Status of A Fish (*Sebastes yourfish*) Off the U.S. Pacific Coast in 2017

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Contents

Executive Summary

executive-summary

Stock

stock

This assessment reports the status of the China rockfish (*Sebastes nebulosus*) resource in U.S. waters off the coast of ... using data through 2018.

Catches

catches

Information on historical landings of China rockfish are available back to xxxx... (Table a). Commercial landings were small during the years of World War II, ranging between 329 to 395 metric tons (mt) per year.

(Figures a-b)
(Figure c)

Since 2000, annual total landings of China rockfish have ranged between 135-412 mt, with landings in 2018 totaling 278 mt.

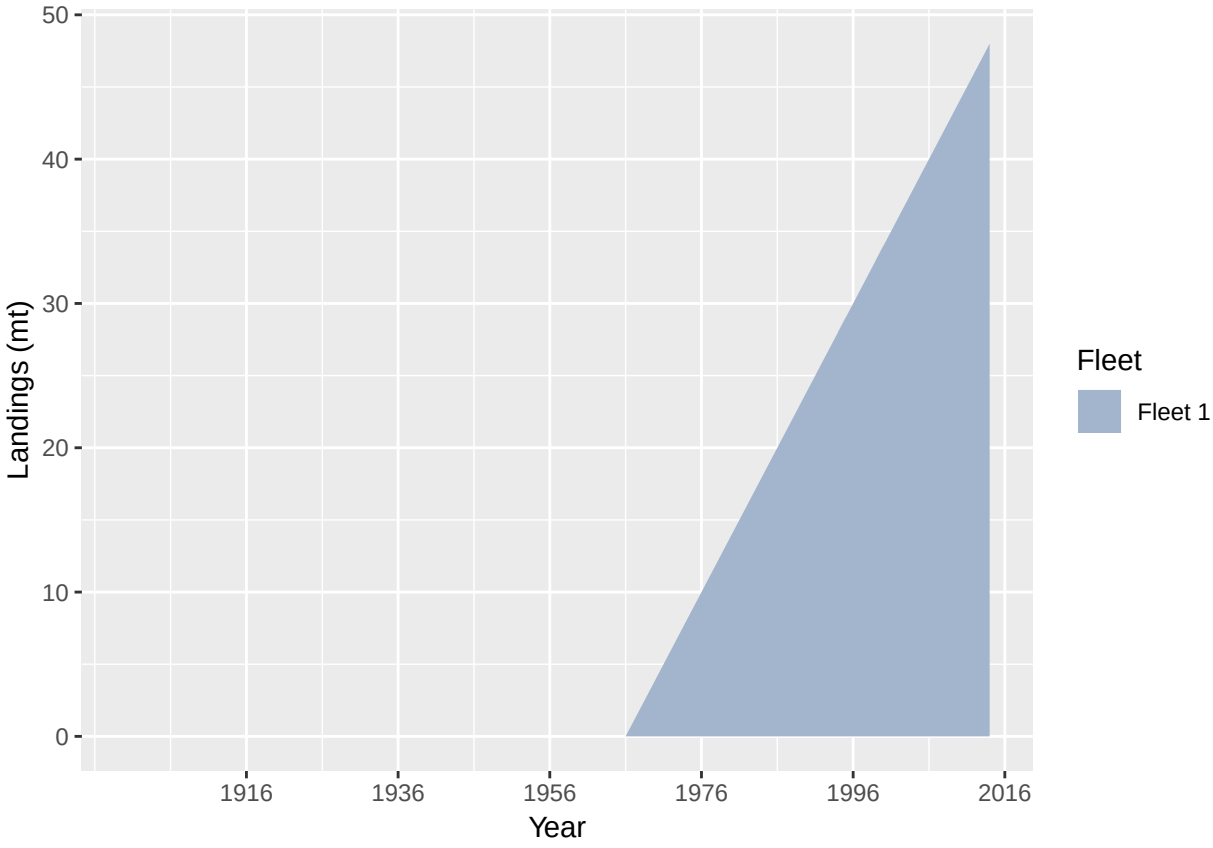

Figure a: China rockfish catch history for the recreational fleets. `fig:Exec_catch1`

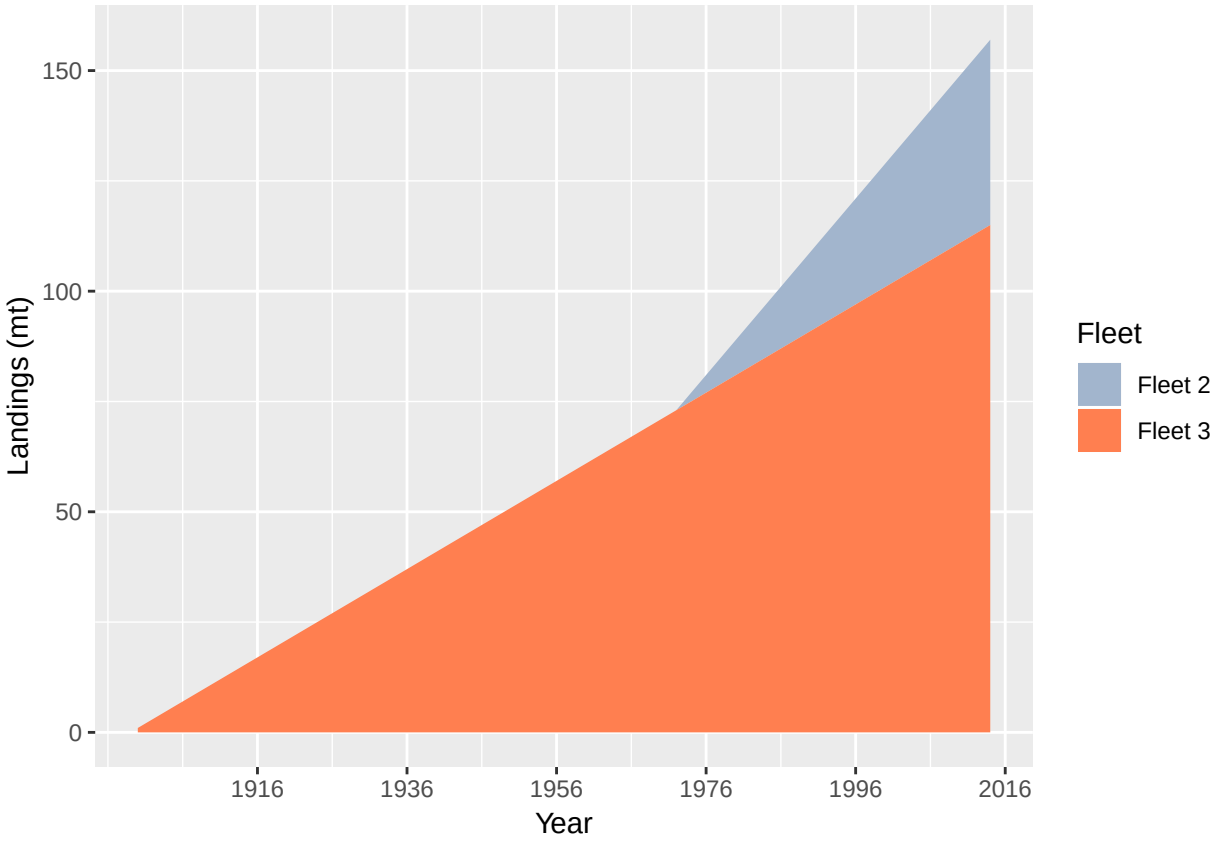

Figure b: Stacked line plot of China rockfish catch history for the commercial fleets. `fig:Exec_catch2`

Table a: Recent China rockfish landings (mt) by fleet.

tab:Exec_catch

Year	Landings 1	Landings 2	Landings 3	Landings 4	Landings 5	Total
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	-	-	-	-	-	-
2012	-	-	-	-	-	-
2013	-	-	-	-	-	-
2014	-	-	-	-	-	-

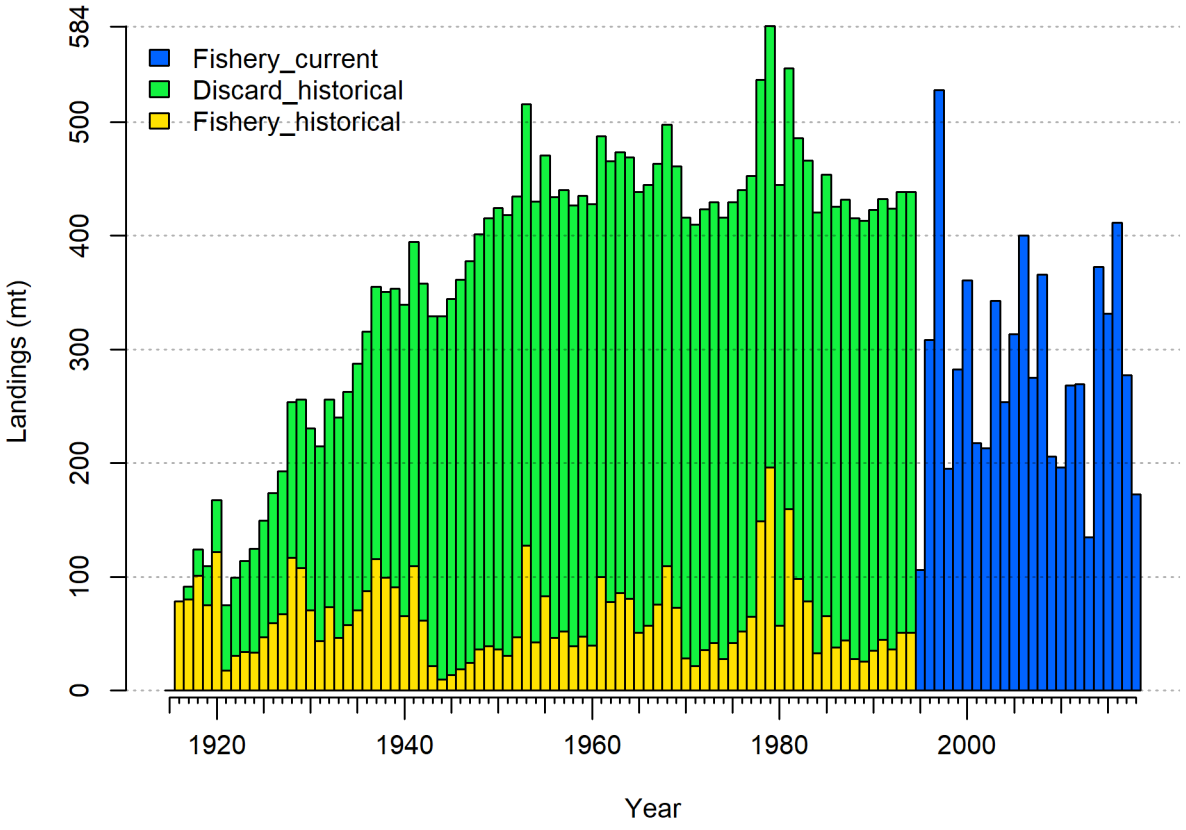

Figure c: Catch history of China rockfish in the Northern model. [fig:r4ss_catches

Data and Assessment

data-and-assessment

This a new full assessment for China rockfish, which was last assessed in ... using Stock Synthesis Version xx. This assessment uses the newest version of Stock Synthesis (3.30.xx). The model begins in 1916, and assumes the stock was at an unfished equilibrium that year.

(Figure d).

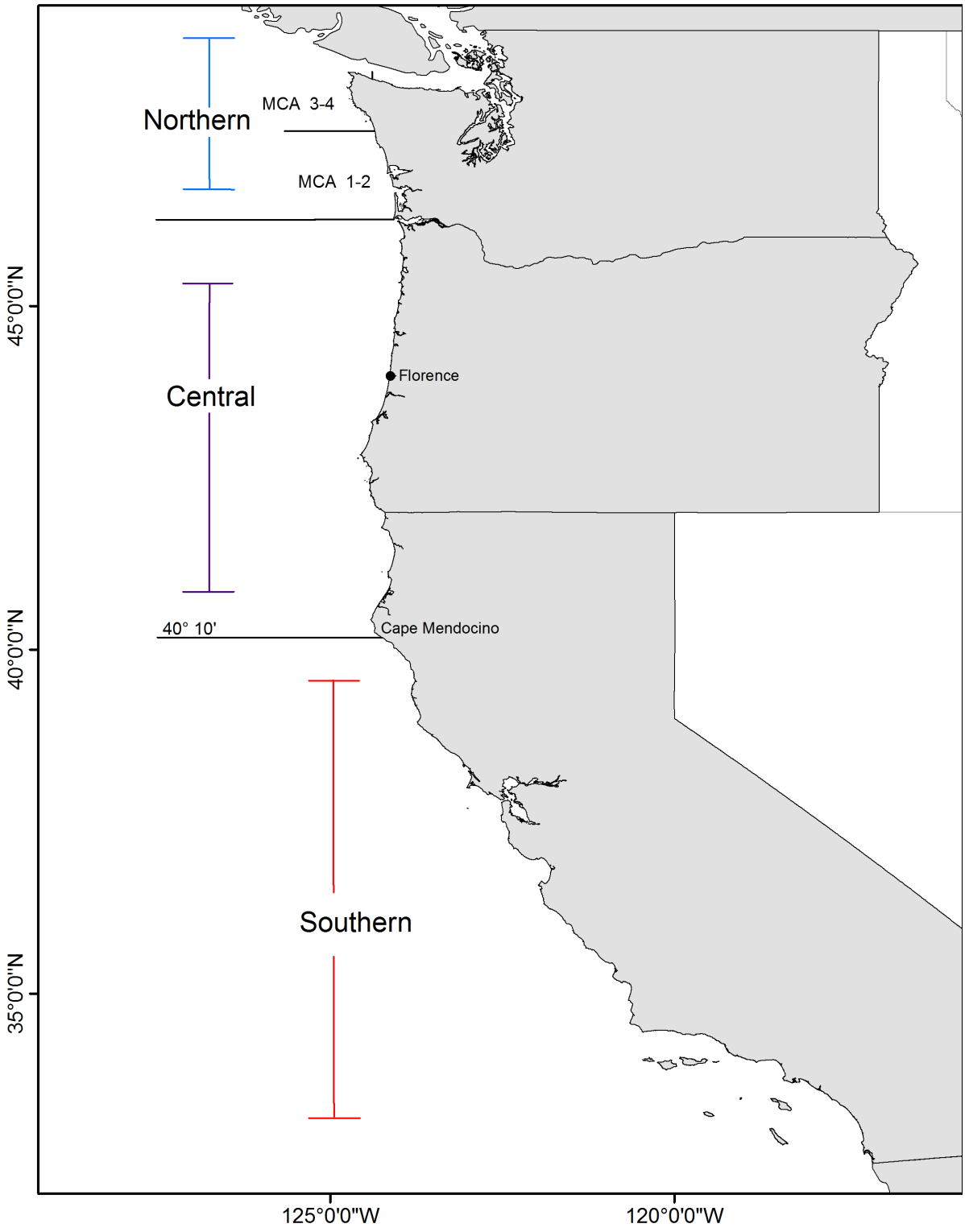

Figure d: Map depicting the distribution of California scorpionfish out to 600 ft. The stock assessment is bounded at Pt. Conception in the north to the U.S./Mexico border in the south. `fig:assess_region_map`

Stock Biomass

stock-biomass

(Figure e and Table b).

The 2018 estimated spawning biomass relative to unfished equilibrium spawning biomass is above the target of 40% of unfished spawning biomass at 86.8% (95% asymptotic interval: ± 28.6%-145%) (Figure f). Approximate confidence intervals based on the asymptotic variance estimates show that the uncertainty in the estimated spawning biomass is high.

Table b: Recent trend in beginning of the year spawning output and depletion for the Northern model for China rockfish.

tab:SpawningDeplete_mod1

Year	Spawning Output (million eggs)	~ 95% confidence interval	Estimated depletion	~ 95% confidence interval
2010	3243.480	(-8232.62-14719.58)	0.846	(0.35-1.342)
2011	3258.300	(-8220.7-14737.3)	0.850	(0.365-1.336)
2012	3268.160	(-8212.76-14749.08)	0.853	(0.374-1.331)
2013	3278.220	(-8204.27-14760.71)	0.855	(0.384-1.326)
2014	3297.910	(-8186.56-14782.38)	0.860	(0.404-1.317)
2015	3301.610	(-8182.82-14786.04)	0.861	(0.408-1.315)
2016	3307.870	(-8176.72-14792.46)	0.863	(0.414-1.312)
2017	3307.270	(-8176.98-14791.52)	0.863	(0.414-1.312)
2018	3314.960	(-8169.88-14799.8)	0.865	(0.422-1.308)
2019	3328.700	(-8302.77-14960.17)	0.868	(0.286-1.451)

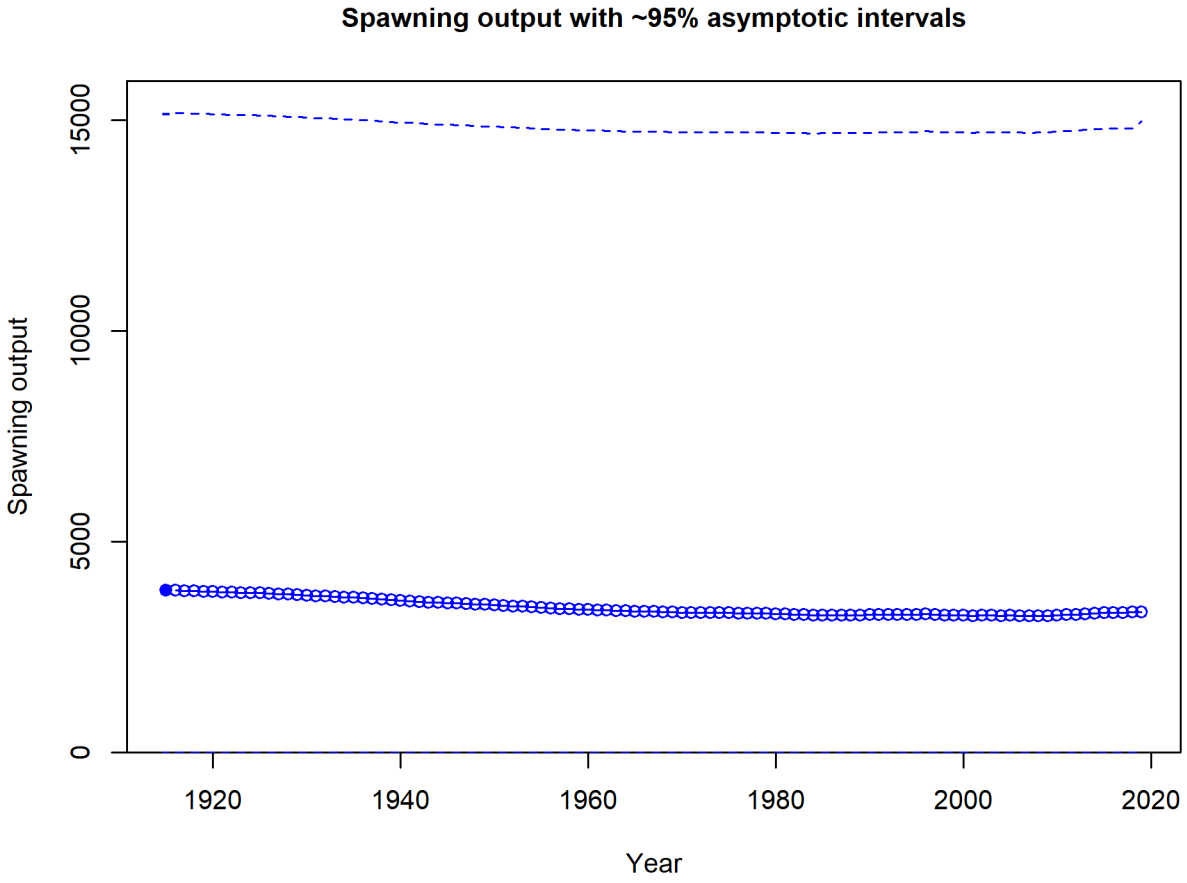

Figure e: Time series of spawning biomass trajectory (circles and line: median; light broken lines: 95% credibility intervals) for the base case assessment model. `fig:Spawnbio_all`

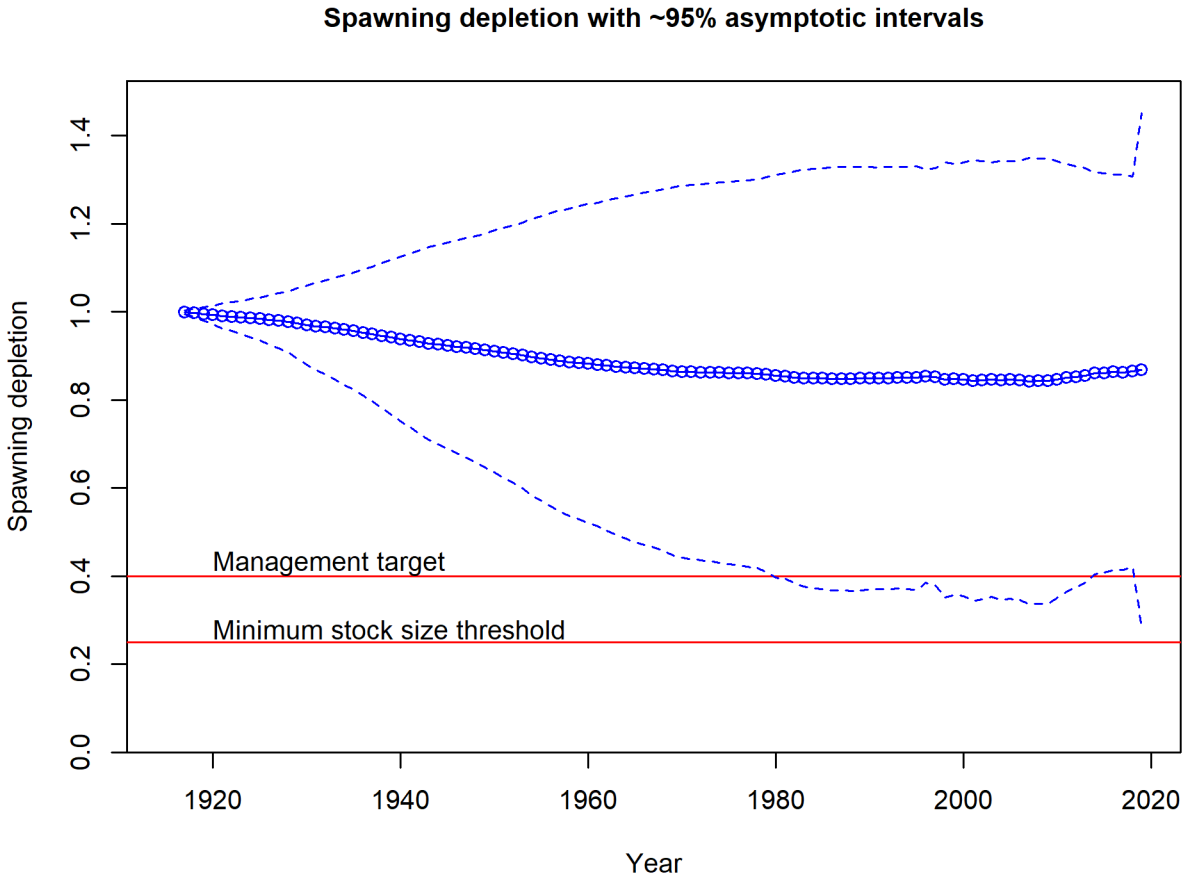

Figure f: Estimated relative depletion with approximate 95% asymptotic confidence intervals (dashed lines) for the base case assessment model. ⌜fig:RelDeplete_all

Recruitment

recruitment

Recruitment deviations were estimated from xxxx-xxxx (Figure g and Table c).

Table c: Recent recruitment for the Northern model.

tab:Recruit_mod1

Year	Estimated Recruitment (1,000s)	~ 95% confidence interval
2010	8193.66	(818.16 - 82057.29)
2011	8209.15	(821.82 - 82001.39)
2012	8219.41	(824.24 - 81965.06)
2013	8229.84	(826.72 - 81926.19)
2014	8250.15	(831.59 - 81849.19)
2015	8253.94	(832.52 - 81833.32)
2016	8260.36	(834.07 - 81808.08)
2017	8259.75	(833.94 - 81808.87)
2018	8267.61	(835.83 - 81779.37)
2019	8281.62	(830.85 - 82548.73)

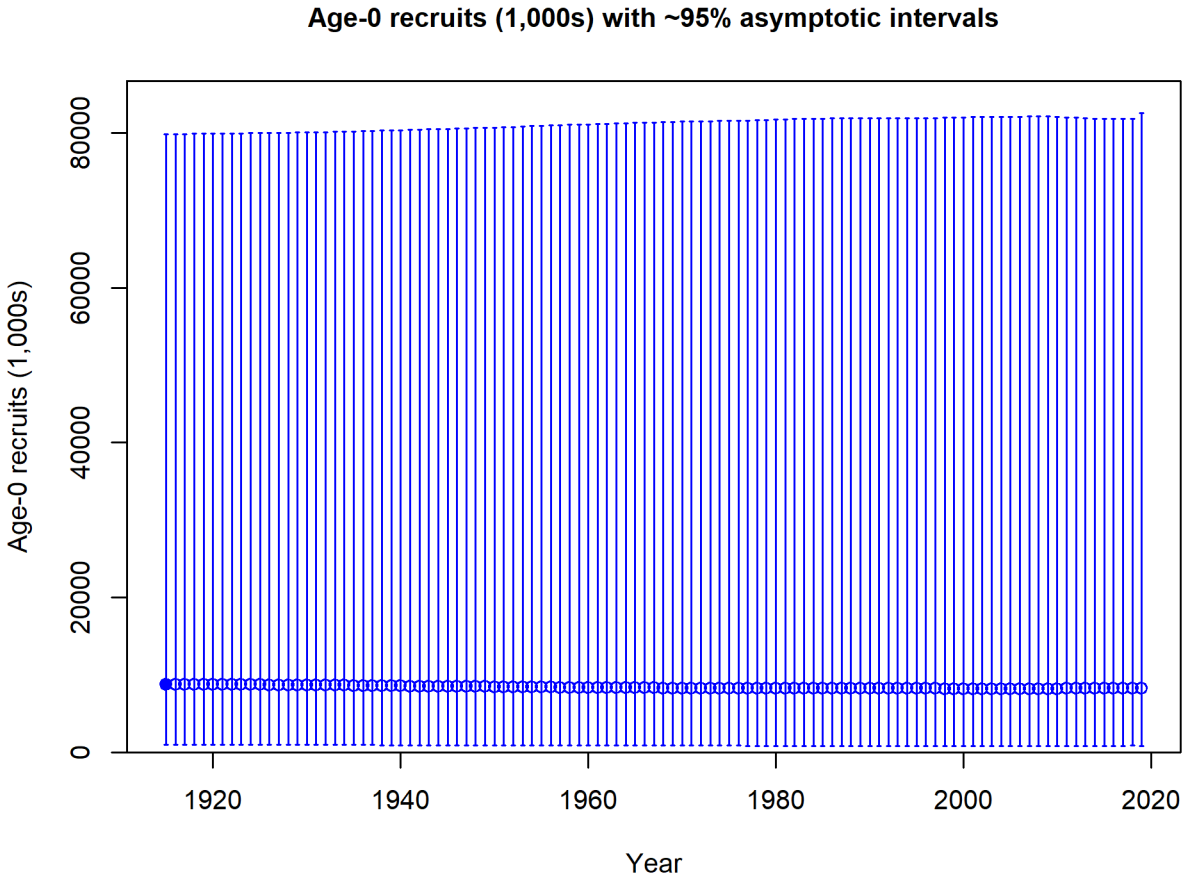

Figure g: Time series of estimated China rockfish recruitments for the base-case model with 95% confidence or credibility intervals. `fig:Recruits_all`

Exploitation status

exploitation-status

Harvest rates estimated by the base model ..... management target levels (Table d and Figure h).

Table d: Recent trend in spawning potential ratio and exploitation for China rockfish in the Northern model. Fishing intensity is (1-SPR) divided by 50% (the SPR target) and exploitation is F divided by F_{SPR}.

tab:SPR_Exploit_mod1

Year	Fishing intensity	~ 95% confidence interval	Exploitation rate	~ 95% confidence interval
2009	0.11	(-0.25-0.47)	0.00	(-0.01-0.02)
2010	0.09	(-0.22-0.4)	0.00	(-0.01-0.02)
2011	0.12	(-0.29-0.54)	0.01	(-0.01-0.02)
2012	0.12	(-0.29-0.54)	0.01	(-0.01-0.02)
2013	0.06	(-0.15-0.28)	0.00	(-0.01-0.01)
2014	0.17	(-0.38-0.72)	0.01	(-0.02-0.03)
2015	0.15	(-0.35-0.65)	0.01	(-0.02-0.03)
2016	0.19	(-0.42-0.81)	0.01	(-0.02-0.04)
2017	0.13	(-0.3-0.56)	0.01	(-0.01-0.02)
2018	0.08	(-0.19-0.35)	0.00	(-0.01-0.01)

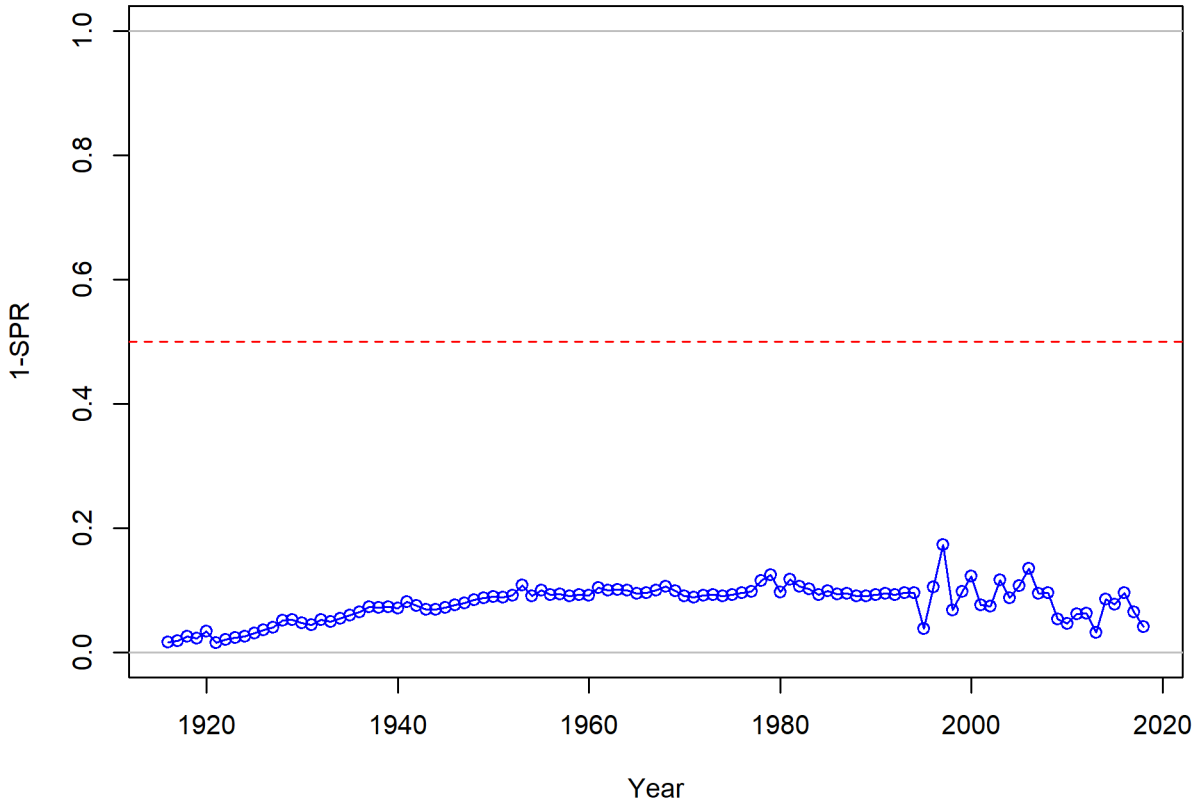

Figure h: Estimated spawning potential ratio (SPR) for the base-case model. One minus SPR is plotted so that higher exploitation rates occur on the upper portion of the y-axis. The management target is plotted as a red horizontal line and values above this reflect harvests in excess of the overfishing proxy based on the $SPR_{50\%}$ harvest rate. The last year in the time series is 2018. fig:SPR_all

Ecosystem Considerations

ecosystem-considerations

In this assessment, ecosystem considerations were not explicitly included in the analysis. This is primarily due to a lack of relevant data and results of analyses (conducted elsewhere) that could contribute ecosystem-related quantitative information for the assessment.

Reference Points

reference-points

This stock assessment estimates that China rockfish in the Northern model is above the biomass target ($SB_{40\%}$), and well above the minimum stock size threshold ($SB_{25\%}$). The estimated relative depletion level for the base model in 2019 is 86.8% (95% asymptotic interval: ± 28.6%-145%, corresponding to an unfished spawning biomass of 3328.7 million eggs (95% asymptotic interval: -8302.77-14960.17 million eggs) of spawning biomass in the base model (Table e). Unfished age 1+ biomass was estimated to be 6,352 mt in the base case model. The target spawning biomass ($SB_{40\%}$) is 1,533 million eggs, which corresponds with an equilibrium yield of 1,232 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 1,048 mt (Figure i).

Table e: Summary of reference points and management quantities for the base case Northern model.

tab:Ref_pts_mod1

Quantity	Estimate	Low 2.5% limit	High 2.5% limit
Unfished spawning output (million eggs)	3,833	-750	1,516
Unfished age 1+ biomass (mt)	6,352	-130	2,575
Unfished recruitment (R_0)	8,752	-187	3,625
Spawning output(2018 million eggs)	3,315	-817	1,480
Depletion (2018)	0.865	0.422	1
Reference points based on SB$_{40\%}$			
Proxy spawning output ($B_{40\%}$)	1,533	-306	6,128
SPR resulting in $B_{40\%}$ ($SPR_{B40\%}$)	0.625	0.625	0.625
Exploitation rate resulting in $B_{40\%}$	0.038	0.037	0.039
Yield with $SPR_{B40\%}$ at $B_{40\%}$ (mt)	1,232	-254	4,998
Reference points based on SPR proxy for MSY			
Spawning output	767	-153	3,064
SPR_{proxy}	0.5		
Exploitation rate corresponding to SPR_{proxy}	0.056	0.054	0.058
Yield with SPR_{proxy} at SB_{SPR} (mt)	1,048	-216	4,254
Reference points based on estimated MSY values			
Spawning output at MSY (SB_{MSY})	1,413	-282	5,644
SPR_{MSY}	0.605	0.603	0.608
Exploitation rate at MSY	0.041	0.039	0.042
Dead Catch MSY (mt)	1,237	-255	5,019
Retained Catch MSY (mt)	1,132	-232	4,588

Management Performance

management-performance

Table f

Unresolved Problems and Major Uncertainties

unresolved-problems-and-major-uncertainties

Table f: Recent trend in total catch and commercial landings (mt) relative to the management guidelines. Estimated total catch reflect the commercial landings plus the model estimated discarded biomass.

tab:mnmgt_perform

Year	OFL (mt; ABC prior to 2011)	ABC (mt)	ACL (mt; OY prior to 2011)	Estimated total catch (mt)
2007	-	-	-	-
2008	-	-	-	-
2009	-	-	-	-
2010	-	-	-	-
2011	-	-	-	-
2012	-	-	-	-
2013	-	-	-	-
2014	-	-	-	-
2015	-	-	-	-
2016	-	-	-	-
2017	-	-	-	-
2018	-	-	-	-

86 # Decision Table

decision-table

Table g: Projections of potential OFL (mt) for each model, using the base model forecast.

tab:OFL_projection

Year	OFL
2019	3131.53
2020	2987.89
2021	2866.67
2022	2765.24
2023	2678.53
2024	2601.89
2025	2531.97
2026	2466.58
2027	2404.32
2028	2344.46
2029	2286.76
2030	2231.39

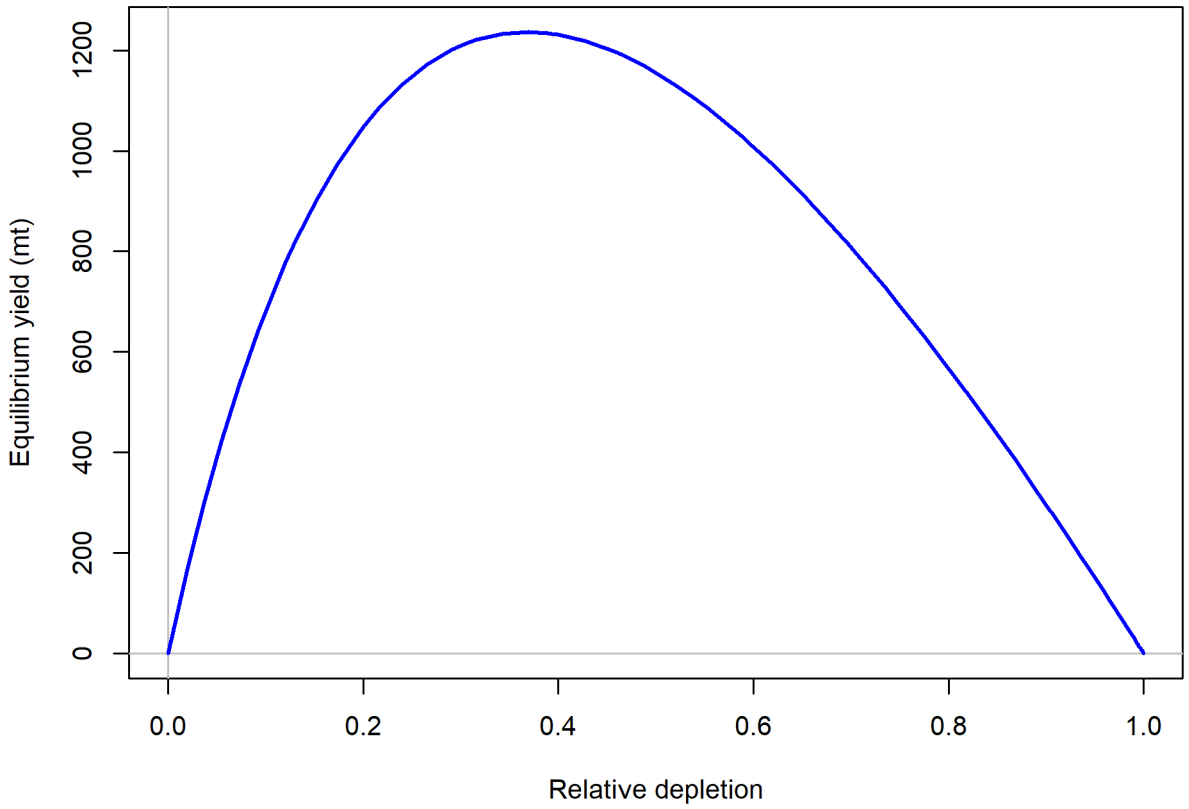

Figure i: Equilibrium yield curve for the base case model. Values are based on the 2018 fishery selectivity and with steepness fixed at 0.718. ⌜fig:Yield_all

Table h: Summary of 10-year projections beginning in 2020 for alternate states of nature based on an axis of uncertainty for the Northern model. Columns range over low, mid, and high states of nature, and rows range over different assumptions of catch levels. An entry of "–" indicates that the stock is driven to very low abundance under the particular scenario.

tab:Decision_table_mod1

			States of nature					
			Low M 0.05		Base M 0.07		High M 0.09	
	Year	Catch	Spawning Output	Depletion	Spawning Output	Depletion	Spawning Output	Depletion
40-10 Rule, Low M	2019	-	-	-	-	-	-	-
	2020	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-
	2022	-	-	-	-	-	-	-
	2023	-	-	-	-	-	-	-
	2024	-	-	-	-	-	-	-
	2025	-	-	-	-	-	-	-
	2026	-	-	-	-	-	-	-
	2027	-	-	-	-	-	-	-
	2028	-	-	-	-	-	-	-
40-10 Rule	2019	-	-	-	-	-	-	-
	2020	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-
	2022	-	-	-	-	-	-	-
	2023	-	-	-	-	-	-	-
	2024	-	-	-	-	-	-	-
	2025	-	-	-	-	-	-	-
	2026	-	-	-	-	-	-	-
	2027	-	-	-	-	-	-	-
	2028	-	-	-	-	-	-	-
40-10 Rule, High M	2019	-	-	-	-	-	-	-
	2020	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-
	2022	-	-	-	-	-	-	-
	2023	-	-	-	-	-	-	-
	2024	-	-	-	-	-	-	-
	2025	-	-	-	-	-	-	-
	2026	-	-	-	-	-	-	-
	2027	-	-	-	-	-	-	-
	2028	-	-	-	-	-	-	-
Average Catch	2019	-	-	-	-	-	-	-
	2020	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-
	2022	-	-	-	-	-	-	-
	2023	-	-	-	-	-	-	-
	2024	-	-	-	-	-	-	-
	2025	-	-	-	-	-	-	-
	2026	-	-	-	-	-	-	-
	2027	-	-	-	-	-	-	-
	2028	-	-	-	-	-	-	-

Table i: Base case results summary.

tab:base_summary

Quantity	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Landings (mt)										
Total Est. Catch (mt)										
OFL (mt)										
ACL (mt)										
(1-SPR)(1-$SPR_{50\%}$)	0.09	0.12	0.12	0.06	0.17	0.15	0.19	0.13	0.08	
Exploitation rate	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	
Age 1+ biomass (mt)	54614.9	54818.3	55033.0	55156.2	55267.5	55499.9	55477.1	55501.5	55442.3	55533.8
Spawning Output	3243.5	3258.3	3268.2	3278.2	3297.9	3301.6	3307.9	3307.3	3315.0	3328.7
95% CI	(-8232.62-14719.58)	(-8220.7-14737.3)	(-8212.76-14749.08)	(-8204.27-14760.71)	(-8186.56-14782.38)	(-8182.82-14786.04)	(-8176.72-14792.46)	(-8176.98-14791.52)	(-8169.88-14799.8)	(-8302.77-14960.17)
Depletion	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
95% CI	(0.35-1.342)	(0.365-1.336)	(0.374-1.331)	(0.384-1.326)	(0.404-1.317)	(0.408-1.315)	(0.414-1.312)	(0.414-1.312)	(0.422-1.308)	(0.286-1.451)
Recruits	8193.66	8209.15	8219.41	8229.84	8250.15	8253.94	8260.36	8259.75	8267.61	8281.62
95% CI	(818.16 - 82057.29)	(821.82 - 82001.39)	(824.24 - 81965.06)	(826.72 - 81926.19)	(831.59 - 81849.19)	(832.52 - 81833.32)	(834.07 - 81808.08)	(833.94 - 81808.87)	(835.83 - 81779.37)	(830.85 - 82548.73)

Research and Data Needs

research-and-data-needs

We recommend the following research be conducted before the next assessment:

1. **xxxx**:
2. **xxxx**:
3. **xxxx**:
4. **xxxx**:
5. **xxxx**:

References

references