PA1_513/2023

Results of the testing of Western Atlantic Skipjack Candidate Management Procedures in a Management Strategy Evaluation Framework

(presented and adopted at the 2023 SCRS Plenary)

DEVELOPING CANDIDATE MANAGEMENT PROCEDURES FOR THE WESTERN ATLANTIC SKIPJACK TUNA

Time-line

2020

* A Demonstration MSE framework for Western Skipjack tuna (SCRS/2020/140);

2021

* Building Capacity on MSE Methods: from concepts to practice (JCAP-2/ICCAT Project);

2022

* Western Atlantic skipjack tuna MSE: RCM (SCRS/2022/097);
* Western Atlantic skipjack tuna stock assessment (SCRS/2022/098);
* Operating model conditioning based on the Stock Synthesis model (SCRS/2022/180);
* COMM adopted conceptual Management Objectives (Res. 22-02);

2023

* SCRS discussion and testing CMPs based on Management Objectives;
* COMM intersessional meeting – update progress;
* SCRS incorporation of COMM feedbacks;
* SCRS CMPs.

Operating Models Structure

Stock Assessment 2022 – W-SKJ
Cardoso et al. (2022)
Kimoto et al. (2022)

Operating model	*Growth vector*	*Steepness*	*SigmaR*	*Scenario*
OM 1	25th	0.6	0.4	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			
OM 10	25th	0.6		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			
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			

Operating Models Structure

Stock Assessment 2022 – W-SKJ
Cardoso et al. (2022)
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Reference

Robustness 01

Robustness 02

Operating model	*Growth vector*	*Steepness*	*SigmaR*	*Scenario*
OM 1	25th	0.6		Perfect TAC implementation
OM 2	50th			
OM 3	75th			
OM 4	25th	0.7		
OM 5	50th			
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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)

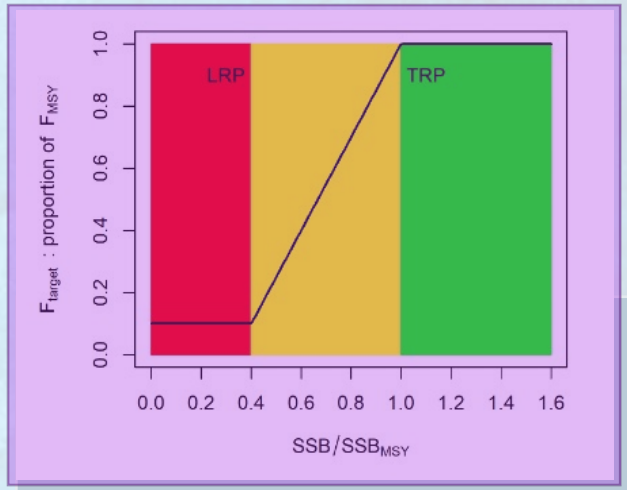
Other decisions:

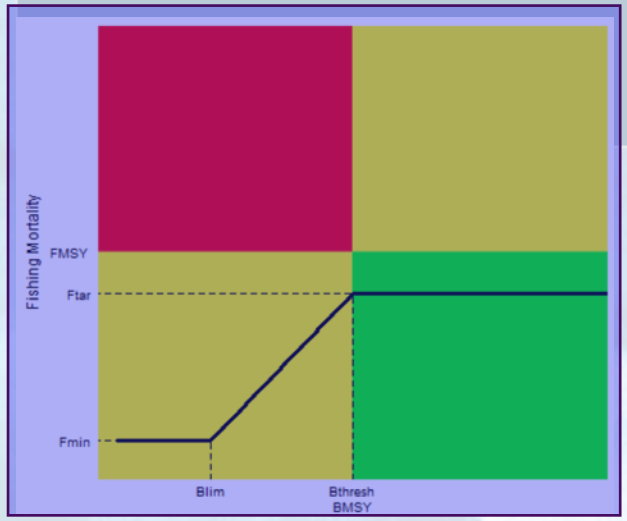
- Management cycle length: 3 years was approved.
- CMP type:
  - Constant catch (CC) and Empirical CMP for comparison only;
  - Model-based CMP for adoption;
- Add climate change robustness test.

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);

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.

Results – PMs vs MPs

Management Procedures	PGK_short	PGK_med	PGK_long	PGK
SP_06	0.401	0.448	0.338	0.37
SP_05	0.221	0.487	0.425	0.419
SP_04	0.861	0.937	0.91	0.912
SP_03	0.842	0.911	0.912	0.905
SP_02	0.883	0.949	0.909	0.916
SP_01	0.883	0.926	0.901	0.905
SPSS_100_40_SBMSY	0.879	0.957	0.916	0.922
SP_100_40_SBMSY	0.845	0.916	0.911	0.906
SCA_100_40_SBMSY	0.832	0.777	0.786	0.789
Islope1	0.831	0.95	0.961	0.945
Iratio	0.857	0.931	0.925	0.92
GB_slope	0.841	0.941	0.937	0.928
CC_40kt	0.588	0.402	0.266	0.33
CC_30kt	0.741	0.729	0.666	0.688
CC_20kt	0.83	0.947	0.965	0.947

Status

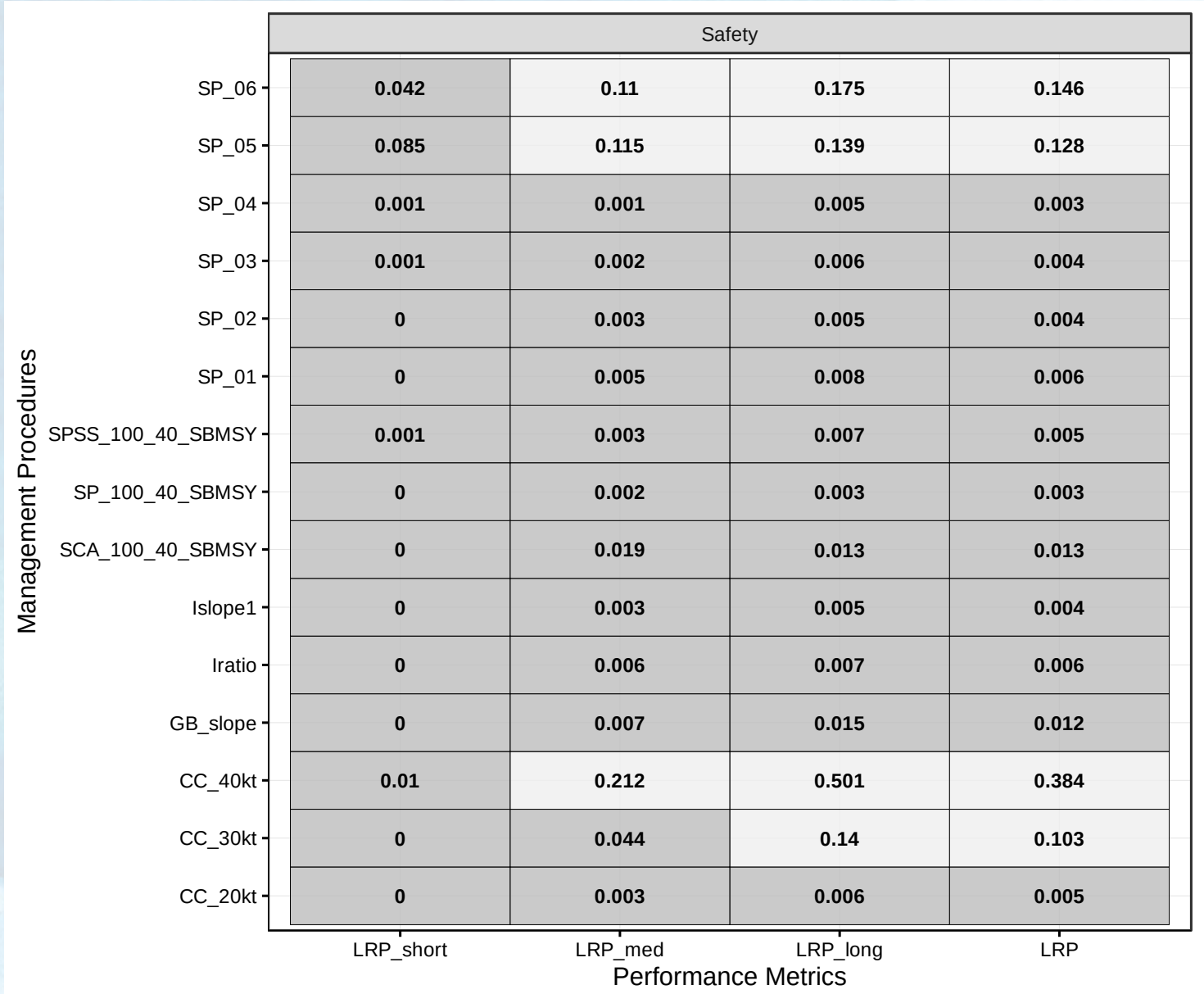
Performance Metrics

Management Procedures	PNOF	POF
SP_06	0.611	0.389
SP_05	0.64	0.36
SP_04	0.966	0.034
SP_03	0.964	0.036
SP_02	0.967	0.033
SP_01	0.959	0.041
SPSS_100_40_SBMSY	0.97	0.03
SP_100_40_SBMSY	0.967	0.033
SCA_100_40_SBMSY	0.864	0.136
Islope1	0.986	0.014
Iratio	0.962	0.038
GB_slope	0.964	0.036
CC_40kt	0.362	0.638
CC_30kt	0.756	0.244
CC_20kt	0.988	0.012

Status

Performance Metrics

Results – PMs vs MPs



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

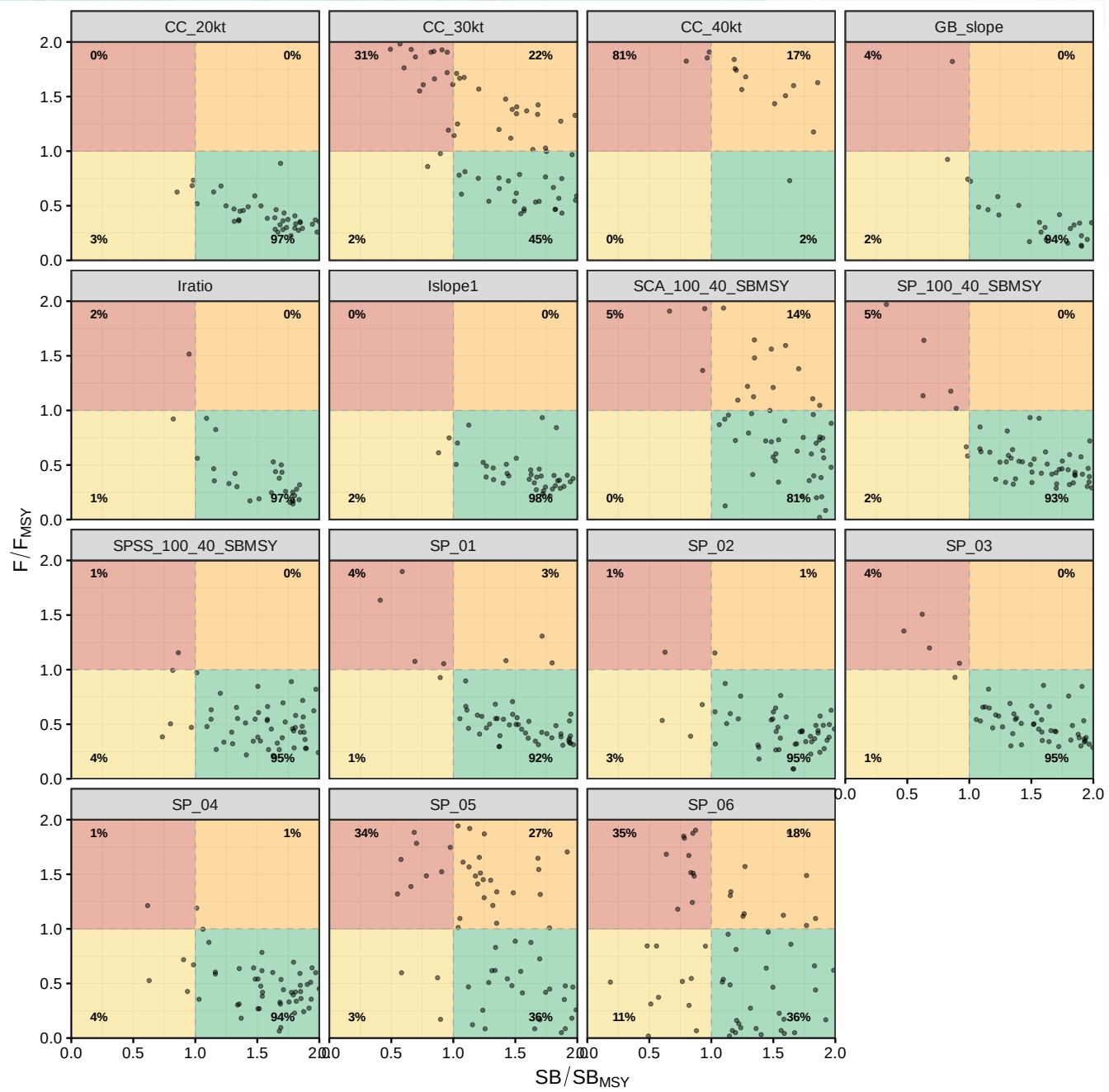
Yield

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

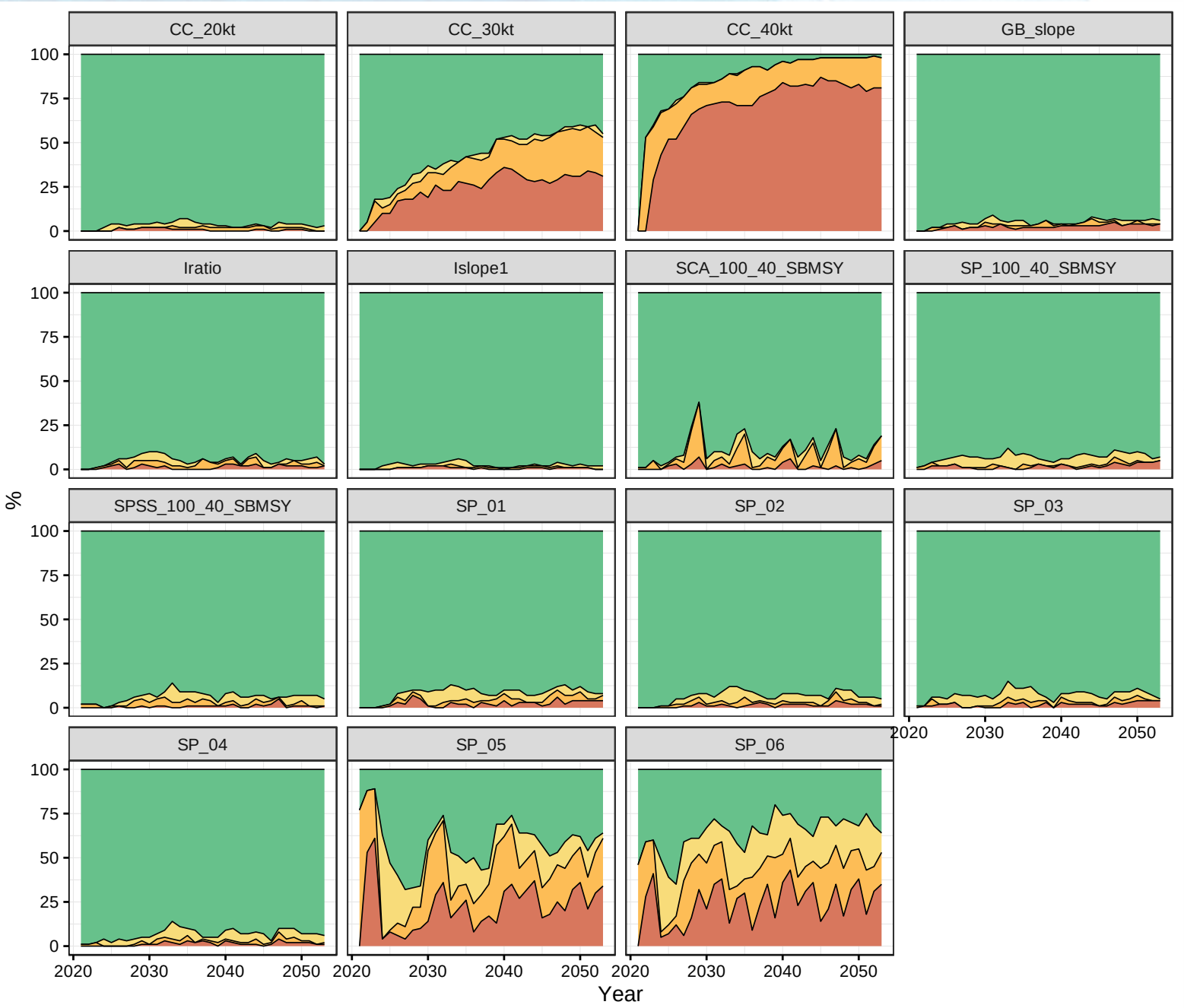
Performance Metrics

DEVELOPING CANDIDATE MANAGEMENT PROCEDURES FOR THE WESTERN ATLANTIC SKIPJACK TUNA

Results – Kobe for the last year



Results – Kobe by year



Results – Trajectories