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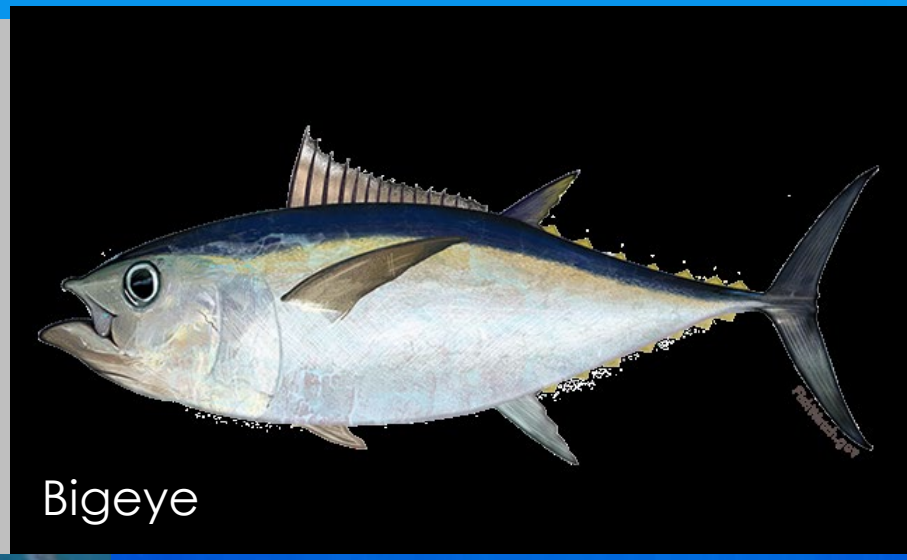
2023 SCRS Report


Bigeye

Panel 1- Tropical Tunas

ICCAT Commission Meeting 2023


Yellowfin


Skipjack

Tropical Tuna Presentation Summary

Presentation Summary

- Brief Review of State of Stocks and Outlook for YFT, BET, and SKJ
- Responses to the Commission
- Work Plan
- MSE Progress
  - Multi-Stock MSE (YFT, BET, E-SKJ)
  - Detailed Presentation of W-SKJ MSE and Candidate Management Procedures

Stock Assessment 2019 – Input data up to 1950-2018

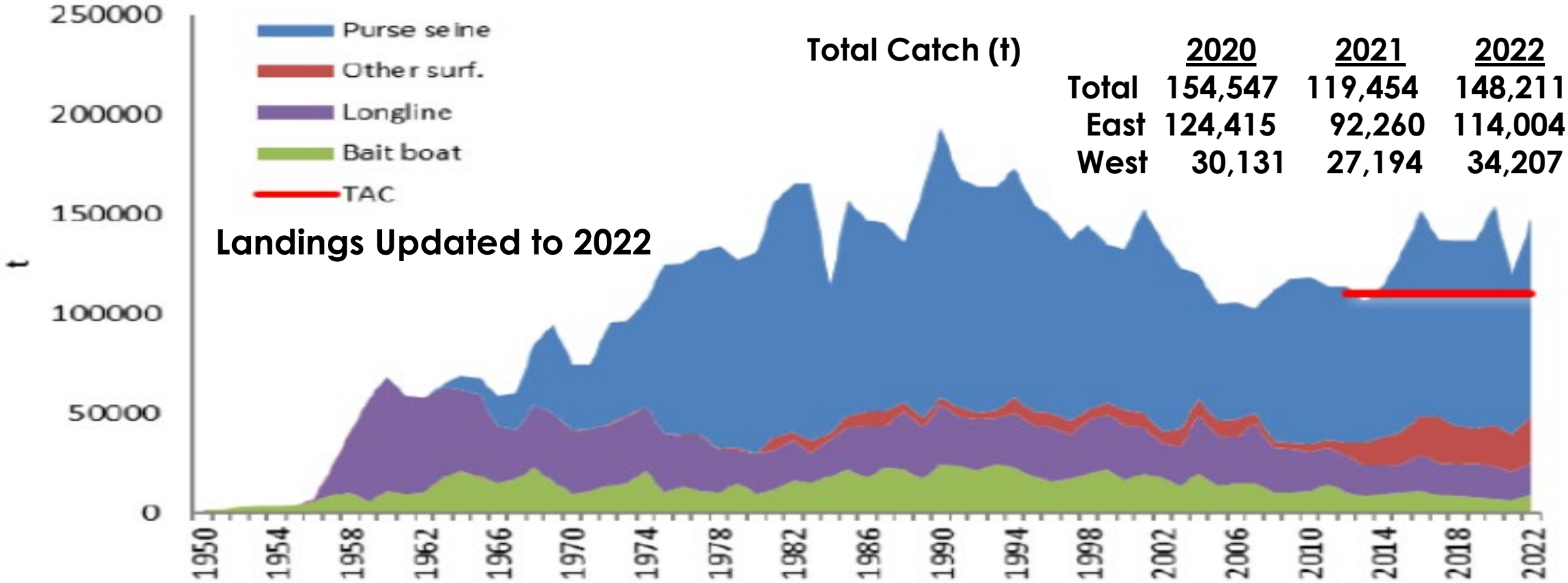
- Ages up to 18 years were observed in otoliths and validated using 14C bomb radiocarbon.
- Growth of YFT estimated using a Richards function than a von Bertalanffy function (AOTTP information)
- Age-specific natural mortality function (e.g. Lorenzen) based on T max of 18 rather than 11 used in previous assessment.
- Several New Indices used in the 2019 assessment.

YFT Fishery Indicators

YFT Task 1 Catches

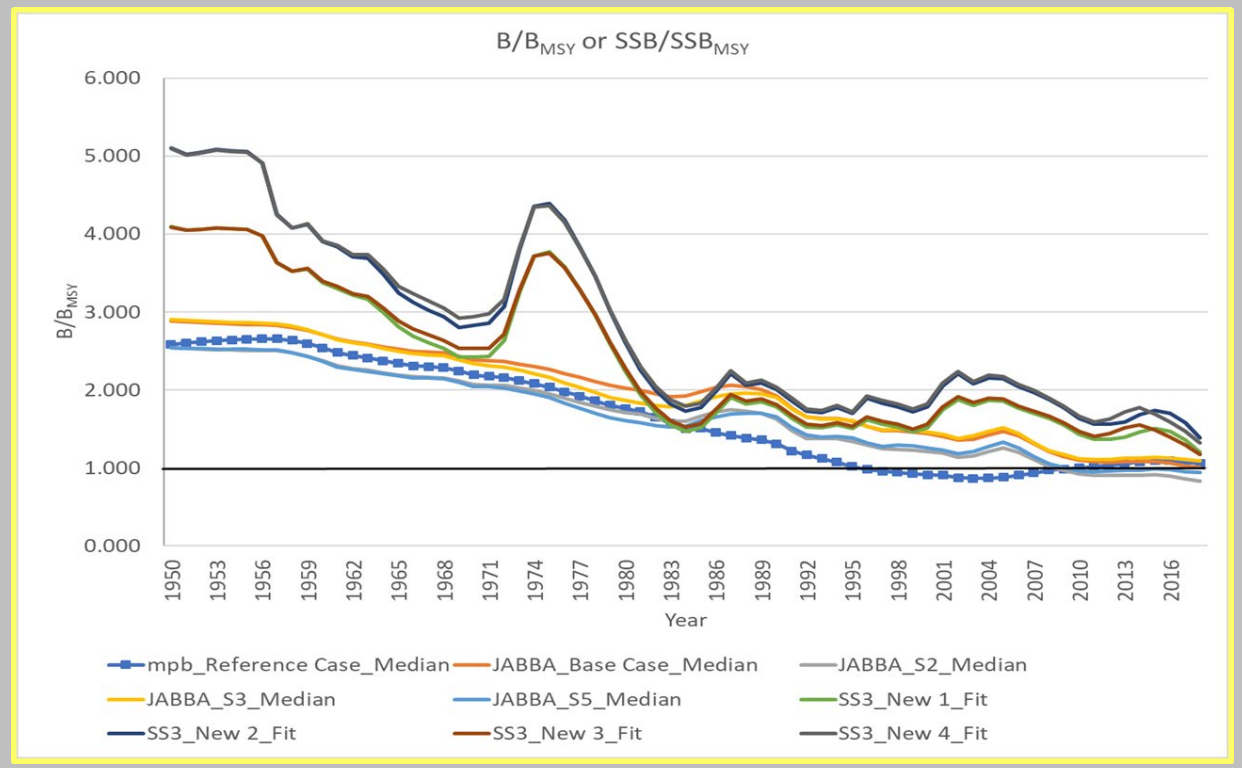
A TAC of 110,000 t was adopted in 2012. Catches have been substantially above TAC since 2014.

Total Catch (t)	2020	2021	2022
Total	154,547	119,454	148,211
East	124,415	92,260	114,004
West	30,131	27,194	34,207

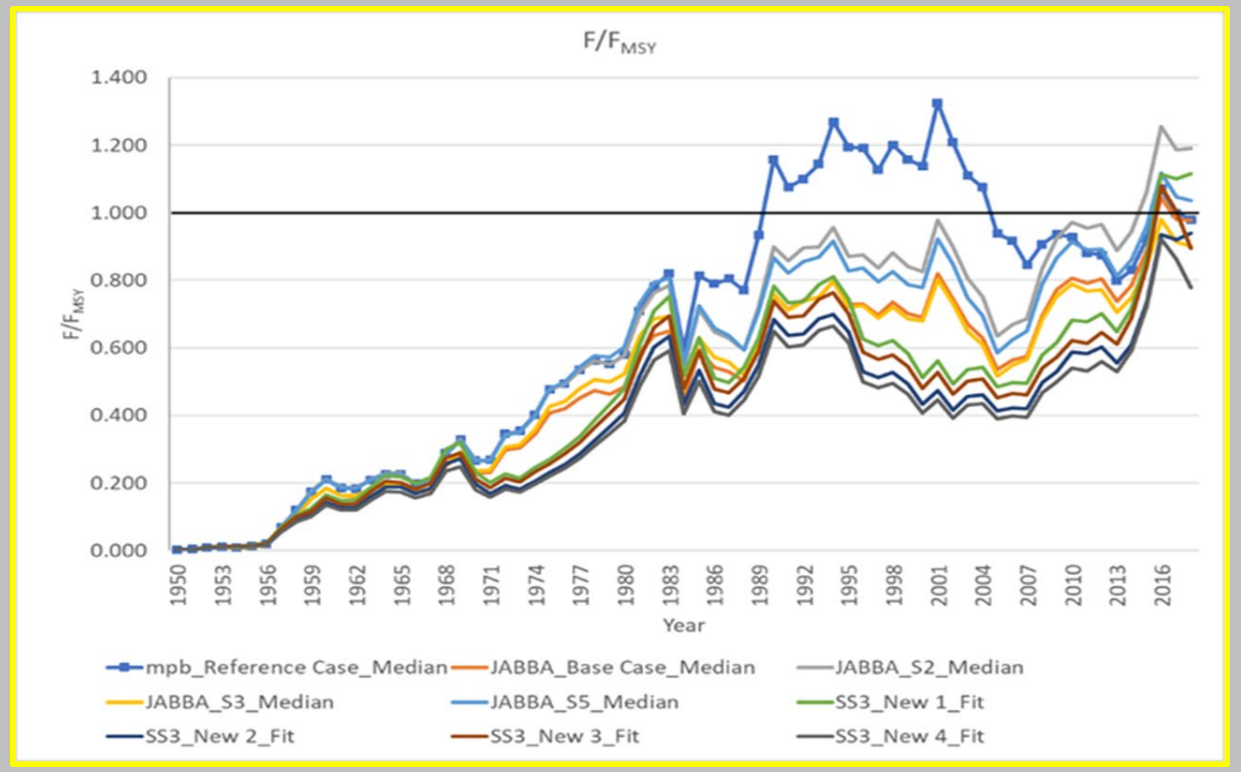


Assessment Results

Biomass relative to Bmsy



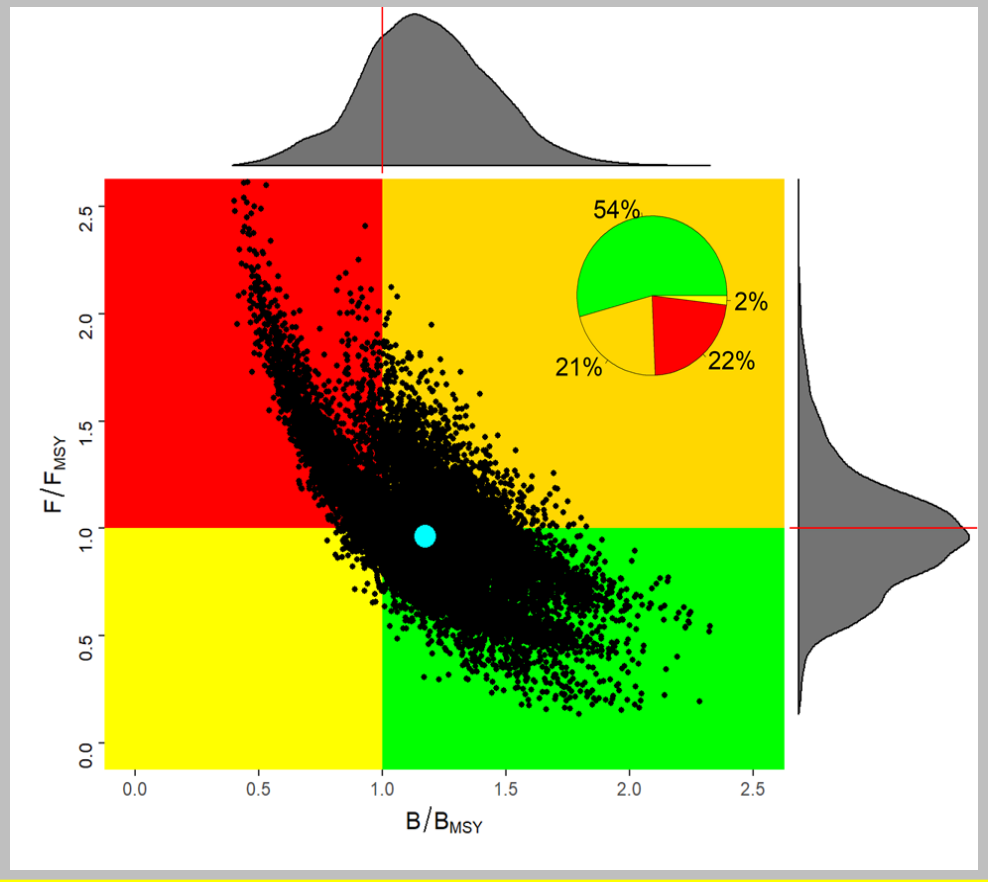
Fishing Mortality relative to Fmsy



YFT Stock Status

Stock Assessment Results:

- Combined Results of Stock Synthesis, JABBA and MPB
- B/B_{MSY} = 1.17
  - Not Overfished
- F/F_{MSY} = 0.96
  - Not Overfishing
- MSY = 121,298 t
  - Mean MSY 2016-2018



The 2019 result appears more optimistic than in 2016. However, the group cautioned that the difference in the results is not due to stock recovery. Instead, the perceived improvement is more likely due to changes in key data inputs (M, growth, indices) and the suite of models applied (JABBA, MPB, SS).

YFT Stock Outlook

- A TAC of 120,000 t is expected to maintain a healthy stock status (no overfishing, not overfished) through 2033 with at least 63% probability

Joint Probability that $F \leq F_{MSY}$ and $B \geq B_{MSY}$

TAC | Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	64	84	95	99	100	100	100	100	100	100	100	100	100	100
60000	64	75	85	92	96	97	98	99	99	99	100	100	100	100
70000	64	74	83	90	94	96	97	98	98	99	99	99	100	100
80000	64	72	79	86	91	94	96	97	97	98	98	99	99	99
90000	64	70	77	82	87	90	92	94	95	96	97	97	98	98
100000	64	68	73	77	82	85	87	89	90	92	93	94	94	95
110000	64	66	69	72	75	77	79	81	82	83	84	85	86	86
120000	63	63	64	65	65	66	66	67	67	68	65	65	66	66
130000	58	57	56	54	52	50	47	46	45	44	43	42	38	38
140000	48	45	42	38	35	31	29	26	24	22	21	20	20	19
150000	39	34	30	25	21	17	15	13	12	12	11	10	9	7

Yellowfin Tuna – Unchanged since 2019 SCRS Report

- Catches above 120,000 t are expected to degrade the condition of the yellowfin stock. Since 2016, catch have averaged 138,000 t, but increased to 156,692 in 2020. Catches above 140,000 t carry an increased risk of driving the stock below 20%B_{MSY} (13% by 2033).
- Overages are frequent and significant. Existing conservation and management measures appear to be insufficient. The Group recommends that the Commission strengthen such measures.
- Increased harvests on small yellowfin and bigeye tunas will have negative consequences on both long-term sustainable yield and stock status.
- Should the Commission wish to increase long-term sustainable yield, the Group recommends that effective measures be found to reduce fishing mortality on small yellowfin and bigeye tuna.

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Stock Status - Bigeye Tuna (BET)

- Latest assessment 2021 based on data to 2019
- Update of fishery indicators:
  - Catch (1950-2020)
  - Juvenile index of abundance based on acoustic buoys from FOBs/FADs (2010-2019)
- New Joint Longline index developed in 2021 (1979-2019).

- Significant changes made in the assessment Inputs (i.e., maximum age and natural mortality assumptions, the relative abundance indices used and the fleet structure.
- Modeling approaches, included non-equilibrium (MPB) and Bayesian state-space (JABBA) production models as wells an integrated statistical assessment models (Stock Synthesis) which was used to provide management advice.

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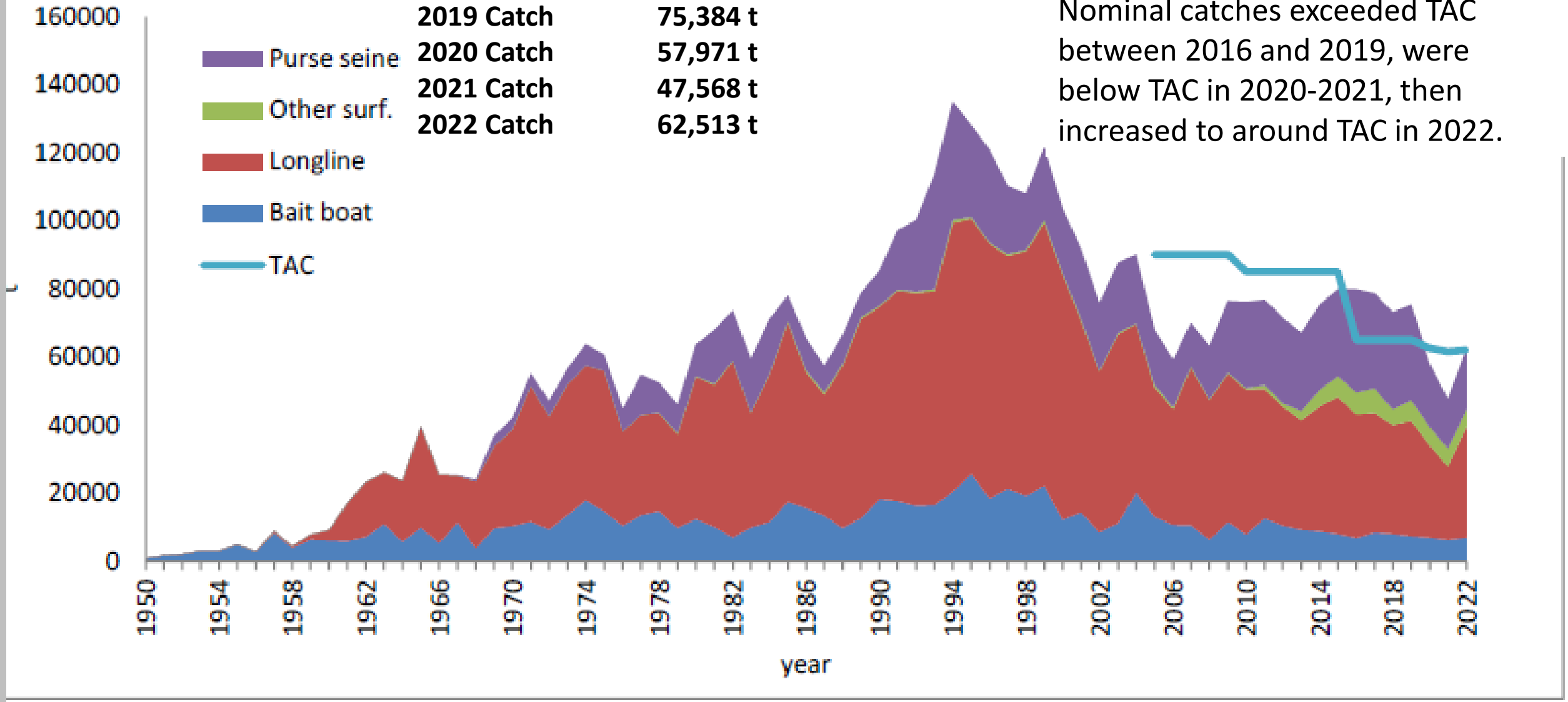
Stock Status - Bigeye Tuna (BET)

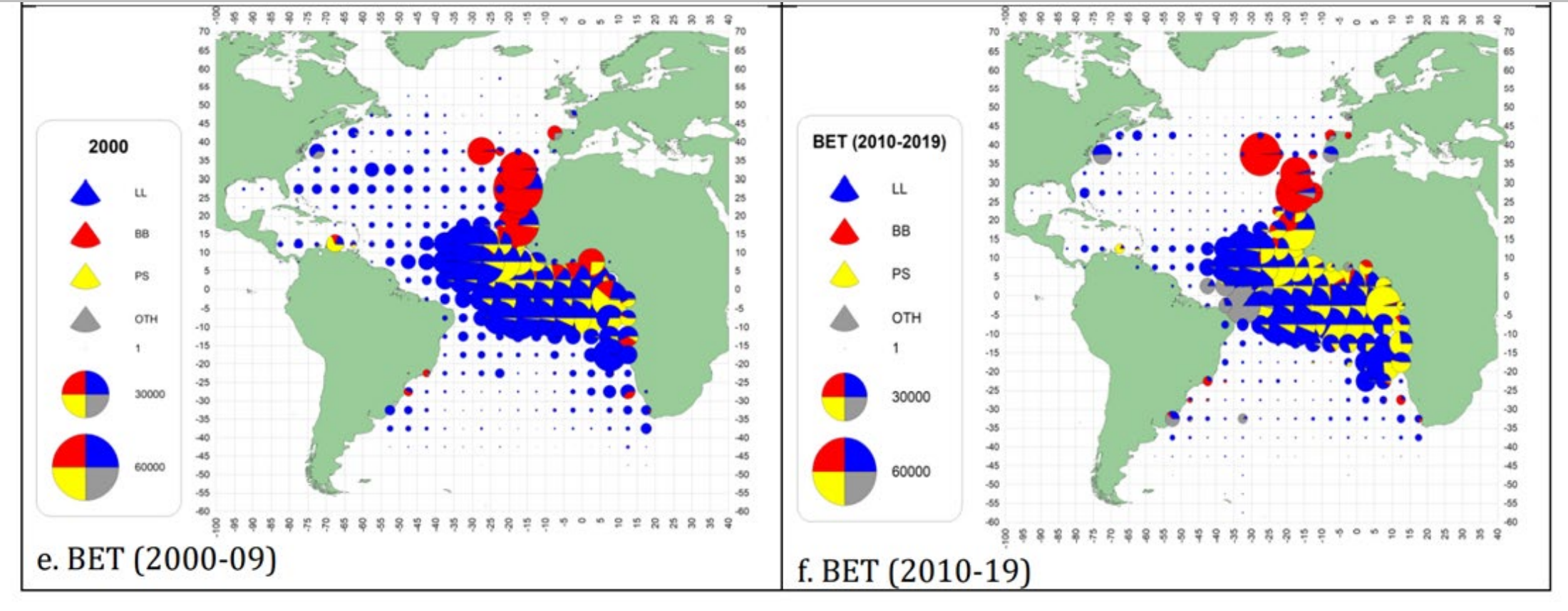
2019 Catch	**75,384 t**
2020 Catch	**57,971 t**
2021 Catch	**47,568 t**
2022 Catch	**62,513 t**

Nominal catches exceeded TAC between 2016 and 2019, were below TAC in 2020-2021, then increased to around TAC in 2022.

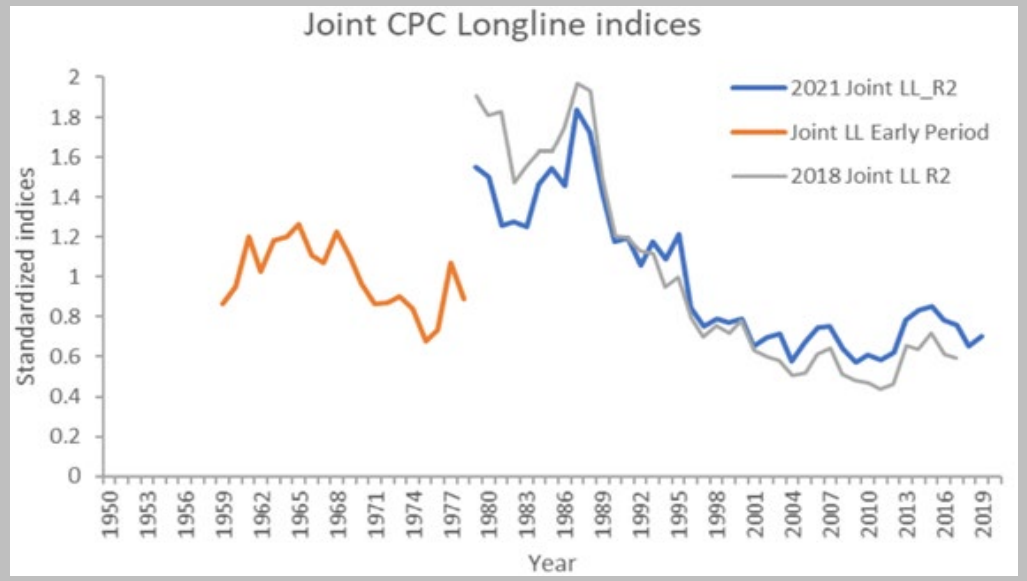


Stock Status - Bigeye Tuna (BET)

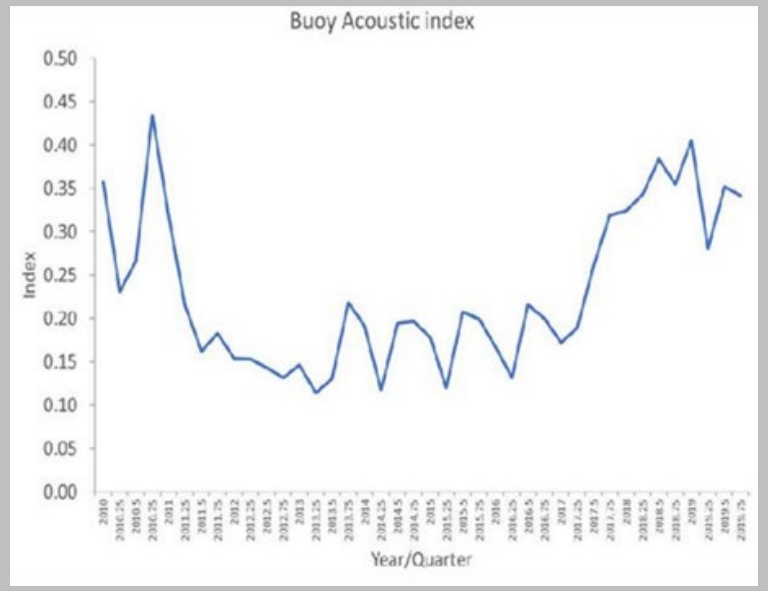
Geographical distribution of the bigeye tuna catch by major gears 2000-09 and 2010-2019.



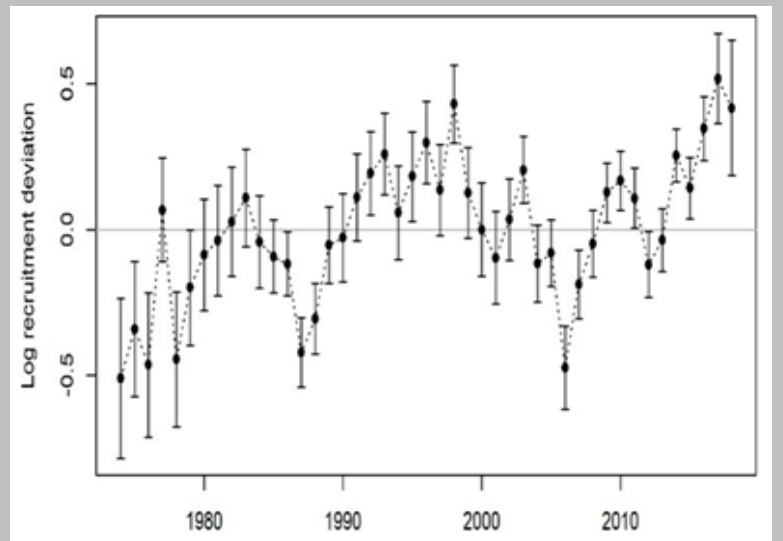
BET Fishery indicators and Recruitment



Joint Longline index (1959-1978 without vessel identification and 1979-2017 with vessel identification included in the standardization.



Quarterly Buoy acoustic index. (2010-2019).

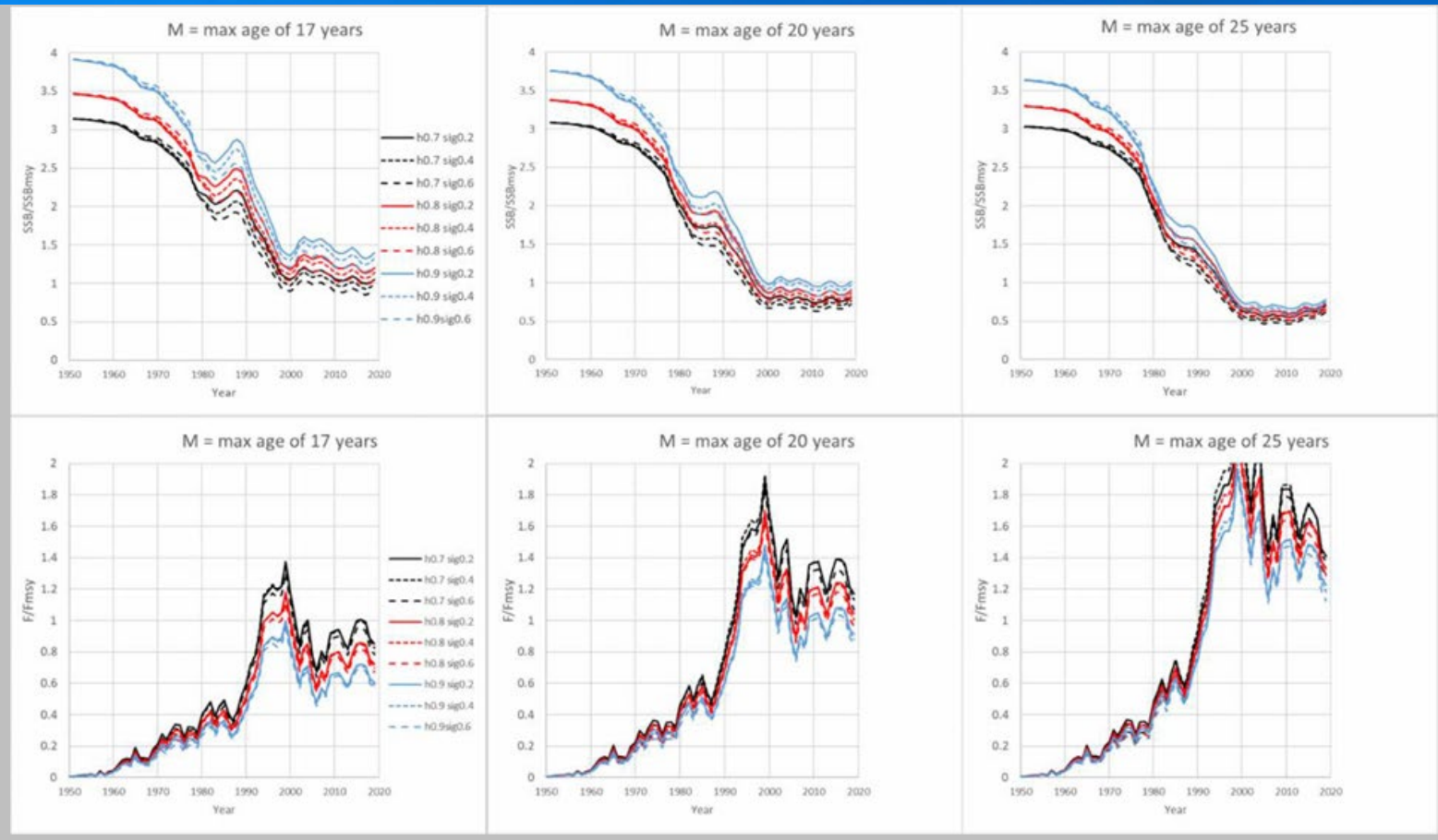


Recruitment Deviations. (1974-2018)

BET SS Stock Trends

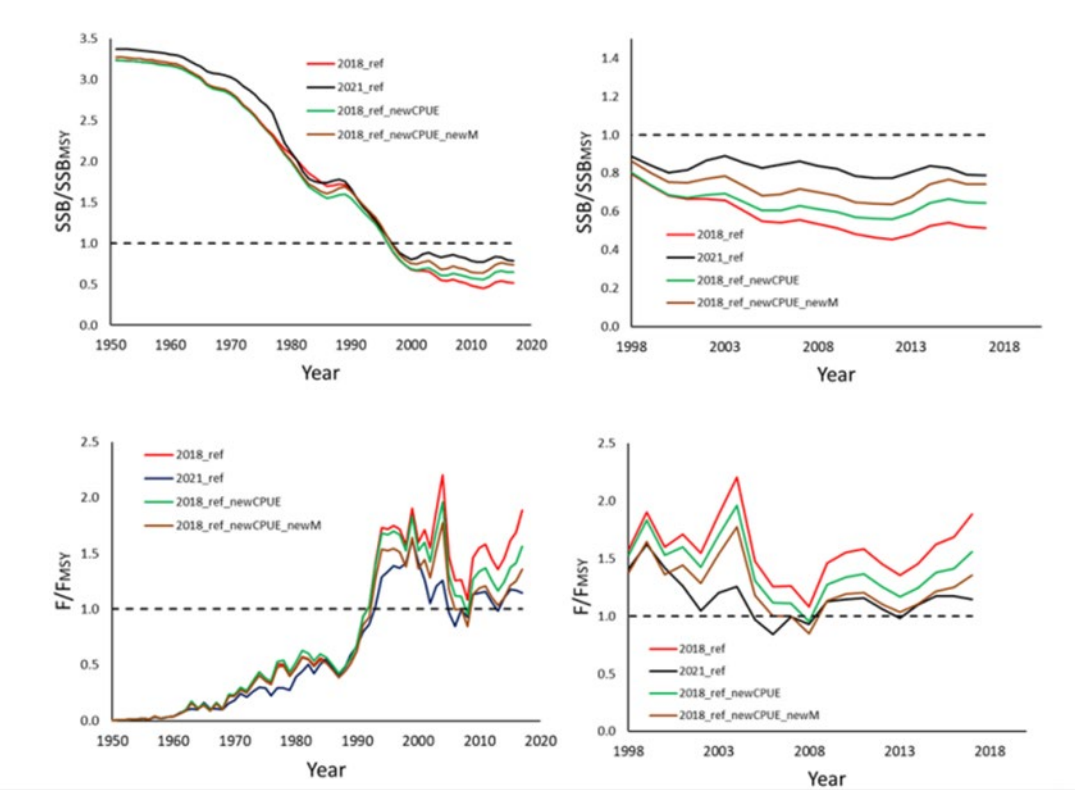
Outputs:

BET-Figure 7. stock status trends across the 27 Stock Synthesis models of the uncertainty grid. Panels in each row represent the different assumptions of maximum age and thus natural mortality. Upper panels represent SSB/SSBMSY trends and lower panels F/FMSY trends. Individual lines represent different combinations of steepness and Sigma R.

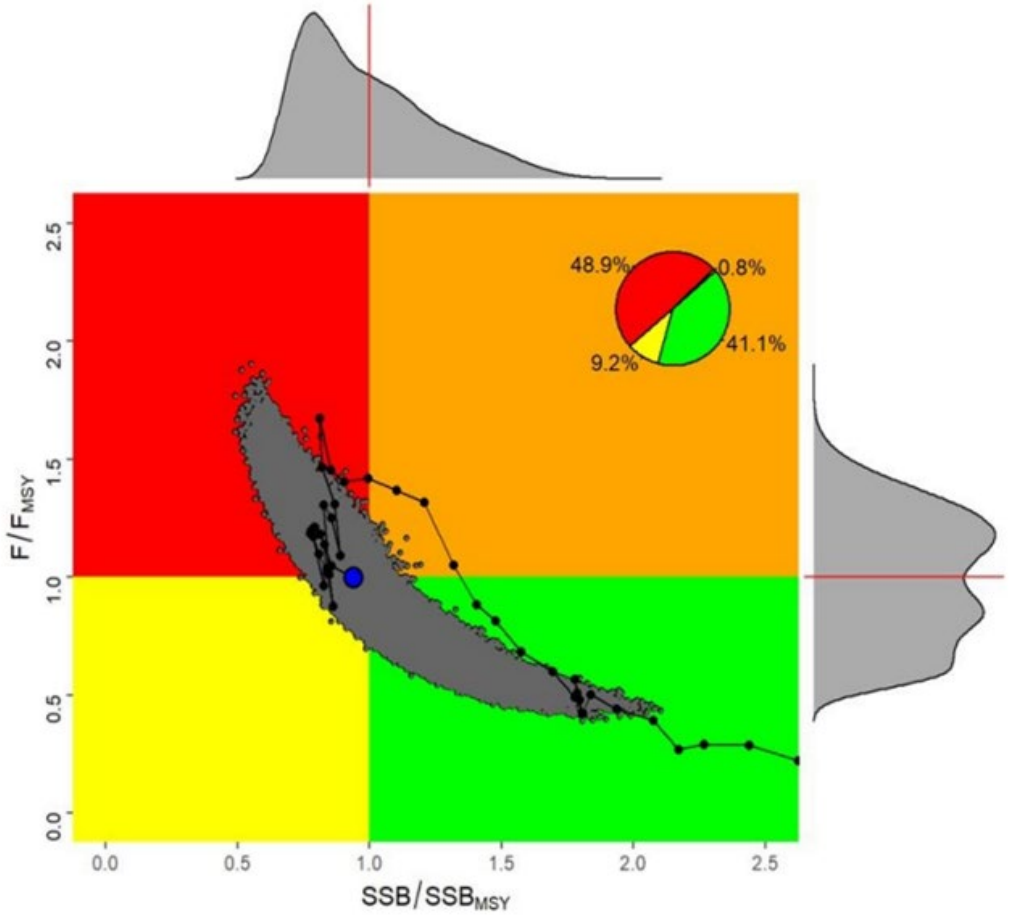


All model configurations show increasing F and decreasing biomass trajectories from 1950-2019. However, the trends slowed from 1998 with a slight upward trend in SSB/SSBmsy and decrease in F/Fmsy in the last few years.

BET Stock Status



Sensitivity runs showing time series of stock status trends (left 1950-2017, right 1998-2017, for SSB/SSBMSY and F/FMSY) demonstrating the effects of changes in stock status resulting from the incorporation of the 2021 joint longline index and the new assumptions about natural mortality.



BET-Figure 8. Stock Synthesis: Kobe plot of SSB/SSB_{MSY} and F/F_{MSY} for stock status of Atlantic bigeye tuna in 2019 based on the log multivariate normal approximation across the 27 uncertainty grid model runs of Stock Synthesis with an insert pie chart showing the probability of being in the red quadrant (48.9 %), green quadrant (41.1 %), orange (0.8%) and in yellow (9.2 %). Blue circle is the median and marginal histograms represent distribution of either SSB/SSB_{MSY} or F/F_{MSY}.

BET Stock Status

ATLANTIC BIGEYE TUNA SUMMARY

Maximum Sustainable Yield	86,833 t (72,210-106440 t)[1]
Current (2020) Yield	**57,486**t[2]
Relative Spawning Biomass (SSB_{2019}/SSB_{MSY})	0.94 (0.71-1.37)[1]
Relative Fishing Mortality (F_{2019}/F_{MSY})	1.00 (0.63-1.35)[1]
Stock Status (2019)	Overfished: Yes Overfishing: No

BET Probability of being in Green

Probability of Not Overfished (SSB >= SSBmsy) and Overfishing not occurring (F <= F_{MSY})

TAC

TAC (1000s mt)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
35	85%	91%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%
37.5	85%	91%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%
40	85%	90%	95%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%
42.5	84%	90%	94%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%
45	84%	89%	94%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%
47.5	83%	89%	93%	96%	97%	99%	99%	100%	100%	100%	100%	100%	100%
50	83%	88%	92%	95%	97%	98%	99%	99%	100%	100%	100%	100%	100%
52.5	83%	88%	92%	94%	96%	97%	98%	99%	99%	100%	100%	100%	100%
55	82%	87%	91%	93%	95%	96%	97%	98%	99%	99%	100%	100%	100%
57.5	82%	86%	90%	92%	93%	95%	96%	97%	98%	98%	99%	99%	99%
60	81%	86%	89%	90%	92%	93%	94%	95%	96%	97%	98%	98%	98%
61.5	81%	85%	88%	89%	91%	92%	93%	94%	95%	96%	97%	97%	97%
62.5	81%	85%	87%	89%	90%	91%	92%	93%	94%	95%	96%	96%	97%
65	81%	84%	86%	87%	87%	88%	89%	90%	90%	92%	92%	93%	93%
67.5	80%	83%	84%	85%	85%	85%	85%	85%	86%	87%	87%	87%	88%
70	79%	82%	83%	82%	82%	81%	81%	80%	81%	81%	80%	81%	82%
72.5	78%	80%	80%	79%	79%	77%	75%	74%	74%	74%	74%	73%	73%
75	76%	78%	77%	76%	74%	72%	70%	68%	68%	66%	65%	65%	64%
77.5	73%	74%	74%	72%	70%	67%	64%	62%	59%	58%	57%	56%	54%
80	70%	71%	70%	68%	64%	61%	57%	55%	52%	50%	48%	47%	46%
82.5	67%	67%	65%	63%	59%	55%	52%	47%	44%	42%	41%	40%	39%
85	63%	63%	60%	58%	53%	48%	45%	40%	37%	36%	34%	34%	34%
87.5	59%	58%	55%	53%	47%	42%	38%	34%	31%	30%	29%	29%	30%
90	55%	54%	50%	48%	41%	37%	32%	28%	26%	25%	25%	26%	25%

BET - Management Recommendations

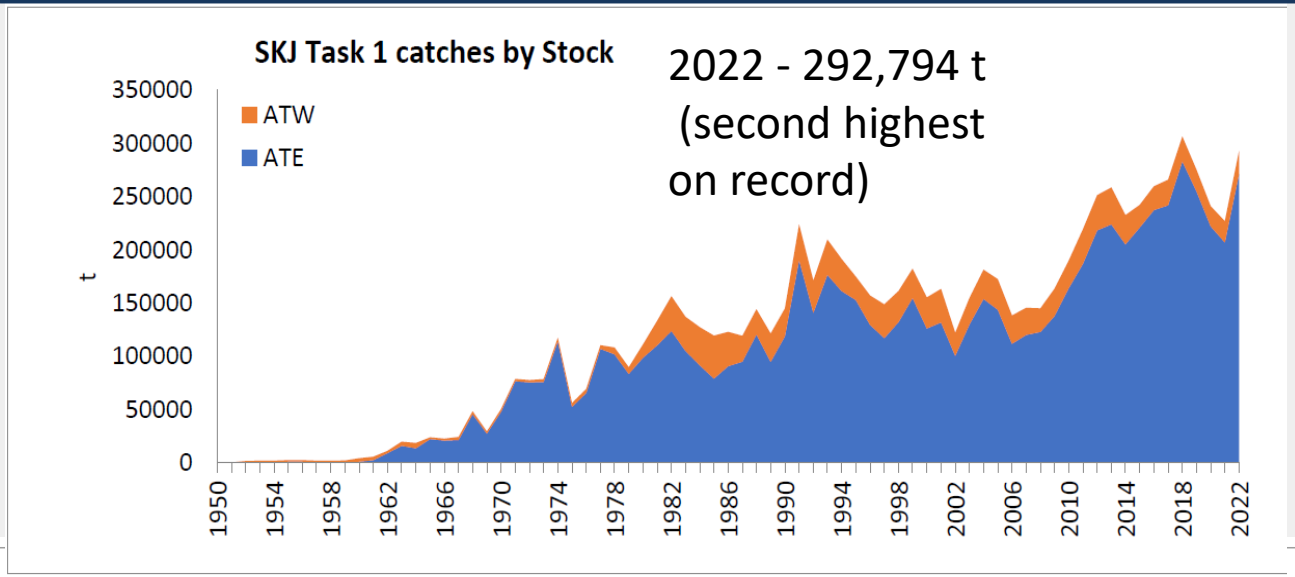
- Status has improved since 2017 and was estimated to be overfished but not undergoing overfishing in 2019
- A future constant catch of 61,500 t, which is the TAC established in Rec. 19-02, will have a high probability (97%) of maintaining the stock in the green quadrant of the Kobe plot by 2034.
- However, current stock status and the outlook for the stock are more uncertain than portrayed in the Summary Table and the K2SM. The SCRS advises that Projection probabilities should be interpreted with caution.
- 2021 optimistic outlook is related to updates to the data and biological parameters, changes in the methodology and data used for the joint longline index, use of the buoy index, changes to the fleet structure (in SS models), and the relatively low catches of BET for 2020 and 2021 (=TAC).
- The Commission should consider adopting a TAC that would shift the stock status of BET towards the green zone of the Kobe plot with a high probability.
- Keep in mind that an increase harvest of small yellowfin and bigeye tunas will have negative consequences on both long-term sustainable yield and stock status.

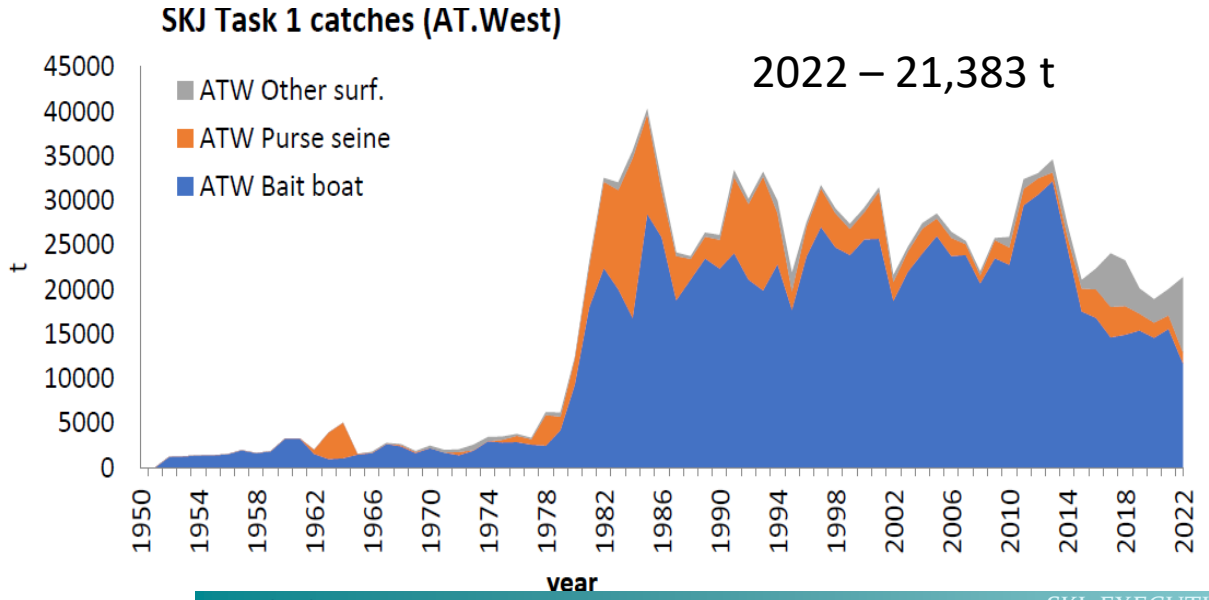
Stock Status Skipjack (SKJ)

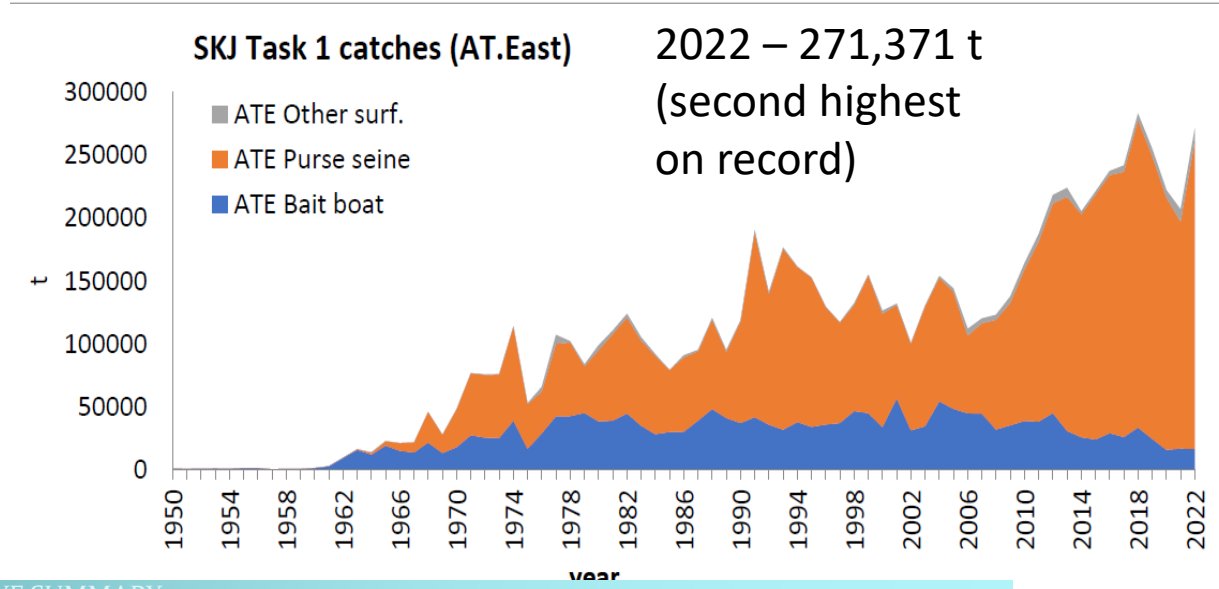
- Last stock assessment for east and west Skipjack was in 2022, using data through 2020.

- First time stock status could be quantified for both stocks (This had been possible for W-SKJ in the past, but not for E-SKJ).
- The new assessments used fishery data from 1950-2020 and 1952-2020, respectively,
- Indices of relative abundance were calculated through 2020.
- Both stocks were evaluated using Surplus Production (JABBA) and Statistically Integrated (SS3) models.

Catches – Tasks I Updated to 2022

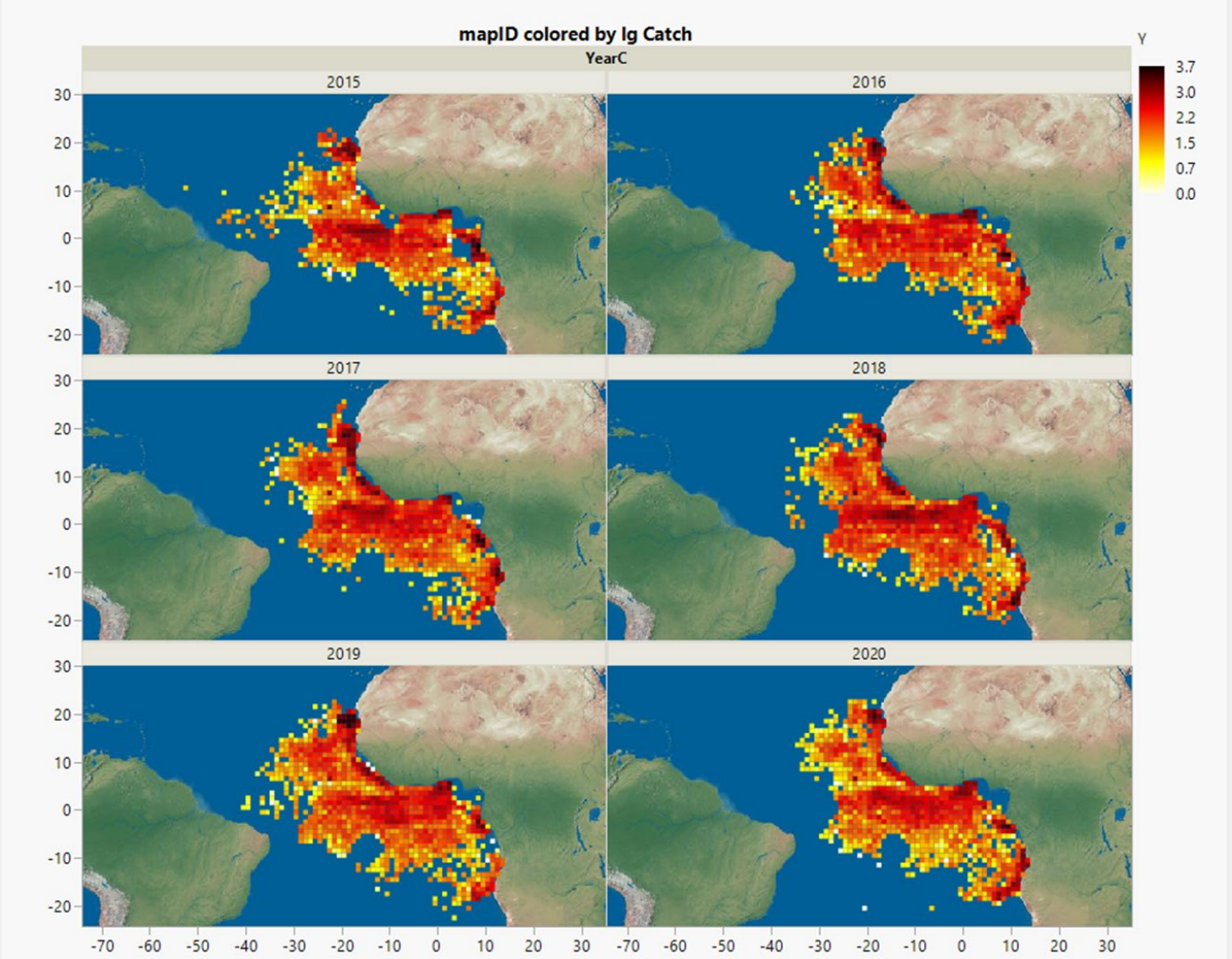




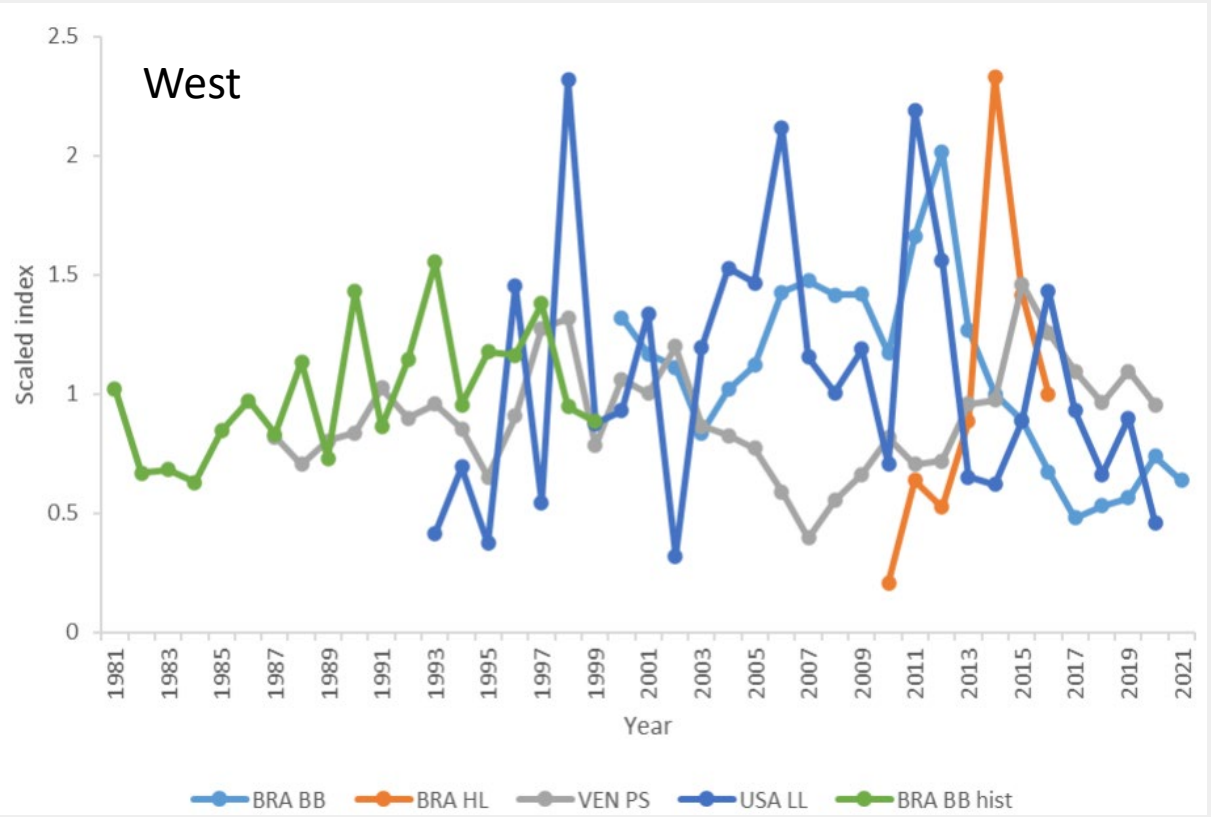


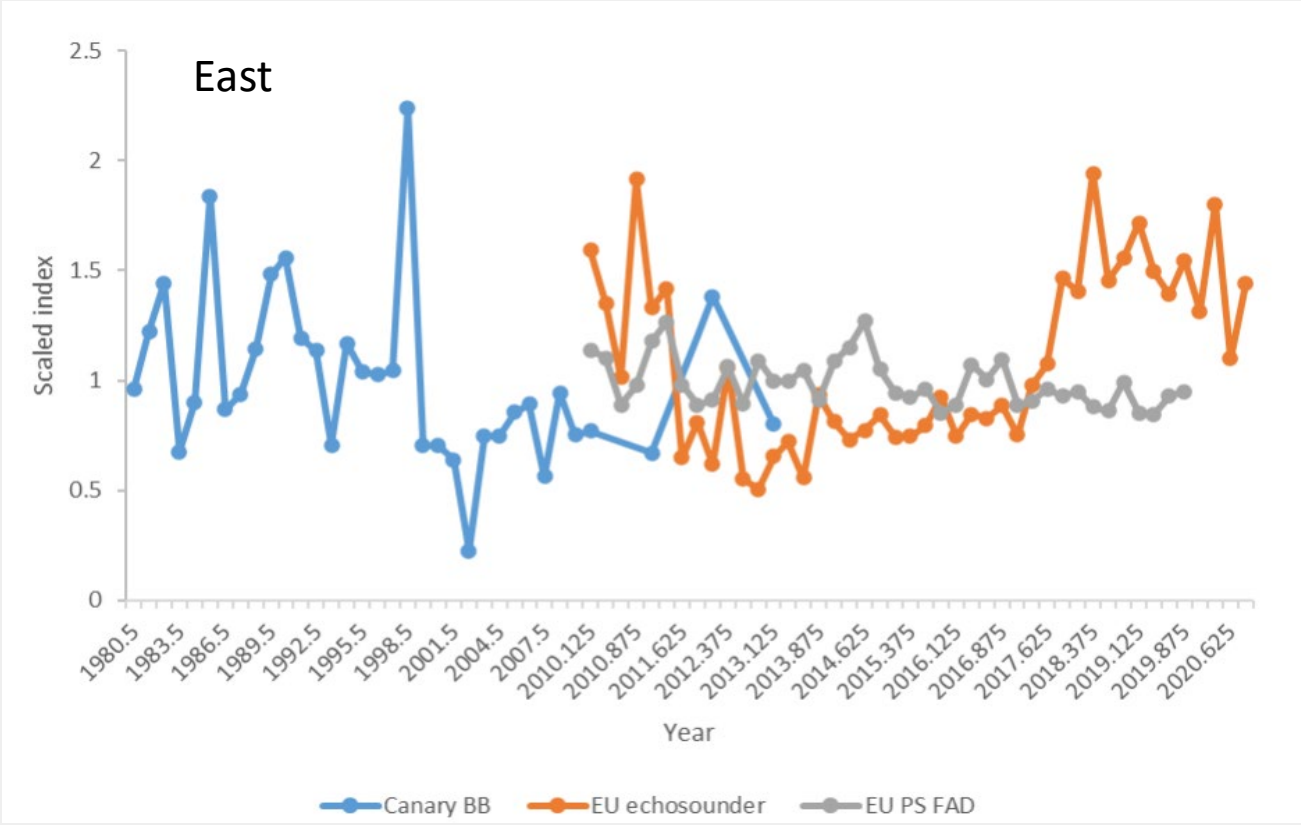
Spatial distribution of SKJ for the PS fisheries

Annual Purse Catches of SJK 2015-2020.



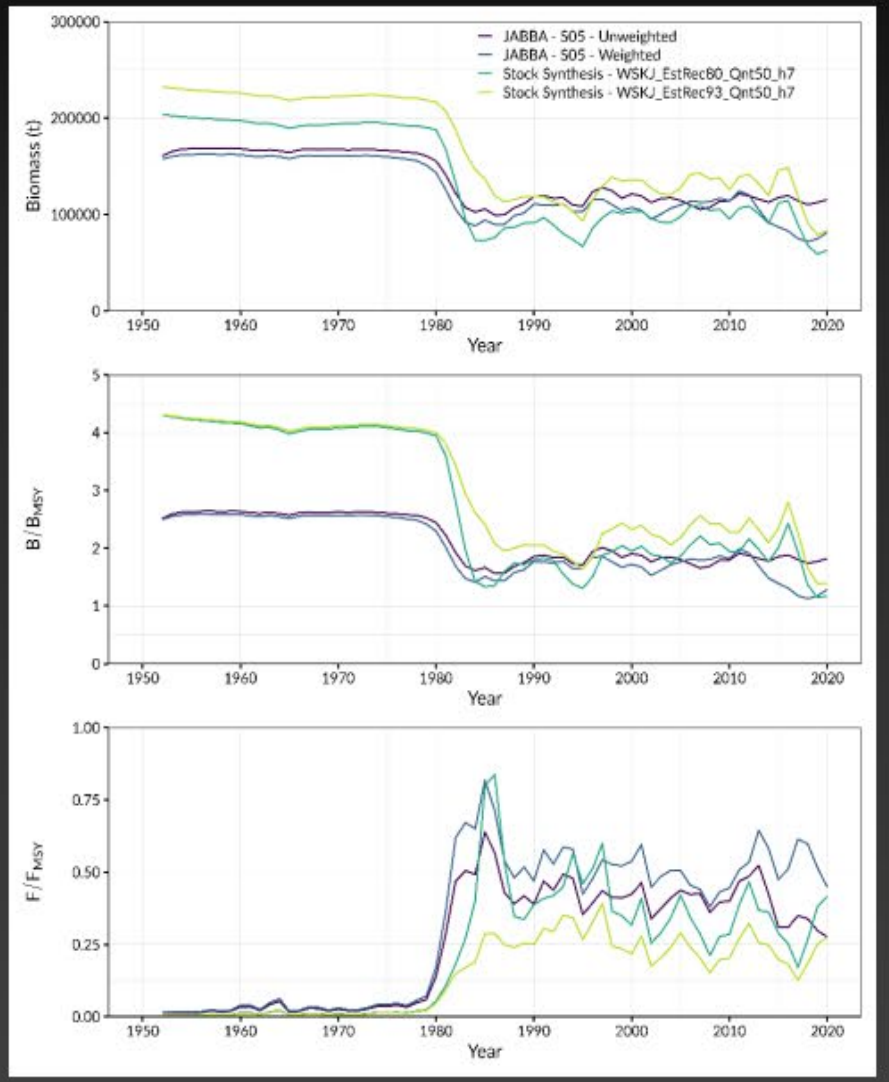
Skipjack Tuna – Indices of Abundance (West – East)



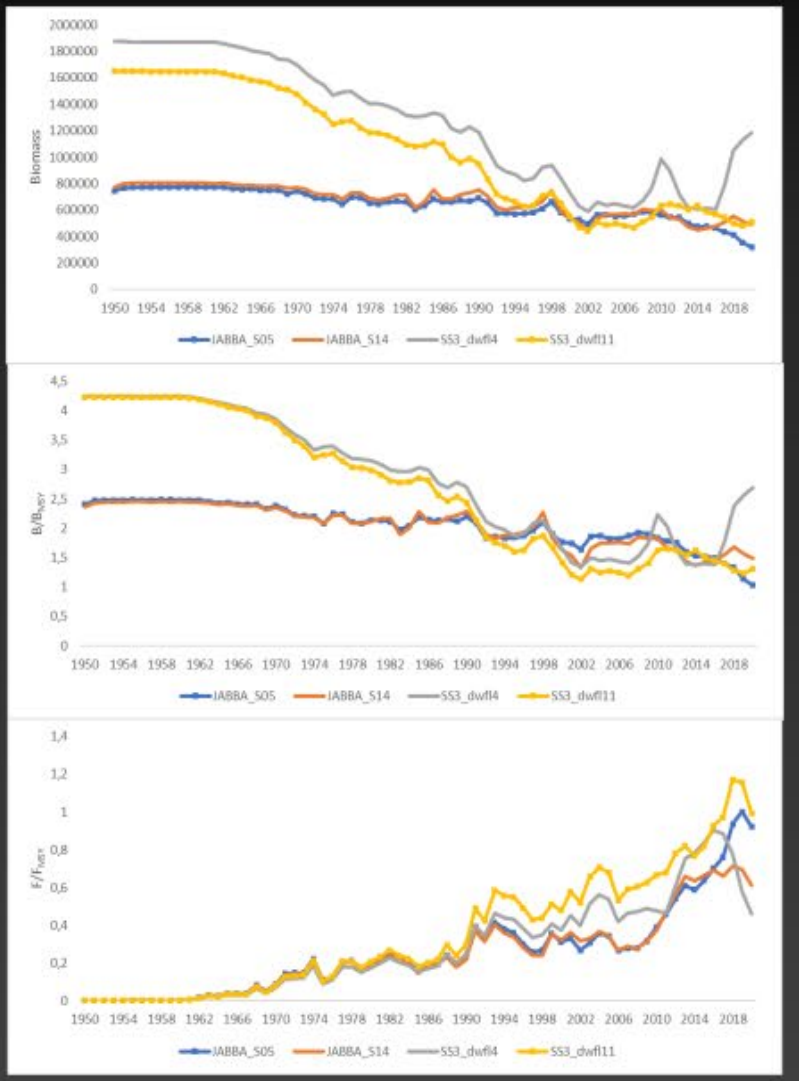


Stock Assessment

Western Skipjack

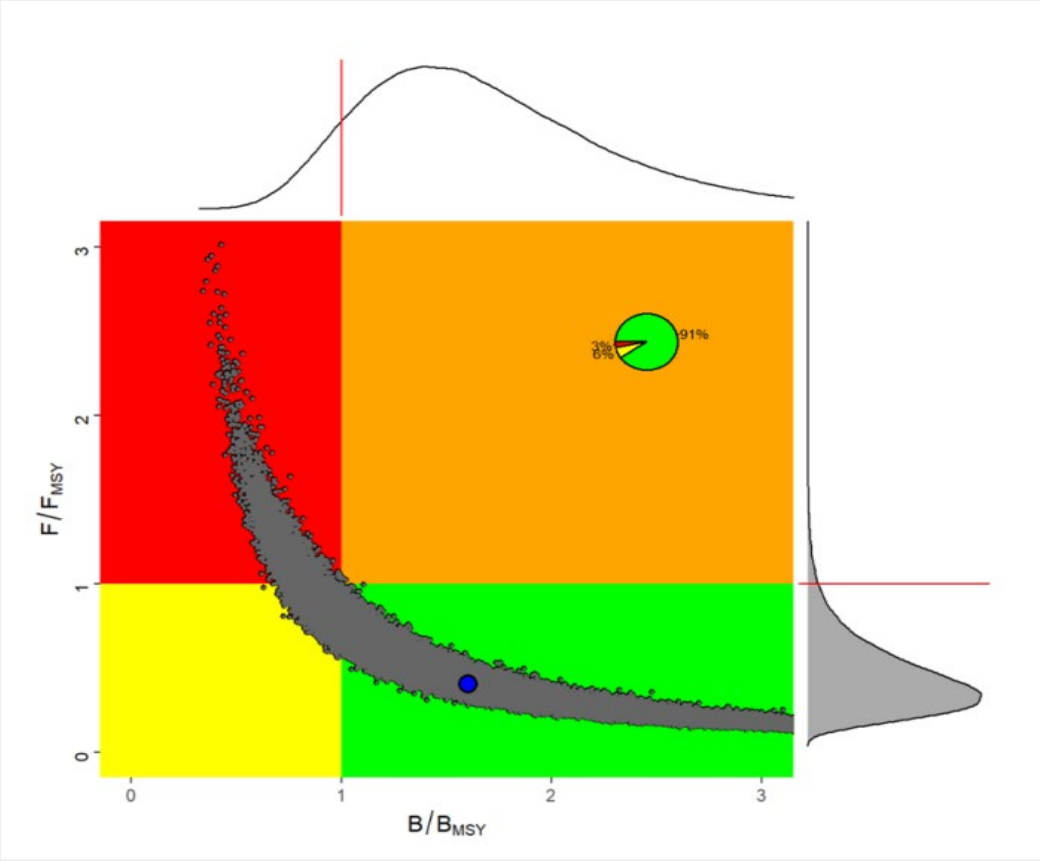


Eastern Skipjack

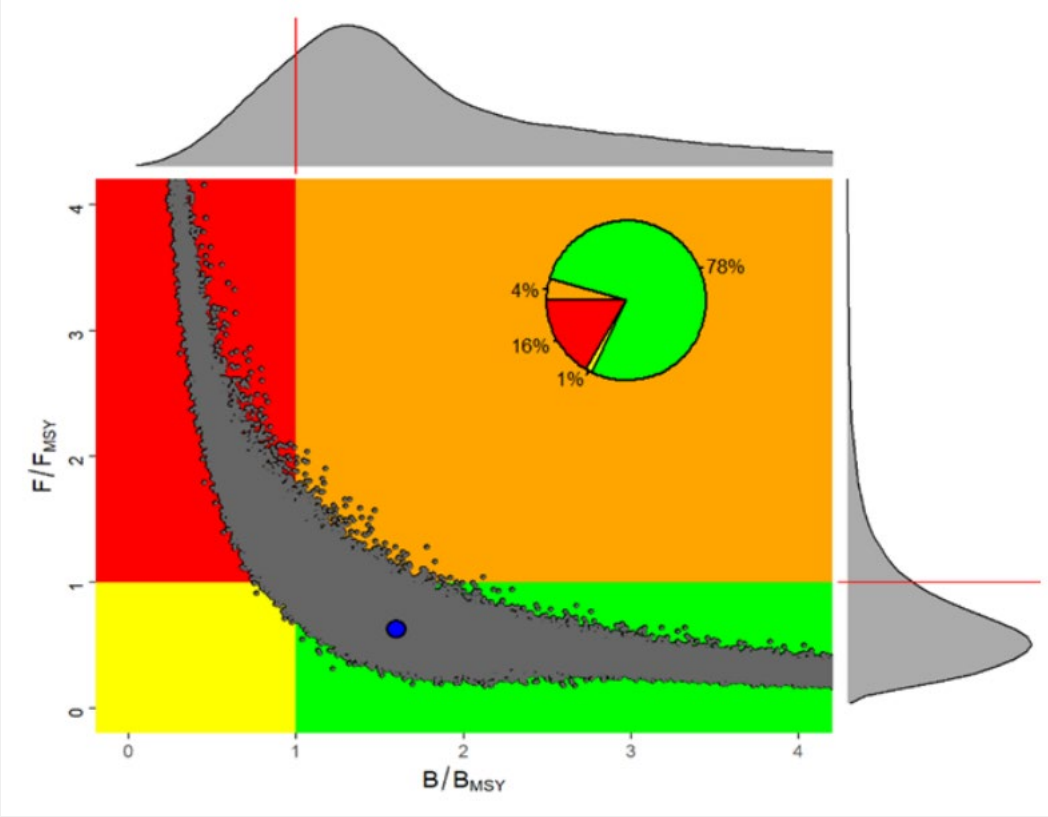


Kobe Phase Plots as of 2020

Western Skipjack



Eastern Skipjack.



TAC Probability combined F<Fmsy and B>Bmsy

Western Skipjack

Probability $F<=F_{MSY}$ and $SSB>=SSB_{MSY}$

TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	99%	100%	100%	100%	100%	100%
18	99%	100%	100%	100%	100%	100%
20	99%	100%	100%	100%	100%	100%
22	99%	99%	100%	100%	100%	100%
24	99%	99%	99%	99%	100%	100%
26	98%	98%	98%	99%	99%	99%
28	97%	97%	97%	97%	97%	97%
30	96%	95%	94%	93%	93%	92%
32	94%	92%	91%	89%	87%	85%
33	93%	91%	88%	86%	83%	80%
34	92%	89%	86%	82%	79%	75%
MSY → 35	91%	87%	83%	78%	74%	70%
36	90%	85%	80%	75%	70%	65%
38	88%	81%	74%	67%	61%	56%
40	85%	76%	67%	59%	53%	48%

Eastern Skipjack.

Probability $F<=F_{MSY}$ and $SSB>=SSB_{MSY}$ or $B>=B_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	82%	88%	91%	92%	93%	93%
110	82%	88%	90%	92%	92%	93%
120	81%	87%	90%	91%	92%	92%
130	81%	86%	89%	90%	91%	92%
140	81%	85%	88%	89%	90%	91%
150	80%	84%	86%	88%	89%	90%
160	79%	83%	84%	86%	87%	88%
170	79%	81%	83%	84%	84%	85%
180	78%	79%	80%	80%	81%	81%
190	77%	77%	77%	77%	76%	75%
200	76%	75%	74%	72%	70%	68%
MSY → 210	75%	72%	70%	67%	63%	61%
220	73%	70%	65%	61%	57%	55%
230	71%	66%	60%	55%	51%	48%
240	69%	63%	55%	49%	45%	41%
250	67%	59%	50%	43%	38%	33%
260	65%	54%	45%	37%	31%	25%
270	62%	50%	40%	32%	24%	17%
280	60%	46%	34%	26%	17%	10%
290	58%	41%	30%	19%	10%	8%
300	55%	38%	25%	13%	7%	6%

Management Recommendations/Summary

- The stock status of the **East Atlantic skipjack tuna** in 2020 was estimated with a high probability (78%) to be in a sustainable condition. A future constant catch of the median MSY (216,617t) will have about 55% probability of maintaining the stock in the green quadrant of the Kobe plot through 2028. However, given the large uncertainty the probability of the stock biomass being below 20% of BMSY in 2028 is about 17%, and the probability of stock biomass being below 10% in 2028 was about 14%.

  The **Western Atlantic skipjack stock** in 2020 was estimated with a high probability (91%) to be in healthy condition. A future constant catch of the median MSY(35,277t) will have about 70% probability of maintaining the stock in the green quadrant of the Kobe plot by 2028. Assuming a constant catch at MSY, the probabilities of the stock biomass being below 20% or 10% of the BMSY until 2028 are less than 1%.
- The Committee reminds the Commission that catches of SKJ will have an impact on juvenile BET and YFT, especially in the purse seine FOB fisheries.
- Results of the candidate Management Procedures (CMPs) of the western Atlantic skipjack tuna MSE to will be presented the Commission for their consideration for MP adoption in line with the MSE Road Map (later in presentation)

Proposal for a Tropical Tuna Research and Data Collection Programme

The SCRS proposes to pursue a coordinated, comprehensive multi-year research programme on Atlantic tropical tuna to advance knowledge of yellowfin tuna, bigeye tuna and skipjack stocks and be able to provide more accurate scientific advice to the Commission.

This proposal's main objective is to improve the current knowledge on the bio-ecology and fisheries for Atlantic tropical tunas stocks, providing important information and more accurate scientific advice to the Commission and building on research undertaken during the Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP).

The research component of the Programme will be focused on a number of themes which will include biology, ecology and monitoring stock status, with planning developed for a 6-year period (initially 2024-2029). This plan will be reviewed annually to ensure that research items and priorities are kept up to date based on the latest stock assessments, management strategy evaluation (MSE) roadmap and any climate change work plan.

The table is provided in the SCRS Report summarizing the identified research themes, topics, and items by Species including initial prioritization.

Tropical Tunas Workplan for 2024

(Background)The most recent stock assessment for yellowfin tuna was conducted in 2019 using catch and effort data through 2018. Note that catch reports for 2018 were very incomplete at the time of the stock assessment meeting, (and 2018 size data were not available, contributing to additional uncertainty in the results) .

The Committee notes that the YFT catches have been above the TAC every year since 2013, averaging nearly 136,400 t. Given that the Committee has expressed concern that catches above 120,000 t are expected to degrade the condition of the yellowfin stock if they continue, the Committee strongly recommends a stock assessment of yellowfin tuna be conducted in 2024

General elements of the TT Workplan include (details in the SCRS Report).

Yellowfin Data Preparatory Meeting

Yellowfin Stock Assessment Meeting

Improvement of basic fishery data

Tropical Tunas Workplan for 2024 (continued)

General elements of the TT Workplan include (details in the SCRS Report):

- Yellowfin Data Preparatory Meeting
- Yellowfin Stock Assessment Meeting
- Improvement of basic fishery data
- Improvement of biological parameters
- MSE
  - Multi-Species MSE
  - W-SKJ MSE
- Responses to the Commission

Tropical Tunas Workplan for 2024 (continued)

- Multi-Species MSE
  - The Committee will adjust performance indicators for the multi-stock MSE based on feedback on operational management objectives obtained from the Commission. Feedback is expected either at the Annual Meeting in 2023, or alternatively after the appropriate meeting of Panel 1 in 2024. Such objectives are essential for a successful multi-stock MSE process as they need to be linked to specific performance indicators used in selecting a management procedure.
  - An external independent contractor will be appointed to review the conditioning of operating model and observational error models developed so far for the multi-stock MSE. TT Officers and the SCRS Chair will develop Terms of reference (TORs) for the contract.
- W-SKJ MSE
  - (If the Commission has adopted a W-SKJ MP in 2023) For the SKJ-W MSE the Committee will start developing guidelines for exceptional circumstances and Climate Change scenarios.

Tropical tuna Funding Requests: 2023 -2024

Tropical Tunas	*2024*	*2025*
Tagging, rewards and awareness		
Tag recovery and maintenance of AOTTP database	15,000	25,000
Biological studies:		
Age and growth	15,000	25,000
Other studies		
MSE		
Western SKJ	25,000	25,000
Multi-stock MSE	50,000	75,000
Independent external review	20,000	
Training workshops for scientists and stakeholders with interpretation	50,000	
TOTAL	**€175,000**	**€150,000**

19.29 Fishing prohibited with FADs, Rec. 22-01 para 28

Background: 1 January to 13 March 2023, throughout the Convention area. This should be reviewed and, if necessary, revised based on advice by the SCRS taking into account monthly trends in free school and FAD-associated catches and the monthly variability in the proportion of juvenile tuna in catches. SCRS should provide this advice to the Commission in 2023.

With the intent to reduce mortality of juvenile tropical tunas, the Commission has established numerous spatial closures to surface fishing gear fishing on FADs in the Gulf of Guinea (Recs. 04-01, 08-01, 11-01, 14-01, 15-01) and the entire Atlantic 19-01, 22-01). The Committee has provided a number of responses to the Commission evaluating the efforts by the Commission to reduce juvenile mortality using measures that include, but are not limited to temporal-spatial closures. Last year) the Committee used statistics available at the Secretariat to prepare a comprehensive response that described the current state of knowledge regarding the monthly proportion of catches of juvenile tropical tunas in the floating objects (FOB) fisheries. It was not possible to update this analysis because the catch-at-size data is not yet available (as it is generally only prepared for stock assessments). However, the information is still relevant.

With regard to the stated objective to reduce juvenile mortality, there is evidence that catches of juvenile bigeye tuna have declined in recent years (Figure 19.29.1A). Current information suggests that the catches of juvenile bigeye in 2020 were the lowest since the mid-2000s, although the cause of that decline cannot yet be attributed fully to the current moratorium as COVID was a confounding factor. In contrast, catches of juvenile yellowfin tuna have increased significantly in recent years, and were at or near their historic high in 2020 (Figure 19.29.1B). The increases in the fraction of the total catches of yellowfin tuna that are taken on FOBs. (Figure 19.29.2) originates from a combination of both increased catches on FOB, drops in the catches of other gears, and the increase of large-scale purse seiners operating in the Atlantic. Together, bigeye tuna and yellowfin tuna account for 20-30% of all tropical tuna caught in FOB sets, in which skipjack tuna is the target. The majority of those catches of yellowfin tuna and bigeye tuna on FOB sets are of juvenile fish. Catches of these juvenile fish are much lower on free school sets (Table 19.29.1).

19.29 Fishing prohibited with FADs, Rec. 22-01 para 28 (continued)

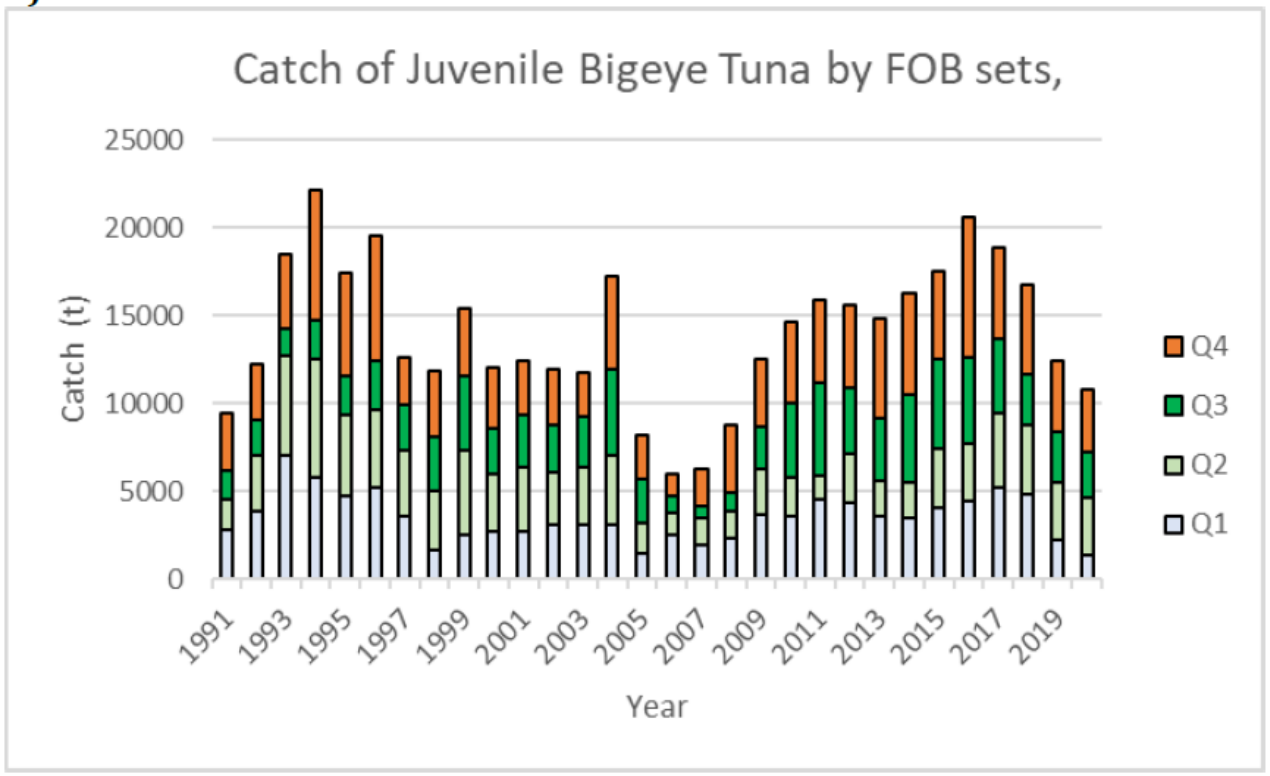
The Committee also notes that a new approach is available to identify spatiotemporal "hot-spots" where catches of juvenile bigeye and yellowfin tuna are particularly high. This approach could be useful to optimize the geographic and temporal scales of alternative moratoria. However, the Committee recognizes that juvenile yellowfin and bigeye tuna are present in the tropical regions of the eastern Atlantic Ocean throughout the year, so moratoria will not achieve their full potential if fishing effort increases or is simply redistributed to other months or areas not included in the moratoria that also contain high numbers of juvenile fish. The Committee also reiterates, that increasing harvest of juvenile fish reduces the overall MSY (Response 19.4; 2018 SCRS Report).

Table 19.29.1. Percent juvenile catch (t) by quarter for bigeye and yellowfin tuna caught in free school (FSC) and FOB sets for the period 2010-2020. Percentages were calculated from the catch at size data used in the latest assessment by considering that juveniles were fish of a size smaller than the size of a 3-year-old.

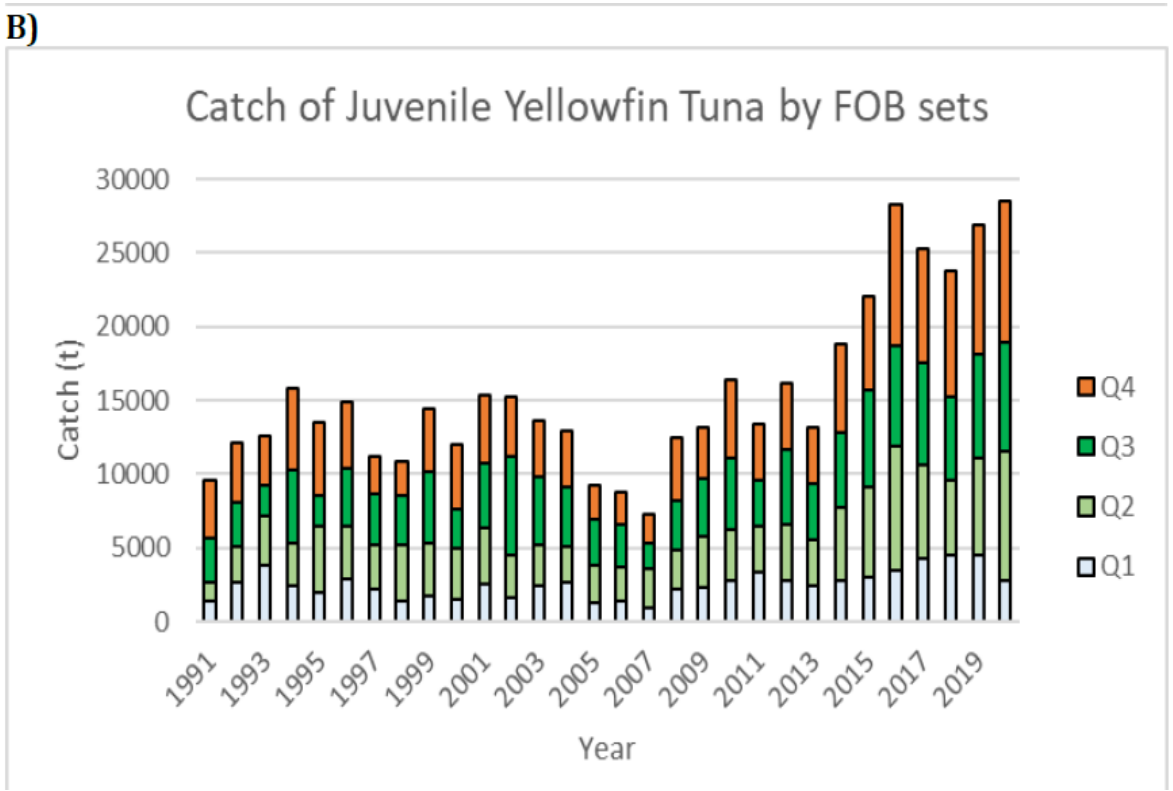
Fishing mode/ species	*Quarter 1*	*Quarter 2*	*Quarter 3*	*Quarter 4*
BET FOB	83.5%	82.9%	82.1%	84.4%
YFT FOB	62.7%	65.6%	67.5%	71.0%
BET FSC	15.2%	16.4%	18.2%	22.0%
YFT FSC	1.6%	2.3%	3.2%	4.9%

19.29 Fishing prohibited with FADs, Rec. 22-01 para 28 (continued)

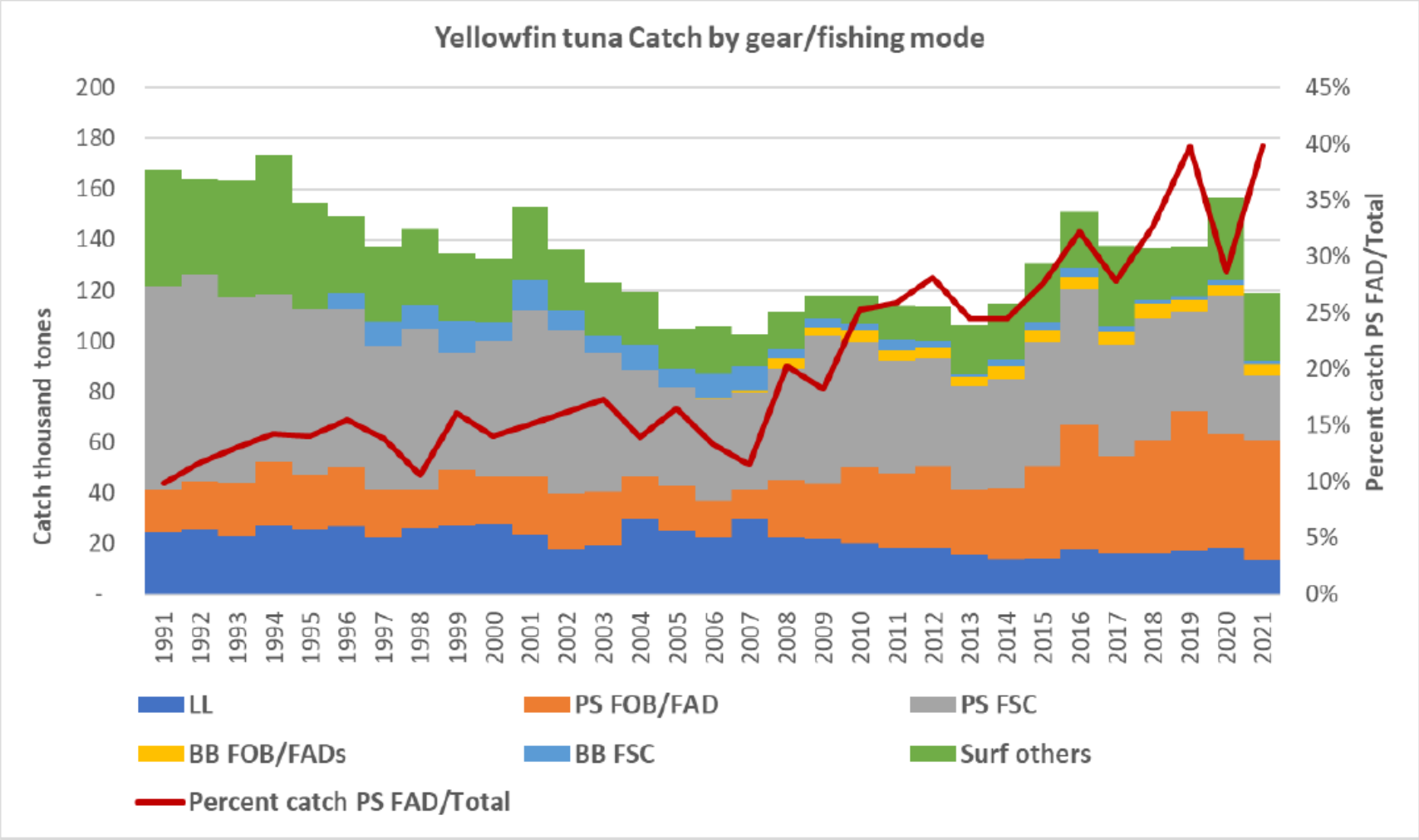
A)



B)



19.29 Fishing prohibited with FADs, Rec. 22-01 para 28 (continued)



Response to the Commission

19.30 The SCRS to inform on CPCs that have provided by 31 July 2023 the required historical FAD set data, Rec. 22-01 para 31
Background: With a view to establishing FAD set limits to keep the catches of juvenile tropical tunas at sustainable levels, in 2023 SCRS should inform the Commission about the maximum number of FAD sets which should be established per vessel or per CPC. To support this analysis, CPCs with purse seine vessels shall urgently undertake to report to the SCRS by 31 July 2023 the required historical FAD set data in the format required by SCRS (Task 2 catch and effort through Form ST03-T2CE) for a minimum of the last five years. CPCs that do not report these data in accordance with this paragraph shall be prohibited from setting on FADs until such data have been received by the SCRS.

In addition, each CPC with purse seine fishing vessels is encouraged not to increase its total fishing effort on FADs from its 2018

In 2021 the Committee provided a summary of the challenges faced by the Committee to provide an answer to this request (Report of Biennial Period, 2022-23). New information has been received recently from CPCs and is now uploaded to the ICCAT databases.

The SCRS/2023/175 document summarizes the current data on Floating object (FOB)/ Fish Aggregating Devices (FADs) deployments, that includes the historical data submissions by CPCs during the last years as requested by the Commission. Table 19.30.1 shows a summary of the total catch (t) by main flag from purse seine (PS) fleets on FOB/FADs (from Task 2 CE) and the corresponding number of FOB/FADs deployed as reported in ST08-FADsDep statistical form. For the main PS fleets, historical data has been submitted from 2014/2015 onwards, however there is some information missing in recent years. Albeit not fully complete, the SCRS considers the current data is the best available data and acknowledges that the historical data does not have the detail information required in ST08 or ST03 T2-CE.

19.30 The SCRS to inform on CPCs that have provided by 31 July 2023 the required historical FAD set data, Rec. 22-01 para 31 (continued)

The Committee reiterates that the data provided on FADs is not sufficient to address the specific analyses requested by the Commission "the maximum number of FAD sets which should be established per vessel or per CPC". Because in order to carry out these analyses it will require to have both the catch associated with each FAD set and or deployed by vessel, and the overall number of sets by vessel during a given time period (fishing effort). Document SCRS/2023/175 also provided the summary of the annual fishing effort units reported by CPCs and the corresponding total tropical tunas catch on FAD or Free Schools (FCS) fishing modes (Table 19.30.2). As requested by the Commission, since 2018 most of the PS tropical tuna fleets have been reporting fishing effort in units of number of sets (or number of successful sets). Unfortunately, the CPCs stop reporting fishing effort in units of days fishing and as a consequence these two units of effort are not comparable, precluding a comprehensive analysis of catch rates for FAD fishing operations.

The Secretariat informed that current ICCAT data for tropical tunas does not have catches for a single vessel unit or by FAD. Catch Task 2 CE is reported at a resolution of 1 month and 1x1 degree, but not disaggregated by vessel or FAD-associated vessel fishing activity, therefore it is not possible to associate catches and number of sets by vessel. This detailed information and resolution would be only available at the national level likely from the vessel logbook forms. Therefore, the Committee recommends that national scientists perform for vessels fishing on FADs an analysis of the per vessel catch rates of tropical tunas on FADs and present it to the SCRS for their evaluation.

19.30 The SCRS to inform on CPCs that have provided by 31 July 2023 the required historical FAD set data, Rec. 22-01 para 31 (continued)

Table 19.30.1. Summary of the total tropical tunas catch (t) by flag-year from PS fisheries on FOB/FADs (Task 2 CE) and the corresponding total number of FOB/FADs deployed as reported in ST08-FADsDep form (yellow highlighted lines).

GearCode PS
Catch t per year/flag of PS on FAD
Number of FOBs deployed by year and Flag

FishMode	Flag	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
FAD	Belize	2,310	2,117	-	3,067	6,114	4,565	7,071	-	28,221	23,959	26,081	25,548	38,212
					-	-	-	-	-	-	4,539	1,663	2,746	-
	Cape Verde	7,140	10,202	6,333	9,866	22,122	21,946	13,255	7,392	7,680	5,728	5,082	606	-
					-	-	-	-	-	-	110	106	441	-
	Côte d'Ivoire	-	-	288	-	2,705	-	-	-	-	-	-	-	-
	Curaçao	14,830	17,574	17,564	19,292	22,340	24,332	28,956	25,644	25,889	20,827	15,686	17,451	5
					-	-	-	-	-	1,958	2,485	2,242	1,675	1,597
	El Salvador	-	-	-	-	-	7,865	23,403	17,197	19,951	21,623	19,513	13,237	15,645
					-	-	-	-	-	868	980	700	1,467	1,656
	EU-España	42,801	44,117	56,534	63,033	52,545	48,642	52,831	59,572	41,980	43,963	33,183	43,792	39,245
					-	-	-	6,232	6,159	7,622	7,782	4,731	4,565	3,843
	EU-France	15,932	13,305	16,677	16,989	20,998	23,222	21,905	21,702	24,307	23,391	15,281	21,089	27,106
					43	1,343	1,396	1,783	2,444	4,970	4,255	3,578	2,390	3,071
	Ghana	29,553	24,608	47,896	44,900	52,044	66,641	58,760	66,529	79,709	79,316	76,584	-	-
					-	9,100	-	17,600	24,825	-	-	-	-	-
	Guatemala	3,911	3,198	4,871	5,447	6,296	10,463	8,393	11,417	10,580	9,341	7,951	7,094	8,510
					-	-	-	-	-	2,658	-	436	403	262
	Guinée Rep	-	-	12,883	9,415	6,680	-	-	-	-	-	-	1,364	5,880
					-	-	-	-	-	-	-	-	-	198
	Maroc	-	-	-	-	-	-	-	-	-	-	405	855	1,137
					-	-	-	-	-	-	-	-	2	162
	NEI (ETRO)	348	-	-	-	-	-	-	-	-	-	-	-	-
	Panama	13,927	19,212	13,215	18,051	18,783	11,257	16,203	11,854	9,541	13,836	12,671	13,246	17,705
					-	-	-	-	-	2,287	3,413	4,201	3,759	2,409
	Senegal	-	-	-	-	-	4,953	18,002	32,019	38,943	44,227	35,051	33,784	-
					-	-	-	312	455	630	1,144	1,181	1,786	-
TOTAL Catch t		130,751	134,333	176,261	190,061	210,628	223,885	248,779	253,327	286,799	286,211	247,487	178,065	153,446
Total Number FOBs deployed		-	-	-	43	10,443	1,396	25,927	33,883	20,993	24,708	18,838	19,234	13,198

19.30 The SCRS (continued)

Table 19.30.2. Summary of the current Task 2 CE data for tropical tunas fleets by flag, fleet code, fishing mode (FOB/FAD, FSC Free schools, or unknown (n/a)) since 2010. Highlighted cells indicate reports of fishing effort type in number of set (NO.SETS) or number of successful sets (SUC.SETS), the values in the table indicate the actual total catch (t) of the three main species (BET, YFT, SKJ). Other acronyms: D.FISH number of days fishing, HOURS.SEA number of hours at sea.

Sum of Total T					YearC												
Flag	FleetCode	FishMode	Eff1Type	Eff2Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Belize	BLZ-BZ-ETRO	FAD	FISH.HOUR	HOURS.SEA	2,310	2,117		3,067	6,114	4,565	7,071						
			NO.SETS	D.FISH									28,221	23,959	26,081	25,548	38,212
		FSC	FISH.HOUR	HOURS.SEA	1,906	1,488		5,246	3,251	2,948	2,068						
			NO.SETS	D.FISH									2,430	4,886	3,212	684	811
		n/a	NO.SETS	D.FISH								17,115					
Cape Verde	CPV-CV-ETRO	FAD	FISH.HOUR	HOURS.SEA	7,140	10,202	6,333	9,866	22,122	21,946	13,255	7,392	7,680	5,728	5,082		
			NO.SETS	(blank)												606	
		FSC	FISH.HOUR	HOURS.SEA	3,208	3,000	2,246	3,761	2,854	5,164	3,236	1,391	4,758	2,610	5,438		
			NO.SETS	(blank)												868	
Côte d'Ivoire	CIV-CI-ETRO	FAD	D.AT SEA	(blank)			288										
			FISH.HOUR	HOURS.SEA					2,705								
		FSC	FISH.HOUR	HOURS.SEA					2								
		n/a	NO.SETS	D.AT SEA				3,743									
Curaçao	CUW-CW-ETRO	FAD	FISH.HOUR	HOURS.SEA	14,830	17,574	17,564	19,292	22,340	24,332							
			NO.SETS	SUC.SETS							28,956	25,644	25,889	20,827	15,686	17,451	
				(blank)													5
		FSC	FISH.HOUR	HOURS.SEA	3,283	2,457	5,159	4,672	5,095	5,321							
			NO.SETS	SUC.SETS							5,765	6,025	11,172	8,255	6,858	5,745	
				(blank)													3
El Salvador	SLV-SV-ETRO	FAD	FISH.HOUR	HOURS.SEA						7,865							
			NO.SETS	SUC.SETS							23,403	17,197	19,951	21,623	19,513	13,237	15,645
		FSC	FISH.HOUR	HOURS.SEA						519							
			NO.SETS	SUC.SETS							2,525	6,300	6,379	3,469	6,653	4,944	4,470
EU-España	EU.ESP-ES-ETRO	FAD	FISH.HOUR	HOURS.SEA	42,801	44,117	56,534										
			NO.SETS	FISH.HOUR				63,033	52,545	48,642	52,831	59,572	41,980	43,963	33,183	43,792	39,245
		FSC	FISH.HOUR	HOURS.SEA	22,440	12,992	17,519										
			NO.SETS	FISH.HOUR				12,737	9,666	17,654	16,715	6,501	14,077	13,872	14,967	6,020	8,346
EU-France	EU.FRA-FR-ETRO	FAD	FISH.HOUR	NO.SETS	15,932	13,305	16,677	16,989	20,998	23,222	21,905	21,702	24,307	23,391	15,281	21,089	27,106
		FSC	FISH.HOUR	NO.SETS	21,433	23,685	17,323	22,356	22,055	19,805	26,774	24,028	26,908	19,086	15,029	10,204	15,784
Ghana	GHA-GH-ETRO-A	FAD	NO.SETS	SUC.SETS	28,668	22,850	23,142	16,321	15,386	20,432	19,255	17,429	27,551	37,148	38,413		
		FSC	NO.SETS	SUC.SETS	3,665	2,298	2,910	1,496	1,151	222	404	105	99	209	76		
	GHA-GH-ETRO-P	FAD	NO.SETS	SUC.SETS	**885**	1,758	24,755	28,579	36,658	46,209	39,506	49,101	52,158	42,168	38,171		
		FSC	NO.SETS	SUC.SETS	50	3	1,511	2,368	3,103	1,487	613	85	65	170	282		
Guatemala	GTM-GT-ETRO	FAD	FISH.HOUR	HOURS.SEA	3,911	3,198	4,871	5,447	6,296	10,463	8,393	11,417	10,580	9,341	7,951	7,094	
			NO.SETS	SUC.SETS													8,510
		FSC	FISH.HOUR	HOURS.SEA	2,805	2,376	2,771	3,259	3,665	1,702	3,022	3,869	2,504	3,246	2,252	1,722	
			NO.SETS	SUC.SETS													3,875
Guinée Rep	GIN-GN-ETRO	FAD	D.FISH	(blank)												1,364	
			FISH.HOUR	HOURS.SEA			12,883	9,415	6,680								
			SUC.D.FI	(blank)													5,880
		FSC	FISH.HOUR	HOURS.SEA					764								
			SUC.D.FI	(blank)													1,201
Maroc	MAR-MA-ETRO	FAD	D.FISH	(blank)													
			NO.SETS	(blank)											405	855	1,138
NEI (ETRO)	NEI.001	FAD	FISH.HOUR	HOURS.SEA	348												
		FSC	FISH.HOUR	HOURS.SEA	40												
Panama	PAN-PA-ETRO	FAD	FISH.HOUR	HOURS.SEA	13,927	19,212	13,215	18,051	18,783	11,257							
			NO.SETS	SUC.SETS							16,203	11,854	9,541	13,836	12,671	13,246	17,705
		FSC	FISH.HOUR	HOURS.SEA	3,432	1,456	4,885	3,687	3,858	2,377							
			NO.SETS	SUC.SETS							2,998	5,120	5,441	4,479	8,334	8,015	9,308
Senegal	SEN-SN-ETRO	FAD	NO.SETS	FISH.HOUR						4,953	18,002	32,019	38,943	44,227	35,051	33,784	
		FSC	NO.SETS	FISH.HOUR						473	2,343	1,460	5,130	3,002	6,031	6,839	
TOTAL					193,012	184,088	230,585	253,385	266,093	281,557	315,241	325,326	365,761	349,494	316,619	223,106	196,106

Response to the Commission

19.31 Further analysis shall be conducted by the SCRS on the impact of support vessels on the catches of juvenile yellowfin and bigeye tuna to be considered in 2023, Rec. 22-01 para 33
Background: Further analysis shall be conducted by the SCRS on the impact of support vessels on the catches of juvenile yellowfin and bigeye tuna to be considered in 2023.

The Committee provided a partial response to this request in 2021. The Committee provided some additional information on support vessels in Restrepo et al. (2022) by comparing the list of support vessels in the International Seafood Sustainability Foundation (ISSF) ProActive Vessel Register and the ICCAT record but was unable to determine which support vessels were active.

The Committee will endeavor to determine in 2024 the information it requires and the type of analysis to be conducted to answer the request of the Commission. The Committee is unable to provide a final response to this request from the Commission.

Response to the Commission

19.32 The SCRS shall refine the MSE process in line with the SCRS roadmap and continue testing the candidate management procedures, Rec. 22-01 para 62

Background: The SCRS shall refine the MSE process in line with the SCRS roadmap and continue testing the candidate management procedures. On this basis, the Commission shall review the candidate management procedures, including pre-agreed management actions to be taken under various stock conditions. These shall take into account the differential impacts of fishing operations (e.g., purse seine, longline and baitboat) on juvenile mortality and the yield at MSY.

A new roadmap of the MSE process was adopted at the 23rd Special Meeting of the Commission in 2022 and was posted to the ICCAT website. Since the roadmap was adopted the SCRS has advanced its work as follows:

–

Continuation of the capacity building program to enhance the ability of scientists and managers from ICCAT CPCs to participate in the tropical tuna MSE process. In June 2023 a one-day tri-lingual training course on MSE for tropical tunas was delivered to 38 scientists from 14 different CPCs. A similar online course for ICCAT managers will be delivered in October 2023. The 2023 courses follow similar courses delivered in 2022 for Spanish and Portuguese speaking CPCs scientists and managers.

–

Progress in the western skipjack (SKJ-W) stock MSE has followed the roadmap calendar and is described elsewhere in section 15.4 of this report.

–

Progress on the Multi-stock MSE has been primarily related to the continued development of operating and observational error models and is summarized elsewhere in section 15.5 of this report.

19.32 The SCRS shall refine the MSE process in line with the SCRS roadmap and continue testing the candidate management procedures, Rec. 22-01 para 62 (continued)

Given the above progress, the SCRS proposes the following changes to the roadmap for the multi-stock MSE:
For the 2023 section on SCRS development add:
- Developing operating and observational error models
- Capacity building workshops

For the 2024 section on SCRS development add:
- External peer review of Observation and Operating models
- Meetings of MSE Technical Sub-Group

Initial development of candidate management procedures (CMPs) and testing of management procedures (MPs)
- Capacity building workshops

For 2025 and beyond section on SCRS development add:
- Presentation of MSE results to Panel 1
- SCRS to finalize MSE results, incorporating feedback from the Commission through Panel 1
- Capacity building workshops

The SCRS proposes the following change to the SKJ-W MSE roadmap:
- For 2024 develop climate change scenarios to test robustness of CMPs
- The revised roadmap is also included under section 13.4 of this report.

Response to the Commission

19.33 Efficacy that full fishery closures along the lines of those proposed in PA1_505A/2019, Rec. 22-01 para 66a
Background: Actions required from the SCRS and the Secretariat:
a) The SCRS shall explore the efficacy that full fishery closures along the lines of those proposed in PA1-505A/20191 might have to reduce the catches of tropical tunas to the agreed levels; and the potential of such scheme to reduce the catches of juvenile bigeye and yellowfin tunas, in line with recommendations from the SCRS;

The Committee concluded in 2022 that work previously conducted on the evaluation of full fishery closures by Sharma and Herrera (2019) and Herrera et al. (2020) made appropriate assumptions about the dynamics of the tropical tuna stocks. To further refine these approaches, the Committee recommended that these evaluations be updated with the most current information available on catch, effort, biomass, biological parameters, etcetera.

The Committee also noted that recent analyses continue to highlight the influence of spatial closures and access agreements to the EEZ of coastal countries on the relationship between the catch of tropical tunas and the effort of the purse seine fishery. This suggests that the predictions of the catch of tropical tunas obtained from total purse seine effort will have considerable uncertainty as long as operations of the fishery respond to changes in access rights and or to changes in the spatial distribution of the stocks. It is therefore essential that any evaluation of total effort closures is accompanied by estimates of the uncertainty of the prediction that account for such potential changes in fleet distribution.

19.33 Efficacy that full fishery closures along the lines of those proposed in PA1_505A/2019, Rec. 22-01 para 66a (continued)

During 2023, the Secretariat in collaboration with the othor scientists (Sharma and Herrera) attempted to update the evaluations as requested by the Commission. The authors kindly provided the algorithms and previous analyses, and the Secretariat proceeded with the updates of input data, including biological parameters (new vectors of maturity for YFT and SKJ), catch, effort, catch-at-size time series, and biomass estimates from the latest assessment of BET (2021).

Unfortunately, after the scrutiny of the fishing effort it was noted that for most of the PS tropical tuna fisheries, the CPCs since 2016 have been reported PS fishing effort in units of the number of sets (or the number of successful sets) following the request from the Commission recommendations (see Table 19.30.2 from item 19.30 of this report). As the prior analyses have been performed using fishing effort in units of "fishing hours" it was not possible to find a comparable or equivalent unit of fishing effort for the recent period (2016-2021), precluding the update of the analyses presented in 2019.

In summary, the Committee could not update the analysis. In order to update the analysis, the Committee, therefore recommends that CPCs provide purse seine fishing effort in both units, fishing hours, and the number of sets.

[1] Available upon request from the ICCAT Secretariat or on the 2019 Commission meeting documents webpage.

Response to the Commission

19.34 Estimate of capacity in the Convention area, to include at least all the fishing units that are large-scale or operate outside the EEZ of the CPC they are registered in, Rec. 22-01 para 66b

Background: Actions required from the SCRS and the Secretariat:

b) The ICCAT Secretariat shall work with the SCRS in preparing an estimate of capacity in the Convention area, to include at least all the fishing units that are large-scale or operate outside the EEZ of the CPC they are registered in. All CPCs shall

In 2022, the Committee conducted an analysis of the completeness of active fleet statistics held by the Secretariat for large-scale purse seiners using estimates from Restrepo et al. (2022). This preliminary analysis showed that the number of purse seiners reported as active in the ICCAT database was higher (four more vessels in both years 2020 and 2021) than those reported by Restrepo et al. (2022). Discrepancies were possible due to a variety of factors including double-counting of vessels reflagged that year, and the inclusion of vessels recently sunk/scrapped, inactive vessels and/or smaller vessels. Additional details are available in Restrepo et al., (2022).

Preliminary analyses conducted in 2023 indicate that the situation has not changed much and that the number of large-scale purse seiners targeting tropical tunas remains around 70 to 80. The Committee notes that challenges remain to properly identify active vessels.

19.34 Estimate of capacity in the Convention area, to include at least all the fishing units that are large-scale or operate outside the EEZ of the CPC they are registered in, Rec. 22-01 para 66b (continued)

To overcome these challenges, the Committee recommends the following improvements to ST01-T1FC as mandatory requirements for every vessel:

1) The International Maritime Organisation (IMO) Number or other unique vessel identifier,
2) Information about fishing capacity (fish hold volume in cubic meters, fish carrying capacity in metric tons, or both), and
3) The nominal number of days fished in the previous year for the Atlantic and Mediterranean.

The Committee requests that the Commission should require this information for large-scale vessels in all major fleets and fisheries as this issue is not limited to the tropical tuna purse seine fishery.
The Committee also recommends that the Secretariat review all Recommendations that refer to vessel records so that the required field codes are consistent with ST01.

The Committee also notes that it has not been able to estimate capacity for other fleet components (support, baitboat (BB) and longline (LL) vessels). If the recommended changes to ST01 are adopted, it should become easier to estimate capacity for these fleet components as well.

Response to the Commission

19.36 Development of Management Objectives for SKJ-W MP tested through MSE, Rec 22-02 para 1 and 2
Background:

1. **Management objectives should be established for western Atlantic skipjack tuna consistent with the Convention's objective: to maintain populations at or above levels that will support maximum sustainable catch (usually referred to as MSY).**

2. Panel 1 should undertake, during a 2023 intersessional meeting of Panel 1, the development of initial operational management objectives for western skipjack. To facilitate this development, the following conceptual management objectives should be considered:

a. Stock Status - The stock should have a [XX% or greater] probability of occurring in the green quadrant of the Kobe matrix using a [X]-year projection periods as determined by the SCRS;
b. Safety - There should be no greater than [XX%] probability of the stock falling below BLIM21 at any point during the X-year projection periods;
c. Yield - Maximize overall catch levels in the short (1-3 years), medium (4-10 years) and long (11-30 years) terms; and
d. Stability - Any changes in TAC between management periods should be [XX]% or less.

19.36 Development of Management Objectives for SKJ-W MP tested through MSE, Rec 22-02 para 1 and 2 (continued)

After the Second Intersessional Meeting of Panel 1 (on western skipjack MSE) that took place in May 2023, the Commission had agreed in a threshold value of 70% of Probability of Green Kobe (PGK) for Stock Status; a 10% maximum acceptable probability to the stock falling below BLIM for Safety; a maximum value of 20% for changes in Total Allowable Catch (TAC) for Stability, and; an evaluation of yield performance of Candidate Management Procedures (CMPs) in the short (1-3 years), medium (4-10 years) and long (11-30 years) terms.

A management strategy evaluation (MSE) for western Atlantic skipjack tuna was developed in 2022 following reconditioning on outputs of the 2022 Skipjack Stock Assessment Meeting (Anon., 2022d). The full suite of uncertainties evaluated in the stock assessment was included in the MSE's uncertainty grid of reference operating models. In 2023, the analysis focused on an evaluation of the relative performance of a variety of candidate management procedures across a set of performance metrics regarding the safety, stock status, yield, and stability of western Atlantic skipjack tuna.

Preliminary results, based mainly on the implementation of constant catch and empirical management procedures, were presented to the Second Intersessional Meeting of Panel 1 (on western skipjack MSE) in May 2023. Panel 1 provided feedback, which the SCRS took into consideration when continuing its CMP development work. These new final results are described in document SCRS/2023/169.

Operating Models Structure

Stock Assessment 2022 – W-SKJ

Cardoso et al. (2022)

Kimoto et al. (2022)

	Operating model	Growth vector	Steepness	SigmaR	Scenario
Reference	OM 1	25th	0.6		Perfect TAC implementation
	OM 2	50th			
	OM 3	75th			
	OM 4	25th	0.7		
	OM 5	50th			
	OM 6	75th			
	OM 7	25th	0.8		
	OM 8	50th			
	OM 9	75th			
Robustness 01	OM 10	25th	0.6	0.4	10% overage TAC error implementation
	OM 11	50th			
	OM 12	75th			
	OM 13	25th	0.7		
	OM 14	50th			
	OM 15	75th			
	OM 16	25th	0.8		
	OM 17	50th			
	OM 18	75th			
Robustness 02	OM 19	25th	0.6		20% overage TAC error implementation
	OM 20	50th			
	OM 21	75th			
	OM 22	25th	0.7		
	OM 23	50th			
	OM 24	75th			
	OM 25	25th	0.8		
	OM 26	50th			
	OM 27	75th			

Management Objectives – Performance Metrics

Second Intersessional meeting of Panel 1 on Western Skipjack MSE
(Online, May 5 2023)

Management Objectives (Res. 22-02)	*Proposed Corresponding Performance Metric Statistics*
Status The stock should have a 70% or greater probability of occurring in the green quadrant of the Kobe matrix using a 30-year projection period as determined by the SCRS.	**PGK_{short}**: Probability of being in the Kobe green quadrant (i.e., $SSB \geq SSB_{MSY}$ and $F < F_{MSY}$) in year 1-3 **PGK_{medium}**: Probability of being in the Kobe green quadrant (i.e., $SSB \geq SSB_{MSY}$ and $F < F_{MSY}$) in year 4-10 **PGK_{long}**: Probability of being in the Kobe green quadrant (i.e., $SSB \geq SSB_{MSY}$ and $F < F_{MSY}$) over years 11-30 **PGK:** Probability of being in the Kobe green quadrant (i.e., $SSB \geq SSB_{MSY}$ and $F < F_{MSY}$) over years 1-30 **POF**: Probability of $F > F_{MSY}$ over years 1-30 **PNOF:** Probability of $F < F_{MSY}$ over years 1-30
Safety There should be no greater than 10% probability of the stock falling below B_{LIM} ($0.4*B_{MSY}$) at any point during the 30-year projection period.	**LRP_{short}**: Probability of breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 1-3 **LRP_{medium}**: Probability of breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 4-10 **LRP_{long}**: Probability of breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 11-30 **LRP**: Probability of breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 1-30 **$nLRP_{short}$**: Probability of not breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 1-3 **$nLRP_{medium}$**: Probability of not breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 4-10 **$nLRP_{long}$**: Probability of not breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 11-30 **nLRP**: Probability of not breaching the limit reference point (i.e., $SSB < 0.4*SSB_{MSY}$) over years 1-30
Yield Maximize overall catch levels in the short (1-3 years), medium (4-10 years) and long (11-30 years) terms.	**AvC_{short}** – Median catches (t) over years 1-3 **AvC_{medium}** – Median catches (t) over years 4-10 **AvC_{long}** – Median catches (t) over years 11-30
Stability Any changes in TAC between management periods should be 20% or less.	**$VarC_{medium}$** – Variation in TAC (%) between management cycles over years 4-10 **$VarC_{long}$** – Variation in TAC (%) between management cycles over years 11-30 **Var_{all}** – Variation in TAC (%) between management cycles over years 1-30

Management Objectives

Second Intersessional meeting of Panel 1 o n Western Skipjack MSE
(Online, May 5 2023)

Other decisions:

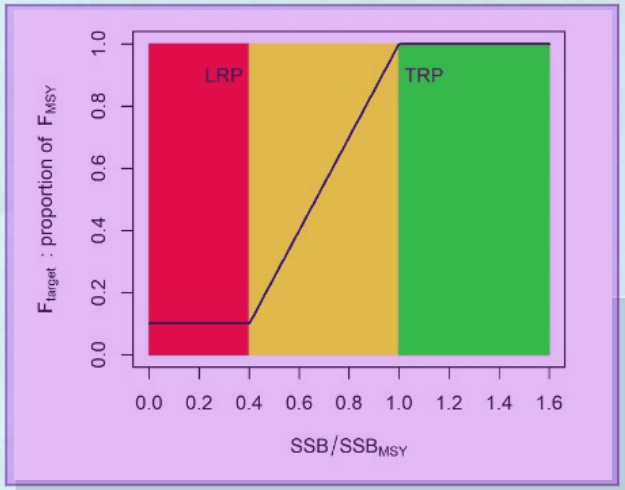
- Management cycle length: 3 years was approved.
- CMP type:
  - Constant catch (CC) and Empirical CMP for comparison only;
  - Model-based CMP for adoption;
- Add climate change robustness test.

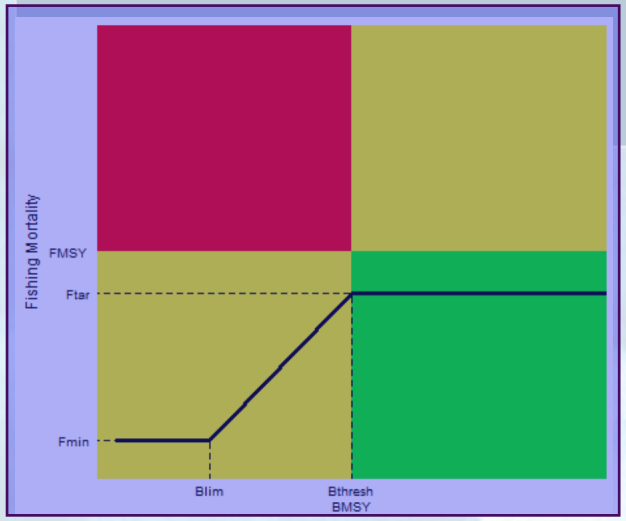
Management Procedures

- **Constant Catch:**
  - CC 20 kt;
  - CC 30 kt;
  - CC 40 kt;
- **Empirical Rule:**
  - GB_slope (Geromont and Butterworth, 2014);
  - Iratio (Jardim et al., 2015);
  - Islope1 (Geromont and Butterworth, 2014; Carruthers et al., 2015);

DEVELOPING CANDIDATE MANAGEMENT PROCEDURES FOR THE WESTERN ATLANTIC SKIPJACK TUNA

Management Procedures – Model Based





- **SCA_100_40_SBMSY** - A statistical catch-at-age model with an 100-40 control rule based on spawning biomass at MSY level and minimum F at 10% of FMSY;
- **SP_100_40_SBMSY** - A surplus production model with an 100-40 control rule based on spawning biomass at MSY level and minimum F at 10% of FMSY;
- **SPSS_100_40_ SBMSY** - A state-space surplus production model with an 100-40 control rule based on spawning biomass at MSY level and minimum F at 10% of FMSY;
- **SP_01** - A surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY with fixed TAC for the 1st management cycle;
- **SP_02** - A state-space surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY with fixed TAC for the 1st management cycle;
- **SP_03** - A surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY without fixed TAC for the 1st management cycle;
- **SP_04** - A state-space surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY without fixed TAC for the 1st management cycle;
- **SP_05** - A surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY without fixed TAC for the 1st management cycle. For this CMP F was set three times larger;
- **SP_06** - A state-space surplus production model with an 100-40 control rule based on spawning biomass at MSY level with associated maximum F at 80% and minimum F at 10% of FMSY without fixed TAC for the 1st management cycle. For this CMP F was set three times larger.

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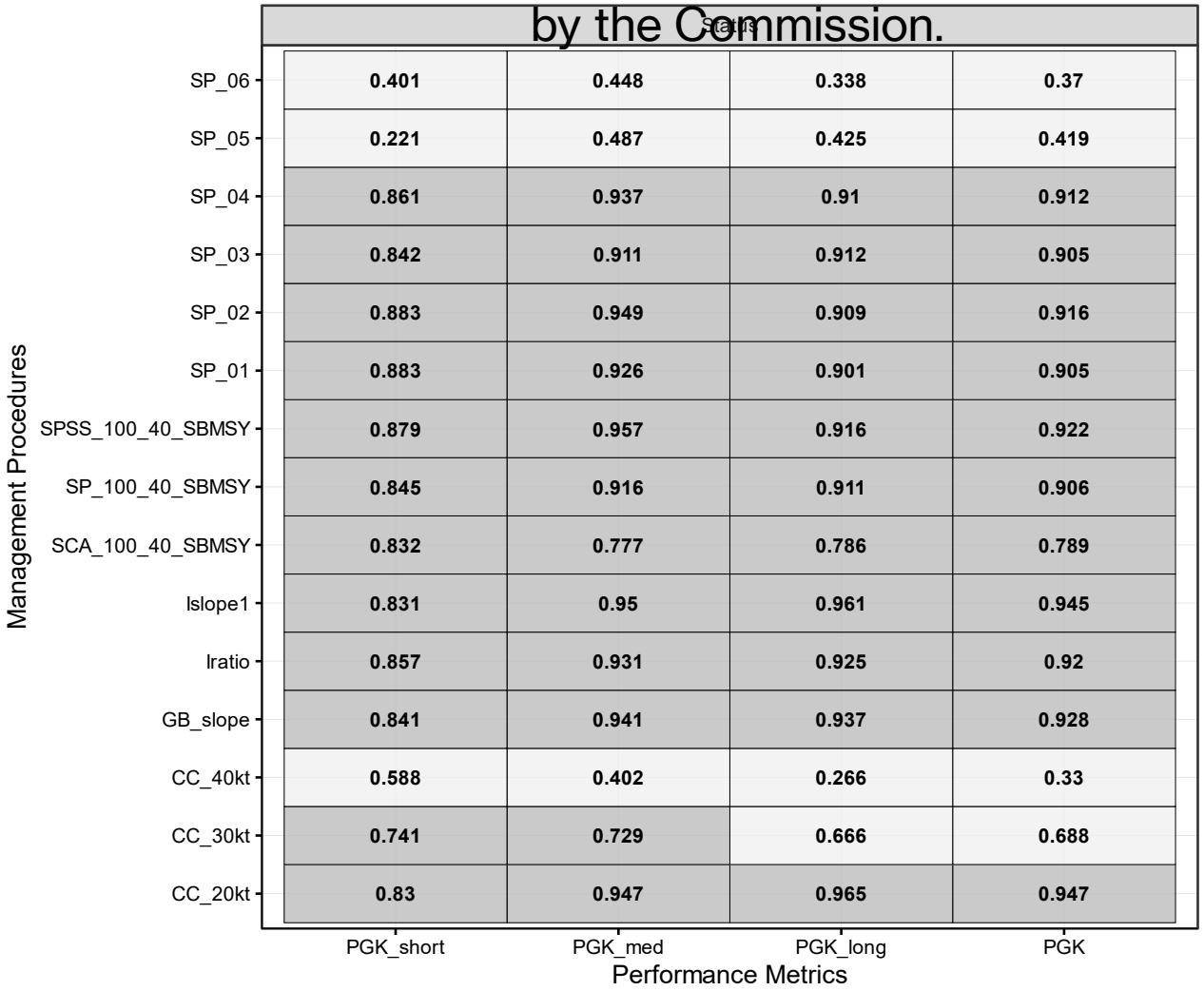
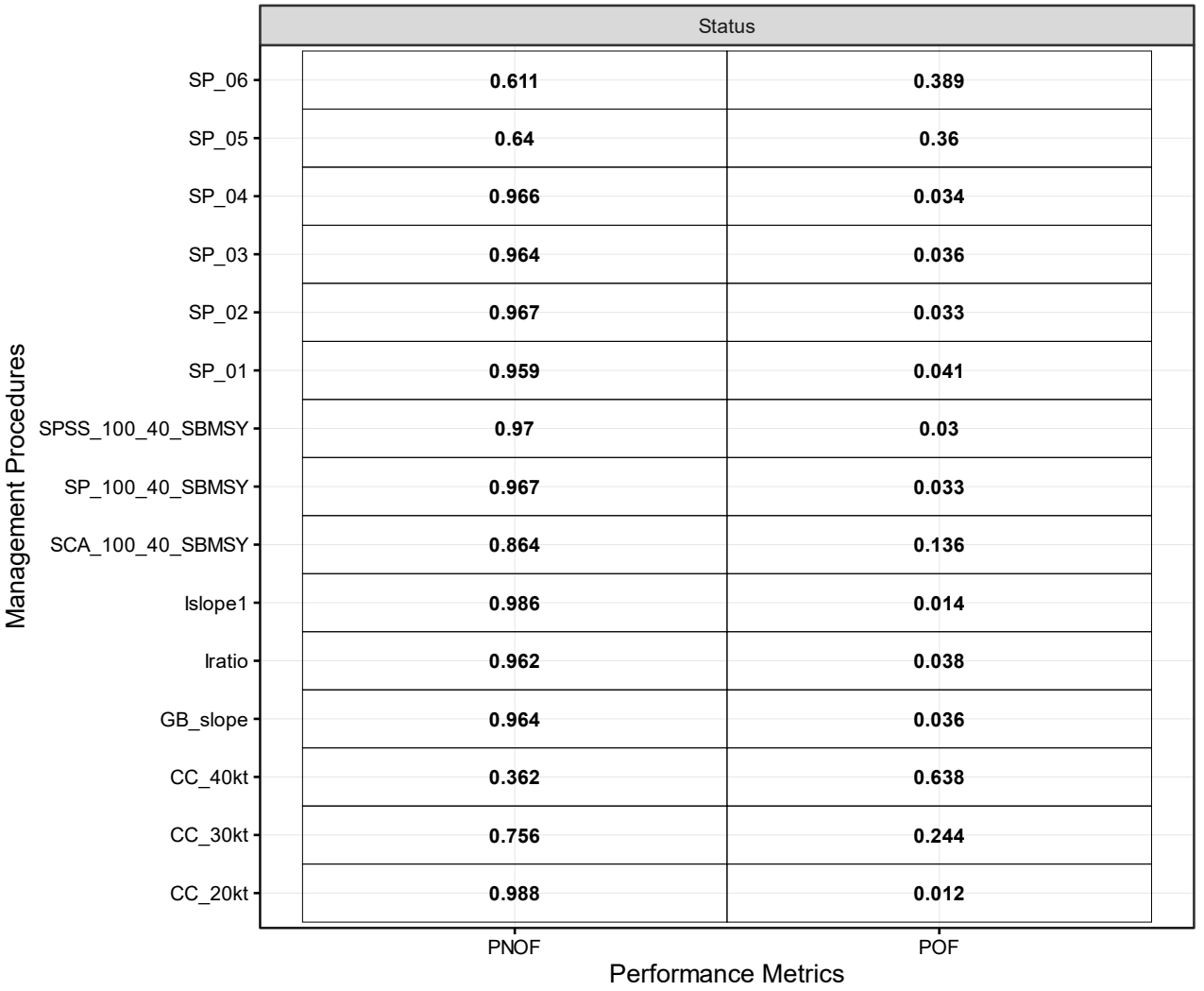
DEVELOPING CANDIDATE MANAGEMENT PROCEDURES FOR THE WESTERN ATLANTIC SKIPJACK TUNA

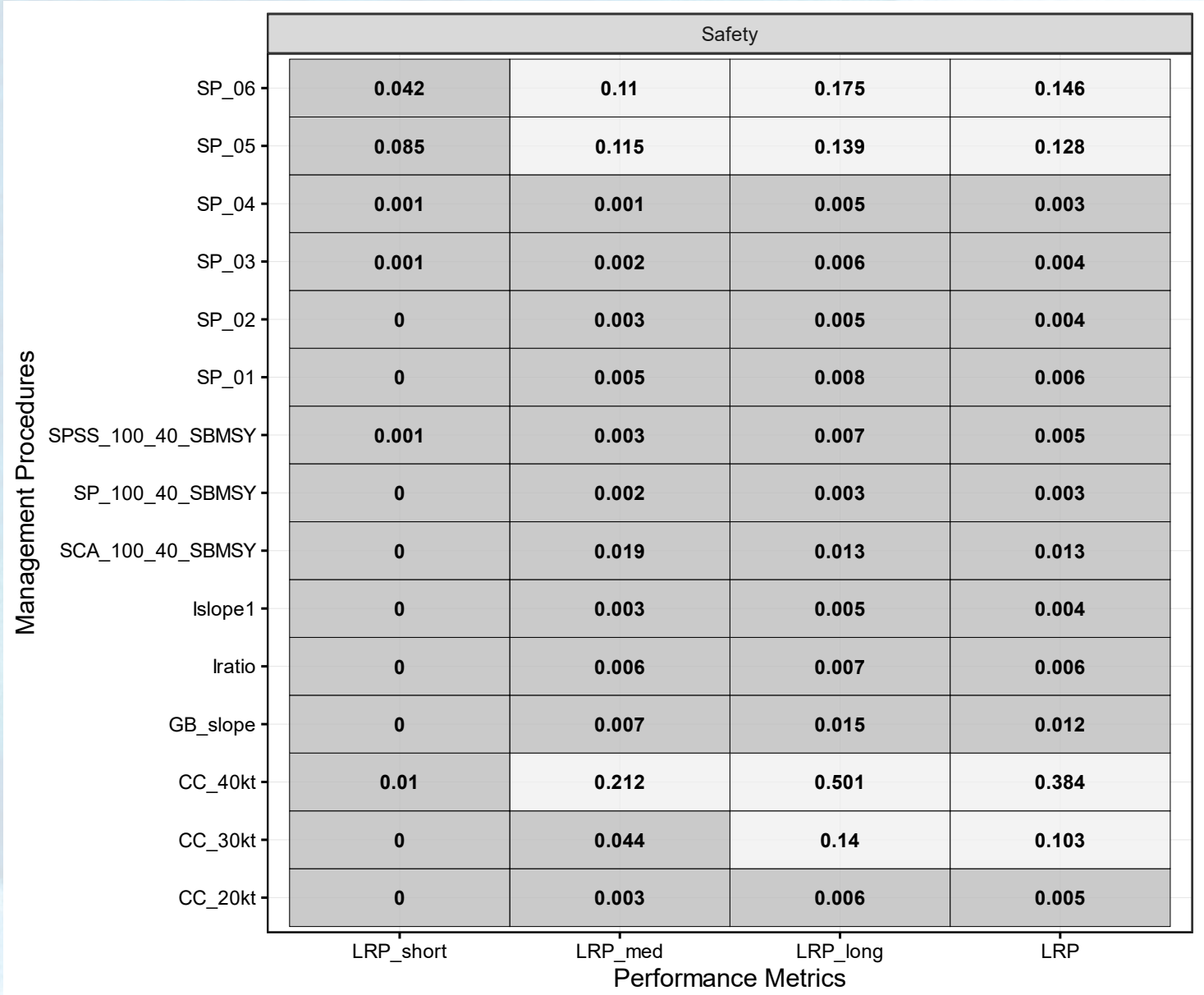
Results – PMs vs MPs

Reference Set Stock Status performance metrics by CMP. The grey colour represents those cases where the values are consistent with the management objective defined by the Commission.





Results – PMs vs MPs



Management Procedures	LRP_short	LRP_med	LRP_long	LRP
SP_06	0.042	0.11	0.175	0.146
SP_05	0.085	0.115	0.139	0.128
SP_04	0.001	0.001	0.005	0.003
SP_03	0.001	0.002	0.006	0.004
SP_02	0	0.003	0.005	0.004
SP_01	0	0.005	0.008	0.006
SPSS_100_40_SBMSY	0.001	0.003	0.007	0.005
SP_100_40_SBMSY	0	0.002	0.003	0.003
SCA_100_40_SBMSY	0	0.019	0.013	0.013
Islope1	0	0.003	0.005	0.004
Iratio	0	0.006	0.007	0.006
GB_slope	0	0.007	0.015	0.012
CC_40kt	0.01	0.212	0.501	0.384
CC_30kt	0	0.044	0.14	0.103
CC_20kt	0	0.003	0.006	0.005

Results – PMs vs MPs

Stability

Management Procedures	VarCmedium	VarClong	VarC
SP_06	0.951	0.687	0.629
SP_05	1	0.659	0.658
SP_04	0.181	0.123	0.108
SP_03	0.13	0.051	0.05
SP_02	0.153	0.125	0.106
SP_01	0.106	0.062	0.061
SPSS_100_40_SBMSY	0.192	0.13	0.12
SP_100_40_SBMSY	0.164	0.061	0.063
SCA_100_40_SBMSY	0.916	0.905	0.904
Islope1	0.019	0.016	0.013
Iratio	0.146	0.12	0.103
GB_slope	0.082	0.067	0.06
CC_40kt	0	0	0
CC_30kt	0	0	0
CC_20kt	0	0	0

Performance Metrics

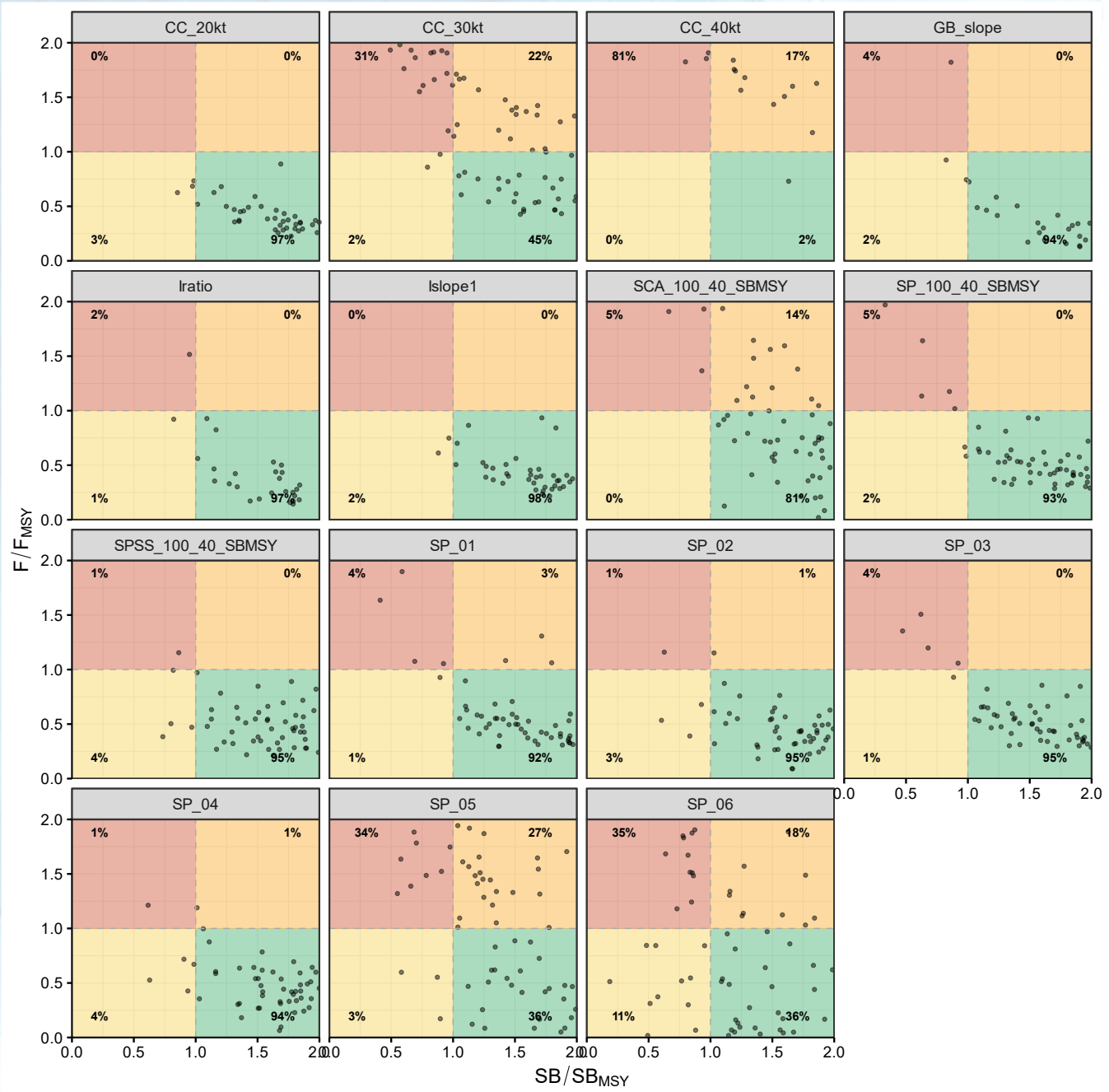
Yield

Management Procedures	AvC_short	AvC_med	AvC_long
SP_06	44848	31568	33706
SP_05	56563	23795	32986
SP_04	16545	23015	24424
SP_03	22018	23254	24524
SP_02	9729	24204	24312
SP_01	9729	26418	24616
SPSS_100_40_SBMSY	9042	24140	24992
SP_100_40_SBMSY	21721	23464	24811
SCA_100_40_SBMSY	19668	25121	24183
Islope1	18363	19389	19678
Iratio	14367	19929	18414
GB_slope	16875	18014	16823
CC_40kt	39840	36713	27360
CC_30kt	29999	29647	27866
CC_20kt	20000	19986	19948

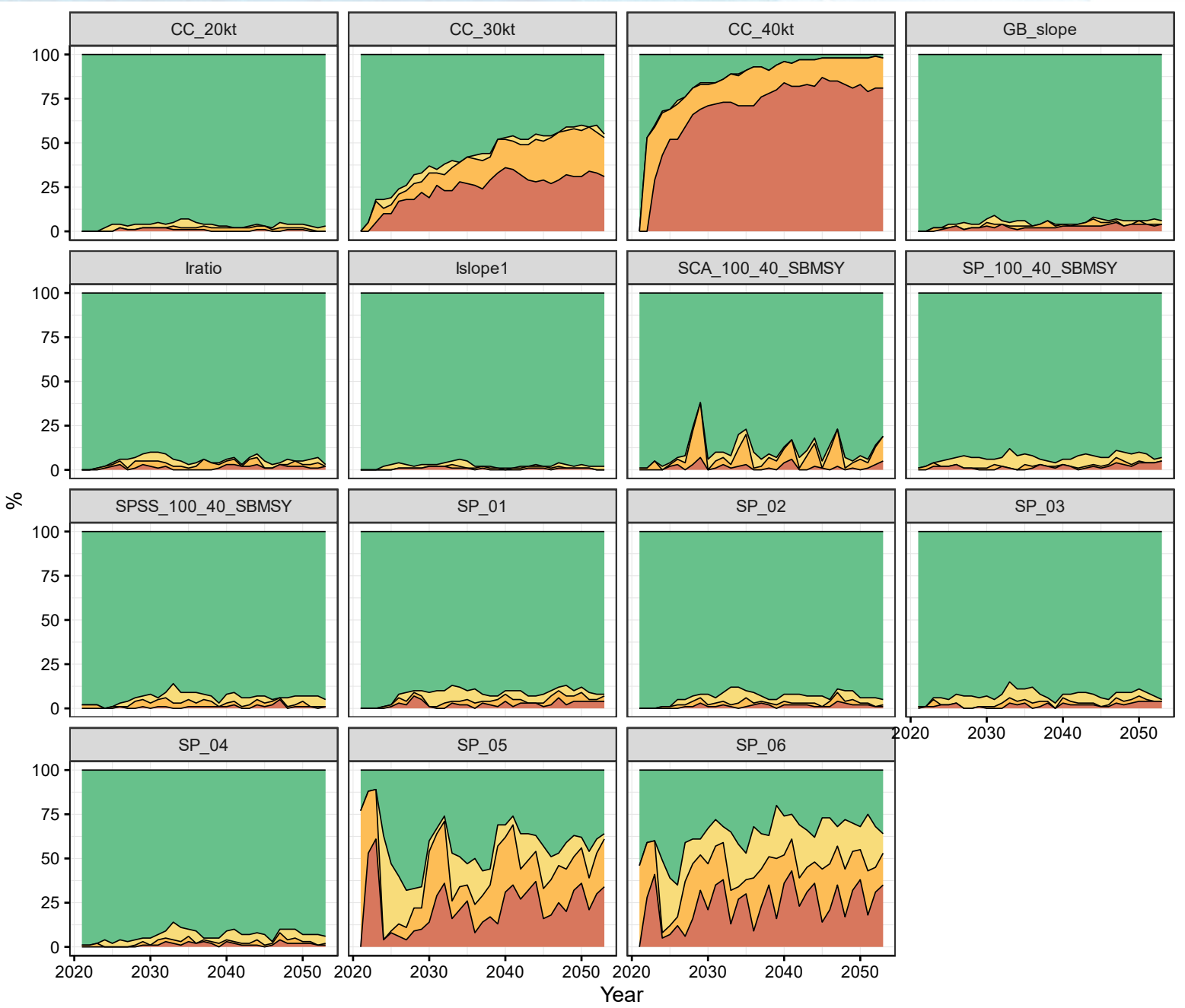
Performance Metrics

DEVELOPING CANDIDATE MANAGEMENT PROCEDURES FOR THE WESTERN ATLANTIC SKIPJACK TUNA

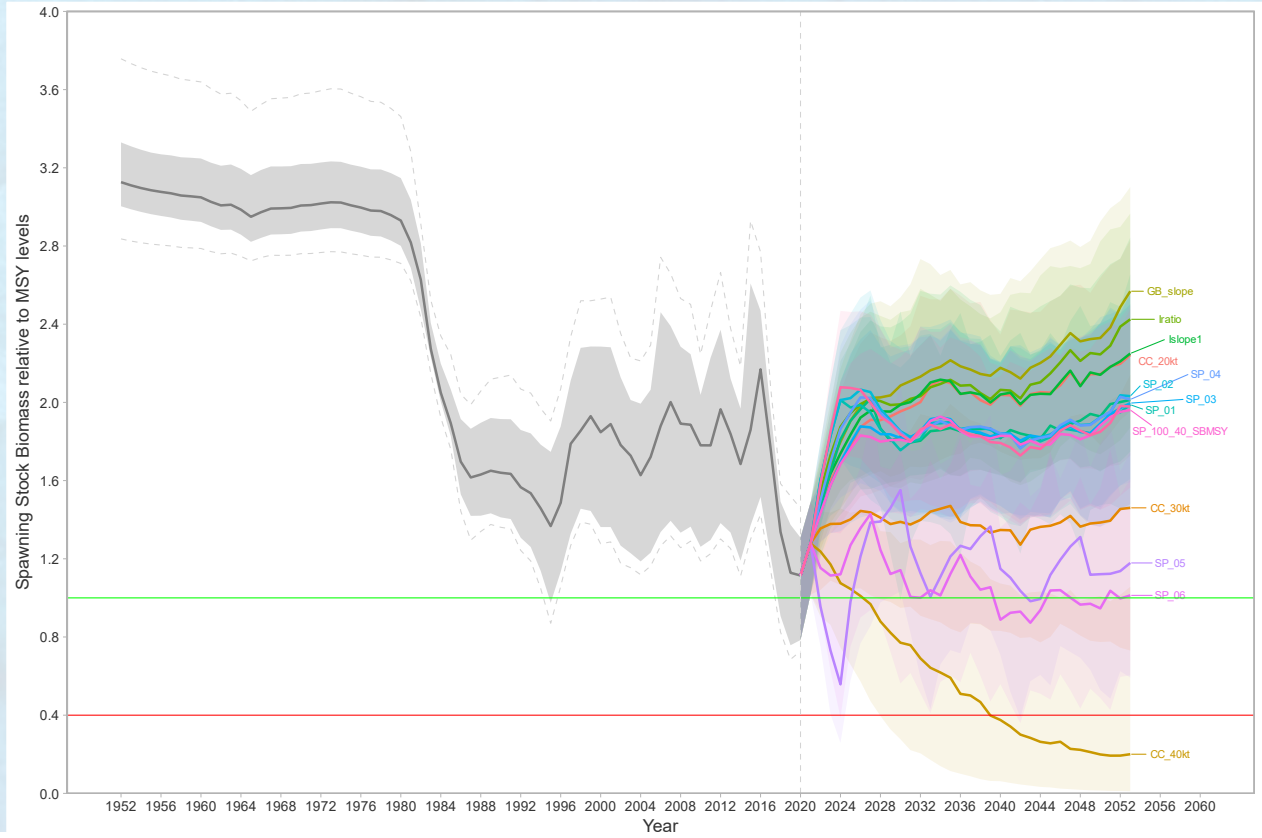
Results – Kobe for the last year



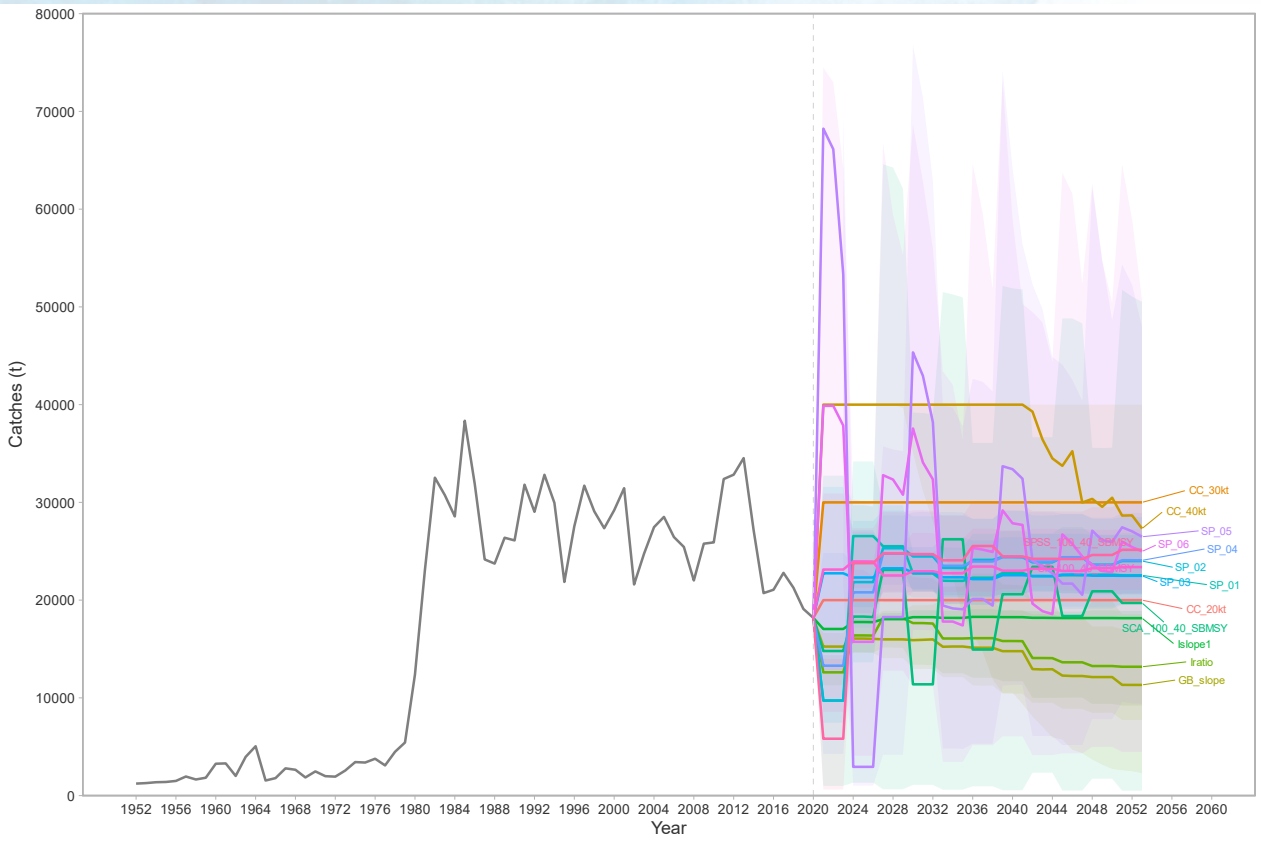
Results – Kobe by year



Results – Trajectories



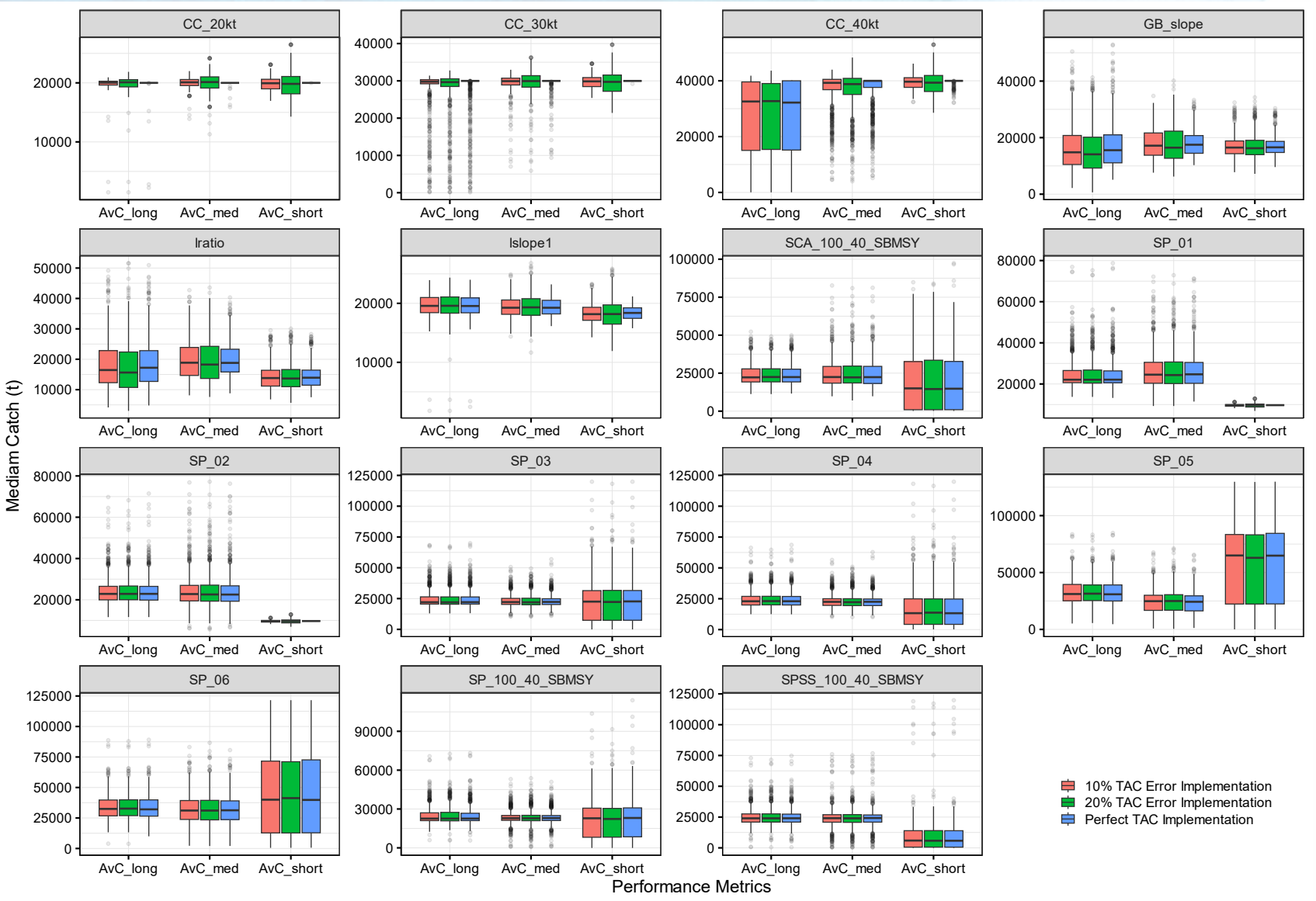
Time-series of the spawning stock biomass relative to MSY levels for the next 30 years of projection according to each of the MPs tested for the reference scenario (Ensemble OMs 1-9). Solid lines represents the median value; Shaded areas represent the 95% confidence intervals estimated to each CMP.



Time-series of the total catches for the next 30 years of projection according to each of the CMPs tested for the reference scenario (Ensemble OMs 1-9). Solid lines represent the median value; Shaded areas represent the 95% confidence intervals estimated to each CMP.

Results – Robustness

Management Objective
Yield

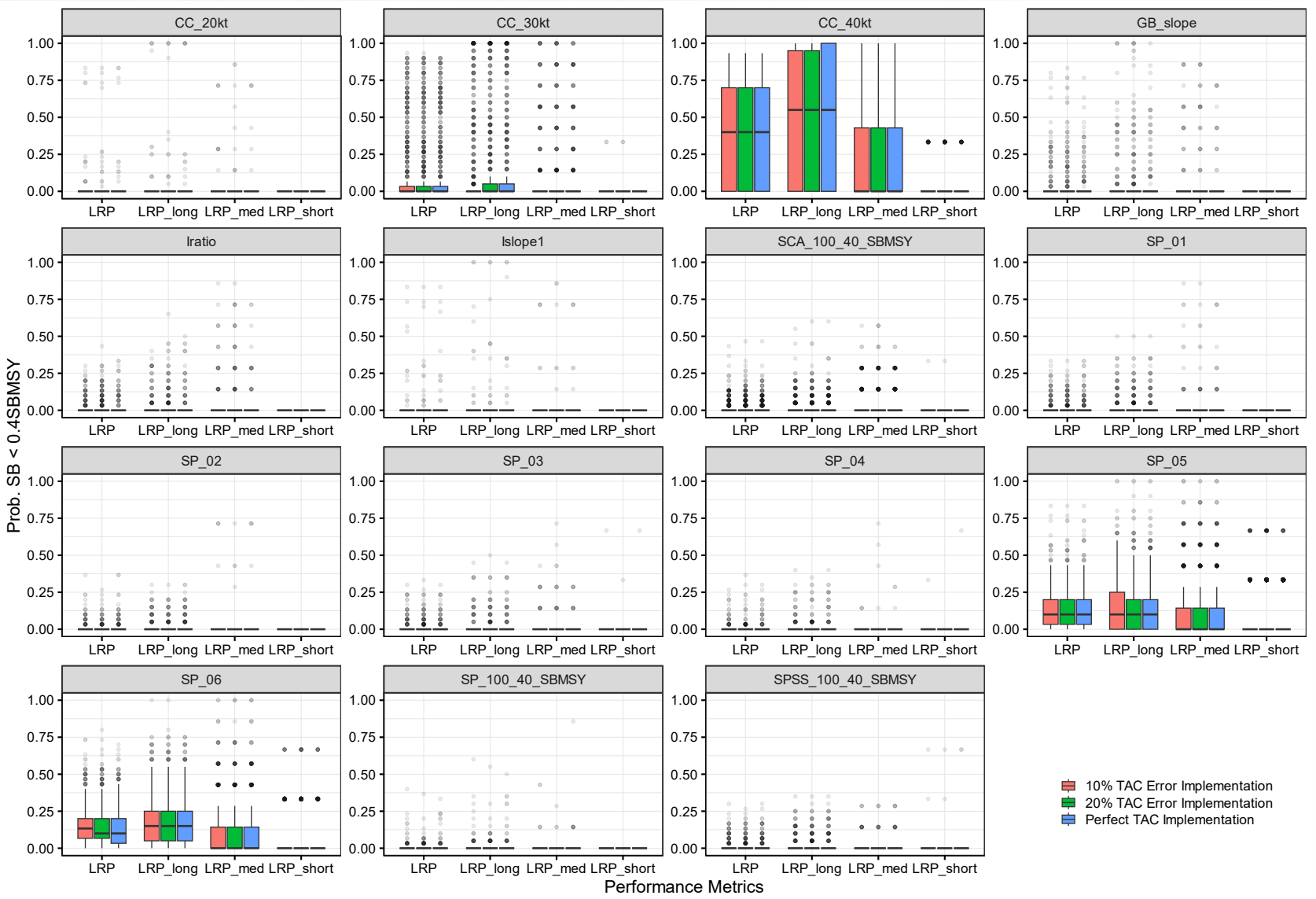


Preliminary results, please contact with the authors for full publication

ICCAT CICTA CICAA

Results – Robustness

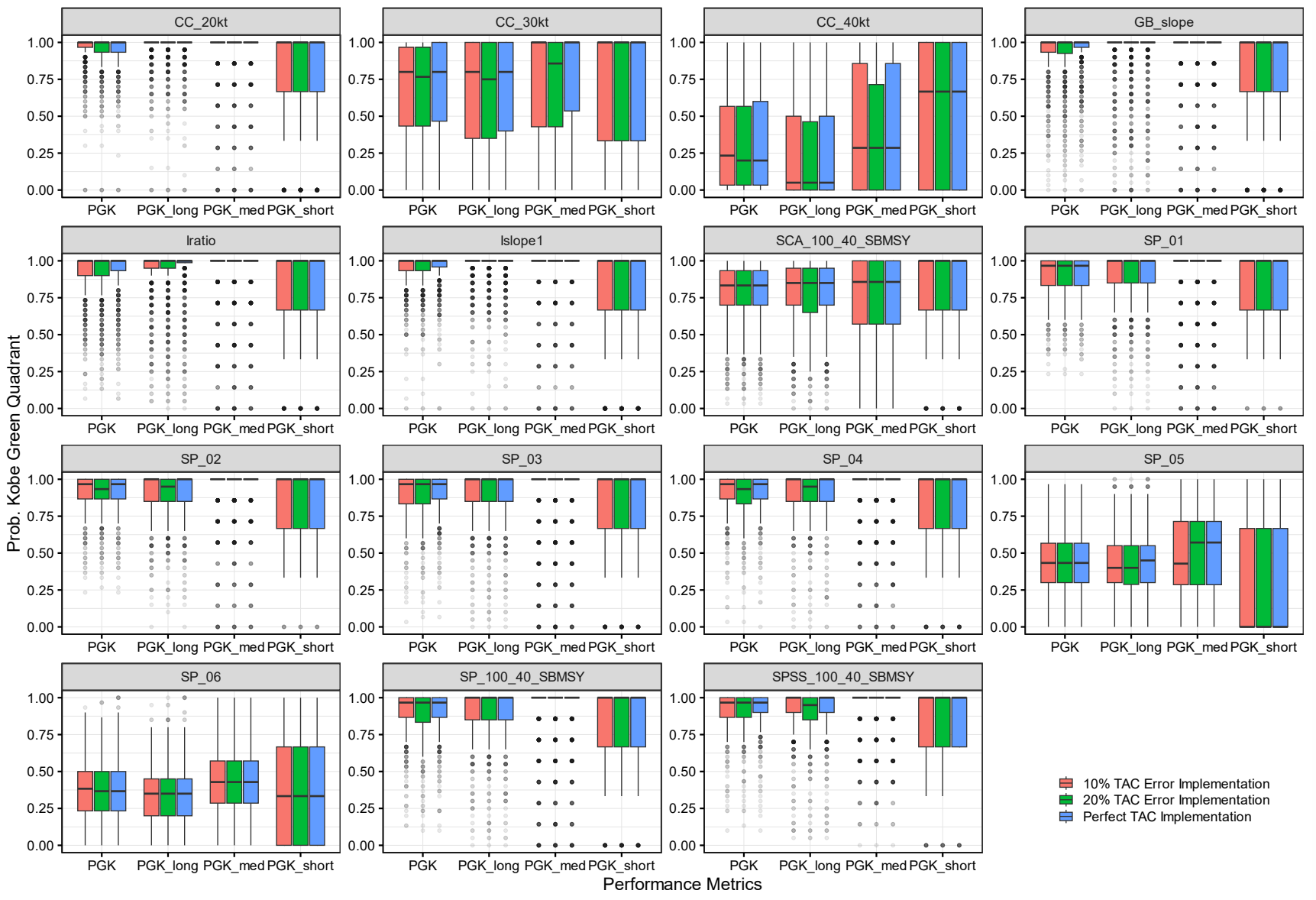
Management Objective
Safety



Preliminary results, please contact with the authors for full publication

Results – Robustness

Management Objective
Status

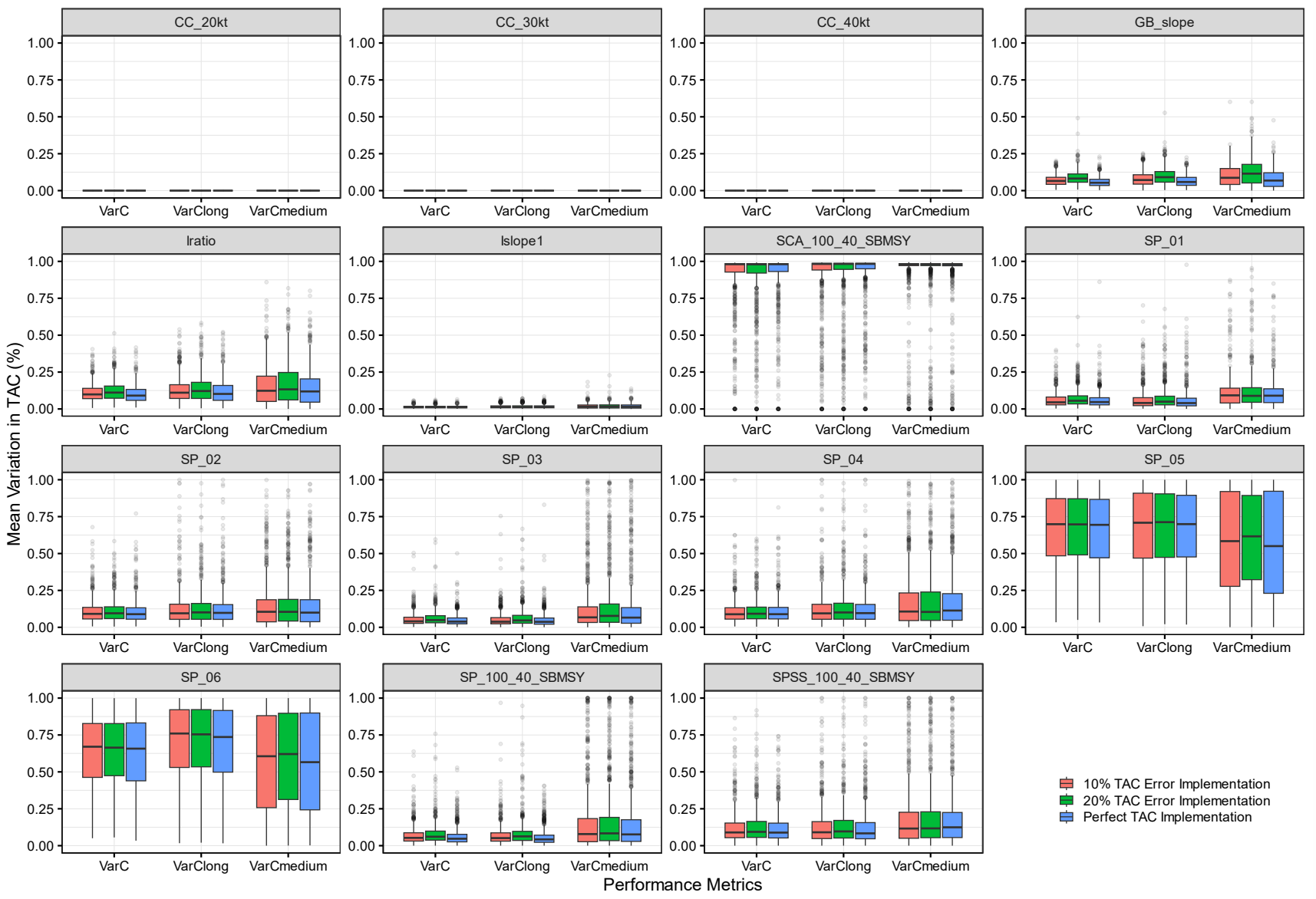


Preliminary results, please contact with the authors for full publication

ICCAT CICTA CICAA

Results – Robustness

Management Objective
Stability



Preliminary results, please contact with the authors for full publication


Thank You


Thank You