

Pacific bluefin tuna; update on indices and other activities by ISC PBFWG



2017/5/8

IATTC SAC8



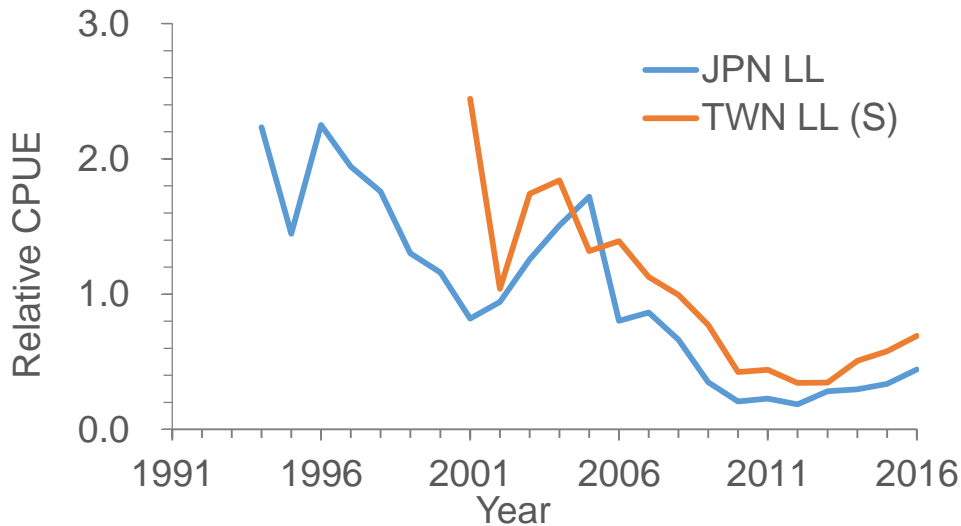
ISC PBFWG in 2016–17

- ❖ No stock assessment this year
 - Update assessment is scheduled in 2018.
- ❖ Update on Indices of Abundance
 - Spawning stock and recruitment
- ❖ Additional projections requested by Commissions.
 - For the consideration of the next rebuilding target.
 - Results were explained to the stakeholders.
- ❖ Development of an emergency rule based on recruitment index.
 - A possible framework to evaluate impact of the most recent recruit.
 - What the ISC and manager will need to do, respectively.
- ❖ Participants
 - Korea, U.S.A, Mexico, Taiwan, IATTC, and Japan

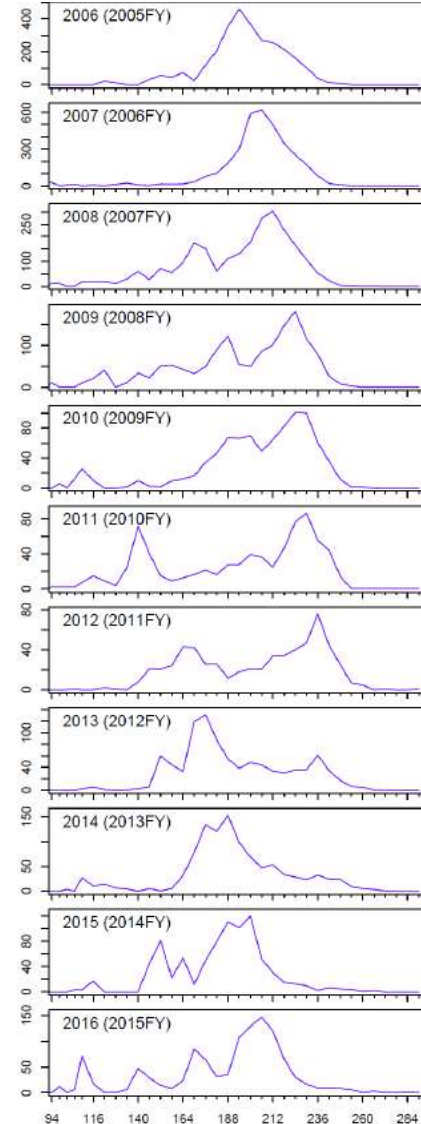


Monitoring of the Spawner (Longline CPUE)

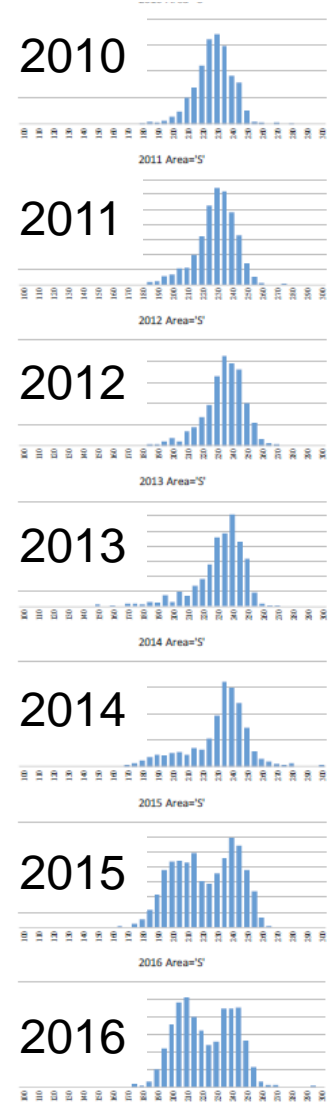
- ❖ Increase slightly for recent years.
- ❖ Small spawners appeared from 2011 (Japan) and 2014 (Taiwan) in the spawning ground.



Japanese longline

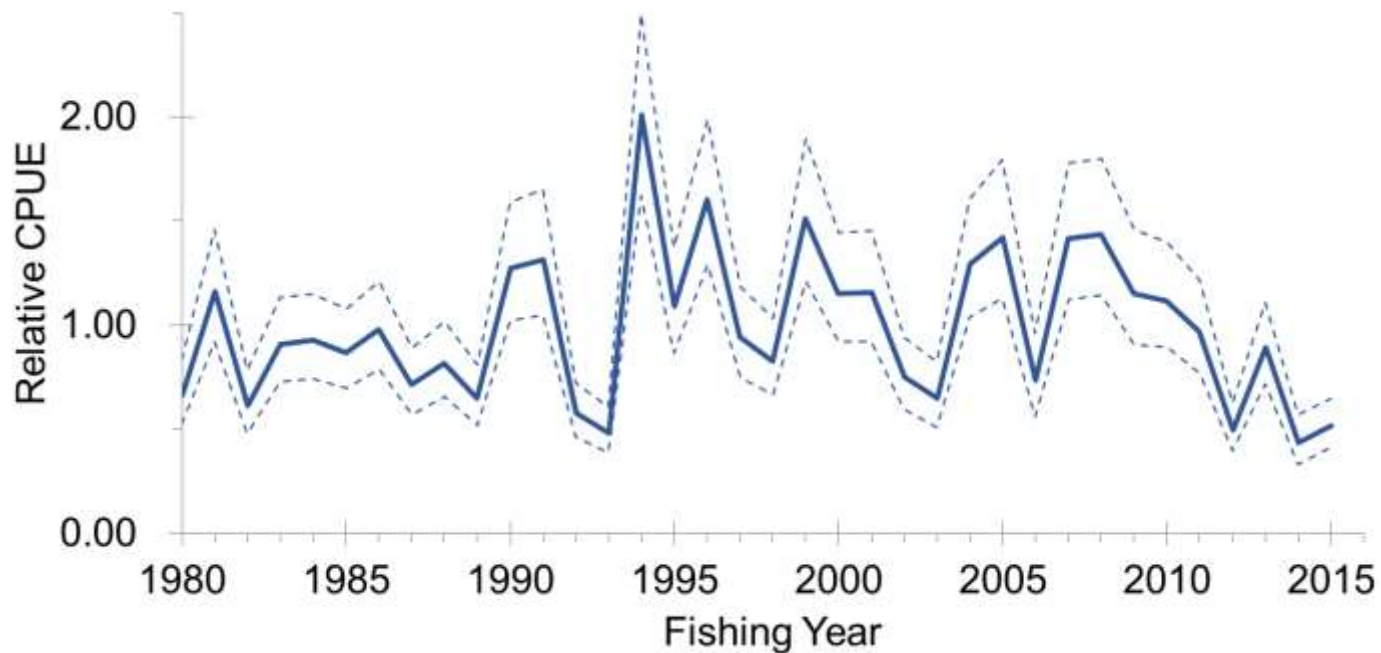


Taiwanese longline



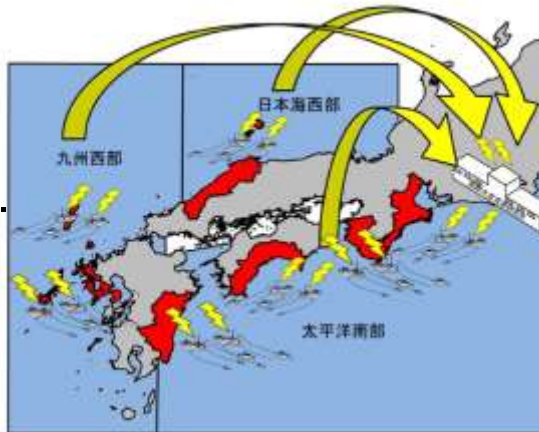
Monitoring of the Recruitment (Troll CPUE)

- ❖ The Age-0 fish abundance indices of the 2015 is slightly larger than the 2014, but is still at a low level.

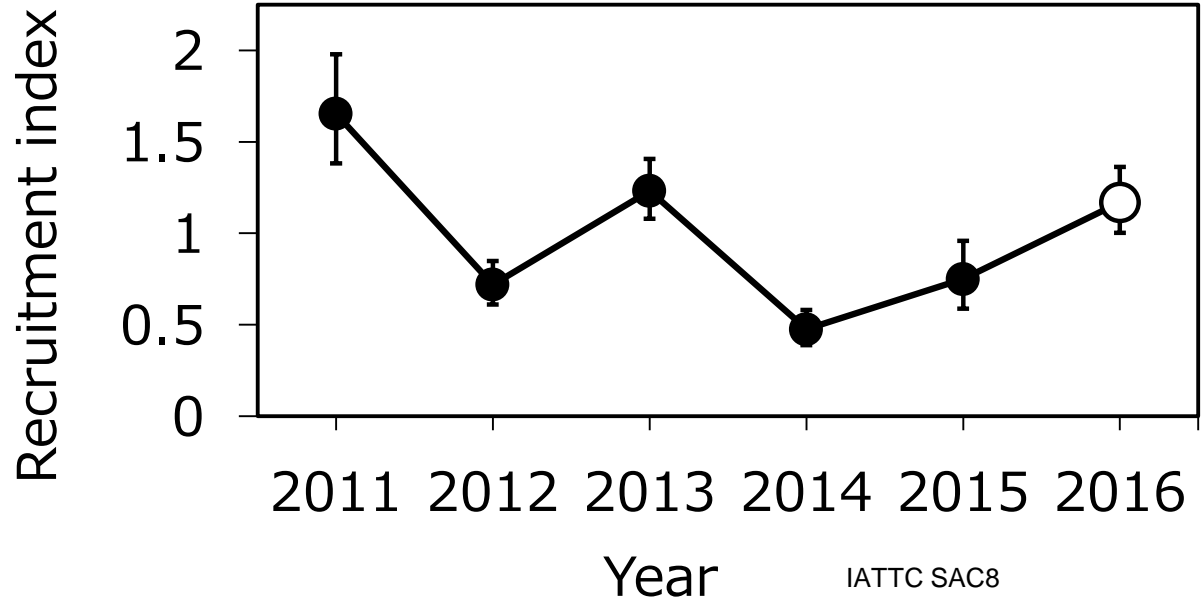


Recruitment Monitoring (Jpn troll vessel monitoring)

- ❖ To obtain recruitment info in a timely manner.
 - Obtain detailed fishery info directory from Troll vessel.
- ❖ Release monitoring results 4 times a year.
- ❖ Available New cohorts information.



- 2015 YC seems to be low level.
- 2016 YC would be higher than 2014 and 2015.



太平洋クロマグロ2016年生まれ 加入量モニタリング速報 (第1段階 2016年10月)

国立研究開発法人
水産研究・教育機構 国際水産資源研究所

- 太平洋南および九州西^{※1}で操業した曳網モニタリング船^{※2}について、夏季(7~8月)のCPUE(漁獲努力量あたり漁獲尾数)を南西諸島海域生まれの加入動向の指標として分析した。
- 2016年における夏季の曳網モニタリング船CPUEは、2011~2015年平均の121%、前年比156%であった。
- 上記から、2016年の南西諸島海域生まれの加入量水準は、2015年を上回る可能性が高い。



^{※1} 太平洋南は、宮崎県、高知県、和歌山県、三重県、九州西は、長崎県。
^{※2} 2011年からモニタリングを開始、11隻の300トンを対象としている。

2011-2015年の平均を1とした時の
相対値

図. 2011~2016年の夏季の曳網モニタリング船CPUEの相対値。図中の垂線は95%信頼区間。

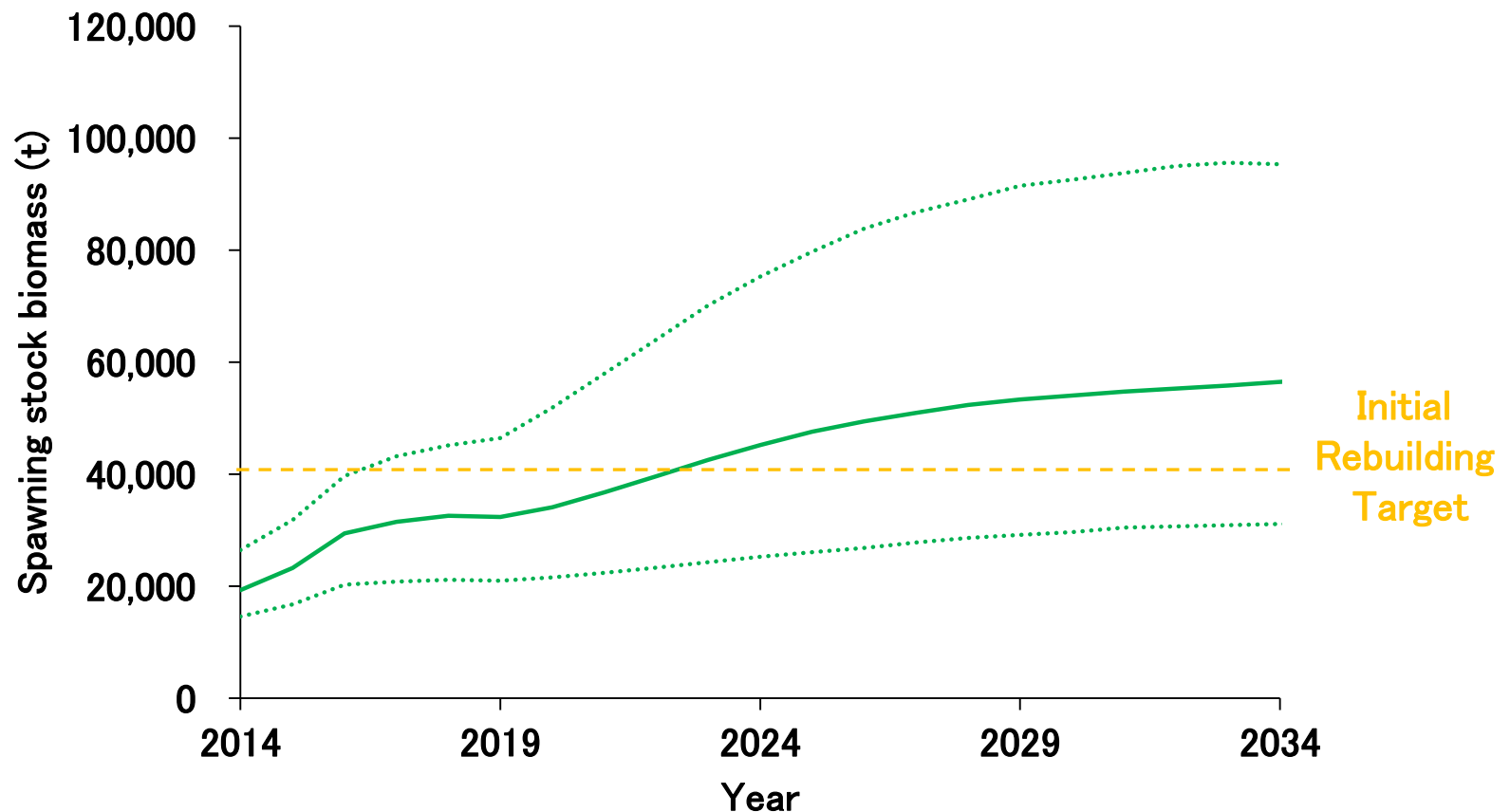
Current Conservation and Management Measures

Initial Rebuilding Target: Rebuilding the SSB to the historical median SSB in 2024 with at least 60% probability.

tRFMO	WCPFC 	IATTC 
Effort control	Total effort shall stay below the 2002–04 annual average levels.	-
Catch limit	<p>< 30kg : 50% of 2002-04 annual average</p> <p>≥30kg : 2002-04 annual average</p>	Commercial fisheries : 3,300 tons / Year

Simulating the Performance of Current measures

- Initial Rebuilding Target will be achieved even if the low recruitment continues.



Formulation of a PBF Rebuilding Strategy

- a. Agree on a second rebuilding target (2017).
- b. Revise their respective management measures as needed to achieve the initial target.
- c. Revise or adopt new measures to achieve the second rebuilding target that would become effective after the initial target is met.

Request from WCPFC and IATTC

- ❖ To evaluate the expected performance of each of the listed harvest scenarios.
 - 19 Harvesting scenarios
 - 3 Recruitment assumptions
 - 6 candidate rebuilding targets

Projection model overview

❖ Quarterly Age-structured forward projection model

- Identical model structure with the stock assessment of PBF
- Given growth, maturity and Natural mortality which are identical with those used in the stock assessment
- Age-specific quarterly Fishing mortality of each fleet were assumed to be past particular year in the assessment (e.g. 2002–04 or 2010–2012).
- Catch upper limit was set in some harvesting scenarios.

❖ Projection time period

- From 2015 to 2034
- Initial condition (2015) was based on the stock assessment result.

❖ Uncertainty

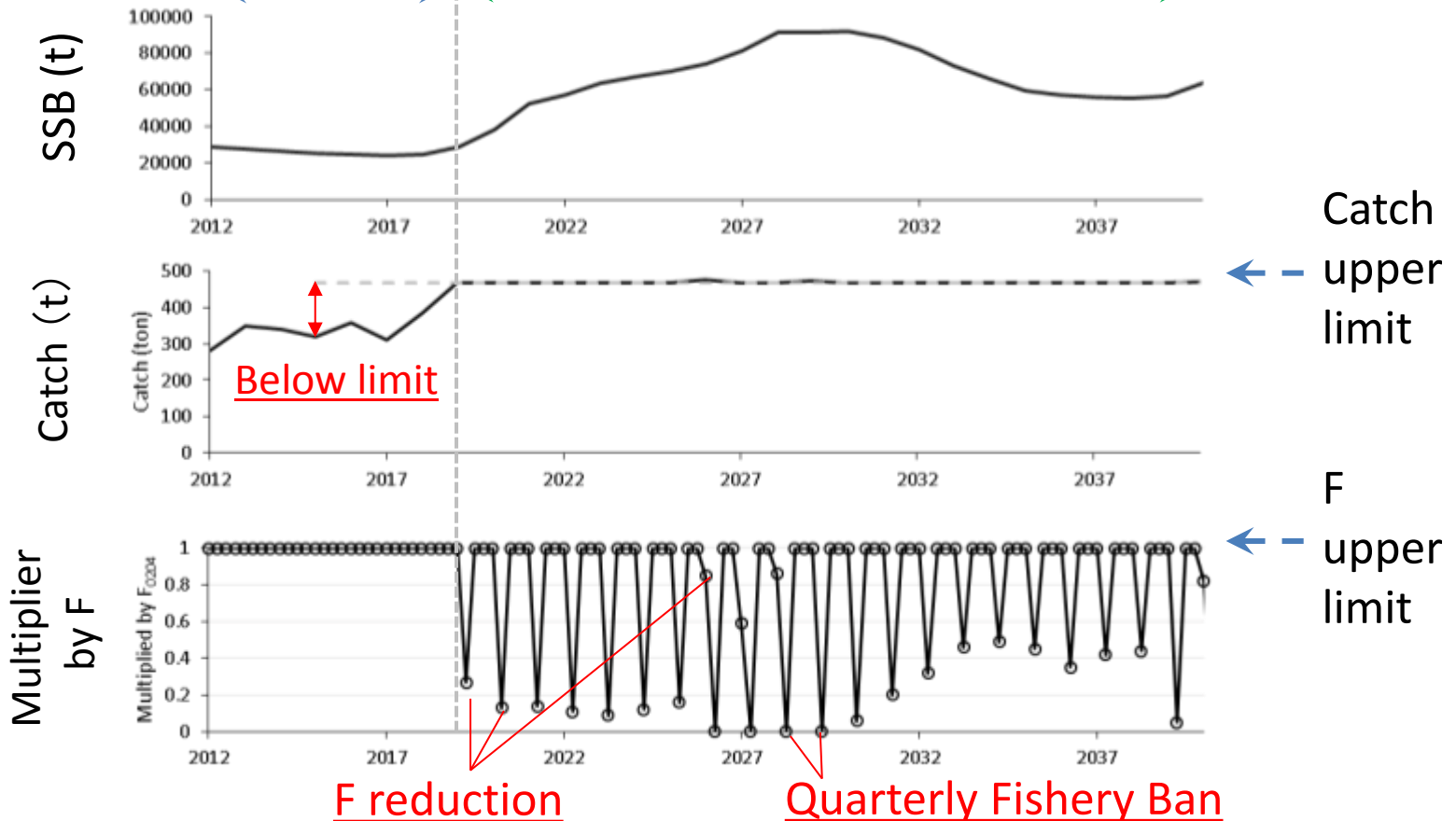
- 300 bootstrap replicates followed by 20 recruitments resampling.

Fishing mortality and Catch controls in projection

When the stock remains at low level, Catch does not meet its upper limit even fishery operates at given Fishing mortality (F).

Once the stock gets recovery, fishery could get better yield with same given F. In the projection, when the catch approaches to its limit, F is adjusted or to be 0 (ban) to maintain catch limit.

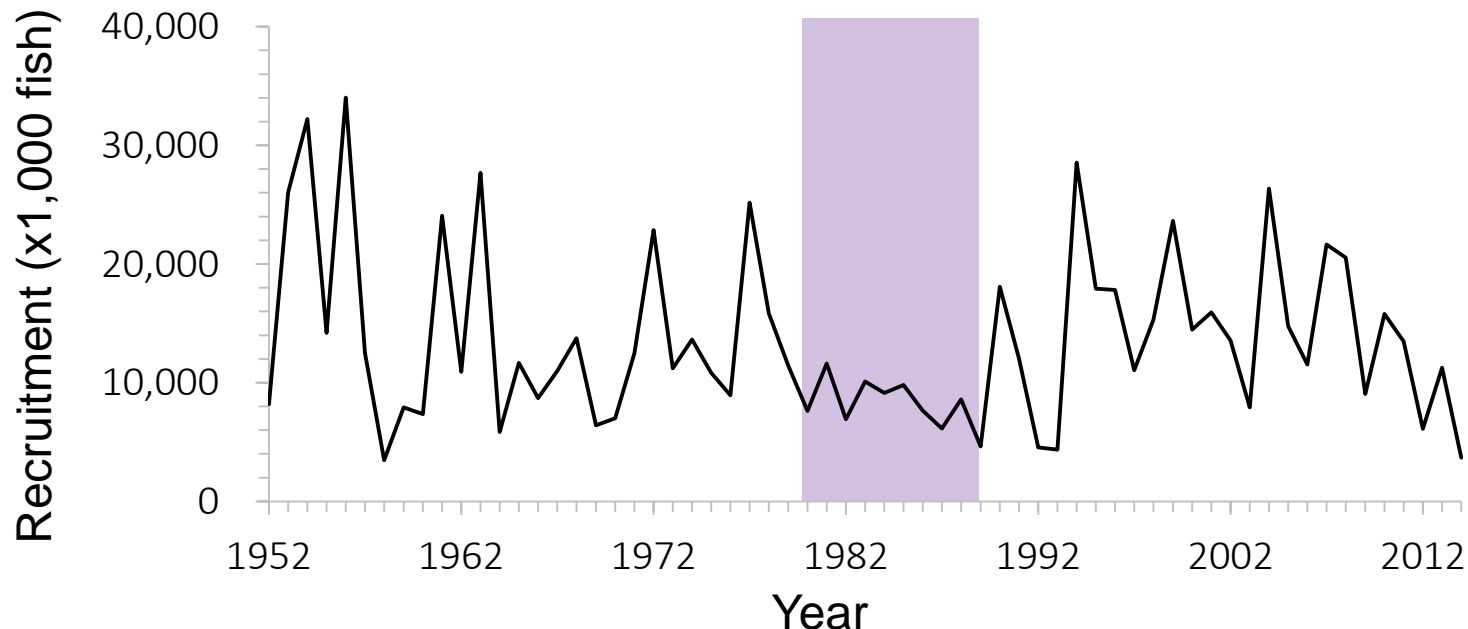
【ex】



Future recruitment assumption

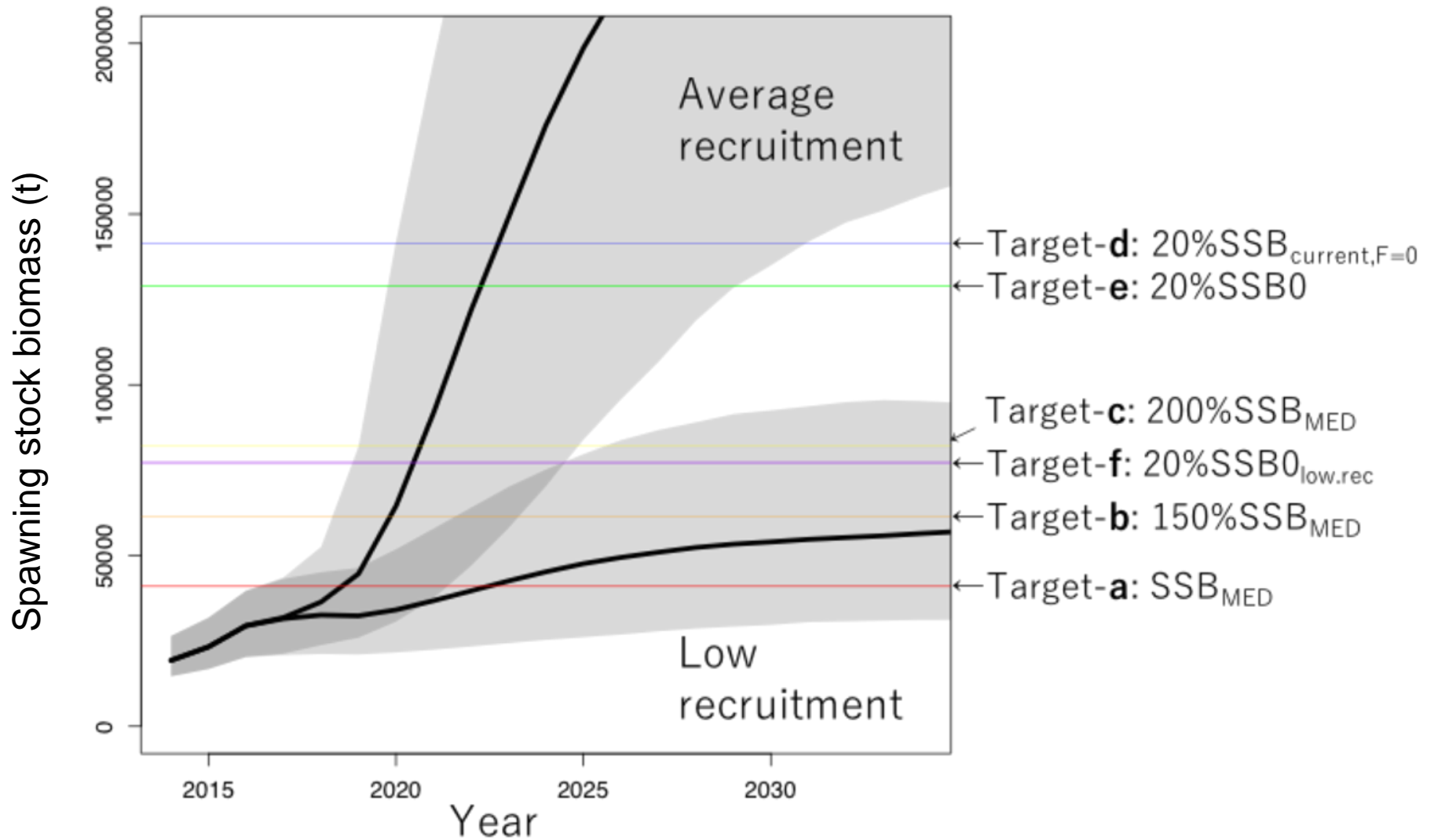
Future recruitments were resampled from

- I. Entire time period (1952-2014); “Average recruitment”
- II. Low recruitment period (1980-1989); “Low recruitment”
 - About 60% of the entire time period in average and less variation.
- III. Low recruitment period for first 10 years and Entire time period for thereafter.



Harvesting Scenario #	Fishing mortality in WPO	Catch limit in WPO		Fishing mortality in EPO	Catch limit in EPO	Threshold of small/large fish
		Small	Large			
1	F2002-2004	50% 2002-2004	Average 2002-04	F2002-2004	3,300 mt comm.	30 kg
2	Enough high value to fullfill its catch limit (multiply F2010-2012 by two)	50% 2010-2012	50% 2010-12	F2002-2004	50% 2010-12	
3	F2002-2004	50% 2002-2004	Average 2002-04	F2002-2004	50% 2002-04	
4	F2002-2004	45% 2002-2004	No catch limit	F2010-2012 (multiply F2002-2004 by 1.3451)	No catch limit	
5	F2002-2004	45% 2002-2004	No catch limit	F2002-2004	3,300 mt comm.	
6	F2002-2004	45% 2002-2004	Average 2002-04	F2002-2004	3,300 mt comm.	
7	F2002-2004	35% 2002-2004	No catch limit	F2010-2012 (multiply F2002-2004 by 1.3451)	No catch limit	
8	F2002-2004	35% 2002-2004	No catch limit	F2002-2004	3,300 mt comm.	
9	F2002-2004	35% 2002-2004	Average 2002-04	F2002-2004	3,300 mt comm.	
10	Fullfill a target with 60%	No catch limit		Fullfill a target with 60%	No catch limit	
11	F2002-2004	50% 2002-2004	"Average 2002-04 catches in WPO (all sizes)" minus "50% 2002-04 catches in WPO (<30 kg)"	F2002-2004	3,300 mt comm.	
12	F2002-2004	25% 2002-2004	"Average 2002-04 catches in WPO (all sizes)" minus "25% 2002-04 catches in WPO (<30 kg)"	F2002-2004	3,300 mt comm.	
13	No fishing					
14	F2002-2004	50% 2002-2004	Average 2002-04	F2002-2004	3,300 mt comm.	85 kg
15	F2002-2004	50% 2002-2004	Average 2002-04	F2002-2004	3,300 mt comm.	30 kg

Six candidates of rebuilding target



Results (SAC-08 INF E(a) Table 3)

Level of Rebuilding targets and probability to achieve

Future Stock level

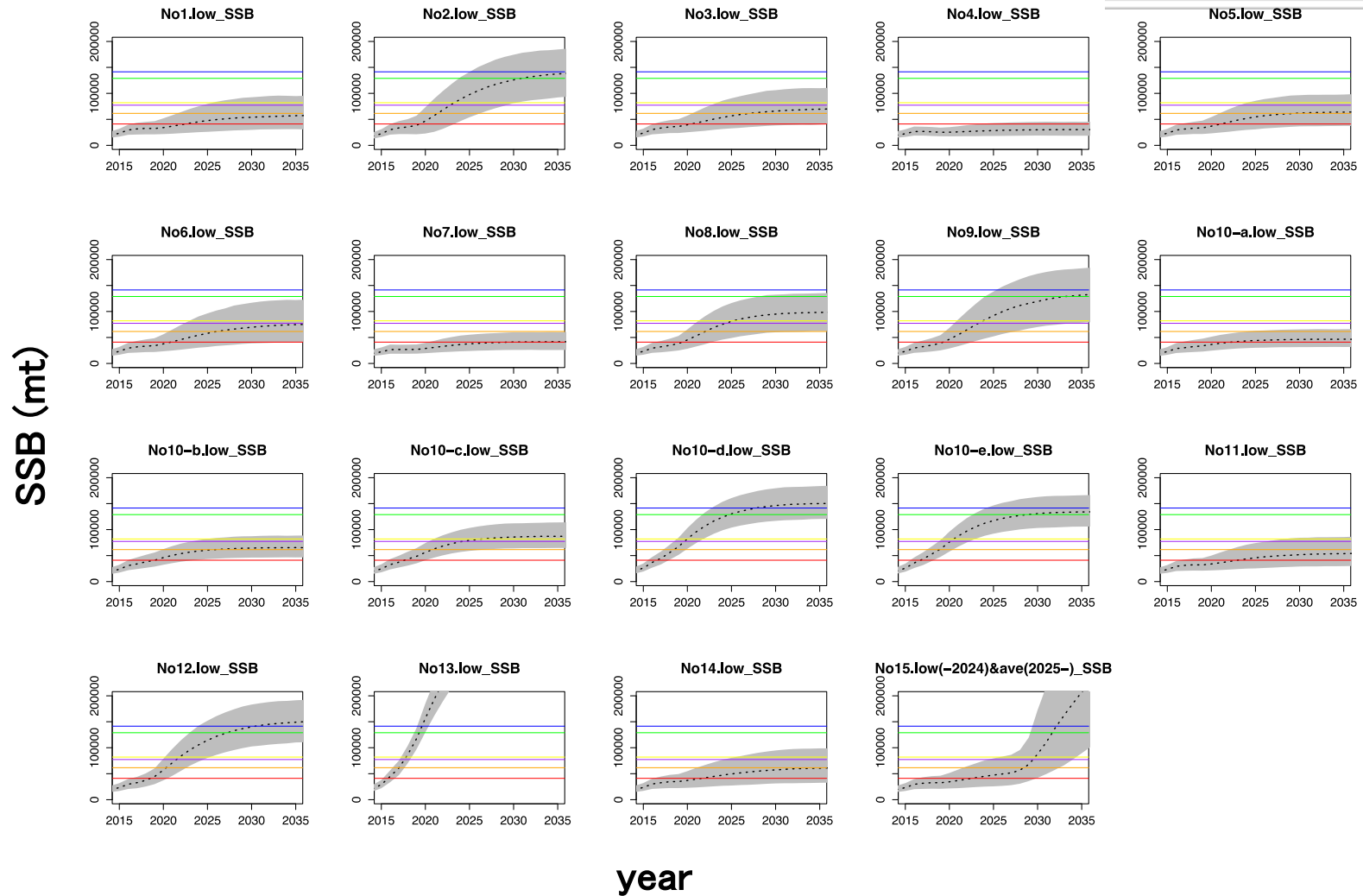
Expected yield in the future

Scenario

Speed risk

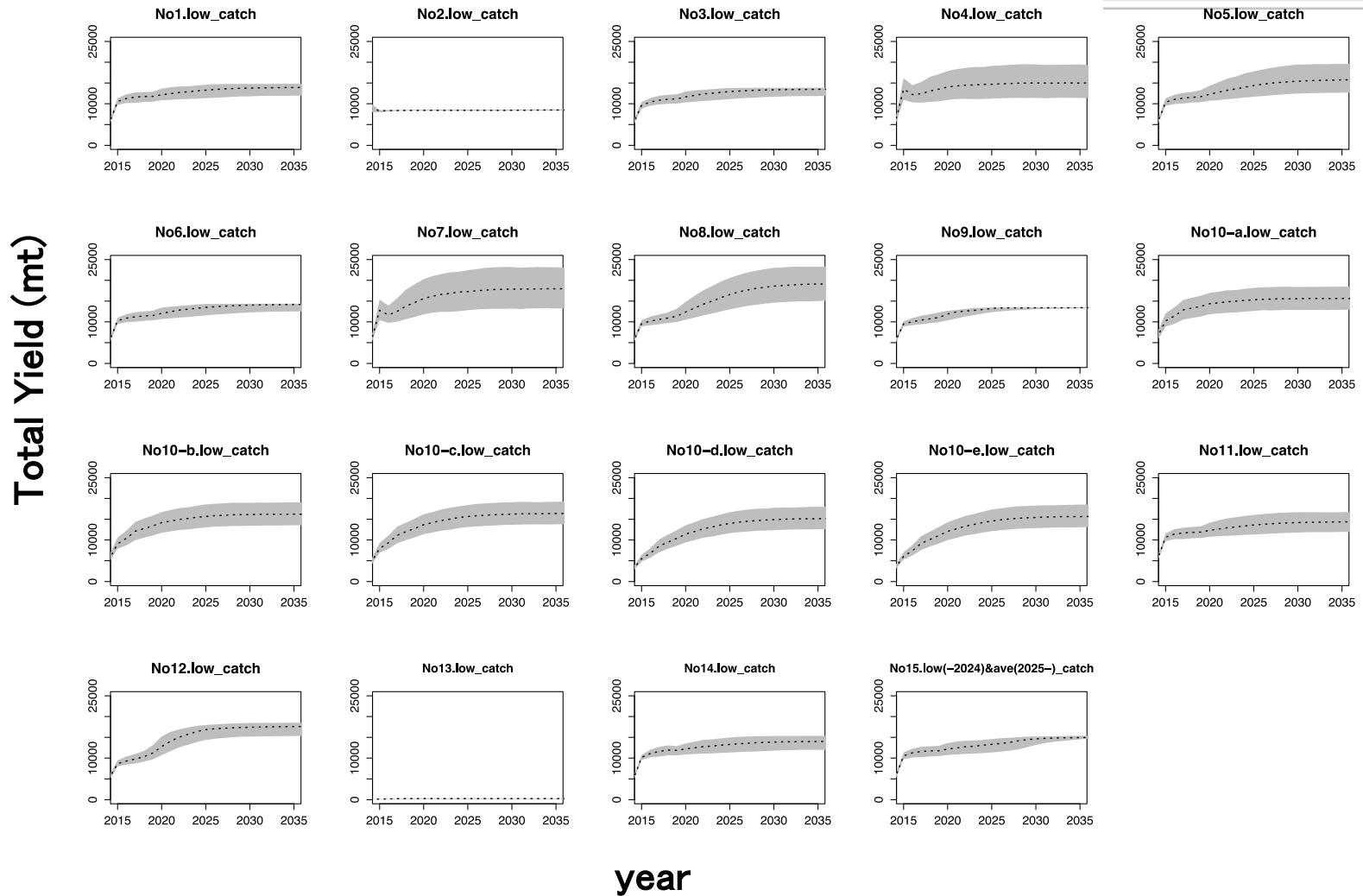
Harvesting Scenario #	Fishing mortality in the WPO	Catch limit in WPO		Fishing mortality in EPO	Catch limit in EPO	Multiplier to F2011-2013	Threshold of small/large fish	Recruitment scenario	Probability of achieving each of the candidate rebuilding targets						The time expected to achieve each of the candidate rebuilding target SSB levels with 60% probability from 2014						Probability of stock is below the median of 2014 at 2024	Probability of SSB falling below the historical lowest at any time during the projection period	Probability of Catch falling below the historical lowest at any time during the projection period	Median SSB at 2024	Expected annual yield in 2024, by area and size category				Expected annual yield in 2030, by area and size category				Expected annual yield in 2034, by area and size category						
		Small	Large						a	b	c	d	e	f	a	b	c	d	e	f					Japan	Korea	Taiwan	EPO	Japan	Korea	Taiwan	EPO	Japan	Korea	Taiwan	EPO			
																																					Small	Large	Small
Scenario1 (the current measures)	F2002-2004	50% 2002-2004	Average 2002-2004	F2002-2004	3,300 mt comm.	-	30 kg	Low	61.5%	35.2%	10.5%	0.1%	0.5%	16.7%	10	-	-	-	-	0.8%	0.0%	0.7%	56466	3969	3915	719	989	3396	3966	4154	719	1362	3400	3964	4190	719	1439	3395	
									Average	99.4%	99.9%	99.4%	94.0%	98.0%	99.8%	6	7	8	10	9	7	0.0%	0.0%	0.3%	291478	4027	4884	720	1504	3620	4025	4909	720	1722	3624	4026	4912	720	1728
Scenario2	Enough high value to fulfill its catch limit (multiply F2010-2012 by two)	50% 2010-2012	50% 2010-12	F2002-2004	50% 2010-12	-	30 kg	Low	96.8%	98.9%	94.6%	29.1%	60.0%	98.2%	6	8	10	-	20	10	0.4%	1.4%	100.0%	136132	3205	1404	554	159	3089	3205	1404	554	158	3092	3205	1404	554	158	3093
									Average	100.0%	100.0%	100.0%	99.8%	100.0%	100.0%	5	6	7	8	8	7	0.0%	1.0%	100.0%	355928	3244	1416	556	157	3373	3245	1415	556	158	3377	3246	1415	556	158
Scenario3	F2002-2004	50% 2002-2004	Average 2002-2004	F2002-2004	50% 2002-04	-	30 kg	Low	81.4%	58.9%	23.0%	0.5%	1.5%	34.6%	8	17	-	-	-	0.4%	0.0%	2.1%	69186	3977	4283	719	1141	2449	3975	4473	719	1524	2449	3975	4484	719	1585	2449	
									Average	99.8%	100.0%	99.8%	96.1%	99.1%	99.9%	5	6	7	10	9	7	0.0%	0.0%	1.3%	305244	4026	4896	721	1568	2657	4025	4912	720	1724	2661	4026	4913	721	1728
Scenario4	F2002-2004	45% 2002-2004	No catch limit	F2010-2012 (multiply F2002-2004 by 1.3)	No catch limit	-	30 kg	Low	6.0%	0.2%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	-	8.3%	1.0%	0.7%	30192	3594	2912	647	691	6919	3592	3098	647	793	6987	3592	3099	647	821	6970	
									Average	88.8%	75.2%	42.8%	1.7%	4.3%	51.9%	7	11	-	-	-	-	0.2%	0.0%	0.1%	78608	3624	7254	648	988	17911	3624	8160	648	2011	17954	3624	8236	648	2171
Scenario5	F2002-2004	45% 2002-2004	No catch limit	F2002-2004	3,300 mt comm.	-	30 kg	Low	77.7%	51.3%	14.9%	0.0%	0.4%	23.4%	8	-	-	-	-	0.5%	0.8%	0.8%	63808	3609	5453	647	1021	3425	3609	6315	647	1620	3426	3608	6382	647	1770	3427	
									Average	99.7%	99.9%	99.1%	84.7%	91.5%	99.6%	5	7	8	11	10	7	0.0%	0.0%	0.5%	209202	3628	16982	649	1855	3641	3628	20033	649	5207	3643	3629	20461	649	5778
Scenario6	F2002-2004	45% 2002-2004	Average 2002-2004	F2002-2004	3,300 mt comm.	-	30 kg	Low	80.6%	65.5%	30.6%	1.2%	3.3%	44.7%	8	15	-	-	-	0.4%	0.0%	0.7%	74204	3609	4310	647	1082	3425	3609	4532	647	1530	3426	3608	4547	647	1599	3427	
									Average	99.8%	100.0%	99.9%	97.2%	99.3%	100.0%	5	7	7	9	9	7	0.0%	0.0%	0.5%	316301	3628	4902	649	1550	3642	3627	4916	649	1725	3646	3628	4916	649	1730
Scenario7	F2002-2004	35% 2002-2004	no catch limit	F2010-2012 (multiply F2002-2004 by 1.3)	No catch limit	-	30 kg	Low	30.9%	3.8%	0.1%	0.0%	0.0%	0.2%	-	-	-	-	-	1.3%	0.1%	1.2%	41645	2810	3865	504	770	9267	2810	4238	504	1061	9373	2810	4253	504	1123	9351	
									Average	95.5%	88.0%	58.8%	3.2%	8.0%	68.9%	7	9	18	-	-	13	0.0%	0.0%	0.7%	88936	2829	8216	505	1086	20076	2829	9176	505	2274	20222	2830	9249	505	2443
Scenario8	F2002-2004	35% 2002-2004	No catch limit	F2002-2004	3,300 mt comm.	-	30 kg	Low	97.4%	94.1%	72.3%	2.3%	7.9%	82.6%	6	9	13	-	-	12	0.0%	0.0%	2.1%	97792	2813	7946	504	1226	3470	2813	9479	504	2404	3471	2813	9603	504	2676	3471
									Average	100.0%	100.0%	99.8%	94.8%	97.7%	100.0%	5	6	7	9	9	7	0.0%	0.0%	1.9%	230687	2832	19516	506	2121	3681	2833	22844	506	5954	3682	2833	23100	506	6548
Scenario9	F2002-2004	35% 2002-2004	Average 2002-2004	F2002-2004	3,300 mt comm.	-	30 kg	Low	97.9%	97.7%	89.0%	24.8%	51.2%	95.1%	6	9	11	-	-	10	0.0%	0.0%	2.2%	130078	2813	4802	504	1311	3470	2813	4872	504	1691	3471	2813	4876	504	1707	3471
									Average	100.0%	100.0%	100.0%	99.7%	99.9%	100.0%	5	6	7	8	8	7	0.0%	0.0%	1.9%	363095	2832	4923	506	1629	3684	2833	4924	506	1729	3687	2833	4924	506	1732
Scenario10	a	Constant F to achieve target a* with 60% of its probability	No catch limit	Constant F to achieve target a* with 60% of its probability	No catch limit	0.798	30 kg	Low	60.4%	8.7%	0.2%	0.0%	0.0%	0.7%	10	-	-	-	-	0.0%	0.0%	3.0%	46453	3822	4849	682	724	5110	3813	5050	679	898	5146	3813	5057	679	922	5148	
									Average	60.3%	19.0%	2.9%	0.0%	0.0%	4.7%	10	-	-	-	-	-	0.1%	0.0%	0.2%	48950	6672	6417	1259	740	7911	6664	6719	1255	1058	7958	6687	6770	1261	1095
Scenario10	b	Constant F to achieve target b* with 60% of its probability	No catch limit	Constant F to achieve target b* with 60% of its probability	No catch limit	0.666	30 kg	Low	96.1%	60.6%	9.7%	0.0%	0.0%	17.8%	6	16	-	-	-	0.0%	0.0%	28.9%	65149	3516	5399	598	810	5166	3508	5710	595	1104	5216	3508	5730	595	1145	5219	
									Average	90.5%	60.1%	19.3%	0.1%	0.4%	28.6%	7	16	-	-	-	-	0.0%	0.0%	1.2%	66924	6339	7315	1148	851	8204	6333	7757	1144	1320	8267	6354	7826	1149	1380
Scenario10	c	Constant F to achieve target c* with 60% of its probability	No catch limit	Constant F to achieve target c* with 60% of its probability	No catch limit	0.554	30 kg	Low	100.0%	96.9%	60.6%	0.1%	0.7%	76.0%	5	8	16	-	-	12	0.0%	0.0%	82.1%	87110	6130	5755	518	866	5098	3188	6144	518	1280	5142	3178	6195	517	1338	5131
									Average	99.1%	92.1%	60.3%	2.1%	5.6%	71.2%	6	8	16	-	-	13	0.0%	0.0%	6.7%	88965	5960	8094	1036	951	8351	5954	8690	1034	1586	8433	5975	8780	1038	1673
Scenario10	d	Constant F to achieve target d* with 60% of its probability	No catch limit	Constant F to achieve target d* with 60% of its probability	No catch limit	0.347	30 kg	Low	100.0%	100.0%	100.0%	60.4%	87.0%	100.0%	3	5	7	16	12	7	0.0%	0.0%	100.0%	149949	2360	5705	352	874	4366	2355	6294	350	1485	4452	2356	6363	350	1591	4459
									Average	100.0%	100.0%	99.8%	60.2%	78.5%	100.0%	4	6	7	16	12	7	0.0%	0.0%	87.4%	152558	4982	9149	798	1100	8112	4979	10080	796	2097	8236	4997	10221	800	2257
Scenario10	e	Constant F to achieve target e* with 60% of its probability	No catch limit	Constant F to achieve target e* with 60% of its probability	No catch limit	0.390	30 kg	Low	100.0%	100.0%	100.0%	27.7%	60.6%	100.0%	3	6	7	-	19	7	0.0%	0.0%	100.0%	133800	2559	5824	389	889	4589	2554	6386	387	1467	4672	2555	6447	387	1564	4679
									Average	100.0%	100.0%	98.6%	39.4%	60.2%	99.5%	4	6	8	-	20	7	0.0%	0.0%	69.6%	136490	5216	9008	819	1077	8234	5212	9869	848	1999	8350	5231	9999	852	2142
Scenario11	F2002-2004	50% 2002-2004	Average 2002-2004 catches in WPO (all sizes)* minus 50% 2002-2004 catches in WPO (<30 kg)	F2002-2004	3,300 mt comm.	-	30 kg	Low	57.8%	29.0%	6.1%	0.0%	0.2%	10.0%	11	-	-	-	-	1.1%	0.0%	0.6%	53683	3967	4389	719*	955	3395	3965	4816	719*	1308	3398	3965	4841	719*	1387	3399	
									Average	99.3%	99.8%	99.0%	89.1%	95.6%	99.7%	6	7	8	11	10	8	0.0%	0.0%	0.3%	263027	4027	4893	720*	1461	3619	4025	4912	720*	1717	3622	4026	4912	720*	1725
Scenario12	F2002-2004	25% 2002-2004	Average 2002-2004 catches in WPO (all sizes)* minus 25% 2002-2004 catches in WPO (<30 kg)	F2002-2004	3,300 mt comm.	-	30 kg	Low	99.9%	100.0%	99.5%	48.0%	79.4%	99.8%	5	7	9	20	15	8	0.0%	0.0%	49.7%	148029	2014	8803	361*	1475	3507	2014	9579	361*	1709	3508	2014	9691	361*	1713	3508

Future SSB trajectories in low recruitment assumption



SAC-08 INF E(a) Figure 4

Future yield trajectories in low recruitment assumption



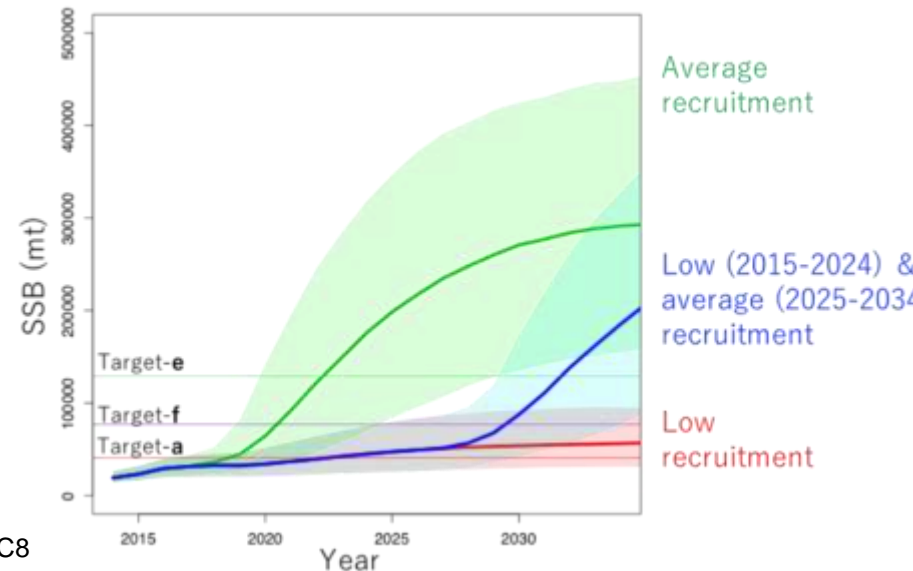
SAC-08 INF E(a) Figure 6

Supplementary explanations

- Under the average recruitment scenario, all of the harvest scenarios will achieve the target-a (initial rebuilding target by 2024).
- Scenarios not achieving the target-a under low recruitment scenario do not have catch limit for EPO and WPO large fish (4 and 7) or has a higher catch limit for large fish in WPO (11).
- By further reducing the catch limit of small fish, the stock can recover even with the increase of catch of large fish in WPO (scenarios 5, 8, 12).

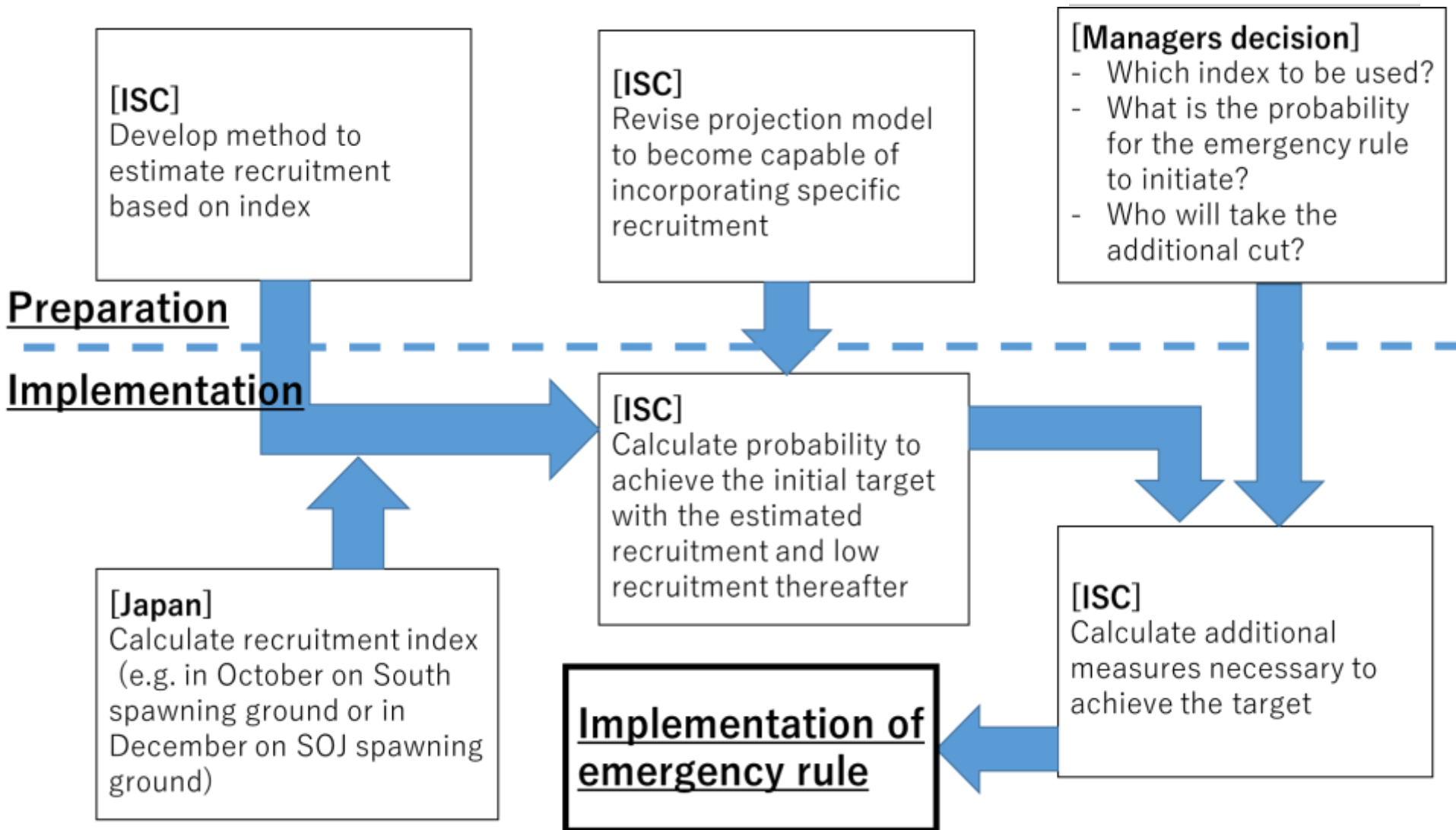
Supplementary explanations

- Different recruitment scenarios forecast an entirely different level of SSB in future. In terms of the next rebuilding targets (e.g. 20%SSB₀) the WG considered that these are longer term objectives and that those rebuilding targets and associated harvest scenarios should be evaluated with the assumed recruitment.
- On the other hand, the evaluation of the initial rebuilding target, which is calculated independent of recruitment, should be conducted based on the low recruitment scenario for precaution.



SAC-08 INF E(a) Figure 1

Possible framework for emergency rule




Future plan

❖ Update stock assessment

- Scheduled in Feb–Mar of 2018.
- Fishery data from 2015 3rd quarter to 2017 2nd quarter will be updated.
- Spawning biomass, recruitment, and Fishing mortality until 2016 will be assessed.
- Use same assessment model with the 2016 assessment in principle.
- Future projection will also be updated.
- Next full stock assessment will be in 2020.

❖ Evaluation of the effect of the most recent recruitment to the stock rebuilding.

- Develop the method to estimate the recruitment based on index.
- Revise the projection model to incorporate required functions.



Gracious
Thank you