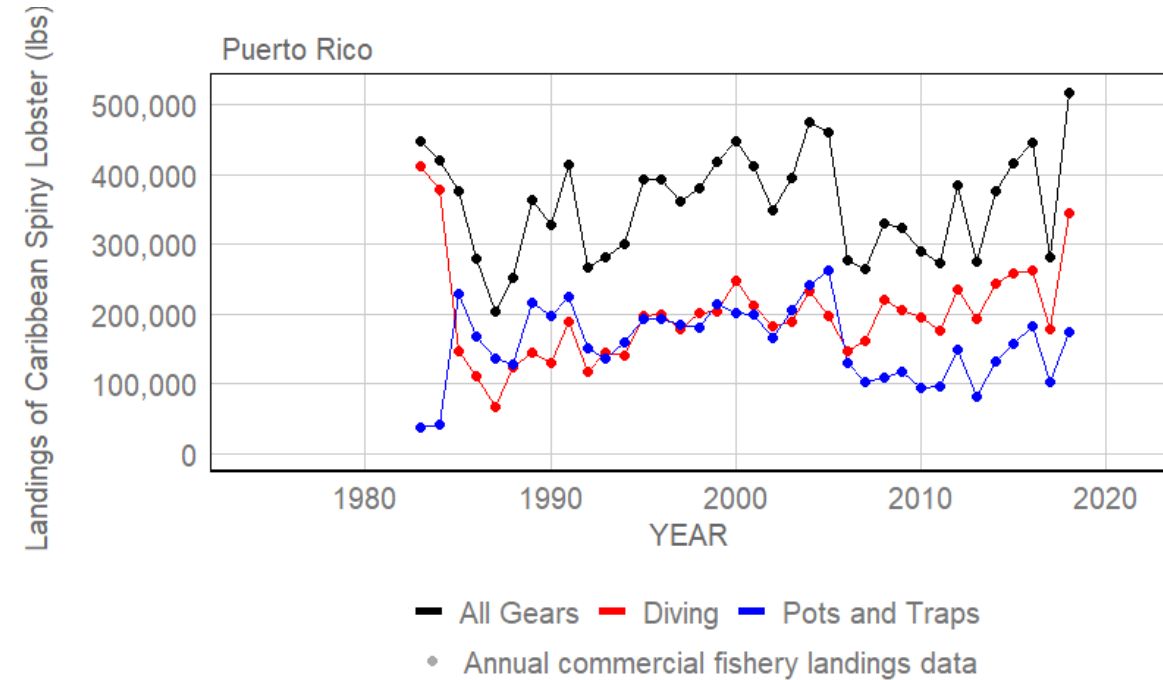
Puerto Rico - Model Structure

Two fisheries:

- Pots and traps, diving

- Selectivity at length: estimated for each fleet

- Initial Fishing Mortality= 0 for pots and traps; estimated for diving

Retention blocks:

- Minimum size limit introduced in 1985, enforced 1999+

- Time block for retention: 1999-2016

Estimated quantities:

- Unfished recruitment (R_0)

- Initial Fishing Mortality

- Selectivity – 3 parameters for each fleet

- Retention – 1 parameter for each fleet

Puerto Rico

Landings of Caribbean Spiny Lobster (lbs) vs YEAR

— All Gears — Diving — Pots and Traps
• Annual commercial fishery landings data
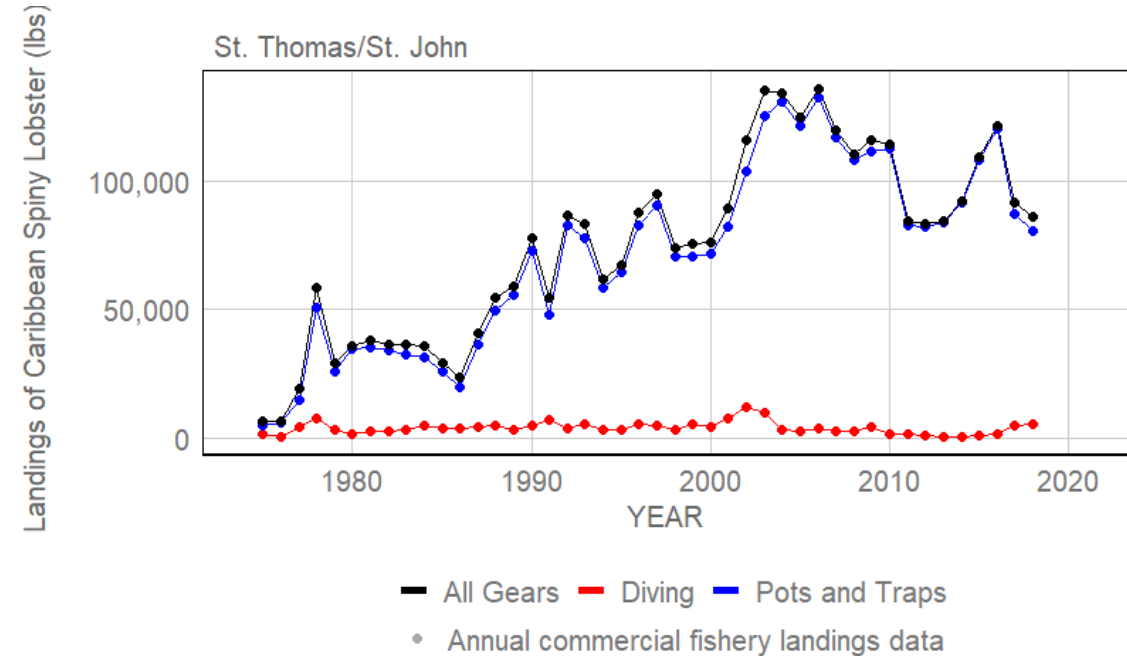
St. Thomas - Model Structure

Two fisheries:

- Pots and traps, diving

- Selectivity at length: estimated for Pots/traps, diving set to match Pots and Traps

- Initial Fishing Mortality = 0

Retention blocks:

- Minimum size limit 89 mm (3.5") introduced in 1985

- Time block for retention over years: 1985-2003, 2007-2016

Estimated quantities:

- Unfished recruitment (R_0)

- Selectivity – 3 parameters

St. Thomas/St. John

Landings of Caribbean Spiny Lobster (lbs)

— All Gears — Diving — Pots and Traps
• Annual commercial fishery landings data

ST. Croix - Model Structure
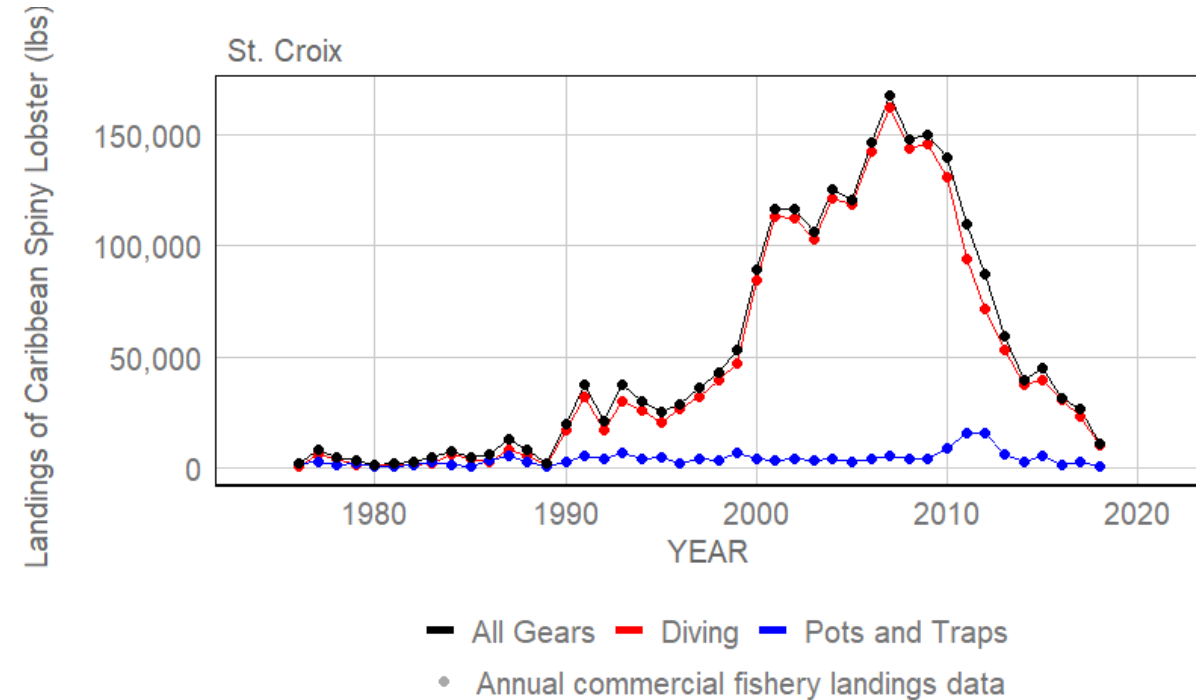
Two fisheries:

- Diving, Pots and Traps
- Selectivity at length: diving used borrowed information from STT, trap fishery set to match diving
- Initial Fishing Mortality= 0

Retention blocks:

- Minimum size limit 89 mm (3.5") introduced in 1985
- Time block for retention over years: 1985-2016

Estimated quantities:
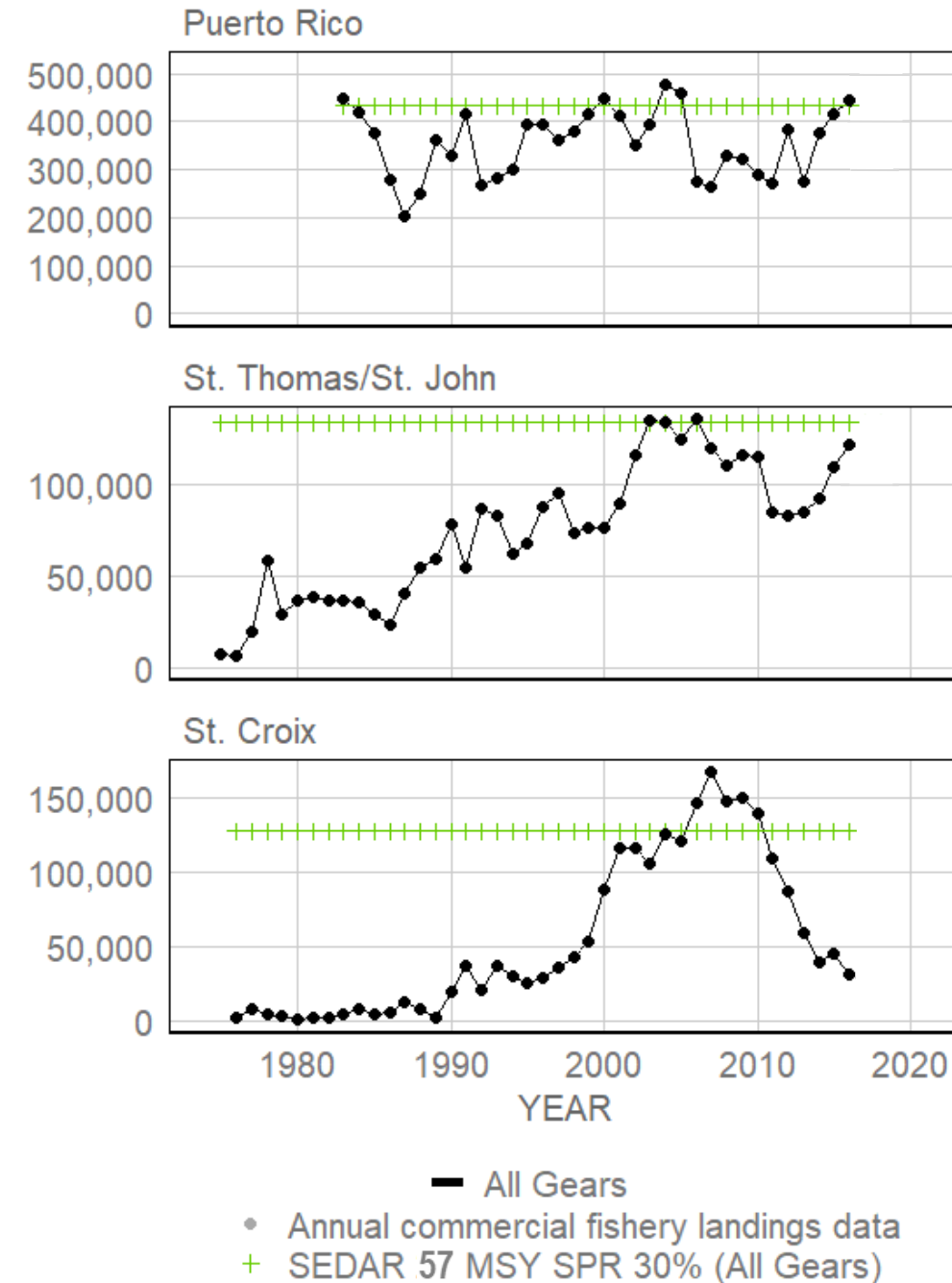
- Unfished recruitment (R0)
- Selectivity – 3 parameters

Conclusions

Not overfished and not overfishing in 2016

Value	Definition	STT	STX	PR
$S_{Current}$	Spawning Output at Beginning of 2017	4.40E+07	6.00E+07	1.52E+08
S_{MSY}	Spawning Output at MSY	2.84E+06	3.06E+07	1.13E+08
$S_{Current}/S_{MSY}$	Calculated from definitions above	**1.549**	**1.961**	**1.345**
$F_{Current}$	Fishing Mortality in 2016	0.166	0.037	0.164
F_{MSY}	Fishing Mortality that produces MSY	0.244	0.203	0.197
$F_{Current}/F_{MSY}$	Calculated from definitions above	**0.680**	**0.182**	**0.832**
MSY	Equilibrium Retained Yield at proxy of S_{SPR30} (lbs)	133,601	127,742	432,501

Puerto Rico

St. Thomas/St. John

St. Croix

Landings of Caribbean Spiny Lobster (lbs)

YEAR

— All Gears
• Annual commercial fishery landings data
+ SEDAR 57 MSY SPR 30% (All Gears)

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Recent Landings

In Puerto Rico, the landings are complete through 2018 and 99% complete in 2019. For 2017, the 2016 correction factors were used and for 2019, the 2018 correction factors were used.

In St. Thomas/St. John and St. Croix, landings are complete through 2018 and 2019 data include records through early September 2019.

For Puerto Rico (PR), 2020 values were set equal to the average landings from 2017-2019.

For St. Thomas/St. John (STT) and St. Croix (STX), 2019 and 2020 values were set equal to the average landings from 2016-2018.
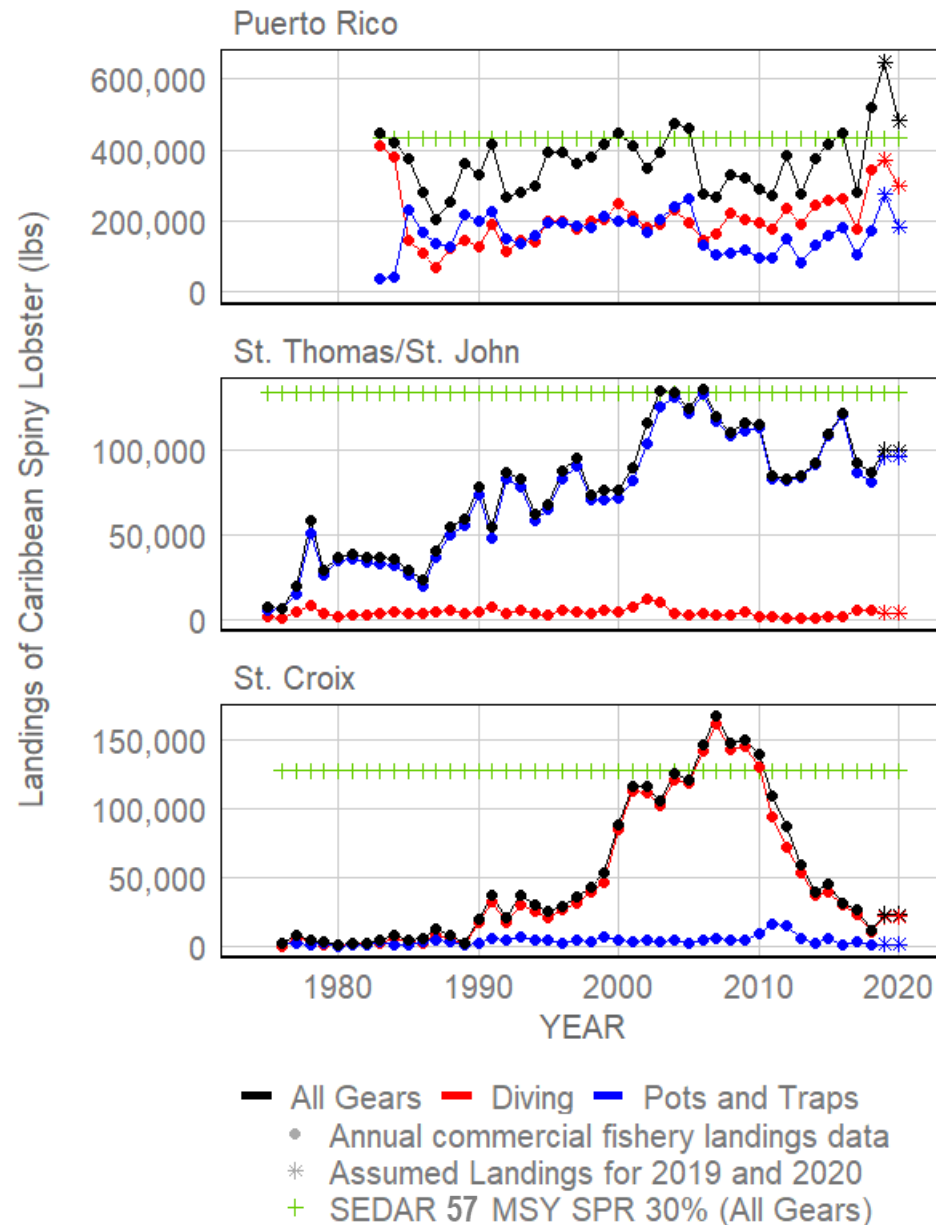
OFL estimates

- OFL was estimated by projecting constant fishing mortality at the FMSY proxy (FSPR30%) beginning in 2021 using provisional catch estimates of commercial removals through the current year (2020).

- **Projections assume that the selection and F allocation patterns will remain constant during the projected period and that recruitment is constant at average levels (h=0.95).**

Final reported landings (2016-2018), provisional landings (2019-2020) and base model OFL projections starting in 2021 by island in pounds			
Year	PR	STT	STX
2016	446,035	121,695	31,528
2017	282,104	91,911	26,191
2018	518,461	86,201	10,957
2019*	647,476	100,773	22,906
2020*	482,680	100,773	22,906
2021	406,257	186,341	197,709
2022	425,164	160,714	158,538
2023	430,109	148,335	143,801
2024	431,140	142,313	137,668
2025	431,566	139,044	134,529
2026	431,905	137,056	132,599

OFL values can be updated when data entry for recent years are finalized

OFL AND ABC ESTIMATED FOR SSC May 2020 (lbs)

OFL ≥ ABC

Overfishing Limit (OFL): Overfishing is occurring when catches exceed this level. Should achieve MSY in the long run.

Acceptable Biological Catch (ABC): Catch reduced below OFL to account for scientific uncertainty

Probability/risk of overfishing (P*)

St. Thomas/St. John OFL and ABC projections starting in 2021 in pounds

Year	OFL	ABC P* = 0.40	ABC P* = 0.41	ABC P* = 0.42	ABC P* = 0.43	ABC P* = 0.44	ABC P* = 0.45
2021	186,341	144,638	148,418	152,275	156,211	160,230	164,337
2022	160,714	124,746	128,006	131,332	134,727	138,194	141,736
2023	148,335	115,137	118,147	121,217	124,350	127,549	130,819
2024	142,313	110,463	113,351	116,296	119,302	122,371	125,508
2025	139,044	107,926	110,747	113,624	116,561	119,560	122,625
2026	137,056	106,383	109,163	112,000	114,895	117,851	120,872

Puerto Rico OFL and ABC projections starting in 2021 in pounds

Year	OFL	ABC P* = 0.40	ABC P* = 0.41	ABC P* = 0.42	ABC P* = 0.43	ABC P* = 0.44	ABC P* = 0.45
2021	406,257	315,336	323,578	331,986	340,567	349,330	358,283
2022	425,164	330,011	338,637	347,436	356,417	365,587	374,958
2023	430,109	333,850	342,576	351,477	360,562	369,839	379,319
2024	431,140	334,651	343,398	352,320	361,427	370,727	380,229
2025	431,566	334,981	343,736	352,668	361,784	371,092	380,604
2026	431,905	335,244	344,007	352,945	362,068	371,384	380,903

St. Croix OFL and ABC projections starting in 2021 in pounds

Year	OFL	ABC P* = 0.40	ABC P* = 0.41	ABC P* = 0.42	ABC P* = 0.43	ABC P* = 0.44	ABC P* = 0.45
2021	197,709	153,462	157,473	161,565	165,741	170,005	174,363
2022	158,538	123,057	126,273	129,554	132,903	136,322	139,817
2023	143,801	111,618	114,536	117,512	120,549	123,651	126,820
2024	137,668	106,858	109,651	112,500	115,408	118,377	121,411
2025	134,529	104,421	107,151	109,935	112,776	115,678	118,643
2026	132,599	102,923	105,614	108,358	111,159	114,019	88,501

OFL values can be updated when data entry for recent years are finalized
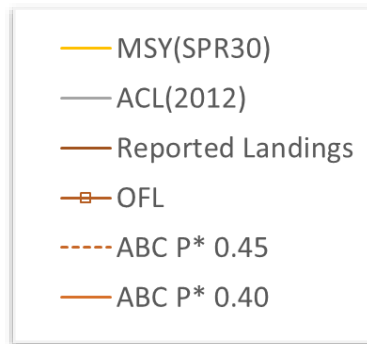
OFL AND ABC ESTIMATED FOR SSC May 2020 (lbs)

Current ACL Effective 2012

STT: 104,199 lbs (47,264 kg)

STX: 107,307 lbs (48,674 kg)

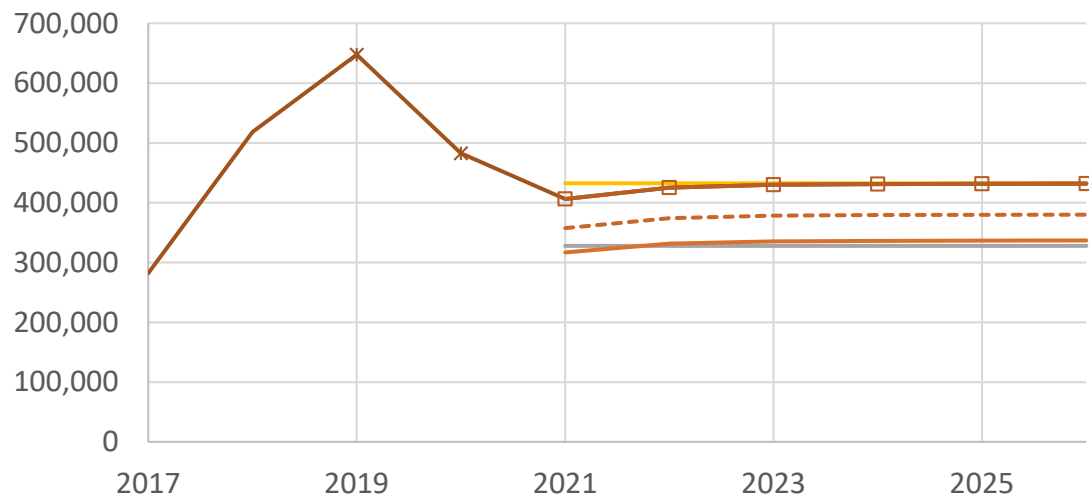**PR: 327,920 lbs** (148,742 kg)

Legend:
- MSY(SPR30)
- ACL(2012)
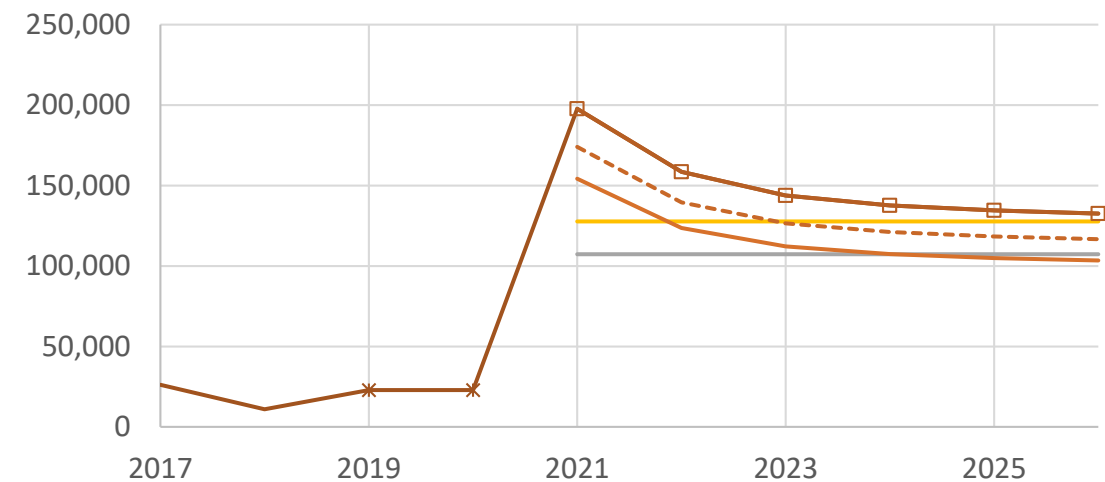- Reported Landings
- OFL
- ABC P* 0.45
- ABC P* 0.40

St. Thomas/St. John - Updated Projections 2021-2026 (lbs)
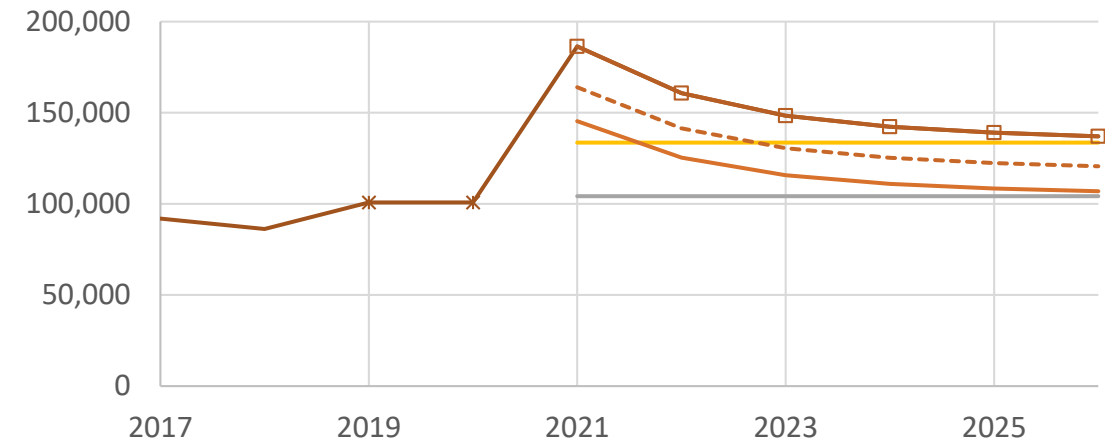
Puerto Rico - Updated Projections 2021-2026 (lbs)

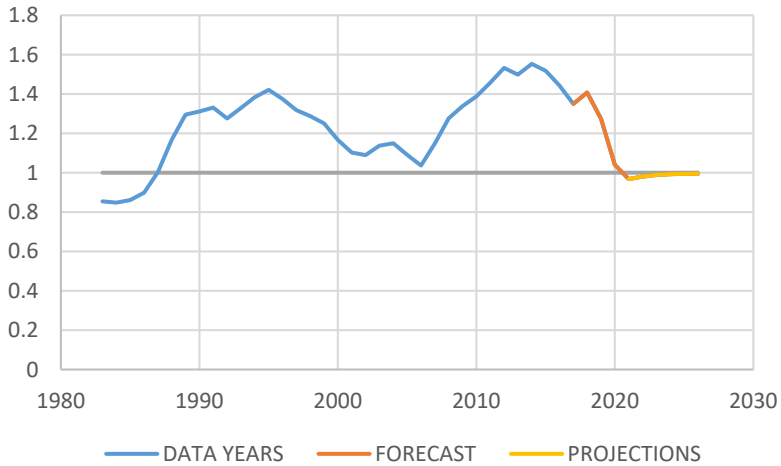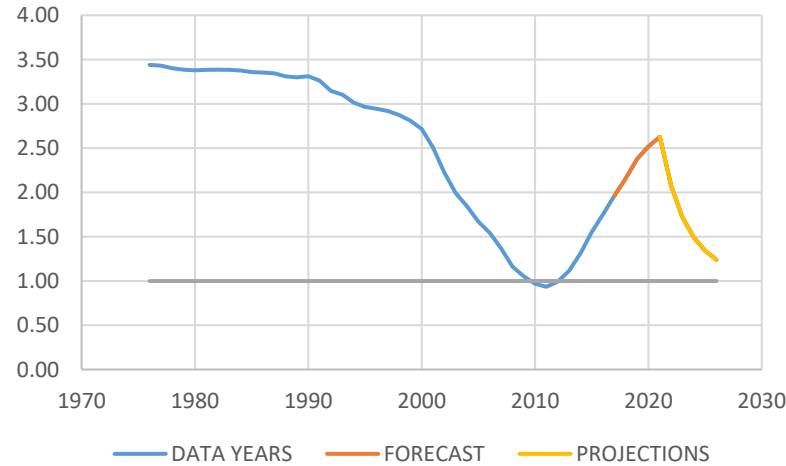St. Croix - Updated Projections 2021-2026 (lbs)

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OFL values can be updated when data entry for recent years are finalized

Questions?

Annual F and SSB estimates to the F and SSB at the MSY Proxy (30% SPR) over time